Gains from Free Trade Agreements: A Theoretical Analysis

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ABSTRACT

Empirical estimates from various studies on impact assessment of free trade agreements show that there are limited economic gains from concluding such arrangements. It has been argued by trade negotiators of many countries that while some partners gain more from an agreement, others gain less or, even suffer from a rise in their current account deficits and overall economic losses. Even the Indian scenario is not an outlier in such a case. This question about unequal gains from an FTA has raised various policy concerns. We attempt to provide an answer to this debate by incorporating the role of the type of commodities that countries trade with each other. In an imperfectly competitive setup with three countries and two types of commodities viz. a final good and an intermediate input, our findings reveal that bilateral free trade in final goods is more welfare-enhancing for the member countries vis-à-vis bilateral free trade in intermediates. However, the former possibility is feasible only for a very small range of parametric values given the pre-requisites for ensuring the formation of an effective FTA. More specifically, we find that a horizontal FTA covering final goods becomes feasible only when the degree of market size asymmetry between the two partners is very less. On the contrary, when we emphasise on the role of vertical trade, i.e., where one of the FTA members exports intermediate inputs to the other, and imports the final good in return, we find that FTA is feasible only when the larger partner is an exporter of final goods and an importer of intermediate inputs, vis-à-vis the smaller partner. In such a case, the larger partner accrues higher gains from such a bilateral engagement. While capturing the role of tradable intermediates, we also show that in the presence of well-connected GVCs, RTAs actually become a less attractive option for enhancing trade and welfare of an economy.

JEL Classification: F12, F15

Key Words: Free Trade Agreements, Global Value Chains, Vertical Industry Structure

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1. Introduction

Globally, the anti-trade sentiment has been on the rise, with various big economies like the United States, China, among others, engaged in multiple escalations in a quest to protect their domestic economies. The Covid-19 pandemic has further aggravated the situation, where many countries have started adopting protectionist measures to preserve their democracies. This has raised scepticism about free(r) trade, making it incumbent for the policymakers and the trade negotiators to explore and explain the benefits of such policies. One such policy instrument is the ability of the countries to form preferential trade pacts, or what in WTO terminology, are referred to as regional trade agreements. At the time when these were allowed as an exception to GATT's (General Agreement of Tariff and Trade, 1948) Most Favoured Nation (MFN) principle (Article I, GATT[2]), it was believed that regional engagements would at least pave a towards global trade expansion by allowing the economies to take advantage of preferential market access being offered by their intra-RTA countries (Pant and Sadhukhan 2009, Pant and Paul 2018). It was also assumed that these arrangements would provide risk cover during periods of global trade turmoil. However, recently, not only the ongoing global trade and investment scenario has raised questions regarding their welfare effects, but various countries such as India, members of the European Union (EU), amongst others, are also raising doubts regarding their usefulness based on the premise that these pacts lead to unequal distribution of gains among the partner economies (Dhar 2014, Hartwell and Movchan 2018, Kwatra and Kundu 2018). Even the former US president, Mr. Trump, had raised this inequality concern while announcing the withdrawal of his country's partnership from the 12-nation Trans-Pacific Partnership (TPP) agreement in the year 2017 (Subramaniam 2016, Garrett 2017).

In this entire discourse on the distribution of (economic) gains from RTAs by some of the dominant players and policy planners in the world market, the Indian industries seem to have been particularly vocal about these arrangements. They have complained that their gains are being hampered by the country's commitments with its member nations. In an interaction with Business Line on June 12th, 2019, for instance, a Ministry of Commerce' official said, "Many sectors such as steel, electronics, chemicals, textiles and agricultural items like spices and Vanaspati have been hit due to the existing FTAs, and the overall trade deficit with partner countries has also gone up."[3] The pharmaceutical sector also criticised the country's trade agreements with ASEAN, Japan, and South Korea on similar grounds and reported only limited gains for their segment (FE Bureau, 2019). In fact, this issue has been at the forefront of the country's policy debates since 2017 when similar concerns were voiced by Indian farmers and spokespersons of various industries, and the country's government decided to review its

[2] The MFN principle states that no member country should follow any discriminatory practice against the other signatories of the agreement.
[3] Sen (2019a)

free trade pacts for the first time (PTI 2017). India's recent decision to opt-out of the RCEP deal after more than 28 rounds of negotiations, is a perfect signal to its growing apprehensions about the welfare effects from these mega trade blocs.[4]

A very specific cause has been pointed out by the North Indian Textile Mills' Association (NITMA), which is one of the biggest textile bodies of the country. In an interaction with the Secretary Textiles, Government of India, the association explained that the India-ASEAN FTA had led to a surge in imports of finished products of spinning mills, mainly from Vietnam and Indonesia, thereby forcing many Indian MSMEs to close their spinning mills (Mathew 2019, TNN 2020). A similar complaint was registered by Indian non-ferrous metal producers and the corresponding metal recycling units of the country (Jha 2019). However, at the same time, it has also been reported by the Hindu Business Line that several Indian industries are not entirely opposed to such deals. For instance, the textile sector, while being against the India-ASEAN FTA or the RCEP talks, wants that the country should negotiate an FTA with the EU (Sen 2019b) even though the Indian automobile industry is completely against it (PTI 2015, PTI 2019). In particular, it has been identified that the cotton textile exporters have been urging the country's government to expedite the FTAs with EU, Australia, and Canada since 2015 (Jha 2015). Further, the findings of the Economic Survey 2019-20 also suggested that at least some of the free trade agreements (signed between 1993 and 2018) have actually benefitted the country by exerting a positive impact on its merchandise exports (Government of India 2020). Thus, it seems that a balanced view needs to be taken by the government on the matter. Besides, although the literature abounds with numerous studies on the welfare assessment of RTAs, with some of them being highly critical of gains from these arrangements, it is not very clear why such complaints have been raised in the past few years only.

Given this backdrop, the first question to ask is – *When and why did this problem emerge?* – The review of the literature suggests that the evolution of preferential trade can actually be traced back to the rise of international trade between different countries around the globe. Even before the formulation of the GATT, RTAs existed between Belgium, the Netherlands, and Luxembourg (popularly known as Benelux) and amongst some of the members of the current European Union (former European Economic Committee). However, it is only in the past two - two and a half decades that the world market experienced an exponential rise in the number of such deals being negotiated by the WTO members – ranging only about 36 in number in the year 1975 and about 100 in 1995, there

[4] Regional Comprehensive Economic Partnership (or RCEP) is a multilateral trade agreement between the ten-country ASEAN bloc and its five FTA partners viz. China, Japan, South Korea, Australia, and New Zealand. Sources: Economic Times (2019a, 2019b), Business Today (2019), Business Line (2019), among others.

are in total 302 physical RTAs[5] in force today (WTO RTA Database). More so, as of September 2019, no less than 695 notifications were received by the WTO, of which 481 were for those that are currently in force. Clearly, then, these arrangements have gained a lot of popularity over time. However, are these economically advantageous too? – From Viner's static theory (1950) based on the concepts of trade creation and trade diversion, the following long-lasted debate initiated by Lipsey and Lancaster (1956), Lipsey (1957), Bhagwati (1971), Kirman (1973), and the like, to the more recent assessments done by Baccini (2019), Nguyen (2019), Mon and Kakinana (2020), Takarada et al. (2020), etc., the literature on RTAs is now flooded with both theoretical and empirical studies. Primarily, three different yet interrelated questions have been addressed in these works – Are RTAs welfare enhancing for the member countries? If yes, does the rise in welfare increase with the conclusion of deeper agreements?[6] What is the impact on the welfare of non-member nations? And lastly, does regionalism hinder the growth of multilateral free trade?

Surprisingly, the answer to none of these questions is unambiguous. Some of these studies have stressed RTAs as a 'bad idea', that reduce welfare for both intra- and extra-RTA partners and detract efforts towards the expansion of multilateral liberalisation (Bhagwati 1991, Grossman and Helpman 1994, Krishna 1998). On the contrary, others have argued that these agreements represent a positive path to multilateralism and, thus, provide evidence that small countries want to participate in a global system, which usually remains dominated by the industrialised economies (Freund 2000, Robinson and Thierfelder 2002).

But, *how do these gains or losses associated with the conclusion of an RTA vary from agreement to agreement, and how are they divided among the member countries*? – The literature seems to give little guidance on the answer to these questions. To date, only a small literature, including studies by Carrère (2006), Kohl (2014), Berlingieri, Breinlich and Dhingra (2018), and Baier et al. (2019), among others, has discussed the asymmetric gains from FTAs. While the former two have analysed across-agreement heterogeneity, Baier et al. (2019) have also empirically studied the underlying determinants of within-agreement heterogeneity in FTA effects based on country-specific institutions, factor endowments, already existing FTAs, monopoly power, pre-FTA trade barriers, etc. Berlingieri, Breinlich and Dhingra (2018), on the other hand, have assessed the impact of EU common external trade policy on consumer welfare (in various EU countries) in terms of changes in variety, access to better quality products, and lower prices. Similarly, entering into deeper agreements leads to greater coordination,

[5] As per the WTO' terminology, the number of physical RTAs are counted by considering goods, services, and accession to an RTA together.

[6] Depth, here, refers to the coverage/content of RTAs. As put forward by Hoffman, Osnago and Ruta (2017), RTAs now do not only allow tariff concessions but, they also cover, in addition, an expanding set of policy areas such as services, investment, and competition policy.

but that also comes at the expense of greater loss of autonomy. This, in turn, raises the question of *whether countries should continue to negotiate RTAs, and if so, with whom*?

When the theory of economic integration started developing, most of the trade was in final goods – goods were being produced in one country, and competition used to take place between domestic and foreign goods with their own national characteristics. This type of trade was actually guided by the so-called *free trade doctrine* as propounded by conventional theorists of the 18th century and early 20th century (Smith 1776, Ricardo 1921 or Heckscher 1919 and Ohlin 1933 among others). As a consequence, the countries from the North (and lately from the South as well) started negotiating RTAs based on this premise. However, this popular doctrine is governed by the assumptions of the perfectly competitive product as well factor markets, small open economies, inter-industry trade, and the theory of first best[7] – none of which prevail in reality. More importantly, another shortcoming of these theories was their assumption that all the production stages are undertaken domestically within each economy. In other words, these theories inherently assumed the absence of tradable intermediates.

However, the past few decades have experienced a fundamental transformation in the composition and structure of trade being conducted between various economies. Today, more than half of world trade is in intermediate products,[8] and the *so-called* two-way/intra-industry trade contributes a significant share in this new variety. Rapid advancements in technologies, reduction in transportation and communication costs, and the gradual reduction of political as well as economic barriers to trade are among some of the crucial factors that have accentuated this process of international slicing of production activities, guided by the global value chains (GVCs). This is why what we observe today is not only trade in final goods but of components and parts as well, thereby raising the scope and coverage of trade agreements.

In this light, and with the development of the New Trade theory post-1975, the theory of RTAs developed further. The implications of these considerations have been well discussed in some of the earlier studies by Smith and Venables (1988), Wonnacott and Lutz (1989), Krugman (1991), Summers (1991), Mukonoki (2004), etc. They have examined the welfare effects of RTAs in the presence of monopolistic competition. Relatively fewer studies such as those by Krishna (2005), Ishikawa et al. (2007), Kawabata, Yanase and Kurata (2010), Kawabata (2014, 2015), on the other hand, have incorporated the features of vertically related markets as well. Across these vertical networks, some countries are engaged in upstream stages of production depending upon their specialisation. In contrast, others are involved in downstream stages where firms transform the imported and indigenous inputs into final products using specific production techniques and, finally, export them into the

[7] For details, refer to any textbook on trade theories such as Batra (1973) or Bhagwati, Panagariya and Srinivasan (1998)).
[8] WTO (2019), Basco, S., & Mestieri (2019)

international market. While the rise of these internationally fragmented value chains has been ubiquitous across the world, their expansion has raised concerns regarding the distribution of gains among various participating economies – depending upon where a country is positioned on the so-called *smile curve* (OECD–WTO-World Bank Group report (2014), Meng et al. (2020)). For instance, it has often been argued that economies that perform high value-added tasks have seen higher mark-ups, while the gains for producers to whom they outsource the manufacturing of parts/low value-added tasks have been declining (World Development Report 2020). Likewise, even the benefits from RTAs could vary depending upon the type of good (whether final or intermediate) that a country trades with the partner country. If the composition of the trade basket differs on each side, then, ceteris paribus, one member may gain more than the other, which is what has been experienced in the recent past. While the studies mentioned above assess the effects of cross-regional RTAs on tariffs, welfare, and incentives for global free trade in a vertical industry set up, the distinction between welfare gains or losses, arising from engaging with partners based on different commodity baskets, has not been explicitly studied in any of them.

Thus, in this essay, we build on these models and aim to theoretically examine whether the welfare effects of free trade agreements (FTAs) are conditional on what type of products (final or intermediates) are traded (imported/exported) by the member countries. In other words, the research question would help us to address the debate regarding the uneven benefits of engagements in different RTAs by focussing on the role of (tradable) commodity baskets.[9] In doing so, unlike the studies by Kawabata, Yanase and Kurata (2010), Kawabata (2015, 2016), we put special emphasis on the role of preferential rules of origin (or ROOs) in determining the effective formation of an FTA, specifically between asymmetric countries in terms of their market sizes. These rules now represent an essential component of a trade agreement, and prevent non-member countries from exploiting differences in tariffs they face while exporting to FTA members. Hence, they act as a means to prevent trade deflection. While these agreements have become more of an empirical concern now, the significance of a theoretical model arises from the fact that in reality, each RTA includes all kinds of trade, and hence may falsely predict a weak or no empirical relationship between the type of products traded by each country and the welfare gains from such arrangements. Developing a theory structure, therefore, allows us to decide the commodity basket for each country, and also entails enough flexibility to ensure that only a specific type of product is allowed to be traded via an RTA route at a time, while others become a part of the exclusion list.

[9] In fact, it seems plausible to assert that the analysis in our study could also be utilised to assess whether the imposition of higher tariffs on imports of intermediate goods or final commodities are more harmful to a country's welfare – something that is extremely relevant for the impact on a country's growth in the post Covid-19 scenario.

We also assess the welfare gains/losses of the non-member country, in the presence of each type of agreement and determine the conditions under which RTAs hinder the progress towards multilateralism. Besides, our theoretical framework also makes it possible to examine whether well-connected global value chains affect the benefits that an intra-RTA bloc or the non-member countries leverage from the RTA. As explained by Bruhn (2014) and Chains (2014), in GVC-led trade, goods cross international borders several times in different forms (raw materials, processed/intermediate inputs, final goods), incurring some amount of tariff at each stage of value-addition. As a consequence, the structure of GVCs may actually multiply the effects of even low-level rates of duties, thus making multilateral liberalisation more preferable vis-à-vis preferential liberalisation. In this context, our second question is an attempt to illustrate whether GVCs make a strong case for bilateral trade agreements or not.

Subsequent sections of this paper are structured as follows. Section 2 outlines the theoretical framework that we have employed to answer our research questions, followed by sections 3 and 4, which entail detailed information on different (trade) scenarios assumed and the corresponding results as well. In particular, section 3 attempts to focus on horizontal FTAs in final goods or intermediate inputs. On the contrary, the case of vertical FTAs, i.e., where the partner countries are involved in exports of products belonging to different production stages, has been discussed in section 4. Finally, the last section summarises some of the important results and concludes the essay.

2. The Analytical Framework

2.1 *A simple three-country, 2-industry set up*

The usual approach to document intra-industry trade is to assume that products produced or services offered in different countries are (at least) slightly different from each other. Hence, their trade raises the welfare of the economies by satisfying consumers' tastes for variety – an insight (first) documented by Krugman in his 1979 study. However, as argued by Brander (1981) and further examined by Venables (1985) and many others, there are equally good reasons to expect a two-way trade in identical products as well – which is popularly referred to as *cross-hauling*. Such type of trade occurs due to strategic interactions among domestic and foreign firms.

We base our analysis along these lines and consider a simple world economy with three countries denoted by i, where $i = A, B, R$. Countries A (the home economy) and B (the partner country) are assumed to be located in the same region, while R represents the rest of the world. In each country, there are two imperfectly competitive industries viz. an upstream industry producing an intermediate input (I), and a downstream industry that utilises (I) for producing the final output (F). For analytical simplicity, we assume that only one unit of intermediate input is required to produce a unit of final

good (and no other inputs are needed). Production of a unit of intermediate input, on the other hand, requires services of a non-tradable factor of production (V). As in Kawabata (2015), the factor market in each country is perfectly competitive, and the average, marginal costs of producing the intermediate input (anywhere in the world market) are assumed to be constant. We normalise this cost to zero. Further, in each industry, all the three countries have a single firm, and produce a homogenous good. We assume away any relocation (i.e., foreign direct investment) of these firms because of prohibitive transaction costs. This completes the description of the supply side of our framework

On the demand side, we assume that consumer preferences in each country i are characterised by an aggregate quasi-linear utility function given by:

$$U_i = u_i(F_i) + X_i \tag{1}$$

Here, F_i represents the consumption of final good (F) in country i, and $u_i(F_i)$ is assumed to take a quadratic form. X_i is the consumption of a competitively produced numeraire good. This type of setting allows us to assume that the income effects are negligible and therefore, in the three countries, the demand function for final good is represented by

$$F_i = \alpha_i - p_i \tag{2}$$

where p_i is the market price of the final good in country i, and $\alpha_i > 0$ represents its market size.[10]

The asymmetry between the three countries is captured by their different market sizes. For expositional simplicity and to focus our analysis on the assessment of different RTAs in the presence of ROOs, we specifically assume that countries B and R are of similar sizes so that $\alpha_B = \alpha_R = \alpha$. On the other hand, $\alpha_A = \theta\alpha$, where $\theta > 0$ represents the degree of market size asymmetry between countries A and B, R. Such a setting is useful to examine the effects of FTAs when the participating economies are of different sizes (which, in turn, also determines the potential market access opportunities that an FTA entails, provided that the good, in question, is demanded in the partner country as well), and also allows to compare and contrasts the benefits from an FTA when the countries involved are of similar sizes, vis-à-vis the rest of the world.

2.2 *Game structure and trade costs under alternative regimes*

To answer our questions of interest, we formulate different cases, each of which represents a different scenario in our 3 country-2 industry set up.

We begin with **Case 1**, where we assume that the three economies only trade in final goods. Therefore, in addition to the domestic cost of production, each downstream firm incurs an additional cost in terms

[10] The linearity of demand may not be essential for our main results, but simplifies their derivation and presentation.

of tariffs for each unit of its final good exported to other trading countries. On the contrary, the inputs are considered as a non-tradable item. Besides, we also assume that the downstream firms perceive each market (domestic or foreign) as a *segmented* market and take distinct quantity decisions while deciding how much to produce and export to any market. To avoid trade deflection and ensure the stability of Cournot equilibrium in each market, we constrain our solutions by the '*arbitrage-free*' conditions, so that no independent arbitrager finds it profitable to supply parallel imports or reimports by buying from the low-priced country and supplying in the high-priced one.[11] Further, we assume that there are no other barriers to trade in the form of other regulatory restrictions, transportation costs, etc.

Thus, this regime is characterised by three stages. In the first stage, the governments in the three countries simultaneously determine their optimal output-tariffs. In the absence of any FTA, we assume that these tariffs are non-discriminatory, and therefore, refer to them as the MFN tariffs. The second stage involves quantity decisions by the upstream firms in their respective markets and determination of market prices based on the anticipated demand by their respective country's downstream firm. Finally, in the last stage, downstream firms choose their output levels and compete globally.

Next, we extend the model and introduce **Case 2** by assuming that countries A and B conclude a free trade agreement, and agree to eliminate tariffs on each other's imports of final goods. It is important to note that there are two particularly distinctive features of FTAs, which distinguish them from Customs Unions (CU). One, unlike a CU, the FTA member countries set their own external tariffs on goods imported from the non-members. Secondly, the FTA members engage in a preferential rule of origin (or ROO) agreement under which goods do not qualify for tariff-free access to a partner's market unless the ROOs are met. This is because, otherwise, goods from non-member countries could enter the FTA through the country with the lowest external tariff, thereby undercutting the other FTA member's higher external tariffs (i.e., to prevent re-exportation). As specified in GATT, these ROOs can take the form of restrictions related to domestic value-added content, a change in tariff heading, etc. However, regardless of the criteria applied, the existing literature shows that these rules can entail large compliance costs for the intra-FTA members, which are often compounded by administrative/book-keeping expenses as well (Anson et al. 2005, Keck and Lendle 2012, Cadot et al. 2014). Thus, in examining the effective formation of an FTA between countries A and B, we consider the role of ROOs in Case 3.

In line with Chang and Xiao (2015), we use a trade-cost approach and assume that the downstream firms belonging to the two member countries, incur an additional per-unit cost of δ while exporting

[11] An arbitrage opportunity is a strategy whereby an independent trader takes advantage of the price-differential between different markets, and earn positive profits by buying goods from a market and selling them in others, thus disturbing the market equilibrium.

their product within the FTA bloc via the FTA route. Further, to induce them to comply with ROO, we specifically put a restriction that δ always falls short of the external tariff rates that the two governments announce to maximise their respective welfare levels.[12] While there have been several studies on assessing the welfare effects of these ROOs, it is essential to mention that they assume the role of tariffs in ensuring that the intra-FTA markets remain segmented even after the conclusion of a free trade agreement.[13]

The significance of introducing Cases 1 and 2 is that they allow us to assess the welfare implications of free trade arrangements, where we assume that the downstream firms are vertically unified entities, i.e., they are dependent only on their own imperfectly competitive domestic markets for fulfilling their input requirements. Though there exist several such studies in the literature (for instance, Chen and Joshi 2010, Chang and Xiao 2015, among others), however, unlike our study, they assume perfectly competitive input markets.

Considering Case 1 as the baseline scenario, we next incorporate the role of trade in intermediate goods in **Case 3**, and assume that now the upstream firms also supply their products to the foreign downstream players. This modifies stages 1 and 2 of our game – now, the governments in stage 1 simultaneously decide about the welfare maximising input and output tariffs. In stage 2, the three upstream firms play in quantities and simultaneously decide about their production and export decisions. Once again, we assume that the markets remain segmented (both downstream and upstream markets), and there does not exist any profitable arbitrage opportunities.

Case 4, as an extension of Case 2, assumes that the governments of countries A and B decide to form an FTA, whereby they agree to eliminate output-tariffs imposed on each other's imports while continuing to impose a positive MFN tariff rate on their imports of intermediate inputs. Thus, the tradable inputs are considered as a part of the exclusion list in this case. However, their tradability now makes it all the more imperative for the FTA partners to lay down the ROO conditions so as to avoid tariff shopping. The objectives of this exercise are twin fold. In particular, we want to assess as to (a). when does an FTA guarantee a higher level of welfare – in the absence or in the presence of globally linked production structures? And, (b). when does an FTA guarantee a larger increase in the level of welfare – in the absence/presence of these global chains?[14] To put it differently, we want to analyse

[12] This is because if the per-unit ROO cost exceeds the member country's MFN tariff rate, then no firm would want to trade via the FTA route.

[13] At times, the rules of origin are also required to incentivise them to move towards bilateral (if not, global) free trade by limiting the benefits that the non-members get by member countries' FTA. Hence, these also help in ensuring the stability of market equilibrium.

[14] Our notion of vertical trade contrasts with the definition of Hummels, Rapoport, and Yi (1998), according to whom three conditions must hold to for vertical specialisation to occur – a). production of a good must involve multiple sequential stages, b). more than one country must specialise in some, but not all, production stages, c). at least one stage must cross border more than once. However, in our present framework, we assume that each of the three countries produce as well as

whether the dramatic rise in the trade of intermediates in the past few decades has raised or reduced the welfare-improving effects of free trade agreements? Hereafter, we refer to Case 4 as the case of *FTA in final goods* in the presence of globally linked production chains.

In the next case, i.e., **Case 5**, we consider a possibility, when instead of bilateral free trade in final goods, the governments in the two partner countries, A and B, agree to eliminate tariffs imposed on each other's imports of intermediate inputs – referred to as the *FTA in intermediates*. Thus, in this case, we assume that final goods become a part of their FTA's exclusion list. The game structure remains the same as in the previous case, except that in the second stage, the upstream firms in the two member countries incur an additional per-unit cost of γ as ROO-induced trade cost while exporting their inputs within the FTA bloc via the FTA route. The rest of the trade, however, takes place at the optimal MFN rates between A, B and C.

After assessing the welfare-improving effects of this FTA, we compare and contrast them with the results obtained in Case 4, and analyse whether the benefits from reciprocity are larger in the case of free trade in final goods or when FTAs are signed to eliminate barriers to trade in intermediates. In other words, our simple model provides us a tractable framework to examine as to when larger gains could be expected – when a country signs an FTA with a member with whom it trades mostly in final goods or with the one, with whom the majority of its trade is in intermediate goods. This type of analysis is specific to those set of countries where trade is mainly intra-industry trade. Besides, we also assess the impact on changes in the individual components of the welfare of countries A and B vis-à-vis the rest of the world. As argued by Copeland and Mattoo (2008),[15] the consumer-lobbies for free trade are often weaker than the producer-lobbies for protection. The latter represents a well-organised interest group, and the government of any country, in general, faces considerable pressure from the producers while deciding about trade-related policy instruments. Thus, such an exercise is useful to assess the likely reasons for producers to support/show resistance for a particular FTA. Lastly, we also utilise a rudimentary method to comment on the terms of trade effect of the two FTAs, the details of which are documented in section 3 of this study. We also verify our results by theorising a situation when A and B trade only in final goods with each other, followed by the case when they trade only in intermediate inputs.

Next, we introduce Cases **6** and **7**, and examine the possibility where the FTA partners are mostly engaged in vertical trade, i.e., where one is engaged in the production and export of intermediate inputs, while the other utilises that input in its final good's industry and export it back to the FTA partner (like

trade in both intermediate input and final good, and therefore, are linked to each other. Since every downstream firm not only employs the local intermediate inputs, but imported inputs as well, and finally exports its product to the rest of the world, it is clear that inputs cross border more than once – one, in their original form, and two, as a part of the final good.

[15] Chapter 3 in Handbook of International Trade in Services, Editors: Mattoo, Stern and Zanini.

the South-South or North-South trade). Thus, we reassess the distributional gains from an FTA by assuming two different scenarios – (i). when Country A imports intermediates from B, while B imports final goods from A, (ii). the opposite of case (i). The advantage of such a setting is that it allows us to comment on the role of import- as well as export-baskets while analysing the gains from engaging in such bilateral trade deals.

3. Analysis and Results

The section illustrates the working of the cases outlined above. As is standard in the literature, we employ backward induction to solve for sub-game perfect Nash equilibrium (SPNE) for each of the alternative regimes.

3.1 *Case* 1 | *Vertically Unified Production Structure and Trade in Final Goods*

As explained in section 2, we first assume that all the economies trade only in final goods. Here, we reproduce the results obtained by Brander (1981), Venables (1985), and others, but by considering an imperfectly competitive input market. In the earlier studies, it was assumed that the input markets are perfectly competitive and are characterised by constant average and marginal costs.

Downstream Markets

Beginning with the third stage of the game, we first represent the set of equations for Country A, followed by countries B and R. Here, it is important to note that the downstream firms (from the three countries) consider each market as a segmented market, and take distinct quantity decisions everywhere. Thus, with trade in final goods, the total amount of final good supplied to country A (which, in equilibrium, is equal to the total amount demanded by its consumers) is given by

$$F_A^1 = F_{AA}^1 + F_{BA}^1 + F_{RA}^1 \tag{3}$$

where, F_{BA}^1 and F_{RA}^1 represent the amount of output that country $B's$ and $R's$ downstream firms sell in country $A's$ downstream market. In all these variables, the first subscript represents the supplying country and the second refers to the destination economy. The superscript identifies the case or the regime under consideration.[16]

Given the price at which the intermediate input is available in each country and the (specific) MFN tariff rate (t_A^1) as imposed by country $A's$ government on its imports of the final good, the three suppliers employ a Cournot strategy (taking as given the output decisions of their competitors) and accordingly determine their profit maximising level of outputs, as shown below

[16] The superscript should not be confused with the power/exponent of the given expression. The exponents are always represented by putting the main expression within the parentheses.

$$F_{AA}^{1} = \frac{\alpha_A - 3d_A^1 + d_B^1 + d_R^1 + 2t_A^1}{4} \quad (4)$$

$$F_{BA}^{1} = \frac{\alpha_A + d_A^1 - 3d_B^1 + d_R^1 - 2t_R^1}{4} \quad (5)$$

$$F_{RA}^{1} = \frac{\alpha_A + d_A^1 + d_B^1 - 3d_R^1 - 2t_A^1}{4} \quad (6)$$

From the quantity equations, it is clear that each firm's supply depends negatively on its own cost, and positively on rival firms' costs. We add the three quantities to determine the total output supplied to country $A's$ consumers and use Equation (2) to compute the equilibrium price of final output in this market. Thus,

$$F_{A}^{1} = \frac{3\alpha_A - d_A^1 - d_B^1 - d_R^1 - 2t_A^1}{4} \quad (7)$$

And,

$$P_{A}^{1} = \frac{3\alpha_A + d_A^1 + d_B^1 + d_R^1 + 2t_A^1}{4} \quad (8)$$

Following the same procedure, we next solve for the third stage's solutions sets in countries B and R, and find similar solutions for the two countries. Thus, once again, we observe standard results in terms of Equations (7) and (8). However, as discussed in sub-section 2.2, two conditions constrain the activities of downstream players and the resulting equilibrium solutions in the three markets (A, B, R). The first assumes that, in any country i $(i \in \{A, B, R\})$, the downstream firms supply positive quantities, i.e., $F_{ji}^{1} > 0 \; \forall \; i, j \in \{A, B, R\}$. This condition requires that $\alpha_i > 0$ should be large enough to ensure that the second-order condition for profit maximisation is satisfied for every downstream firm. We also assume that the final goods market in each of the three countries are segmented, and the three equilibrium prices satisfy the following '*arbitrage-free*' conditions.

$$P_A^1 + t_B^1 \geq P_B^1 \geq P_A^1 - t_A^1 \quad (9)$$

$$P_A^1 + t_R^1 \geq P_R^1 \geq P_A^1 - t_R^1 \quad (10)$$

$$P_B^2 + t_R^2 \geq P_R^2 \geq P_B^2 - t_B^2 \quad (11)$$

Intuitively, these imply that the price differential between any two markets should not exceed the trade costs, and therefore, the two constraints together ensure a unique and stable Cournot equilibrium in each country.

Upstream Markets

With non-tradable intermediate inputs, the downstream firm in each country relies on the local upstream firm for its input requirement. Therefore, the derived demand for intermediate input in country A is given by the sum of the supplies of the local downstream player in the world market, i.e.,

$$I_A^1 = I_{AA}^1 = F_{AA}^1 + F_{AB}^1 + F_{AR}^1 \tag{12}$$

$$\Rightarrow I_A^1 = \frac{\alpha_A + \alpha_B + \alpha_R - 9d_A^1 + 3(d_B^1 + d_R^1) + 2\,(t_A^1 - t_B^1 - t_R^1)}{4} \tag{13}$$

And the inverse demand function is, therefore, given by

$$d_A^1 = \frac{\alpha_A + \alpha_B + \alpha_R + 3(d_B^1 + d_R^1) + 2\,(t_A^1 - t_B^1 - t_R^1) - 4\,I_A^1}{9} \tag{14}$$

The monopoly (upstream) firm, thus, maximises its profit and derive the equilibrium level of input to be supplied to the local downstream player in country A, given by:

$$I_A^1 = \frac{\alpha_A + \alpha_B + \alpha_R + 3(d_B^1 + d_R^1) + 2\,(t_A^1 - t_B^1 - t_R^1)}{8} \tag{15}$$

Substituting the value of I_A^1 in Equation (14), we find

$$d_A^1 = \frac{\alpha_A + \alpha_B + \alpha_R + 3(d_B^1 + d_R^1) + 2\,(t_A^1 - t_B^1 - t_R^1)}{18} \tag{16}$$

Similar equations characterise Stage 2 in Countries B and R as well. An important point to note here is that even though the intermediates are of the non-tradable variety, their domestic price in each country is influenced by the other countries' market sizes, the prices charged by their upstream firms, and the output-tariffs imposed by their governments (apart from the home country's market size and tariffs). This is precisely because these inputs are traded (indirectly) along with the final goods in which their services are embodied. Besides, this interdependence arises because the market share of each of the three downstream firms (as represented by Equation (7)), depends on their respective country's input prices.

Therefore, solving the three price equations simultaneously, we obtain the equilibrium values of input prices in the three markets. These prices are:

$$d_A^1 = \frac{7\alpha_A + 7(\alpha_B + \alpha_R) + 6\,t_A^1 - 10(t_B^1 + t_R^1)}{84} \tag{17}$$

$$d_B^1 = \frac{7\alpha_B + 7(\alpha_A + \alpha_R) + 6\,t_B^1 - 10(t_A^1 + t_R^1)}{84} \tag{18}$$

$$d_R^1 = \frac{7\alpha_R + 7(\alpha_A + \alpha_B) + 6\,t_R^1 - 10(t_A^1 + t_B^1)}{84} \tag{19}$$

Here, in each of the three equations, a positive coefficient on the three countries' market sizes indicates a higher demand for final goods (which are traded in the world market), and therefore, a higher derived demand for the intermediate input as well. Likewise, a higher import tariff imposed by any country's government (in contrast to a higher tariff imposed by its trading partners) discourages imports while encouraging domestic production and hence, domestic requirement of inputs rises. Higher demand for inputs, in turn, leads to a higher market price in each of the three countries.

Tariffs and Welfare

Finally, we solve for the equilibrium in stage 1 of this game, where the governments simultaneously decide about their respective country's optimal level of output-tariffs (considering the other countries' tariffs as given). With the involvement of this fourth agent, the welfare in each country is equal to the sum of consumer surplus, producer surplus, and tariff revenue. Therefore, using the first-order condition, i.e., $\frac{\partial W_i^1}{\partial t_i^1} = 0$ $(i \in \{A, B, R\})$, we derive the optimal output-tariff rate in A, B, and R as

$$t_A^1 = 0.322\alpha_A - 0.045(\alpha_B + \alpha_R) + 0.041(t_B^1 + t_R^1) \tag{20}$$

$$t_B^1 = 0.322\alpha_B - 0.045(\alpha_A + \alpha_R) + 0.041(t_A^1 + t_R^1) \tag{21}$$

$$t_R^1 = 0.322\alpha_R - 0.045(\alpha_A + \alpha_B) + 0.041(t_A^1 + t_B^1) \tag{22}$$

By solving these equations simultaneously, we obtain the Nash equilibrium tariffs under regime 1:

$$t_A^1 = 0.320\alpha_A - 0.033(\alpha_B + \alpha_R) \tag{23}$$

$$t_B^1 = 0.320\alpha_B - 0.033(\alpha_A + \alpha_R) \tag{24}$$

$$t_R^1 = 0.320\alpha_R - 0.033(\alpha_A + \alpha_B) \tag{25}$$

Two observations are particularly noteworthy here – one, ceteris paribus, from Equations $(20) - (22)$, it is clear that unlike those studies that assume the absence of an intermediary stage of production, tariff in each country now depends on the other countries' tariff rates as well. This is happening even when we assume that the intermediate inputs are non-tradable, and the countries only engage in horizontal trade in final goods. Further solving for the optimal rates, Equations $(23) - (25)$ indicate that it is beneficial for a country to charge a lower tariff – the smaller is its size, and the larger is the size of its trading partners. These observations can be re-interpreted in terms of the free-trade optimality for the small open economies when both the product and factor markets are perfectly competitive. Even in the presence of imperfection in the product market (if not in the factor markets), our results indicate that it is welfare-improving for a comparatively smaller country to impose a lower level of tariff vis-à-vis its larger trading partners.

Therefore, based on our assumption about market sizes, we can write the three countries' welfare function as:

$$W_A^1 = (\alpha)^2(0.053 - 0.055\theta + 0.360\theta^2) \quad (26)$$

$$W_B^1 = (\alpha)^2(0.348 - 0.006\theta + 0.016\theta^2) \quad (27)$$

$$W_R^1 = (\alpha)^2(0.348 - 0.006\theta + 0.016\theta^2) \quad (28)$$

$$\Rightarrow GW^1 = (\alpha)^2(0.750 - 0.068\theta + 0.392\theta^2) > 0 \; if \; (\alpha, \theta) > 0 \quad (29)$$

Once again, this final solution set is constrained by two conditions – one, the positive output and input conditions require that:

$$0.251 < \theta < 2.565 \quad (30)$$

while for the arbitrage-free conditions to hold,

$$0.355 < \theta < 3.375 \quad (31)$$

With $\theta > 0$, Equations (30) and (31) imply

$$0.355 < \theta < 2.565 \quad (32)$$

This implies that beyond some limit, there will exist a possibility for profitable arbitrage to occur. However, if we do not impose these conditions, then the optimal range for θ is given by $(0.251, 2.565)$. What this implies is that, unlike a perfectly competitive scenario, a shift from autarky to trade (restricted trade, in this case), doesn't necessarily guarantee higher welfare for the participating economies. Nonetheless, the welfare-maximising tariffs are also positive, and not zero as shown in Equations (20)-(22).[17]

3.2 Case 2 | *Vertically Unified Production Structure and Free Trade in Final Goods between A and B*

We now consider the possibility of the formation of a free trade agreement between countries A and B while retaining our assumption regarding autarkic intermediate input markets.

Akin to the previous case 1, there are three stages of decision making. However, the only difference is that the FTA member countries now do not impose any positive tariff on each other's imports of final goods. But to avoid tariff shopping and trade deflection, they agree to abide by the preferential ROO requirements to obtain tariff-free access to partner country's downstream market. After solving all the

[17] This is a well-established result, and has been demonstrated in studies such as Brander and Spencer (1984), Ishikawa (2000), Furusawa, Higashida and Ishikawa (2004), etc.

stages of the game, we find the range of feasible values of α, δ (ROO-induced trade cost), and θ, while ensuring that the following conditions hold:

a. A positive level of quantities for final goods produced by each downstream firm, which, in turn, will ensure positive intermediate input quantities as well. The purpose is to ensure that no single firm (upstream or downstream) ends up serving the entire world market.
b. No possibility of 'profitable arbitrage' in the case of downstream markets, i.e.

$$P_A^2 + \delta \geq P_B^2 \geq P_A^2 - \delta \tag{33}$$

$$P_A^2 + t_R^2 \geq P_R^2 \geq P_A^2 - t_R^2 \tag{34}$$

$$P_B^2 + t_R^2 \geq P_R^2 \geq P_B^2 - t_B^2 \tag{35}$$

These conditions assume a crucial role in determining which RTAs improve welfare, and under what conditions.

c. Post-FTA external tariff rates imposed by the two member countries do not exceed their pre-FTA MFN rates, i.e., $t_A^3 \leq t_A^2$ and $t_B^3 \leq t_B^2$. It is important to ensure this constraint since it is explicitly mentioned in GATT's Article XXIV that the formation of any FTA should not raise trade barriers for the non-FTA members. Henceforth, this condition is referred to as the *GATT's condition*.
d. Post-FTA external tariff rates imposed by the two member countries are more than the ROO-induced trade cost, i.e., $t_A^3 > \delta$ and $t_B^3 > \delta$. As discussed by Ju and Krishna (2005) and Chang and Xiao (2015), this condition on the ROO-cost ensures that the FTA members' external tariffs effectively induce their exporting firms to comply with the ROOs. Let's call this as the *ROO condition*.
e. Since any country would be willing to conclude an FTA as long as doing so enhances its overall welfare, we finally assume that

$$W_A^2 > W_A^1 \text{ and } W_B^2 > W_B^1$$

i.e., we subject the final set of solutions to the constraint that the post-FTA welfare level of member countries should not be less than or equal to their pre-FTA welfare level. This is referred to as the *welfare-improving condition* for the conclusion of an effective FTA.

Downstream Markets

Profit maximisation in each of the three countries' final goods market yields the following set of solutions. In country A, the total amount of final good supplied is now given by:

$$F_A^2 = \frac{3\alpha_A - d_A^2 - d_B^2 - d_R^2 - \delta - t_A^2}{4} \tag{36}$$

And, from (2),

$$P_A^2 = \frac{3\alpha_A + d_A^2 + d_B^2 + d_R^2 + \delta + t_A^2}{4} \tag{37}$$

Similarly, in country B,

$$F_B^2 = \frac{3\alpha_B - d_A^2 - d_B^2 - d_R^2 - \delta - t_B^2}{4} \qquad P_B^2 = \frac{3\alpha_B + d_A^2 + d_B^2 + d_R^2 + \delta + t_B^2}{4} \tag{38}$$

In country R, the equilibrium can be represented by the same set of equations as in Case 1, and further, we ensure that conditions (a) and (b) hold in this stage.

Upstream Markets

With no change in the second stage of this regime vis-à-vis the no-FTA case (1), the internally-consistent equilibrium prices of the three suppliers are given by:

$$d_A^2 = \frac{7(\alpha_A + \alpha_B + \alpha_R) + 3(t_A^2 + t_B^2) - 10(\delta + t_R^2)}{84} \tag{39}$$

$$d_B^2 = \frac{7(\alpha_A + \alpha_B + \alpha_R) + 3(t_A^2 + t_B^2) - 10(\delta + t_R^2)}{84} \tag{40}$$

$$d_R^2 = \frac{7(\alpha_A + \alpha_B + \alpha_R) - 13(t_A^2 + t_B^2) + 6(\delta + t_R^2)}{84} \tag{41}$$

Equations (39)-(41) show that the optimal input prices for the FTA members are decreasing in the ROO-induced cost, while that of the non-member country R, is increasing in δ. The intuition is that, ceteris paribus, higher ROO cost implies higher exporting cost for the firms operating in the member countries. Hence, they will export less within the FTA bloc compared to when δ is low. This, in turn, will reduce their production, and hence, their demand for inputs, while at the same time, raising the demand for inputs in country R. The latter happens because of a comparatively higher rise in the exports of R with a higher ROO cost.

Tariffs and Welfare

We now turn to the determination of welfare-maximising output-tariffs in each of the three countries. The only difference from Case 1 (i.e., the pre-FTA case) is that now the two FTA members do not earn any tariff revenue on their imports from each other. Solving for the three optimal output-tariff rates simultaneously, we obtain

$$t_A^2 = 0.361\delta + 0.166\alpha_A - 0.005\alpha_B - 0.048\alpha_R \tag{42}$$

$$t_B^2 = 0.361\delta - 0.005\alpha_A + 0.166\alpha_B - 0.048\alpha_R \tag{43}$$

$$t_R^2 = 0.034\delta - 0.039(\alpha_A + \alpha_B) + 0.319\alpha_R \tag{44}$$

From Equations (42)-(44), it is clear that higher ROO-induced cost is not only associated with a higher level of output-tariffs in both the FTA members (due to the ROO condition) but in the non-member country as well (because of the complementarity between different tariff rates as observed in Equations

(20)-(22)), meaning thereby it makes exports more costly in comparison to when $\delta = 0$. In fact, for countries A and B, the responsiveness of tariffs to a unit change in δ is more than the responsiveness to a unit change in their own or trading partner's market size (as represented by the parameter α).

Therefore, with $\alpha_B = \alpha_R = \alpha$ and $\alpha_A = \theta\alpha$ (where $\theta > 0$), we find

$$W_A^2 = 0.576(\delta)^2 + \alpha\delta(-0.380 + 0.055\theta) + (\alpha)^2(0.122 - 0.057\theta + 0.319(\theta)^2) \quad (45)$$

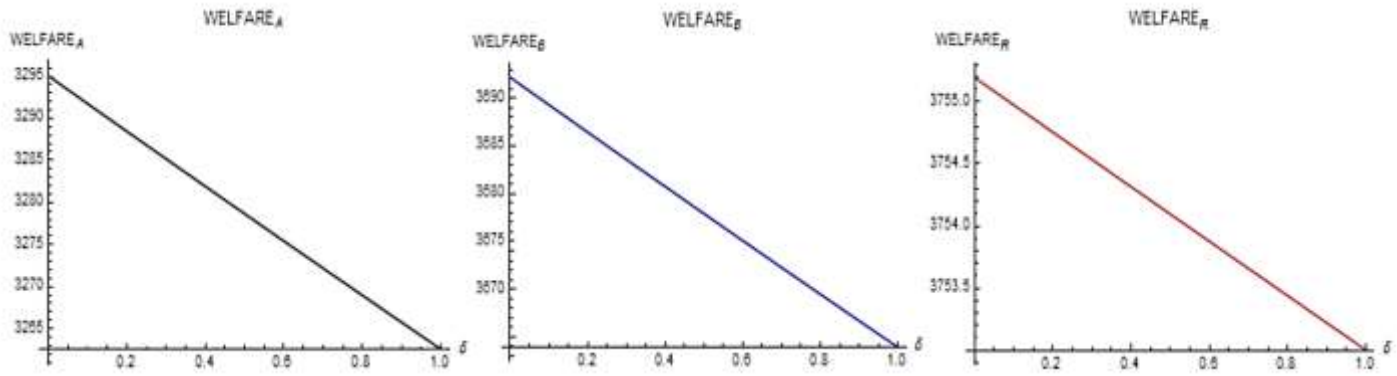
$$W_B^2 = 0.576(\delta)^2 + \alpha\delta(0.043 - 0.368\theta) + (\alpha)^2(0.312 - 0.017\theta + 0.090(\theta)^2) \quad (46)$$

$$W_R^2 = 0.009(\delta)^2 + \alpha\delta(0.0006 - 0.025\theta) + (\alpha)^2(0.358 - 0.004\theta + 0.026(\theta)^2) \quad (47)$$

$$\Rightarrow GW^2 = 1.161(\delta)^2 - \alpha\delta(0.336 + 0.339\theta) + (\alpha)^2(0.792 - 0.079\theta + 0.435(\theta)^2) \quad (48)$$

Thus, the ROO-cost, while ensuring the absence of profitable arbitrage opportunities (thereby eliminating the possibility of trade deflection), raises the cost of exporting for the downstream firm in each of the two member countries, viz. A and B, and hence, negatively affects their welfare. Figure 1 illustrates this point graphically. Assuming that α takes a value equal to 100 and θ equals 0.9, it plots each country's welfare on the vertical axis against the ROO cost on the horizontal axis.

Figure 1: ROO cost and Welfare in each country, Case 2 (α=100, θ=0.9)



Source: Author's representation

Thus, the welfare of both the member and non-member countries decreases in δ, given that other parameters remain unchanged. Moreover, the same result holds when country A becomes large vis-à-vis countries B and R (i.e., when $\theta > 1$), or when θ equals 1. This implies that the two FTA members will fix the lowest level of the ROO-induced trade cost (that prevents trade deflection), given that they have the option to choose it freely.

With these results, we next determine the feasible values of the market size asymmetry, and ROO cost that satisfy conditions (a)-(e) stated above. These conditions are a pre-requisite to ensure the formation of an effective FTA between countries A and B. For expositional simplicity, and to make our results

more intuitive, we specifically consider three different subsets of values that the parameter θ can take viz. $\{\theta: \theta \in (0,1) \cup \{1\} \cup (1,\infty)\}$. The distinctive feature of each of these subsets are as follows:

- $\theta \in (0,1)$: This implies that Country A is small vis-à-vis countries B and R, of which the latter represents the ROW.
- $\theta = \{1\}$: This case assumes the absence of any market size asymmetry, and therefore, focusses on FTAs between similar countries. In other words, the significance of this case is that it controls for the differences in market sizes of the three trading partners, allowing us to focus only on the RTA effects.[18]
- $\theta \in (1,\infty)$: In this subset, country A becomes the large country vis-à-vis the ROW.

Henceforth, we referred to these subsets as *subcases*. Since there are three parameters in our model viz. α, θ, and δ, we use three-dimensional region plots to represent our results graphically. In each of the plots, we restrict the values of α in the range $(0,100]$, and assume that $\delta \in [0,1]$, though such is not the case when we mention the feasible bounds in equation form. This has been done to intuitively interpret our results via graphical demonstration since the expressions (so derived) are quite complicated.

Subcase 2.1: $\theta \in (0,1)$

From the previous Case 1, we know that the feasible bound for θ is given by:

$$0.355 \leq \theta < 2.565$$

Therefore, along with this constraint, and assuming that conditions (a), i.e., the quantity constraint, (c) or the GATT condition, and the welfare-improving condition as in point (e), hold, we find the optimal values that the three parameters can take.

$$(\delta = 0 \;\&\; 0.781 < \theta < 1 \;\&\; \alpha > 0), \text{ or}$$

$$(\delta > 0 \;\&\; 0.781 < \theta < 1 \;\&\; \alpha > \beta^{2.1}(\theta,\delta)) \tag{49}$$

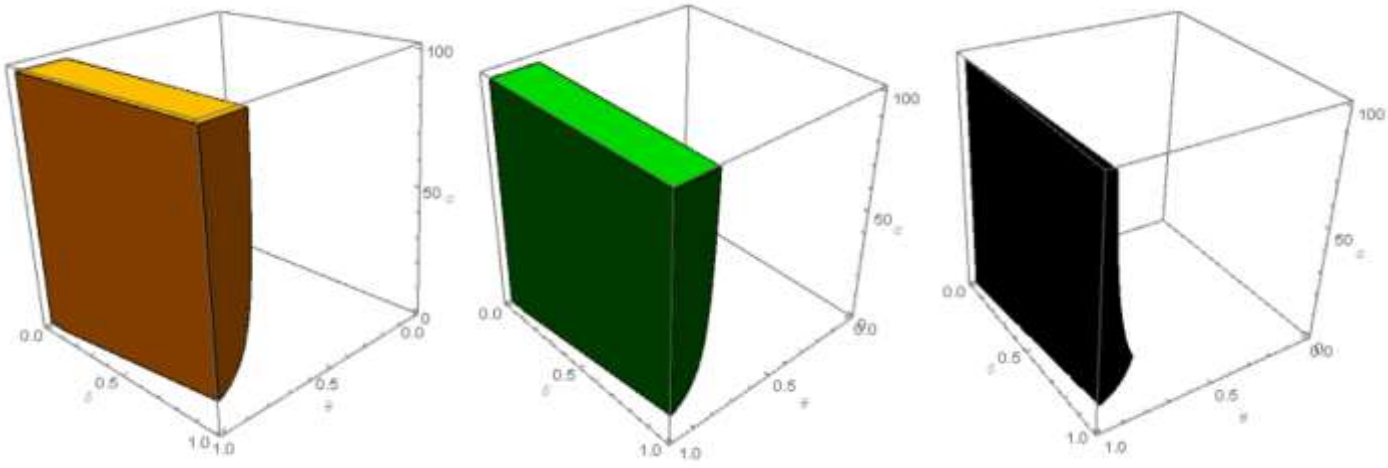
where $\beta^{2.1} = \frac{567.\left(-2.251\times10^{13}\delta+1.929\times10^{14}\delta\theta\right)}{-2.154\times10^{16}-6.591\times10^{15}\theta+4.377\times10^{16}\theta^2} + 0.5\sqrt{\frac{3.012\times10^{34}\delta^2-2.153\times10^{33}\delta^2\theta-1.201\times10^{34}\delta^2\theta^2}{\left(-2.154\times10^{16}-6.591\times10^{15}\theta+4.377\times10^{16}\theta^2\right)^2}}$

The region covered by these values is plotted in the leftmost panel (yellow-area) in Figure 2. Regardless of whether δ takes a value greater than or equal to zero, the feasible range indicates that only when the market size asymmetry is very less, i.e., when θ takes a value closer to 1, then the FTA

[18] In the presence of homogenous final goods and intermediate inputs, we can also interpret this Subcase (i.e., when $\theta = 1$) as representing the formation of a customs union between symmetric countries, but in the absence of market integration (characterised by $\delta = 0$).

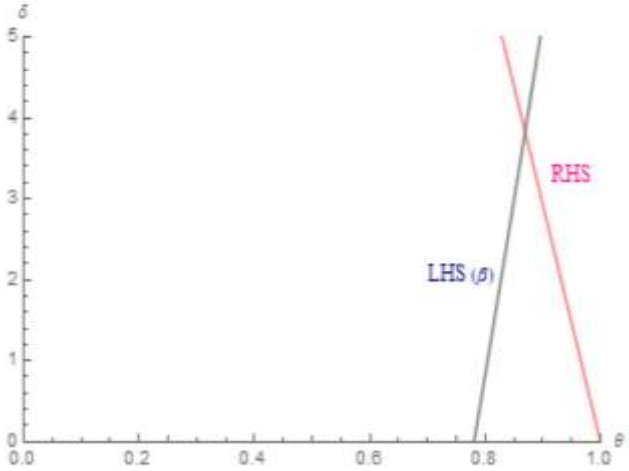
becomes welfare improving for both the partner countries. This signifies that the formation of a free trade agreement may not necessarily be Pareto-improving. In fact, a similar range binds the values of the parameters when we combine the constraints (a), (c), and (e) along with the constraint imposed by the ROO-cost that is constraint (d), as shown by the green region in the second panel of Figure 2. This implies that in this specific case, the ROO constraint is not binding. On the other hand, with a decrease in the value of θ (i.e., when $\theta \in [0.355, 0.781]$), we find that the FTA becomes welfare-deteriorating for the big country, i.e., country B.

Figure 2: Feasible Regions, Subcase 2.1



Further, it is worth noting that in equation (49), for a given value of α, $\beta^{2.1}$ represents a positive association between the values of θ and δ. In other words, it shows that when the market size asymmetry falls (in which case, the price differential will be low), the ROO cost increases. This is shown by the blue line (labelled as LHS(β)) in Figure 3. A similar result was also observed by Chang and Xiao (2015). This is because, if θ takes a value close to 1, then the welfare-improving condition will hold for both the members even at higher values of δ.

Figure 3: Relationship between Market Size Asymmetry and the ROO cost, Subcase 3.1



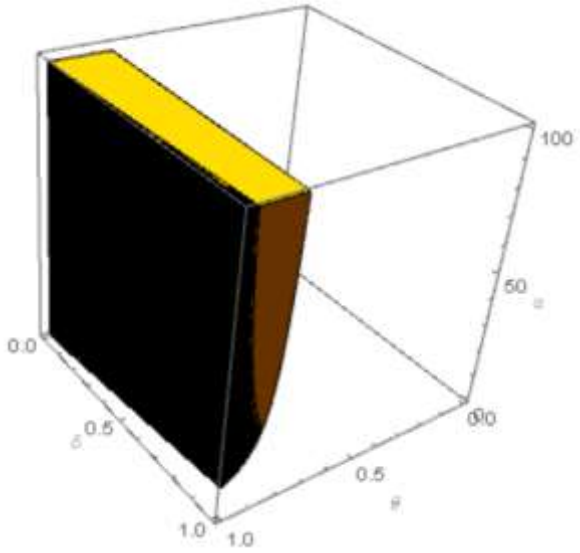
However, when we ensure that the arbitrage-free bounds also hold (as represented algebraically by the set of inequalities (33)-(35)), then we find that there exists an upper bound on the values that α can take,[19] and it shows a negative link between θ and δ (Pink line labelled as RHS in Figure 3).[20] The entire feasible region in this case (in comparison to Equation (49)), is given by:

$$\delta > 0 \;\&\; \left(0.869 < \theta \leq 1 \;\&\; \beta^{2.1} \leq \alpha \leq -\frac{1591.\delta}{-466.+466.\theta}\right) \tag{50}$$

This region has been plotted in black in the rightmost panel in Figure 2, which is smaller in volume vis-à-vis the yellow or the green regions in the other two panels of the same figure. Thus, imposing the arbitrage-free bounds restricts the solution set and shows that only a small range of parametric values supports the formation of an effective FTA with ROO. This is because when the countries are dissimilar, then the likelihood of a tariff shopping increases. Hence, the arbitrage-free bounds impose a higher penalty in terms of the ROO cost to ensure that the markets remain segmented. On the contrary, when we do not assume the 'arbitrage-free' bounds, the possibility of welfare improvement from FTAs increases as represented by Figure 4 that plots the feasible region with (black coloured region) and without (yellow and black coloured region) the arbitrage-free constraints.[21]

Figure 4: Area bounded by the (effective) welfare-improving A-B FTA, Subcase 2.1

[19] Such an upper bound is usually missing from studies that assume the absence of arbitrage-free bounds.
[20] Here, the LHS and RHS correspond to the lower and upper bounds of α in equation (50).
[21] Even though a standard comparison is not possible because we don't have free trade, and ours is a qualification vis-à-vis the perfect competition framework, yet here also the general equilibrium results regarding free trade optimality holds.



Assessment of gains from the $A-B$ FTA, and its effect on MFN tariffs

In the feasible region represented by equation (50), we find that even though the welfare of country A falls short of the welfare of country B as in the previous two cases when $\theta < 1$, but the change in welfare for the former is (unambiguously) more than the increase in welfare for country B with the formation of the FTA. This implies, like in the case of perfectly competitive markets, a smaller partner gains more from integration vis-à-vis the large partner as freer trade does not enlarge the latter's market by as much as it does the smaller partner's market access (Schiff 1996, Soo 2011). An important observation is that the $A-B$ FTA necessarily worsens the trade balance of country B vis-à-vis the smaller partner, yet it gains in terms of welfare within the feasible region. Further, decomposition of welfare gains shows that while the FTA ensures higher consumer surplus as well as higher profits for the upstream firm in each of the two members, it reduces surplus for the downstream firms. This is because, with FTA, their exports increase to the member country and to the rest of the world, and so do their export earnings, but their revenue from domestic sales fall. As a consequence, their total profits (i.e., earnings from both domestic and export sales) decline vis-à-vis the pre-FTA scenario. Thus, even though free trade expands the market coverage for the downstream firms within the FTA, but it does so at the expense of their sales in their own domestic markets. This is the reason why domestic producers or producer lobby often urge the government to deviate from liberal trade policy.[22] This means that in order to leverage The gains to consumers, on the other hand, can be explained via the so-called pro-competitive effects of trade due to a fall in price of final goods (Impullitti and Licandro 2018), while the upstream firms profit with an increase in overall demand for final goods in the two markets. Moreover, our findings also suggest that the FTA necessarily improves the participating

[22] To some extent, these findings relate to the complaints registered by the local Television manufacturing units in India regarding the adverse effects of zero duty imports of TVs (from the ASEAN countries, specifically Vietnam) on their domestic production as well as sales (Rathee 2019).

countries' terms of trade vis-à-vis the rest of the world.[23] This is despite the fact that the FTA members reduce their external tariff imposed on imports from country R, unlike what we observe in the case of a perfectly competitive framework, where lower tariffs are associated with lower terms of trade (Batra 1973).

It is worth pointing out here that in the pre-FTA case (1), $d_A^1 < d_B^1 = d_R^1$. What this implies is that the free trade area leads to some degree of trade diversion in the case of country A by shifting some of the production of final goods to countries B and R, while it leads to only trade creation in the case of B. Thus, the arguments by Lipsey (1957) and Bhagwati (1971) regarding welfare-enhancing effects of a trade diverting FTA, also hold in the present case with imperfectly competitive output and input markets, and intra-industry trade. A similar outcome was also observed by Krishna (1998).

Further, we find that even if we do not put impose the tariff condition (c), then also, under the feasible bounds, Bagwell-Staiger's tariff complementarity effect holds[24] – i.e., the bilateral FTA induces each of the member countries to reduce the external tariff rate imposed on imports from the non-member country, R. In fact, in response to this, within the feasible bounds, the MFN tariff imposed by the non-member country also reduces in comparison to case 1. Equation (51) indicates the link between the output-tariffs set by the FTA members and the non-member, R.

$$t_R^2 = 0.008\delta - 0.045(\alpha_A + \alpha_B) + 0.322\alpha_R - 0.036(t_A^3 + t_B^3)) \tag{51}$$

What about country R's welfare, and how does it compare with the welfare gains to the FTA partners? – In the region bounded by inequality (50), the welfare of R is higher than the pre-FTA case, and it is also higher than the welfare of the similar-sized country B. This implies that the non-member is able to accrue substantial gains when the member countries integrate with each other. This is because the external tariffs imposed by all the countries reduce, and hence, country R's trade with the two FTA members also increases, and so does its total welfare. However, while comparing the gains with country A, we find that for the majority of the combinations of parametric values (approx. 75 per cent), gains are higher for the small FTA member than the rest of the world. We also find that while the $A - B$ FTA unambiguously benefits the producers in country R, the consumers suffer from welfare loss due to an increase in the price of final good in the post FTA scenario. This is because of a higher rise in the price of intermediate inputs in country R (with an increase in its demand by the downstream firm), vis-à-vis the FTA members.

[23] The terms of trade, for any country, represent the ratio of export-price to import price. For instance, for country A's trade with country R, export price is given by p_R^3, i.e., the price at which A's goods are sold in R's downstream market, and accordingly, the import price is given p_A^3.
[24] Bagwell and Staiger (1999).

These findings can be summarised in the following proposition.

Proposition 1. *In a 3-country, 2 (imperfectly-competitive) sector framework with non-tradable intermediate inputs, forming a free trade agreement between a small and a large trading partner (when the rest of the world is also large) with rules of origin is welfare improving only when the degree of market size asymmetry is very less, and the ROO-induced trade cost is not very high. The critical value of this preferential cost varies positively or negatively with the degree of market size asymmetry depending upon whether or not the arbitrage-free bounds (ensuring the absence of trade deflection) hold. Nonetheless, the rest of the world unambiguously benefits from the welfare-improving FTA between the two participating economies.*

Subcase 2.2: $\theta \in \{1\}$

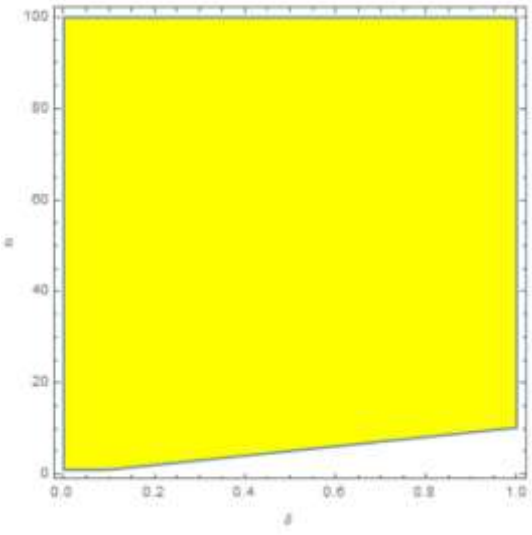
In the absence of any market size asymmetry, we find that the feasible region is given by:

$$\delta = 0 \,\&\, \alpha > 0, \text{ or}$$

$$0 \leq \delta \leq 0.098\alpha \tag{52}$$

Figure 5 plots the range of values that ensure the formation of an effective FTA between countries A and B.

Figure 5: Region bounded by the (effective) welfare-improving A-B FTA, Subcase 2.2



Rest all the results remain the same as in the case when $\theta < 1$. In fact, for all three countries, we find higher welfare is positively associated with the size of their economies and negatively associated with the ROO-induced trade cost. More so, any change in δ impacts the FTA members more than it impacts the non-FTA country. This implies that the welfare-enhancing effects of FTAs depend not so much (only) on the three countries' market sizes but on the preferential rules of origin, which should be strategically designed in order to ensure that FTAs lead to economic gains for the member economies.

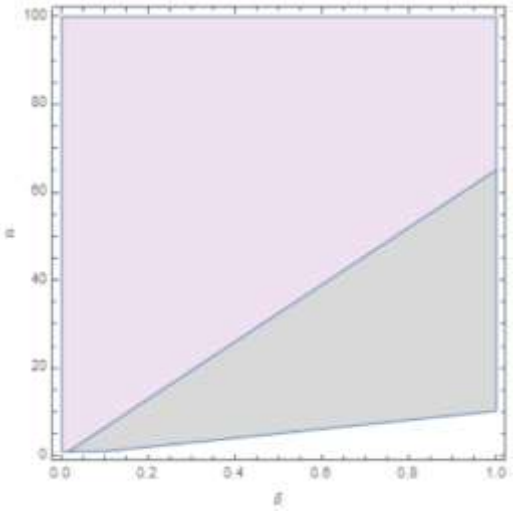
On comparing the rise in welfare from the pre- to the post-FTA scenarios for the member and the non-member countries, we find:[25]

$$W^2_{AorB} - W^2_{AorB} > W^2_R - W^1_R \text{ if } 0 \leq \delta < 0.015a$$

$$W^2_{AorB} - W^1_{AorB} \leq W^2_R - W^1_R \text{ if } 0.015 \leq \delta < 0.098a$$

Thus, the lower the value of δ, the higher are the chances that the rise in welfare level will be more for the members than for the non-member country. Figure 6 also highlights this point, where the change in welfare is higher for the partner countries in the purple region, while the grey area represents the opposite case. The figure plots a on the vertical axis whilst δ on the horizontal axis.

Figure 6: Gains from FTA (Members V/s Non-Member), Subcase 2.2



Subcase 2.3: $\theta \in (1, \infty)$

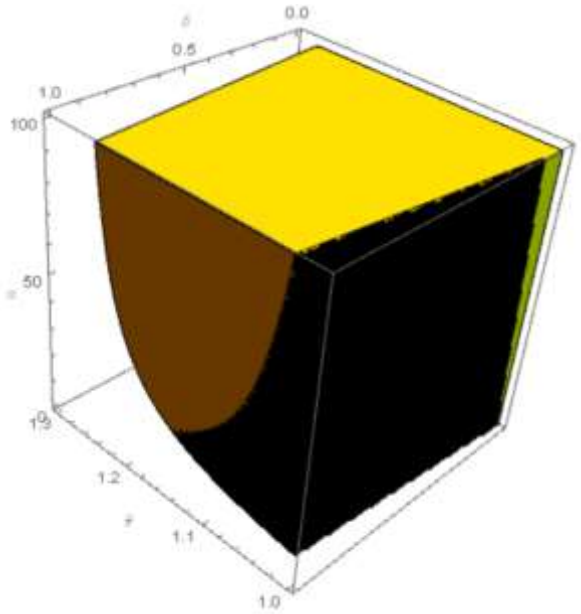
This case considers country A as a large country, and countries B and R as small. Once again, we find that the arbitrage-free bounds restrict the parameter space by a large amount, and only the black region in Figure 7 represents the feasible set of values for α, θ, and δ to ensure an effective FTA. On the contrary, the entire coloured region (yellow plus black) represents the feasible bounds when we do not put the arbitrage-free constraints to ensure a stable equilibrium. Algebraically, the region is defined by the following:

$$\delta > 0 \;\&\; 1 < \theta < 1.151 \;\&\; \beta^{2.3} < \alpha \leq -\frac{3.414\delta}{1.-1.\theta} \tag{53}$$

where, $$\beta^{2.3} = \frac{\delta(-4.514\times10^{17}+6.495\times10^{16}\theta)}{-1.629\times10^{17}+3.774\times10^{15}\theta+9.656\times10^{16}\theta^2} + \sqrt{\frac{\delta^2(-1.900\times10^{34}-5.348\times10^{34}\theta+1.363\times10^{35}\theta^2)}{(1.629\times10^{17}-3.774\times10^{15}\theta-9.656\times10^{16}\theta^2)^2}}$$

[25] From symmetry, A's welfare is same as B's welfare.

Figure 7: Region bounded by the (effective) welfare-improving A-B FTA, Subcase 2.3



Regardless of whether country R is small or large, we find that, in the free trade area, a large country's welfare is more than the small country's welfare. However, the rise in welfare (from pre- to post-FTA scenario) is more for the smaller partner (i.e., partner B in the present subcase) in the entire feasible region. This is despite the fact that the larger country's trade balance worsens post the conclusion of the FTA. The welfare of country R also increases, and therefore, the world welfare (or the global welfare) as well. But, in contrast to Subcase 2.1, we find that for most of the feasible parametric values, country B now gains more from engaging into the $A-B$ FTA vis-à-vis country R. Therefore, we establish the following proposition.

Proposition 2. *In our 3-country, 2 (imperfectly-competitive) sector framework with non-tradable intermediate inputs, the formation of a welfare-improving FTA between two asymmetric countries (where asymmetry is measured in terms of their market sizes) always benefits the smaller partner more vis-à-vis the large partner, irrespective of whether the non-member country is small or large. When the non-member country is small and is similar in market size as one of the FTA members, then, at all optimal equilibria, we find that the welfare gains for the non-member unambiguously exceed the gains to the smaller FTA member (due to the formation of the FTA). However, when the non-member country is large, then the similar-sized partner gains more for the majority of the combinations of the feasible parametric values.*

This means that if one small country partners with a large country, then it may also incentivise the other small country to join the agreement to appropriate higher gains from free trade – something that has also been observed empirically as well. This also relates to the domino theory of regionalism, as

explained by Baldwin (1993), and demonstrates the so-called 'contagion effect' in the proliferation of FTAs in the past few decades (Baldwin and Jaimovich 2012).[26]

Not only B gains more, but the terms of trade of both the FTA partners improve vis-à-vis the rest of the world with the conclusion of the $A - B$ FTA. However, R's welfare gains are more than the larger partner's gains. Further, our results suggest that the MFN tariff of R necessarily reduces in comparison to Case 2. Thus, within the context of our framework, when $\theta > 1$, it seems plausible to conclude that regionalism acts as a building block towards multilateral free trade.

3.3 Case 3 | *Vertically-linked production structures and Trade in Final and Intermediate Goods*

So far, we have addressed the possibility of only horizontal trade between countries. However, vertical trade, i.e., a trade where trading partners transact in different stages of production, has gained significant importance in the past few decades. In fact, these types of transactions lead to the formation of what are popularly referred to as the global value chains or GVCs.

In reality, a GVC may consist of 'n' different stages of production being carried out at 'n' different places in the world market ($n \epsilon \mathbb{N}$), however, in our present setup, we are considering only a 2-stage value chain where the first stage involves production of an intermediate input and the final stage involves transformation of this input into a final good for consumption. Further, we assume that all three countries now start trading in both intermediate inputs and final goods. Like in the case of final goods, each upstream supplier also employs a Cournot strategy while deciding how much to sell in a particular market, taking as given the quantity of inputs produced and sold by the other two firms. The role of arbitrage-free bounds cannot be neglected in determining the final equilibrium in the intermediate input market as well.

Downstream Markets

As in the Case 1, with trade in only final goods, a similar set of equations will characterise the equilibrium in the three downstream markets in this case as well.

Upstream Markets

In stage 2, however, the three upstream firms (one from each country) compete in quantities in each of the three countries, and decide about the optimal level of inputs to be supplied to their own downstream market, and the downstream firms in other countries. Once again, due to market segmentation, it is sufficient to focus on only one country's equilibrium level of input (and hence,

[26] Even though we do not explicitly model the behaviour of the non-member on formation of FTAs between the member countries, our finding suggests a purely economic motive that might have induced the non-members to join some of the free trade agreements.

market prices). Thus, based on the (stage-1) market-clearing conditions in the three countries, we can derive the inverse demand for the intermediate input by the downstream firm in country A as follows

$$I_A^3 = \sum_i F_{Ai}^3 \qquad \text{where } i = \{A, B, R\}$$

$$\Rightarrow I_A^3 = \frac{a_A + a_B + a_R - 9\,d_A^3 + 3\,(d_B^3 + d_R^3) + 2\,(t_A^3 - t_B^3 - t_R^3)}{4} \tag{54}$$

$$\Rightarrow d_A^3 = \frac{a_A + a_B + a_R - 9\,d_A^3 + 3\,(d_B^3 + d_R^3) + 2\,(t_A^3 - t_B^3 - t_R^3) - 4I_A^3}{9} \tag{55}$$

Now, based on our technological assumption, the derived demand by country A's final output producer can be obtained by summing up the supplies of the intermediate inputs from its own country's supplier, and producers in other foreign countries, viz. countries B and R. Algebraically,

$$I_A^3 = \sum_i I_{iA}^3 \qquad \text{where } i = \{A, B, R\} \tag{56}$$

The profit functions of the three suppliers are given by:

$$\tau_{AA}^3 = (d_A^3)\, I_{AA}^3 \tag{57}$$

$$\tau_{BA}^3 = (d_A^3 - s_A^3)\, I_{BA}^3 \tag{58}$$

$$\tau_{RA}^3 = (d_A^3 - s_A^3)\, I_{RA}^3 \tag{59}$$

where s_A^3 represents the (MFN) input-tariff imposed by country A's government. By assumption, (akin to final good's case) no country imposes any tax on the local upstream firm. Considering d_B^3 and d_R^3 as exogenous, the marginal first-order conditions (FOCs) for the two exporters along with the FOC for the local player determine the optimal level of inputs to be supplied to country A's downstream firm. These quantities are given by:

$$I_{AA}^3 = \frac{a_A + a_B + a_R - 9\,d_A^3 + 3\,(d_B^3 + d_R^3) + 18s_A^3 + 2\,(t_A^3 - t_B^3 - t_R^3)}{16} \tag{60}$$

$$I_{BA}^3 = \frac{a_A + a_B + a_R - 9\,d_A^3 + 3\,(d_B^3 + d_R^3) - 18s_A^3 + 2\,(t_A^3 - t_B^3 - t_R^3)}{16} \tag{61}$$

$$I_{RA}^3 = \frac{a_A + a_B + a_R - 9\,d_A^3 + 3\,(d_B^3 + d_R^3) - 18s_A^3 + 2\,(t_A^3 - t_B^3 - t_R^3)}{16} \tag{62}$$

$$\Rightarrow d_A^3 = \frac{a_A + a_B + a_R - 9\,d_A^3 + 3\,(d_B^3 + d_R^3) + 18s_A^3 + 2\,(t_A^3 - t_B^3 - t_R^3)}{36} \tag{63}$$

Similarly, solving stage 2 in upstream markets of B and R, we find

$$d_B^3 = \frac{a_A + a_B + a_R - 9\,d_A^3 + 3\,(d_A^3 + d_R^3) + 18s_B^3 + 2\,(-t_A^3 + t_B^3 - t_R^3)}{36} \tag{64}$$

$$d_R^3 = \frac{a_A + a_B + a_R - 9\,d_A^3 + 3\,(d_A^3 + d_B^3) + 18s_R^3 + 2\,(-t_A^3 - t_B^3 + t_R^3)}{36} \tag{65}$$

As stated earlier, it is important to note that with quantity competition, there is no strategic interdependence between the three country's input prices. This interdependence arises only because of the interaction of the three downstream players in the third stage in each of the three countries. This is because, the value of the final goods produced by each firm, in turn, depends upon the cost of intermediate inputs in each market. The three equations (63), (64), and (65) are thus solved simultaneously to obtain:

$$d_A^3 = 0.033(a_A + a_B + a_R) + 0.508s_A^3 + 0.046(s_B^3 + s_R^3 + t_A^3) - (t_B^3 + t_R^3) \qquad (66)$$

A similar equation characterises the equilibrium input prices in countries B and R as well. Thus, what we observe from here is that a country's intermediate input price varies positively with input tariffs imposed by its own government and so does with input tariffs imposed by others. The former could be because tariffs lead to an increase in domestic prices of the importable good (at least in the absence of a (Metzler) paradoxical kind of situation). The positive association could also be due to each producer's market power that allows him to shift some burden of tariffs on to the final consumers (i.e., downstream firms in our case). Further, with an increase in input-tariff imposed by foreign countries, the price of their inputs increases, thereby raising the cost of producing the final output by their respective downstream firm. Consequently, the demand for their final output falls in the world market, of which country A is a part. As a result, the demand for country A's final output may rise. This leads to an increase in its derived demand of input and hence, an increase in input price too.

Further, it is necessary to ensure that the opening up of upstream markets does not lead to profitable arbitrage opportunities. Therefore, we assume that the following set of inequalities hold:

$$d_A^3 + s_B^3 \geq d_B^3 \geq d_A^3 - s_A^3 \qquad (67)$$

$$d_A^3 + s_R^3 \geq d_R^3 \geq d_A^3 - s_A^3 \qquad (68)$$

$$d_B^3 + s_R^3 \geq d_R^3 \geq d_B^3 - s_B^3 \qquad (69)$$

Tariffs and Welfare

Akin to the previous cases, the welfare of country i (where $i = \{A, B, R\}$) is equal to the sum of domestic surplus and export profits. However, domestic surplus now also includes revenues earned from the imposition of input-tariffs. Thus, with no FTA, each country chooses its non-discriminatory input as well as output tariff to maximize its own welfare. From the FOCs, and given the rate of input and output tariffs imposed by the other two countries' governments, we find that for country A,

$$t_A^3 = 0.296\alpha_A - 0.035(\alpha_B + \alpha_R) + 0.008(s_B^3 + s_R^3) + 0.028(t_B^3 + t_R^3) \qquad (70)$$

$$s_A^3 = 0.030\alpha_A + 0.029(\alpha_B + \alpha_R) + 0.009(s_B^3 + s_R^3) - 0.043(t_B^3 + t_R^3) \qquad (71)$$

Thus, unlike the results observed by Freund (2000) and Saggi (2006), country A's tariffs depend on the other countries' tariff rates even in the presence of segmented markets and constant marginal costs of producing the intermediate inputs. This feature is specific to models that assume different stages of production. The problem confronting the other countries is exactly analogous to that confronting in country A, and therefore solving the three countries' tariff equations simultaneously, we obtain

$$t_A^3 = 0.295\alpha_A - 0.027(\alpha_B + \alpha_R) \qquad s_A^3 = 0.032\alpha_A - 0.018(\alpha_B + \alpha_R) \tag{72}$$

$$t_B^3 = 0.295\alpha_B - 0.027(\alpha_A + \alpha_R) \qquad s_B^3 = 0.032\alpha_B - 0.018(\alpha_A + \alpha_R) \tag{73}$$

$$t_R^3 = 0.295\alpha_R - 0.027(\alpha_A + \alpha_B) \qquad s_R^3 = 0.032\alpha_R - 0.018(\alpha_A + \alpha_B) \tag{74}$$

These results are similar to what we observed in equations (20) – (22), and with $\alpha_B = \alpha_R = \alpha$ and $\alpha_A = \theta\alpha$, we find

$$W_A^3 = (\alpha)^2(0.052 - 0.032\theta + 0.373\theta^2) \tag{75}$$

$$W_B^3 = (\alpha)^2(0.374 - 0.001\theta + 0.018\theta^2) \tag{76}$$

$$W_R^3 = (\alpha)^2(0.374 - 0.001\theta + 0.018\theta^2) \tag{77}$$

$$\Rightarrow GW^3 = (\alpha)^2(0.800 - 0.030\theta + 0.408\theta^2) \tag{78}$$

Further, assuming that all the quantities are positive, and the arbitrage-free conditions bind the final set of solutions, we determine the (feasible) degree of market size asymmetry, as represented by equation (79):

$$\alpha > 0 \;\&\; 0.375 \leq \theta \leq 3.062 \tag{79}$$

Before switching to the next case, i.e., Case 4, to assess the welfare-improving effects of an FTA (with an emphasis on trade in final goods) in the presence of vertically integrated markets, we compare the outcomes from Case 3 vis-à-vis Case 1 with vertically unified product markets. Table 1 briefly encapsulates our findings from this analysis, which can be summarised in the following proposition:

Proposition 3. *In our 3-country, 2 (imperfectly-competitive) sector framework, the opening up of intermediate input markets incentivises the three economies to reduce their nominal output tariffs (in almost all the optimal equilibria) and expand their overall trade volumes, regardless of whether the degree of market size asymmetry is greater than or equal to or less than one. In doing so, the welfare of each country rises, and so does the global welfare.*

Table 1: Comparison of Outcomes, Case 3 Vs. Case 1

S. No.	Basis for Comparison	Observations (Case 3 V/s Case 1)

1	Feasible Region	In comparison to Case 3, the feasible values of θ in Case 1, belong to the range [0.355, 2.565). This implies that introducing vertically integrated production structures allows for a greater degree of market size asymmetry when $\theta > 1$, while allowing for a little less asymmetry when $\theta < 1$ (ensuring the absence of any profitable arbitrage opportunities). However, the overall feasible range for θ, unambiguously increases. What this could imply is that the introduction of tradable intermediates allows a wider range of (welfare-improving) trade participation even between those set of countries who do not (otherwise) trade with each other.[27]
2	Output-tariffs	$t_A^3 \geq t_A^1 \; if \; 0.375 \leq \theta \leq 0.456$ $t_A^3 < t_A^1 \; if \; 0.456 < \theta < 2.565$ However, tariff rates for countries B and R unambiguously fall in the entire feasible range. This implies that fragmented production structures or the so-called international production chains assume a crucial role in guiding a country's trade policy. Blanchard, Bown and Johnson (2017) also reached a similar conclusion in an empirical study on GVCs and trade policy for a total of 14 major economies during the period 1995-2009.
3	Trade	With a fall in output-tariffs, we find that all three countries trade more in final goods in Case 3 than in Case 1.
4	Welfare of each country	In each of the three countries, consumer surplus, profits for the final good producers, and tariff revenues are higher in Case 4 than in Case 2. However, the surplus for the upstream firms is lower than before. This mainly happens because of the inelastic nature of the input demand in our set up. Nonetheless, the total welfare increases with the opening up of the input markets.
5	Global Welfare	Global welfare is also higher in Case 3, than in Case 1.

[27] In our model set-up, value added of final good exceeds the value added of intermediate inputs. Thus, our findings imply that these global production/supply chains enable the trade and exchange of even low value-added tasks, and hence allow the hitherto less open economies to expand their trade volumes and raise their overall welfare, while benefitting other large open economies too as the latter get access to relatively cheaper inputs.

Thus, becoming a part of a global value chain or opening up of intermediate input markets, not only ensures higher welfare for the participating economies but also incentivises them to adopt liberalised trade policies, hence, benefitting the world as a whole.

3.4 Case 4 | *Trade in Final and Intermediate Goods, FTA in Final Goods*

In this case, we assume that countries A and B enter into a free trade agreement whereby they agree to eliminate tariffs on each other's exports of the final good. However, intermediate inputs become a part of the negative list on which tariffs are not eliminated.

Apart from analysing the welfare effects of this FTA, we will also assess its benefits vis-à-vis case 2 in which intermediates were assumed to be non-tradable in nature. Further, in the next sub-section, we will also compare and contrast the welfare with respect to the FTA that allows free trade in intermediates (i.e., with Case 5).

Downstream Markets

Stage 3 solutions are similar to those observed in case 2. These solutions are constrained by positive quantity conditions, and the arbitrage-free bounds as represented by Equations (33)- (35).

Upstream Markets

With no change in Stage 2 of this game, we follow the same procedure as in the previous case 3 (the pre-FTA scenario but with trade in intermediates) and find the consistent equilibrium values of intermediate input prices in the three countries. These prices are:

$$d_A^4 = 0.033(a_A + a_B + a_R) + 0.508s_A^4 + 0.046(s_B^4 + s_R^4) + 0.023(t_A^4 + t_B^4) - 0.056(\delta + t_R^4) \quad (80)$$

$$d_B^4 = 0.033(a_A + a_B + a_R) + 0.508s_B^4 + 0.046(s_A^4 + s_R^4) + 0.023(t_A^4 + t_B^4) - 0.056(\delta + t_R^4) \quad (81)$$

$$d_R^4 = 0.033(a_A + a_B + a_R) + 0.508s_A^4 + 0.046(s_B^4 + s_R^4) - 0.079(t_A^4 + t_B^4) + 0.046(\delta - t_R^4) \quad (82)$$

Thus, once again, we find that the optimal input prices vary negatively with the ROO cost in the case of the two FTA members, while it is directly related to δ in the case of country R. Nonetheless, we impose the arbitrage-free bounds in the three upstream markets to ensure the stability of Cournot equilibrium in each of them.

Tariffs and Welfare

The welfare maximising governments in countries A and B implement a positive input-tariff on intra-FTA imports, as on the imports from country R. However, a positive output-tariff is imposed only on imports of final goods from country R. Besides, the latter continues to impose the non-preferential

tariffs on its imports of intermediate inputs and final goods. The following equations (83)-(88) represent the consistent Nash equilibrium tariffs rates in the three countries:

$$t_A^4 = 0.147a_A - 0.007a_B - 0.036a_R + 0.351\delta \quad (83)$$

$$t_B^4 = -0.007a_A + 0.147a_B - 0.036a_R + 0.351\delta \quad (84)$$

$$t_R^4 = -0.032(a_A + a_B) + 0.295a_R + 0.029\delta \quad (85)$$

$$s_A^4 = 0.0001a_A + 0.037a_B + 0.017a_R - 0.003\delta \quad (86)$$

$$s_B^4 = 0.037a_A + 0.0001a_B + 0.017a_R - 0.003\delta \quad (87)$$

$$s_R^4 = 0.021(a_A + a_B) + 0.034a_R - 0.012\delta \quad (88)$$

So, a higher ROO cost, while being positively associated with the output-tariffs (due to the so-called ROO condition), negatively impacts the optimal rate of input-tariffs. This could be because a higher output-tariff implies a higher cost of importing, which, in turn, negatively affects the imports of any country while positively impacting its local production of the final good. Since a higher production of final goods requires more intermediate inputs as well (some of which are also imported from abroad), a lower s_i^4 $(i \in \{A, B, R\})$ reduces the cost of imports, and hence, the cost of producing final good. Substituting Equations (83)-(88) in the second and third stage solutions, and therefore, in the welfare-functions of the three countries, where $\alpha_B = \alpha_R = \alpha$ and $\alpha_A = \theta\alpha$ (where $\theta > 0$), we find

$$W_A^4 = 0.590(\delta)^2 + \alpha\delta(-0.375 + 0.032\theta) + (\alpha)^2(0.113 - 0.031\theta + 0.335(\theta)^2) \quad (89)$$

$$W_B^4 = 0.590(\delta)^2 + \alpha\delta(0.027 - 0.371\theta) + (\alpha)^2(0.341 - 0.009\theta + 0.085(\theta)^2) \quad (90)$$

$$W_R^4 = 0.010(\delta)^2 - \alpha\delta(0.014 + 0.022\theta) + (\alpha)^2(0.387 + 0.005\theta + 0.028(\theta)^2) \quad (91)$$

$$\Rightarrow GW^4 = 1.190(\delta)^2 - \alpha\delta(0.336 + 0.339\theta) + (\alpha)^2(0.841 - 0.035\theta + 0.448(\theta)^2) \quad (92)$$

Although the ROO-cost helps in ensuring the absence of parallel imports or trade deflection even after the formation of an FTA, yet higher the ROO cost, ceteris paribus, lower is the welfare of any country (member or non-member, i.e., country R). This result is analogous to what we observed in case 2.

Next, we determine the feasible range of values for α, market size asymmetry, and the ROO-induced cost. Akin to case 2, for ease of interpretation, we consider three subcases viz. $\{\theta: \theta \in (0,1) \cup \{1\} \cup (1,\infty)\}$ and subject the optimal solutions so obtained to the five pre-requisites for ensuring the formation of an effective FTA (with ROO). The only difference from case 2 is that now we have to ensure that the arbitrage-free bounds hold in upstream markets as well. Further, we also assess whether FTAs lead to higher welfare gains in the presence or the absence of tradable intermediates. In so doing, we obtain the following proposition:

Proposition 4. *In our 3-country, 2 (imperfectly-competitive) sector framework with tradable intermediate inputs, even though a greater degree of market size asymmetry supports welfare-enhancing trade between the three trading partners compared to when the inputs are non-tradable, such is not the case when a pair of two asymmetric countries bilaterally eliminate output-tariffs on each other's imports. In the case of the latter, an even smaller range of the degree of market size asymmetry supports the formation of a free trade zone (when intermediate inputs become a part of the exclusion list) between the two partners, regardless of whether their (bilateral) trade balance improves or worsens after the conclusion of the FTA.*

Proof of this proposition is discussed in the three subcases below.

Subcase 4.1: $\theta \in (0, 1)$

In Case 3, given $\alpha > 0$, the feasible bound for θ was given by:

$$0.375 \leq \theta \leq 3.062$$

Combining this constraint with the ones ensuring positive quantities, lower external tariffs (vis-à-vis the pre-FTA scenario), and the welfare-improving conditions, while assuming $\theta < 1$, we find

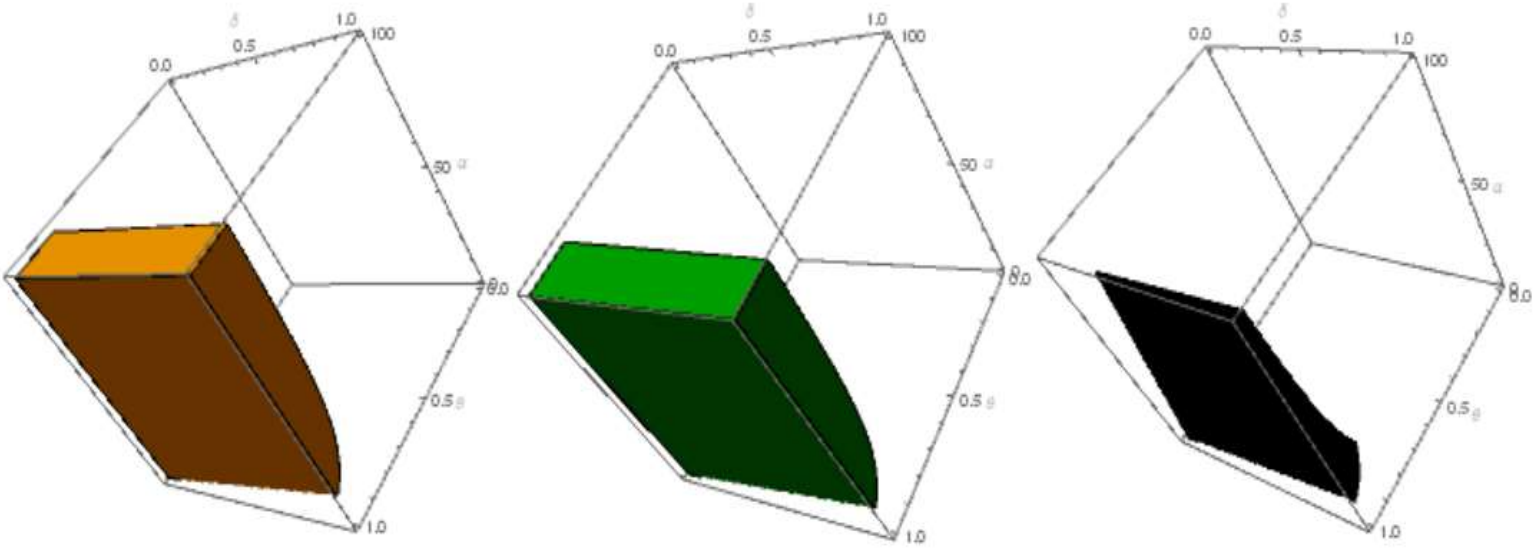
$$\delta \geq 0 \;\&\; 0.779 < \theta < 1 \;\&\; \alpha > \beta^{4.1} \tag{93}$$

Where

$$\beta^{4.1} = 2.339 \times 10^{-9} \sqrt{\frac{\delta^2(1.544\times10^{66}+6.272\times10^{64}\theta-4.207\times10^{65}\theta^2)}{(6.858\times10^{23}+2.052\times10^{23}\theta-1.392\times10^{24}\theta^2)^2}} + \frac{\delta(-2.820\times10^{23}+3.832\times10^{24}\theta)}{-6.858\times10^{23}-2.052\times10^{23}\theta+1.392\times10^{24}\theta^2}$$

This region is shown in the leftmost panel of Figure 8. This is the same as the region when we also include the ROO constraint, i.e. when we assume that the ROO cost is strictly less than the FTA partners' external output-tariffs (the green coloured region in the middle panel of Figure 8).

Figure 8: Region bounded by the (effective) welfare-improving A-B FTA, Subcase 4.1



However, imposing the arbitrage-free bounds limits the parametric space, and only a small subset of values supports the formation of an effective FTA. The black coloured region shows this in the rightmost panel of Figure 8. Equation (94) algebraically represents this range.[28]

$$\delta > 0 \;\&\; 0.876 < \theta < 1 \;\&\; \beta^{4.1} < \alpha \leq \frac{1.133\times10^{16}\delta}{3.270\times10^{15}-3.270\times10^{15}\theta} \tag{94}$$

In this range, θ takes values that are close to one. This implies that in an imperfectly competitive setup like ours, even with vertical trade, an effective FTA could be formed only between countries that are not very different from each other in terms of their market sizes, provided that the arbitrage-free bounds hold. In the absence of these bounds, however, the range of θ increases, as shown by the yellow or green regions in the leftmost and middle-panel of Figure 8. Further, it is imperative to note that the parametric values are constrained by the welfare-improving condition for country B, i.e., the larger FTA partner (whose deficit with the FTA partner rises in the feasible range, even though intra-FTA trade volumes expand).[29]

Assessment of gains from the $A-B$ FTA, and its effect on MFN tariffs

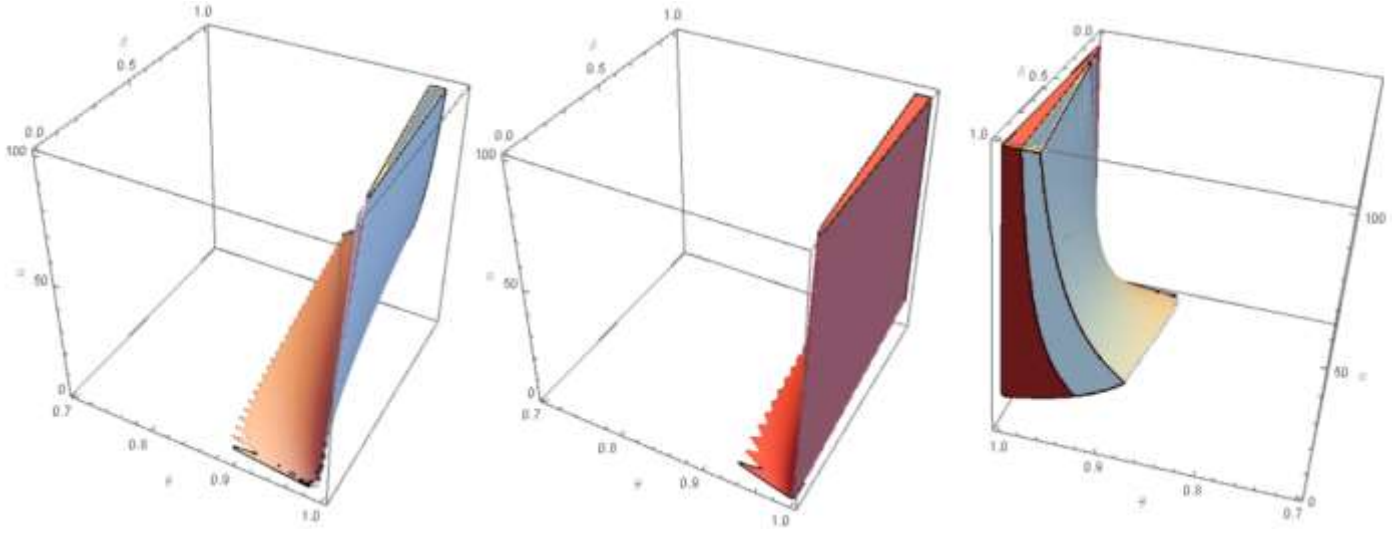
Similar to case 3, we find that the smaller partner (i.e., country A) gains more by concluding the $A-B$ FTA vis-à-vis the larger partner. The FTA unambiguously benefits the consumers of the two countries. In fact, the surplus for upstream firms also rises, however, it necessarily falls for the downstream firm

[28] Had we not introduced the arbitrage-free bounds to ensure the stability of market equilibrium in all the cases, there would not have been any restriction on the country size as well.

[29] From our observations in Cases 2 and 4 so far, it seems plausible to conclude that FTAs of a country should not be evaluated only in terms of their impact on a country's trade balance. A similar argument has also been put forward in India's recent Economic Survey 2019-20, in which the authors have called the trade-balance approach as the mercantilist way of weighing the gains from trade. We further verify our assertion in the rest of the trade scenarios that we assume for answering our research questions.

in country B with a fall in the price of the final good post the formation of the $A-B$ FTA. In the case of country A, the downstream firm gains when θ is towards the lowest end within the feasible region, i.e., when country A is comparatively smaller vis-à-vis country B and the rest of the world. This is because, in such a range, its downstream firm gains in terms of a higher increase in market access than when θ approaches 1. This result contrasts with our findings in Subcase 3.1. We show these findings graphically in Figure 9. The leftmost panel shows the area where the producer surplus rises for the downstream firm in country A, while the middle-panel graphs the area where it falls. On the extreme right, the Figure shows the back-view of the two regions in the same 3-D plot.

Figure 9: Change in country A's downstream firm's surplus, Subcase 4.1[30]



Further, we find that the optimal input tariffs also fall in the member countries vis-à-vis case 4, and their tariff revenue unambiguously decreases post the formation of the FTA. The intuition is that with the FTA, the demand for the member countries' exports increases, and therefore, their domestic production also rises (even though domestic sales as well as revenue fall). Since both domestic and imported inputs are utilised in their production, it is beneficial for the country to reduce their input-tariff and make its final goods more cost-competitive in the world market.[31] On the contrary, in country R, all the components of welfare rise. This finding also contrasts with Subcase 2.1, in which we found that the consumer surplus falls due to an increase in the price of the final good and highlights the critical role played by tradable intermediate inputs. In fact, in the present subcase, although R's optimal rate of MFN output-tariffs fall with a fall in country A's and B's external output-tariff, its optimal input-tariff rate rises. Equations (70) and (71) show these links between output and input tariffs

[30] Here also, we restrict the values of α in the range $(0, 100]$, and δ in the range $[0, 1]$. Since the two parameters are positively associated with each other, that's why we observe that the possibility of the effective formation of a welfare-increasing FTA is more when δ is high.

[31] This is similar to what we observed in Equations (86)-(88).

explicitly. The former result, along with the tariff complementarity effect, signifies that in this specific case, regionalism does act as a building bloc towards multilateralism to some extent.

On comparing the changes in the welfare of country R pre- and post-FTA formation, vis-à-vis the gains accrued by the member countries, we find that the FTA is most welfare-improving for country R, followed by country A and B. However, the non-member's terms of trade necessarily deteriorate vis-à-vis the member countries. Hence, it seems plausible to conclude that the rise in terms of trade incentivises the large partner to sign such an FTA despite the fact that it is able to appropriate lesser gains by concluding that, vis-a-vis the similar-sized non-partner country. Nevertheless, there would have been no such gains (less or more) in the absence of any free trade agreement.

Comparison of gains vis-à-vis Subcase 2.1

We first find out the intersection of the feasible regions obtained in Subcases 2.1 and 4.1, and then compare the welfare gains for partners and the non-partner economy. The range of values of α, δ, and θ that support the effective formation of an FTA (in final goods) in the absence as well as the presence of tradable intermediates, is given by:

$$\delta > 0 \;\&\; 0.877 < \theta < 1 \;\& \tag{95}$$

$$3.371 \times 10^8 \sqrt{\frac{\delta^2(6.602 \times 10^{16} + 2.682 \times 10^{15}\theta - 1.799 \times 10^{16}\theta^2)}{(2.044 \times 10^{16} + 6.117 \times 10^{15}\theta - 4.148 \times 10^{16}\theta^2)^2}} + \frac{\delta(-8.405 \times 10^{15} + 1.142 \times 10^{17}\theta)}{-2.044 \times 10^{16} - 6.117 \times 10^{15}\theta + 4.148 \times 10^{16}\theta^2} < \alpha \leq \frac{3.414\delta}{1-\theta}$$

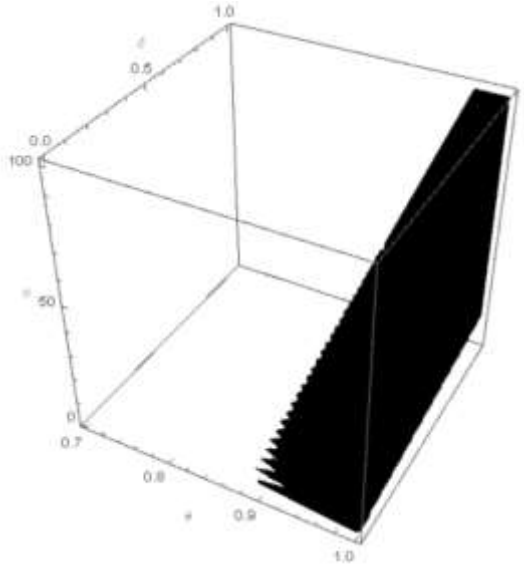
Here, the upper limit of α is the same as what we observed in Case 2, while the feasible values of θ are constrained by the bounds in Case 4. Figure 10 graphs the region bounded by these inequalities:

(Figure 10 here)

In this region, we find that in comparison to Subcase 2.1,

1. $W_i^4 > W_i^2 \; \forall \; i = \{A, B, R\}$, i.e., the welfare of both the member and non-member countries increases, and so does the global welfare as well. Considering specific components of total welfare for each country, we find that except for upstream firms, surplus for others is more in Subcase 5.1 than in Subcase 2.1.
2. The optimal MFN (output) tariff rates (imposed by both the member and non-member countries) reduce. This is because, unlike the scenario where intermediates are non-tradable, output tariffs now also affect the demand (both local and foreign) of the intermediate inputs, and hence, the earnings of the input suppliers and the revenues earned by the governments.

Figure 10: Feasible Region, Subcases 2.1 and 4.1



However, when we compare the change in welfare levels, both pre- and post-FTAs in the absence and presence of trade in intermediates, we observe:

1. $[(W^4_{A\,or\,B} - W^3_{A\,or\,B}) - (W^2_{A\,or\,B} - W^1_{A\,or\,B})] < 0$
2. $[(W^4_R - W^3_R) - (W^2_R - W^1_R)] > 0$

This implies that as far as the intra-FTA members are concerned, the rise in post-FTA welfare is more in the absence of tradable intermediates. There could be two plausible reasons for this – one that relates to what we can call as the 'base-effect' and the second relates to how the GVCs are designed/structured. We know that any change in welfare, in itself, depends upon the endpoint and the point of comparison. As a consequence, when an economy starts from a no-GVC scenario, its welfare was comparatively low (Case 1), and any movement towards freer trade or higher integration with the world market (Case 2) raises its welfare by a higher amount. On the contrary, the opening up of intermediate input markets (Case 3), in itself, represents a step towards higher economic integration and is also associated with higher welfare levels (both at the individual and the global level). Thus, any further movement towards liberalised regime, say in the form of an FTA in final goods (Case 4), while being welfare improving, may not lead to an equivalent rise in welfare that we observe when a country switches from pre-FTA to a post-FTA scenario in the absence of GVCs.

Moreover, in our present set up, the structure of GVCs are such that tariffs imposed by the rest of the world, upstream or downstream, matter as much as barriers put in place by the FTA partner. This is because the goods (both final and intermediate) are homogenous in nature, and country R's optimal input tariffs rise post the formation of the $A - B$ FTA. In such a case, it may be possible that multilateral market opening is preferred over preferential arrangements, as a result of which we

observe that the welfare-enhancing effect of an FTA falls in the presence of global value chains. Nevertheless, this also implies that the role of GVCs or trade in intermediates is important to incorporate while assessing the impact of regional trade agreements. On the contrary, with lower input- and output-tariffs in case 4 vis-à-vis case 2, country R is able to accrue higher gains with FTA formation in the presence of tradable intermediate inputs.

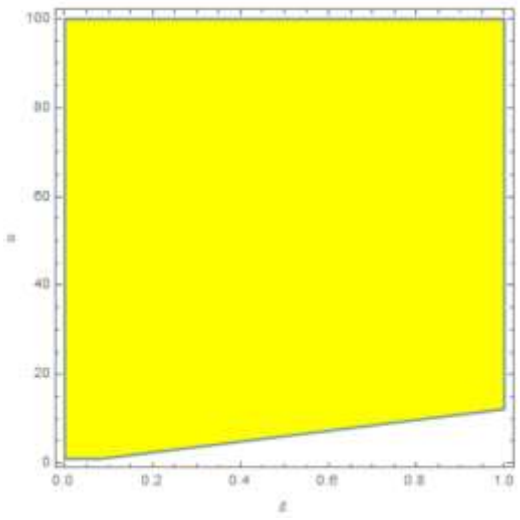
Subcase 4.2: $\theta \in \{1\}$

In the absence of any market size asymmetry, the feasible bounds on δ and a are given by:

$$0 \leq \delta \leq 0.082a \tag{96}$$

In this subcase, apart from the ROO-constraint, the arbitrage-free conditions also become non-binding. This is because in the presence of exactly similar (segmented) markets, the possibility of trade deflection (due to divergence of prices) does not arise. This is why studies on FTAs that focus on symmetric markets do not specifically restrict their solution sets by assuming the arbitrage-free bounds to prevent trade deflection. We plot the region bounded by the inequality (96) in Figure 11.

Figure 11: Region bounded by the (effective) welfare-improving A-B FTA, Subcase 4.2



Akin to Subcase 2.2, we observe that country A and B's optimal input-tariff rates fall with the formation of the FTA, while the optimal rate for country R rises, and so does its tariff revenue. However, unlike the previous subcase, with $\theta = 1$, the downstream firm in country A, as in country B, unambiguously losses some of its profits compared to the pre-FTA case (3), though the consumers and the upstream firm necessarily gain. Another related point worth mentioning here is that not just the downstream firm gains in country R (or, the non-member country), the increase in its overall welfare also exceeds the rise in welfare of the two FTA partners. This contrasts our finding from Case 2, where we showed that at lower values of δ, the FTA partners gain more than country R.

Comparison of gains vis-à-vis subcase 2.2

The intersection of the feasible regions given in subcases 2.2 and 4.2, is given by:

$$(a > 0 \;\&\; \delta = 0), or\ (a > 0 \;\&\; 0 < \delta < 0.0821a) \tag{97}$$

Once again, we find that even though both the FTA partners are better off in case 5 than in case 3, the rise in their welfare is more in the latter than in the former. This reinforces our previous result, where we stated that the presence of GVCs curtails the attractiveness of RTAs in the case when tariffs are eliminated only on the imports of final goods. The output-tariffs are, however, lower than in case 2 for each of the three countries, and so do their terms of trade with the rest of the world (i.e., the ratio of the price of exports to imports).

Subcase 4.3: $\theta \in (1, \infty)$

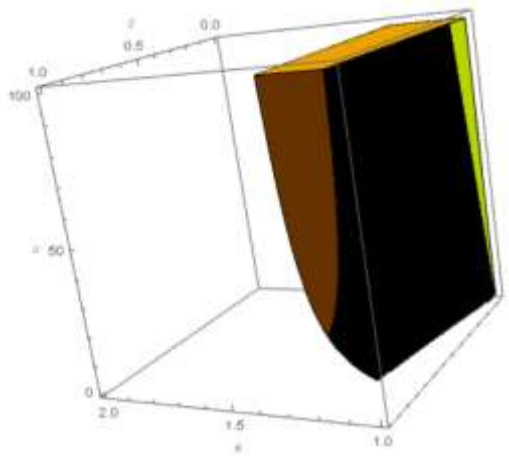
When the rest of the world becomes small in comparison to one of the two FTA members, the feasible region becomes:

$$\delta > 0 \;\&\; 1 < \theta < 1.142 \;\&\; \beta^{4.3} < \alpha \leq \frac{3.466\delta}{-1+\theta} \tag{98}$$

$$\beta^{4.3} = \frac{\delta(-1.171 \times 10^{25} + 9.893 \times 10^{23}\theta)}{-3.830 \times 10^{24} - 4.130 \times 10^{22}\theta + 2.358 \times 10^{24}\theta^2}$$
$$+ 7.321 \times 10^{-8} \sqrt{\frac{\delta^2(-7.449 \times 10^{62} - 4.608 \times 10^{63}\theta + 1.640 \times 10^{64}\theta^2)}{(3.830 \times 10^{24} + 4.130 \times 10^{22}\theta - 2.358 \times 10^{24}\theta^2)^2}}$$

Figure 12 graphs the region bounded by the inequalities mentioned above (98).

Figure 12: Region bounded by the (effective) welfare-improving A-B FTA, Subcase 4.3



Once again, the existence of arbitrage-free bounds (ensured with the help of ROO cost even after the formation of the FTA) restricts the parameter space (the ratio of the black region to the entire coloured region in Figure 12). The region is restricted by the welfare-improving condition for country A, i.e.,

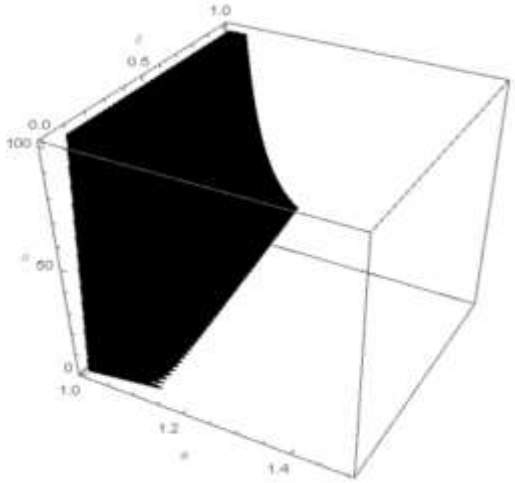
the larger FTA partner in subcase 4.3. Even though $W_A^4 > W_B^4$, yet welfare gains (from pre- to post-FTA) are higher in the case of B than in A.

On comparing the gains accrued by the non-member country (which is now smaller than country A), we find that both A and B (unambiguously) gain less vis-à-vis country R. However, the terms of trade effect is favourable towards the FTA members. In fact, analogous to Subcase 4.1, we find that while the downstream firm's profit falls in country A post the FTA formation, it may rise in the case of the smaller partner, B when θ takes a comparatively large value within the feasible bounds. Out of the other three agents, consumers and the upstream firm in each FTA member benefit (due to the so-called pro-competitive effects of FTAs triggered via the fall in both output- as well input-tariffs), while the government revenue necessarily fall. The country R's government, however, earns higher revenue with lower output-tariffs and higher input-tariffs vis-à-vis Case 3.

Comparison of gains vis-à-vis subcase 2.3

The feasible region under consideration is represented by the following Figure 13.

Figure 13: Region bounded by the (effective) welfare-improving A-B FTA, Subcase 4.3



The same results, as in the previous two subcases, 4.1 and 4.2, are observed here too. Therefore, the following proposition is noteworthy.

Proposition 5. *In our vertical industry set-up, FTAs (in Final Goods) lead to a higher level of welfare in the presence than in the absence of tradable intermediates. However, the welfare gains vis-à-vis the pre-FTA scenario are more in the case of latter than the former.*

We know that the link between global value chains and free trade agreements runs in both the directions – on the one hand, the issue is how much FTAs can enhance GVC participation (Ignatenko, Raei and Mircheva 2019), while the other policy question concerns whether these international production

chains alter the merits of engaging in free trade agreements, and deeper trade agreements as well (Ruta 2017). While we do not model the depth of FTAs, our framework allows us to analyse this two-way association between two forms of economic integration. In line with the empirical study by Hoffman, Osnago, and Ruta (2017), we measure GVC participation as imports of intermediate inputs, and find that in each of the three Subcases discussed above, with FTA, each partner's intra-FTA exports of inputs, as well as its exports to country R, rise, and so do their imports. In fact, the exports and imports of final goods also expand, vis-à-vis the pre-FTA case in all the three countries. This implies that trade policy plays an important role in determining the benefits from GVC integration. Further, in comparison to Case 2, where the production of final goods was entirely national in each of them, we find that with the introduction of trade in intermediates, the level of economic integration among all the countries rises (as demonstrated in case 2), but the attractiveness of FTAs as a welfare-enhancing economic instrument falls. Thus, while GVCs do support the effective formation of welfare-enhancing FTAs, but the rise in welfare is lower than in Case 2. This shows the feedback effect of the increase in GVC trade on the trade policy of any country. In fact, our three subcases $(4.1 - 4.3)$ suggest that this result holds regardless of the market sizes of the FTA partners and the rest of the world.

It is equally imperative to point to the issue of Inverted Duty Structure (IDS) here. IDS refers to the situation when customs duties on imports of final goods exceed the rate of duties imposed on intermediate inputs that are required for their production. Several Indian industrialists have complained that with the rise in FTAs signed by the country (specifically with its East Asian partners viz. the ASEAN bloc, South Korea, or Japan), the issue of duty of inversion has arisen, which has adversely affected their competitiveness, and hence, profitability in the market of India's FTA partners. This is because, in certain cases (especially when inputs are imported from the non-FTA partners), they have to pay a higher cost for their imported inputs (due to higher import duties), while at the same time, FTAs expose their final products to intense foreign competition (Jha 2019, Chandrashekhar 2019).

With free trade in final goods, the present case 4 thus represents a specific scenario where the possibility of IDS occurs as far as the $A - B$ FTA is concerned. This is because not only countries A and B import inputs from Country R, but inputs are also excluded from the FTA's exemption list. Thus, akin to the complaints that have been raised by the Indian manufacturers, we also observe that in each of the three subcases, the downstream firm's surplus does fall (except for the smaller FTA partner in subcases 4.1 and 4.3 for some feasible values of α, θ, and δ). However, all these subcases only indicate the possibility of welfare-improving FTAs. This implies that even if the downstream firm's profits decline post the formation of the FTA, yet the government could ensure that every agent gains by devising a mechanism to make some transfers from the beneficiaries of the FTA in A and B (viz. consumers and upstream firm) to those who lose from such an arrangement (maybe in the form

of some subsidies or taxes). Nonetheless, it is also important to note that IDS does not necessarily imply negative effective protection, as argued by Pathania and Bhattacharjea (2020), and hence, may not necessarily affect the competitiveness of a country's exports. The effective rate of protection becomes negative when value added under free trade exceeds value added under restricted trade, or when value added under free trade becomes negative, as defined by Corden (1971). Although we do not specifically compute ERP in our study, it is worth mentioning here that with zero tariffs being imposed by FTA members on each other's imports of final goods, and a fall in external output-tariff as well, input-tariffs fall too. In fact, in our set up, we find that while the $A - B$ FTA unambiguously raises the export sales and revenue for the downstream firm post the formation of the agreement, their domestic sales contract, due to which their overall profits fall short of the pre-FTA case.

3.5 Case 5 | *Trade in Final and Intermediate Goods, FTA in Intermediate Goods*

We now consider the possibility of the conclusion of an FTA between countries A and B, whereby they agree to eliminate tariffs on imports of intermediate inputs while continuing to impose positive MFN tariffs on imports of final goods from each other. The objective of this exercise is to ascertain whether the composition of tradable commodity baskets matters while determining the (potential) welfare-enhancing effects of an FTA.

Like in the case of bilateral free trade in final goods, we assume that the intra-FTA members maintain their independence in setting differential external input-tariffs on their respective imports from the rest of the world. However, to prevent imports of grey products, we assume that the upstream firm in each of the two FTA countries has to incur an additional per-unit cost of γ in order to claim the tariff-free treatment for their exports within the free trade area. The three-stage solutions obtained via the process of backward induction are detailed below.

Downstream Markets

The stage-3 equilibrium solutions are similar to what we obtained in case 3 since there is no change as far as the downstream markets are concerned. The equilibrium level of outputs and market prices are, therefore, given by Equation (7) with each $F_i^5 > 0 \; \forall \; i \in \{A, B, R\}$. Further, the arbitrage-free bounds as in Equations (9)-(11) stabilise the equilibrium prices in the three segmented markets.

Upstream Markets

As in case 3, each upstream firm maximises its profits and determine the level of input to be supplied to its own country's downstream firm, and foreign downstream firms as well, taking the inputs provided by rival upstream firms and the ROO-cost/ input-tariffs as given. The Cournot Nash Equilibrium prices in three markets are given by:

$$d_A^5 = 0.033(a_A + a_B + a_R) + 0.254s_A^5 + 0.023(s_B^5 + 2s_R^5 + 2t_A^5) - 0.056(t_B^5 + t_R^5) + 0.277\gamma \quad (99)$$

$$d_B^5 = 0.033(a_A + a_B + a_R) + 0.254s_B^5 + 0.023(s_A^5 + 2s_R^5 + 2t_B^5) - 0.056(t_A^5 + t_R^5) + 0.277\gamma \quad (100)$$

$$d_R^5 = 0.033(a_A + a_B + a_R) + 0.508s_R^5 + 0.023(s_A^5 + s_B^5 + 2t_R^5) - 0.056(t_A^5 + t_B^5) + 0.046\gamma \quad (101)$$

From Equations (99)-(101), we observe that the link between γ and optimal input-prices corresponds to the link that we found between δ and the optimal output-prices in cases 2 and 4. The positive association is intuitive because a). a higher ROO-cost makes the imported input more expensive, as in the case of higher input-tariffs, and b). With an increase in γ, ceteris paribus, the cost of producing final goods in FTA partners also increases, which, in turn, negatively affects the demand for their final good, while positively affecting the demand for country R's final goods and intermediate inputs. Thus, there exists an indirect but positive association between γ and d_R^6.

The arbitrage free-bounds are now given by:

$$d_A^5 + \gamma \geq d_B^5 \geq d_A^5 - \gamma \quad (102)$$

$$d_A^5 + s_R^5 \geq d_R^5 \geq d_A^5 - s_A^5 \quad (103)$$

$$d_B^5 + s_R^5 \geq d_R^5 \geq d_B^5 - s_B^5 \quad (104)$$

Tariffs and Welfare

Substituting the values of a_A, a_B, and a_R, we find the welfare maximising input- and output tariffs in each of the three countries as given below:

$$t_A^5 = -0.066a + 0.286a\theta + 0.190\gamma \quad (105)$$

$$t_B^5 = 0.253a - 0.033a\theta + 0.190\gamma \quad (106)$$

$$t_R^5 = 0.270a - 0.026a\theta - 0.104\gamma \quad (107)$$

$$s_A^5 = 0.015a + 0.013a\theta + 0.372\gamma \quad (108)$$

$$s_B^5 = 0.021a + 0.007a\theta + 0.372\gamma \quad (109)$$

$$s_R^5 = 0.049a + 0.017a\theta + 0.032\gamma \quad (110)$$

The comparative statics results for the effect of the ROO-cost on input- and output-tariffs in the three countries show that, ceteris paribus, any increase in γ unambiguously raises the output-tariffs in the FTA members, but reduces the optimal rate in Country R. This is because a higher γ is associated with a higher cost of imported inputs in countries A and B, which, in turn, makes their final outputs more costly. As a consequence, their respective governments raise the optimal rate of output-tariff to protect their downstream firm while balancing its negative effects on its consumers (due to an increase in the

price of the final good). On the other hand, the final output becomes relatively less costly in country R, and therefore, we observe a fall in t_R^6. As regards the input-tariffs, a positive association with γ is clear from equations (99)-(101). A higher γ leads to higher d_i^5 ($\forall\, i \in \{A, B, R\}$), and thus, a rise in input-tariffs in all the three countries. Further, in the FTA members, we already know that $s_A^5 > \gamma$ and $s_B^5 > \gamma$.

Utilising equations (105)-(110) and substituting their values in solutions obtained from stage 3 and 2, we compute the level of total welfare in all the three countries under consideration.

$$W_A^5 = 1.299(\gamma)^2 - \alpha\gamma(0.192 + 0.172\theta) + (\alpha)^2(0.057 - 0.027\theta + 0.373(\theta)^2) \quad (111)$$

$$W_B^5 = 1.299(\gamma)^2 - \alpha\gamma(0.207 + 0.157\theta) + (\alpha)^2(0.375 + 0.006\theta + 0.021(\theta)^2) \quad (112)$$

$$W_R^5 = 0.065(\gamma)^2 + \alpha\gamma(-0.062 + 0.032\theta) + (\alpha)^2(0.380 + 0.003\theta + 0.018(\theta)^2) \quad (113)$$

$$\Rightarrow GW^5 = 2.663(\gamma)^2 - \alpha\gamma(0.462 + 0.298\theta) + (\alpha)^2(0.812 - 0.017\theta + 0.412(\theta)^2) \quad (114)$$

Once again, we find that regardless of the value of θ, the welfare of each country (FTA member or non-member), and hence, the global welfare, falls with a rise in the ROO-induced trade cost. This finding is similar to cases 2 and 4, where we assumed bilateral free trade in final, and not in intermediate goods, between A and B.

Now, we have to determine the feasible regions for α, θ, and γ that ensure the effective formation of an FTA. Thus, we constraint our solutions obtained from the three stages by imposing the five pre-requisites as detailed in case 2,[32] and accordingly compare the welfare-enhancing effects of this FTA vis-à-vis FTA in final goods, i.e., case 4, to answer our second research question. In doing so, we establish the following proposition:

Proposition 6. *In our vertically integrated set up, a (horizontal) free trade agreement is not always Pareto-improving for the FTA members, vis-à-vis the no-FTA case. When these engagements potentially raise the welfare of the two members, their downstream/upstream lose some of their surpluses, depending on whether the (bilateral) output- or input-tariffs get eliminated within the free trade zone. However, this doesn't happen because of a loss in their export competitiveness; rather, their exports to the FTA partners rise but at the expense of their domestic sales and revenue.*

While we have already proved this proposition (partially) in Cases 2 and 4 when countries A and B negotiate an FTA in final goods, the following discussion in Subcases 5.1-5.3 justify our assertion when the two countries agree to eliminate tariffs on each other's imports of intermediate inputs.

[32] Condition (b) laid down in case 3, also entails the arbitrage-free bounds in upstream markets, as represented in Equations (102)- (104).

Subcase 5.1: $\theta \in (0,1)$

Considering the feasible region obtained in case 3 (i.e., the pre-FTA case), and the five pre-requisites for the formation of the $A-B$ FTA, we find the optimal range of values for the three parameters:

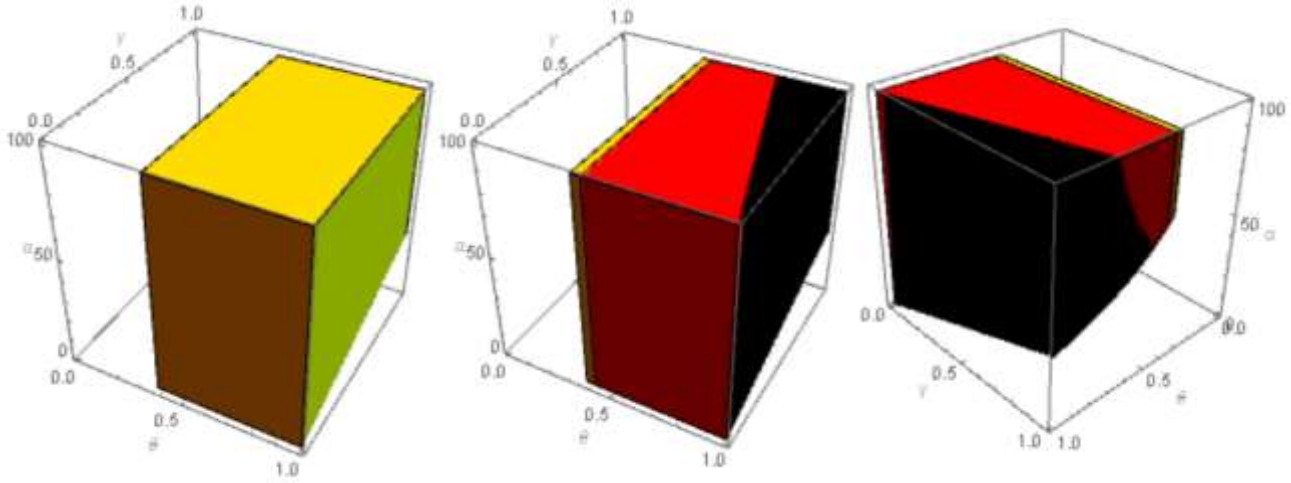
$$\gamma > 0 \;\&\; 0.475 < \theta < 1 \;\&\; \beta^{5.1} < a \leq -\frac{29.28\gamma}{-1+\theta} \tag{115}$$

where,

$$\beta^{5.1} = \frac{\gamma(3.754 \times 10^{26} + 2.847 \times 10^{26}\theta)}{4.213 \times 10^{24} + 2.074 \times 10^{25}\theta + 1.213 \times 10^{25}\theta^2} + 2.627 \times 10^{-8}\sqrt{\frac{\gamma^2(1.755 \times 10^{68} + 1.685 \times 10^{68}\theta + 3.486 \times 10^{67}\theta^2)}{(4.213 \times 10^{24} + 2.074 \times 10^{25}\theta + 1.213 \times 10^{25}\theta^2)^2}}$$

The black coloured region in the middle panel of Figure 14 graphs these inequalities and the rightmost panel of the figure shows its side view. The left-panel (yellow coloured region), on the other hand, shows the full set of values for the three parameters in the absence of the arbitrage-free bounds, and the red coloured region (out of the yellow region) shows the feasible set of value when arbitrage free-bounds are imposed only in the case of downstream markets.

Figure 14: Region bounded by the (effective) welfare-improving A-B FTA, Subcase 5.1



From figures (4), (8), and (14), it seems plausible to conclude that the possibility of a rise in parallel imports or profitable arbitrage opportunities in downstream markets is very low in Case 5 with free trade in intermediates than in Cases 2 or 4. While that in the upstream markets, is relatively high, and hence, imposing the three inequalities (102)-(104) squeezes our solution set from red to the black coloured region in the above figures. This signifies why it is imperative to consider the arbitrage-free bounds while analysing the benefits of FTAs in order to control for trade deflection or any kind of tariff-shopping that could disturb the Cournot equilibrium. However, most of the existing studies on RTAs (in which the model structure is quite similar to ours) such as Kawabata, Yanase and Kurata

(2010) or Chang and Xiao (2015), etc., do not explicitly model these possibilities. This could mean that the likelihood of concluding a welfare-improving FTA (whether with partners with whom a country mostly trades in final or intermediate inputs, or both of them) that has already been established in such studies is overestimated. The recent study by Conconi et al. (2018) also showed that in the case of the North American Free Trade Agreement (NAFTA), these rules led to a significant fall in imports of intermediate goods from the extra-FTA trading partners vis-à-vis the NAFTA countries.

Further, from the right panel of Figure (14), it is observed that as the value of γ increases, the likelihood of the formation of a welfare-improving FTA between asymmetric countries also increases. This is because, with our assumptions of linear demand and constant (and same) marginal cost of producing intermediate inputs, higher γ is required to eliminate the arbitrage opportunities when countries are dissimilar in terms of their market sizes. This contrasts with our findings in cases 2 and 4, which show that a final-goods FTA (in the presence of arbitrage-free bounds) is (potentially) welfare-enhancing only between relatively similar countries. Thus, with the introduction of tradable intermediates, the scope of the formation of an effective FTA between different relatively dissimilar countries expands – something that could be related to the fact that the period when RTAs were negotiated in large numbers also coincides with the period when even GVCs started expanding on a much wider scale (i.e., in the past two-two and a half decades).

Assessment of gains from the $A-B$ FTA, and its effect on MFN tariffs

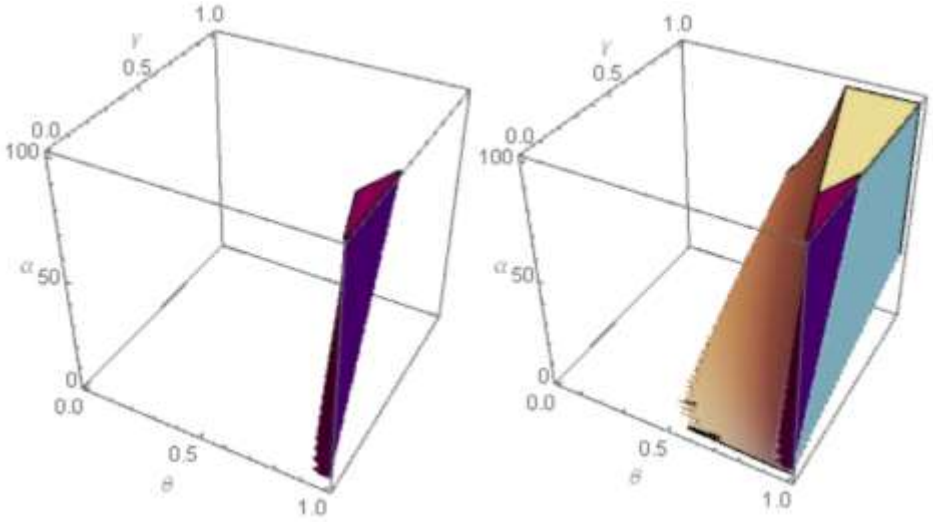
Akin to the FTA in final goods, in the feasible region as represented by Equation (115), we find that the welfare of the smaller partner, A, falls short of the welfare of country B, but the increase in welfare due to FTA formation is more in the former than the latter. Downstream firms in the two countries unambiguously gain due to the fall in their production cost with a fall in the price of intermediate inputs. This is because, not only the FTA partners eliminate input-tariffs on imports within the FTA, but their external tariff rate also falls, and hence, the cost of imports from R also goes down. This, in turn, reduces the price of final goods and benefits the consumers unambiguously. However, the surplus earned by upstream firms reduce post the formation of the FTA,[33] and so does the tariff revenue of the governments of the two countries. The reason is that even though the FTA allows the two countries' upstream firms to export more to each other by incurring the per-unit ROO cost, however, their domestic sales as well as exports to the rest of the world fall unambiguously. The latter happens because of an increase in output tariff by country R's government post the conclusion of the $A-B$

[33] In the case of the smaller partner (A), surplus increases for its upstream firm for a very small subset of values of α, θ, and γ.

FTA.[34] Thus, from our findings in Cases 2, 4, and 5, it seems plausible to conclude that (in our specific framework), FTAs hurt the producers of goods on which tariffs are eliminated. However, this doesn't happen because of a loss in their export competitiveness; rather, their exports to the FTA partners rise but at the expense of their domestic sales and revenue.

Regarding country R, we find that its overall welfare rises in the feasible region, but the profit earned by its downstream firm falls. This is despite the fact that its optimal input-tariff as well as input price also decline post the formation of the $A-B$ FTA.[35] Further, unlike cases 2 and 4, we find that for some combination of the feasible values of the three parameters, the rise in welfare is more for both the FTA partners vis-à-vis country R, and therefore, in the new equilibrium, $W_B^5 > W_R^5$. This is shown in the left panel of Figure 15, in which the rise in the welfare of country A is also more than the change in the welfare of R. From the region plot, it is clear that such a possibility arises when θ takes a value close to one, and γ also takes a small value (within our chosen range for α). This could be because the loss for country R's downstream firm is more, the lower is the degree of market size asymmetry (or, higher the value of θ) between the two FTA partners. Besides, country A will be better off due to the larger size of country B's market.

Figure 15: Comparison of welfare gains from the A-B FTA, Subcase 5.1



The right panel of Figure 15 shows the blue and yellow regions, where country R gains more than countries A and B, along with the purple area, where the opposite happens. Nevertheless, even in this subcase, we find that the terms of trade of the FTA partners improve, vis-à-vis country R.

[34] This could be because with free trade in intermediates, input prices decline in both A and B, as a consequence of which the prices of their final goods fall too. This implies that the relative price of final output produced in country R rises, and therefore, to protect its domestic downstream firm, the government raises the optimal output tariff. Nonetheless, this result contrasts with our previous findings, where we showed that three countries' output-tariffs are complementary to each other.
[35] The rise in input tariff of country R (when A and B forms an FTA in intermediates), implies that Bagwell-Staiger's tariff complementarity condition does not hold in this case.

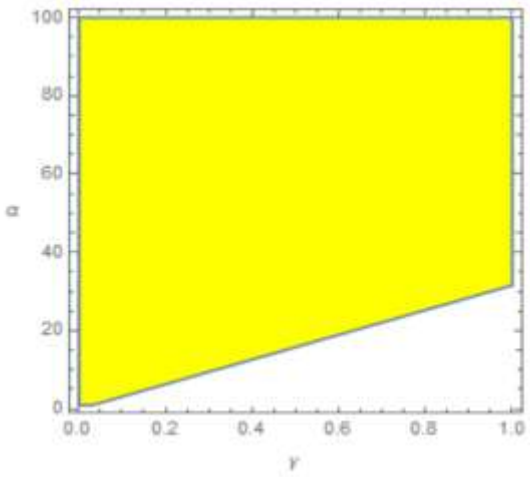
Subcase 5.2: $\theta \in \{1\}$

In the absence of any market size asymmetry, we find that the feasible region is now given by ($a > 0$):

$$0 \leq \gamma < 0.032\alpha \tag{116}$$

Figure 16 graphs this region.

Figure 16: Region bounded by the (effective) welfare-improving A-B FTA, Subcase 5.2



As the size of markets increases, each market becomes more attractive, and hence, the possibility of trade deflection increases. This is why γ varies positively with α. Akin to the previous subcases discussed in subsections 2.2 and 4.2, we find that the ROO and GATS conditions, along with the arbitrage-free bounds, are not binding in this case. The latter is evident since in the absence of any market size asymmetry, prices remain stable in a Cournot equilibrium, and there doesn't exist any possibility of profitable arbitrage to occur.

Assessment of gains from the $A - B$ FTA, and its effect on MFN tariffs

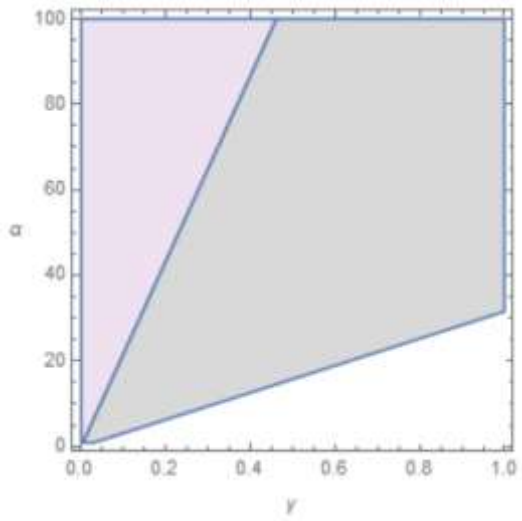
Within the feasible range of γ, we find that the upstream firm's profit and government's tariff revenue necessarily fall post the formation of the FTA. However, the total loss is less than the gains accrued by consumers and the downstream firm in the partner economies, and hence, their total welfare is higher vis-à-vis case 3. The welfare for the non-member rises too because of a fall in MFN rates imposed on its exports of intermediate goods and final output by the FTA members. In fact, we find that at higher values of γ, the non-FTA partner benefits more vis-à-vis the FTA partners – a conclusion that was also reached while solving cases 2.2 and 4.2.

$$W^6_{AorB} - W^4_{AorB} > W^6_R - W^4_R \text{ if } \{\ 0 \leq \gamma < 0.005a\ \}$$

$$W^6_{AorB} - W^6_{AorB} \leq W^6_R - W^4_R \text{ if } \{\ 0.005a \leq \gamma \leq 0.032a\ \}$$

Figure 17 plots the above-mentioned inequalities. In the purple region, the partners gain more than the non-partner, while the gray-coloured region highlights the opposite scenario.

Figure 17: Comparison of welfare gains from the A-B FTA, Subcase 6.2



The rest of the results are similar to what we observed in subcase 5.1. The terms of trade improve for countries A and B. While the optimal output tariff of R necessarily rises (and the profit of its downstream firm fall with the FTA), its input-tariff declines for most of the feasible parametric values as represented by the following inequalities (117), (118).

$$s_R^5 < s_R^3 \quad \text{if} \quad \gamma < 0.028a \tag{117}$$

$$s_R^5 \geq s_R^3 \quad \text{if} \quad 0.028a < \gamma \leq 0.032a \tag{118}$$

Thus, unlike a horizontal FTA in final goods, the one in intermediate goods doesn't necessarily prove to be a building block towards multilateral free trade in our model set up. Put differently, input-tariffs imposed by the three trading partners are not necessarily complementary to each other (specifically when γ takes a very high value within the feasible range). This could be because when γ takes a comparatively high value, then due to the ROO condition, even the external input tariffs imposed by the two FTA members, are comparatively high compared to when γ is zero or very small. As a consequence, country R's government imposes a higher s_R^6 to protect its upstream firm, which otherwise also earns (relatively) less in terms of its export revenue due to the formation of the $A - B$ FTA.

Subcase 5.3: $\theta \in (1, \infty)$

When country A becomes larger vis-à-vis country B, and the rest of the world (i.e., country R), then, we observe that a larger range for θ supports the five pre-requisites for ensuring the formation of an effective (horizontal) FTA in intermediate goods (compared to Subcase 4.3). The feasible region is algebraically represented in Equation (119), and demonstrated graphically in Figure (18).

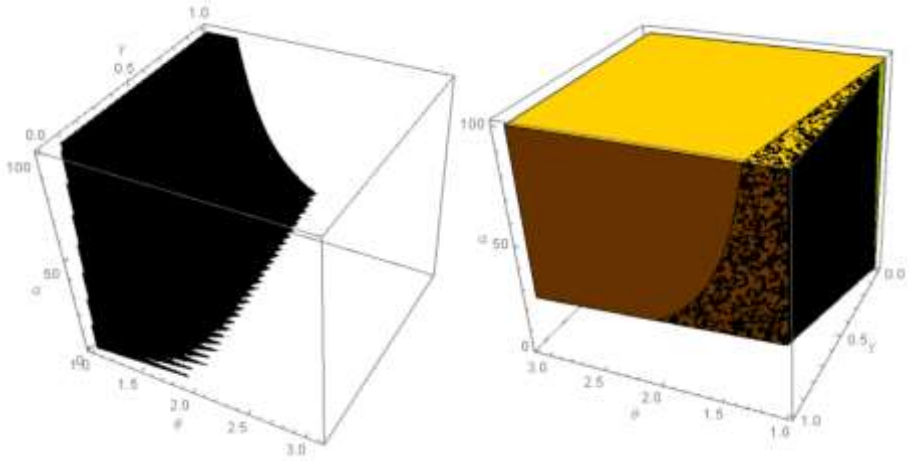
$$\gamma > 0 \;\&\; \left(1 < \theta < 1 + \varepsilon \;\&\; \beta^{5.31} < A \leq \frac{732.\gamma}{-25.+25.\theta}\right) \; or \; \left(1 < \theta < 2.017 \;\&\; \beta^{5.32} < A \leq \frac{732.\gamma}{-25.+25.\theta}\right) \tag{119}$$

where, ε is a very small number, and

$$\beta^{5.31} = \frac{\gamma(3.754 \times 10^{26} + 2.847 \times 10^{26}\theta)}{4.213 \times 10^{24} + 2.074 \times 10^{25}\theta + 1.213 \times 10^{25}\theta^2} + 2.627 \times 10^{-8} \sqrt{\frac{\gamma^2(1.755 \times 10^{68} + 1.685 \times 10^{68}\theta + 3.486 \times 10^{67}\theta^2)}{(4.213 \times 10^{24} + 2.074 \times 10^{25}\theta + 1.213 \times 10^{25}\theta^2)^2}}$$

and $\beta^{5.32} = \frac{1.580\times10^{9}(3.309\times10^{17}\gamma+2.964\times10^{17}\gamma\theta)}{2.605\times10^{25}+2.591\times10^{25}\theta+3.721\times10^{24}\theta^2} + 2.472 \times 10^{-8} \sqrt{\frac{1.464\times10^{68}\gamma^2+5.021\times10^{68}\gamma^2\theta+3.159\times10^{68}\gamma^2\theta^2}{(2.605\times10^{25}+2.591\times10^{25}\theta+3.721\times10^{24}\theta^2)^2}}$

Figure 18: Region bounded by the (effective) welfare-improving A-B FTA, Subcase 5.3

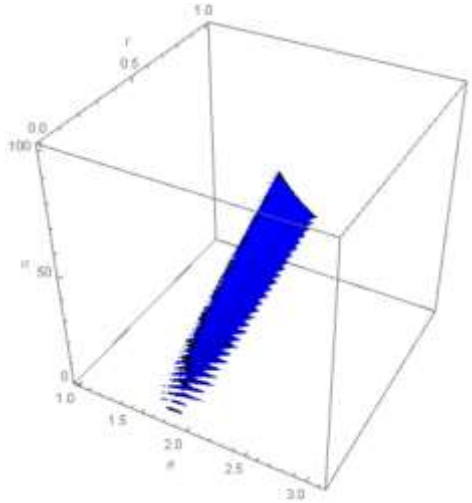


Here, in both the panels, the black coloured region represents a combination of those parametric values which support the effective formation of the $A - B$ FTA. In contrast, the yellow plus black region excludes the constraints imposed by the arbitrage-free bounds. The right panel shows the back view of the left panel to highlight all the feasible values of the three parameters within our chosen range. Thus, even though the FTA is welfare-enhancing even when country A is three times the size of country B, or R, but our feasible bounds suggest that to exclude the possibility of profitable arbitrage opportunities, the value of θ should not exceed 2.017.

Assessment of gains from the $A - B$ FTA, and its effect on MFN tariffs

Within the feasible region, we find that even this type of horizontal FTA is more beneficial for the smaller partner, vis-à-vis the larger partner as overall welfare increases more (post the conclusion of the FTA) in the case of the former than the latter. In each of the two countries, we find that consumers benefit due to an increase in the total supply of the final good, and so does the downstream firm as its domestic and foreign sales increase. However, the upstream profits in country A necessarily falls due to a fall in the domestic sales and revenue of the upstream firm (even though its export sales rise). On the contrary, for the one in country B, profits increase for a small range of feasible values of the three parameters. This range is shown in Figure 19:

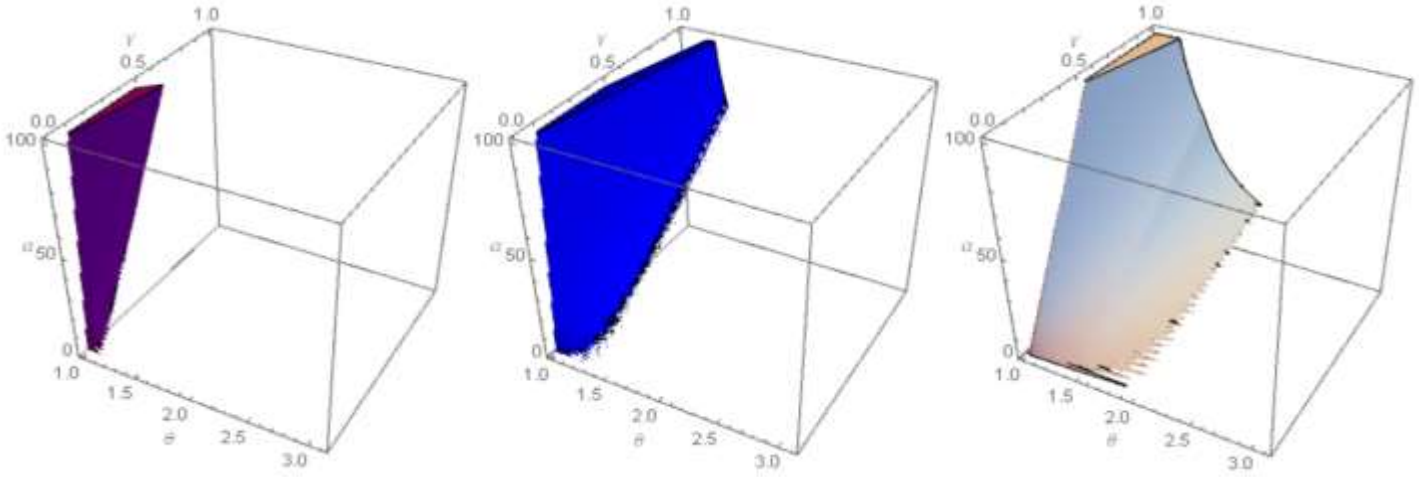
Figure 19: Feasible region for an increase in profit of upstream firm in country B, Subcase 5.3



From the figure, it is clear that only when θ takes a value closer to its upper-limit, surplus for country B's upstream firms rise (under certain restrictions on the values of α and γ). Besides, the two FTA partners also lose some of their tariff revenue due to the elimination of input tariffs on each other's exports. Also, because their optimal external tariffs rates on imports of inputs as well outputs fall post the formation of the free trade agreement. However, the FTA raises their terms of trade, vis-à-vis the rest of the world.

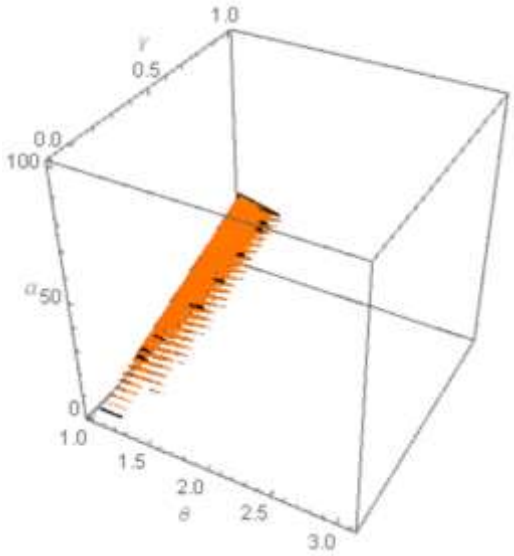
As regards country R, we find that the FTA improves its welfare within the feasible region represented by Equation (119). In fact, the rise in its welfare exceeds the welfare gain for the FTA partners in the greyish region shown in the rightmost panel of Figure 20. The leftmost panel displays the region where the benefits are more for the larger FTA partner (A) vis-à-vis R, and in the middle panel with the blue coloured region, country B benefits more than country R.

Figure 20: Comparison of welfare gains, Subcase 5.3



Thus, for all higher (feasible) values of the degree of market size asymmetry, we observe that the non-member benefits more because the rise in its consumer surplus, upstream profits, and tariff revenue dominates the fall in its downstream profits (due to a decline in its domestic as well as export sales, as we also observed in subcase 5.1). On the contrary, the overall sales of the downstream seller in countries A and B unambiguously rise. This implies that the forward-linkage effect induced by free trade in intermediates raises the efficiency of firms in the FTA members by lowering their production cost, and hence, benefits them unambiguously vis-à-vis the non-member country. As a consequence, country R raises its optimal output-tariff to protect its downstream firm. The optimal input-tariff also rises, but for a very small region (as shown in Figure 21); otherwise, it declines, thus, following Bagwell-Staiger's tariff complementarity condition.

Figure 21: Feasible region (Decline in country R's optimal input-tariff), Subcase 5.3



This completes the description of the welfare-gains from the two FTAs in the presence of tradable intermediate inputs.

Subcase 5.4: Comparison of Gains – Case 4 and 5

We now compare the gains across the two types of Horizontal FTAs – one that allows free trade in final goods, and two, whereby the FTA members eliminate tariffs on each other's imports of intermediate goods (Cases 4 and 5, respectively). Since, for each of the two cases, case 3 represents the pre-FTA scenario, we directly compare their outcomes to analyse their welfare-enhancing effects.

Put differently, this analysis is also useful to understand whether higher gains accrue to a free trade area involving more trade in final or intermediate goods. Nevertheless, both of these are GVC-related trade.[36]

It is important to note that while comparing the gains across the two FTAs, our analysis is guided by four different parameters viz. θ, δ, γ, and α since we need to ensure that all of them lie within their feasible ranges as shown in Cases 4 and 5 above. The restriction on the size parameter, α, arises because of the manner in which we introduce the two ROO-induced trade costs. As a result, our expressions become even more complicated relative to those represented in subsections 3.2, 3.4 and, 3.5, and we can't easily represent them graphically. Hence, we compute the quadruple integrals of our functions and evaluate the hypervolumes (which is equal to the product of the four dimensions) of the 4-D regions to compare different outcomes across the two FTAs. Table 2 details our findings from this assessment. Besides, for subcases 4.2 and 5.2 (that assume the absence of any market size asymmetry, i.e., when $\theta = 1$), we use 3-D region plots to demonstrate our results graphically.

(Table 2 here)

Therefore, we establish the following proposition.

Proposition 7. *An FTA in final goods or intermediate inputs improves the welfare of both member countries and the non-member as well, under certain conditions. However, the increase in welfare for the FTA members is more when bilateral tariffs are eliminated on imports of final goods than on intermediate inputs. In other words, considering a set of countries where trade is predominantly intra-industry trade, then it is beneficial to conclude an FTA with a partner with whom a country trades mostly in final goods than with whom the majority of the trade is in intermediate inputs.*

This has already been shown in Table 2. Thus, a priori, even though it may seem plausible to think that a country may accrue higher welfare gains by signing an FTA with a nation from which it is mostly importing intermediate products since the reduction (or even elimination) of input-tariffs will not only

[36] As defined in Ignatenko, Raei and Mircheva (2019), this type of trade incorporates those imports and exports that either embody imported value added (i.e., trade in final goods in our case), or are exports of domestic value added that are re-exported in other countries' exports (trade in intermediates). GVC-non-related trade, on the other hand, is defined as the import/export that gets directly absorbed in other countries.

Table 2: Comparison of Gains, Case 4 V/s. Case 5

S. No.	Basis for Comparison	Case 4 V/s 5	Remarks
1	Feasible range for 'θ'	• Case 4: $0.876 < \theta < 1.142$ • Case 5: $0.475 < \theta < 2.017$	The formation of an FTA in final goods is feasible only within a small range of the degree of market size asymmetry (i.e., when the smaller FTA partner is not too small in comparison to the larger partner and the rest of the world, or when it is larger, then it should not be very large in comparison to the other partner, and the ROW). On the contrary, bilateral free trade in intermediates is advantageous even when the degree of market size asymmetry is relatively high. This implies that if the two countries (who are willing to conclude an FTA) trade mostly in final goods, then the FTA will be beneficial to both only if they are not too different from each other in terms of their market sizes. If they are very different from each other, i.e., if θ goes beyond the range $(0.876, 1.142)$, then the larger partner will not gain, and the FTA will not be inherently stable within the context of our framework. However, suppose they trade mostly in intermediate inputs. In that case, the FTA will be advantageous to both even if one of them is exactly half in size vis-à-vis the other (given the restrictions on the other parameters of the system).
'Common' Feasible Range for θ: $0.876 < \theta < 1.142$ (This represents the common region bounded by the feasible parametric values computed in Cases 4 and 5)			
2	Domestic Sales	$F_{ii}^5 > F_{ii}^4$ and $I_{ii}^5 < I_{ii}^4$ But, $F_A^5 < F_A^4$, $F_B^5 < F_B^4$, and $F_R^5 > F_R^4$	An FTA in final goods not only raises the intra-FTA exports of final goods but also leads to an increase in their exports of intermediate inputs to country R, vis-à-vis Case 6. This is because of the so-called backward-linkage effect – a reduction in the cost of their exports of final goods not only benefits the end customers since $F_A^5 < F_A^4$, and
3	Export Sales	F_{AB}^4, F_{BA}^4, F_{RA}^4, F_{RB}^4, I_{AR}^4, I_{BR}^4, I_{RA}^4, I_{RB}^4, are greater than in Case 5.	

		I_{AB}^5, I_{BA}^5 are higher than in Case 4.	$F_B^5 < F_B^4$, but also the upstream firm in the two FTA partners, by raising their overall production, and exports.[37] However, the rise in the latter is more in Case 5. Analogously, an FTA in intermediates positively affects the exports as well as domestic sales of final goods of the downstream firm in countries A and B. This can be termed as the forward-linkage effect. But, the rise in their overall production and exports is more in Case 5. Besides, domestic sales of the goods under consideration fall in each of the two cases. As a consequence, domestic supplies of the downstream firms in FTA partners are higher in Case 6, while those of the upstream firms are higher in Case 5.
4	Price of Final Goods	$P_i^5 > P_i^4 \; \forall \; i \in \{A, B, R\}$	The elimination of output-tariffs within the FTA (Case 4), as well as the subsequent reduction of external MFN tariffs by both the FTA members and the non-member, unambiguously lead to a decrease in the price of final goods in all the three markets. In fact, the output prices fall in Case 5 as well, though its magnitude is less in comparison to Case 4. Similarly, input-prices fall in case 5, and not just in case 6 due to the FTA in intermediates. The important point to note is that this result does not only hold for the FTA partners, but also for country R.
5	Output-tariff	$t_i^5 > t_i^4 \; \forall \; i \in \{A, B, R\}$	
6	Price of Intermediate Inputs	$d_i^5 < d_i^4 \; \forall \; i \in \{A, B, R\}$	
7	Input-tariff	$s_i^5 < s_i^4 \; \forall \; i \in \{A, B, R\}$	
8	Consumer Surplus	$CS_A^5 < CS_A^4$, $CS_B^5 < CS_B^4$, but $CS_R^5 > CS_R^4$	A higher increase in the total supply of final goods to A and B in case 4 leads to a more significant increase in their consumer surplus. Conversely, in country R, consumers gain more in Case 5 than in 4. This happens due to a rise in the downstream exports of the FTA partners to country R because of a fall in their input cost post the conclusion of the $A - B$ FTA in intermediate goods.

[37] The exports of inputs by the upstream firm in the large country increases in 99.88 percentage of the total volume bounded by the feasible range.

9	Downstream Firm's Surplus	$PS_A^5 > PS_A^4$, $PS_B^5 > PS_B^4$, but $PS_R^5 > PS_R^4$	In each of the two FTAs (Cases 4 and 5), we find that the producers of the goods on which import tariffs are eliminated, gain in terms of market access for their exports within the FTA bloc, but suffer from a loss in their sales and earnings from the domestic market. On the contrary, the producers in the preceding/subsequent stage of production gain due to the so-called backward/forward-linkage effect.
10	Upstream Firm's Surplus	$PS_A^5 < PS_A^4$, $PS_B^5 < PS_B^4$, but $PS_R^5 < PS_R^4$	
11	Government Revenue	$GR_A^5 > GR_A^4$, $GR_B^5 > GR_B^4$, but $GR_R^5 \gtrless GR_R^4$	Even though the tariff revenue falls in both the cases for the FTA partners, yet, we observe that the fall is more in Case 4 than in Case 5 This is despite the fact that both input- and output-tariffs decrease in the two cases.
12	Welfare	In more than 97% of the feasible region, we find that $W_A^5 < W_A^4$, $W_B^5 < W_B^4$. For country R, $W_R^5 < W_R^4$ in the entire feasible region.	This implies that within the common feasible bounds, bilateral free trade in final goods is more welfare-enhancing for the member countries vis-à-vis bilateral free trade in intermediate inputs. In this region, for only 11% of the region, $\delta < \gamma$. For the non-member, benefits are necessarily higher in case 4 than in case 5. Further, we find the favourable terms of trade effect is also stronger in Case 4 than in 5 for the two FTA members.[38]
13	Terms of Trade	$ToT_A^5 < ToT_A^4$, $ToT_B^5 < ToT_B^4$	
14	Global Welfare	$GW^5 < GW^4$ (in 99.99% of the region covered by the feasible set of values).	The overall welfare increases more in case 4, not only when $W_A^5 < W_A^4$, $W_B^5 < W_B^4$, but otherwise, too.

[38] We also verify our results by assuming $\delta < \gamma$.

benefit the producers who will be able to source these inputs at a lesser cost, but also the consumers who would then be able to purchase the final goods at a lower price. Further, this will also increase the effectiveness of their products in the world market by reducing the cost of exports (Dhir 2020).

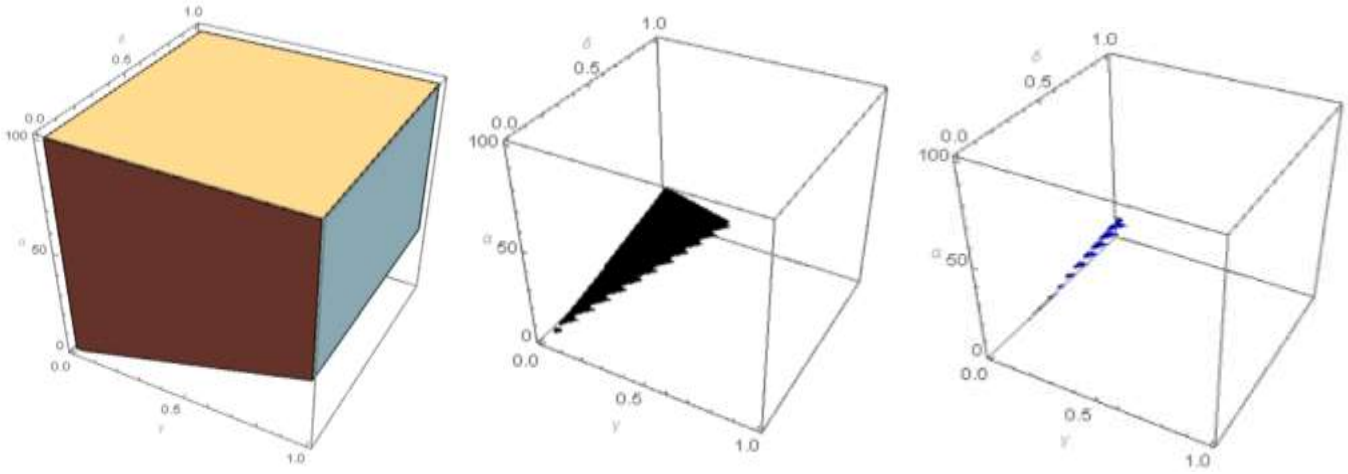
However, our analysis shows that this may not necessarily be the case. In fact, for the majority of the feasible values of the four parameters, we find that bilateral free trade in final goods leads to a higher increase in welfare of the two members than the elimination of only input-tariffs on each other's imports. We can also demonstrate this result for a special case when θ takes a value equal to one, or put differently, when we correct for the differences in the three countries' market sizes.

Given the five pre-requisites to ensure the formation of an effective FTA, from cases 4 and 5, we find

$$0 < \delta \leq 0.082\alpha \;\&\; 0 < \gamma \leq 0.032\alpha, \text{ where } \alpha > 0 \qquad (120)$$

This range is shown by the coloured region in the leftmost panel of Figure 22.

Figure 22: Comparison of welfare gains within the feasible region, Subcase 5.4



In fact, except for the small black-coloured area in the middle panel of Figure 22, in the entire feasible region on the left, the welfare of both the partners and the non-partner country is higher in case 5 than in Case 5. In particular, we find that FTAs in intermediates are likely to be more welfare-improving in comparison to FTAs in final goods when γ takes a very small value and δ takes a comparatively large value. This is because higher γ is associated with lower welfare gains in case of the former, while higher δ is associated with lower gains from FTAs in final goods.

A similar conclusion also holds when we compare global welfare in the two cases. The rightmost panel of Figure 22 shows the blue region where global welfare in Case 4 falls short of the overall welfare in Case 5. Here, an even smaller range of feasible values of γ and δ now support the possibility of FTA in intermediates being more welfare-improving than FTA in final goods.

As a specific case, we compare and contrasts the welfare effects of an FTA between A and B when (i). they trade only in final goods, and (ii). where they trade only in intermediate inputs with each other. Our findings reinforce our results that we observe in Cases 4 and 5 (regardless of the value of θ). In addition, we also find that the absolute level of welfare of the two partners is more in (i) than in (ii) post the formation of the FTA.

4. Alternative Trade Regimes and the case of Vertical FTAs

So far, we focussed only on horizontal FTAs, where we assumed that trade between the prospective FTA partners is predominately horizontal trade in either final goods or intermediate inputs. Now, we consider the possibility of forming an FTA between a pair of countries, where vertical trade (i.e., when countries are engaged in exports and imports of different products belonging to a particular value chain) is dominant. More specifically, we assume that country B now exports only intermediate inputs to country A, while the latter exports only final goods to B (which also embed imported intermediates from B). Such kind of trade dominates the exchanges between developing and developed markets. We call this Case 6. The rest of the trade engagements remain the same as in Case 3. Therefore, we continue to assume that A and B trade in both the commodities with the rest of the world and accordingly solve the three stages of the game to compute the sub-game perfect

In the absence of FTA, we find

$$W_A^6 = (\alpha)^2(0.059 - 0.035\theta + 0.358(\theta)^2) \tag{121}$$

$$W_B^6 = (\alpha)^2(0.354 - 0.001\theta + 0.006(\theta)^2) \tag{122}$$

$$W_R^6 = (\alpha)^2(0.371 - 0.002\theta + 0.021(\theta)^2) \tag{123}$$

And, given the two constraints viz. positive quantities, and the arbitrage-free bounds, the possible values of θ belong to the range $[0.397, 2.758]$. These conditions ensure that all the producers (upstream or downstream) are engaged in production activity, and no independent agent can destabilise the Cournot equilibrium by exploiting the arbitrage opportunities (if any). However, when A and B conclude the FTA, wherein the governments of the two countries impose an ROO-induced cost of δ on the intra-FTA imports so as to avoid trade deflection, we find that the feasible values of the three parameters viz. α, θ, and δ are restricted by the following set of conditions:

$$\delta \geq 0, \text{ and}$$

$$(\mathbf{1.204 < \theta \leq 1.437} \ \& \ \alpha > \beta^{6.1}) \tag{124}$$

where, $\beta^{6.1} = \frac{1.2874\times10^{-19}(3.694\times10^{35}\delta+2.504\times10^{35}\delta\theta)}{-1.130\times10^{16}+7.597\times10^{15}\theta+1.486\times10^{15}\theta^2} + 6.776\times10^{-21}\sqrt{\frac{1.864\times10^{74}\delta^2-2.545\times10^{73}\delta^2\theta+4.593\times10^{72}\delta^2\theta^2}{(-1.130\times10^{16}+7.597\times10^{15}\theta+1.486\times10^{15}\theta^2)^2}}$

or, $$(\mathbf{1.437 < \theta \leq 2.044}\ \&\ \beta^{6.1} < \alpha \leq \beta^{6.2})$$

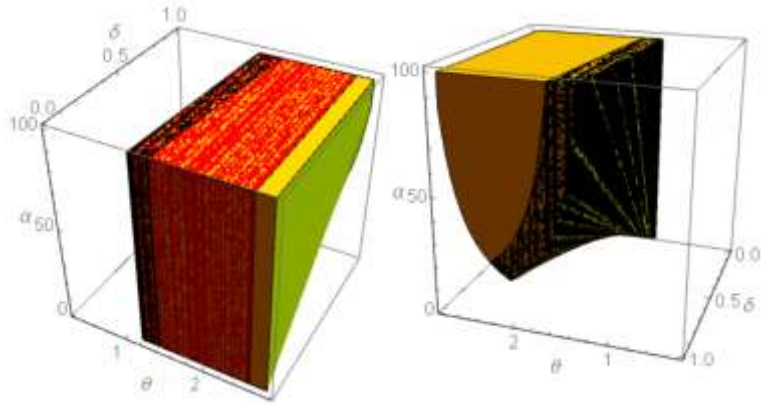
where, $$\beta^{6.2} = \frac{4.312\times10^{18}\delta}{-2.981\times10^{17}+2.074\times10^{17}\theta}$$

or, $$(\mathbf{2.044 < \theta < 2.257}\ \&\ \ \beta^{6.3} < \alpha \leq \beta^{6.2})$$

where, $\beta^{6.3} = \frac{\delta(6.260\times10^{19}+2.318\times10^{18}\theta)}{2.006\times10^{19}-6.723\times10^{18}\theta+4.682\times10^{15}\theta^2} + 1.388\times10^{-17}\sqrt{\frac{-8.875\times10^{72}\delta^2+1.130\times10^{73}\delta^2\theta+2.109\times10^{70}\delta^2\theta^2}{(2.006\times10^{19}-6.723\times10^{18}\theta+4.682\times10^{15}\theta^2)^2}}$

Since this range is quite complicated, therefore, to intuitively interpret our results, we again use 3-D region plots.

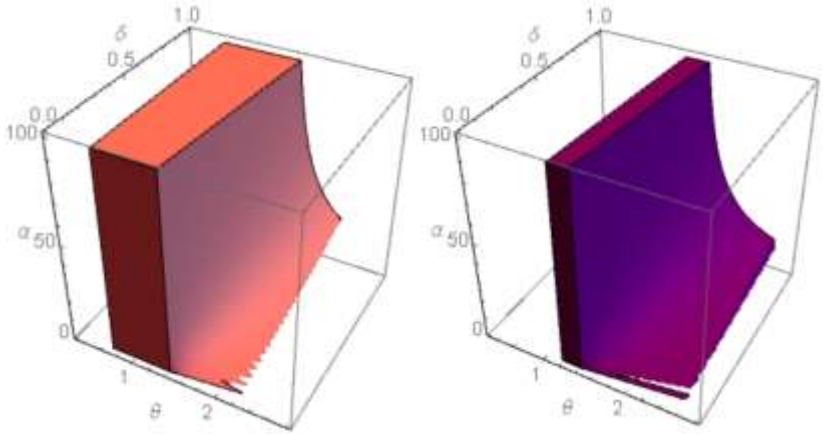
Figure 23: Region bounded by the (effective) welfare-improving A-B FTA, Case 6



In the left-panel of Figure 23, the entire coloured region (yellow, red, and black) shows the feasible range when only the welfare-improving conditions and the positive quantity constraints are assumed. This gets reduced to the red and black region, when we impose the arbitrage-free bounds in the downstream markets. Further, out of the two, only the black region represents the set of feasible values where all the pre-requisites for the effective formation of the $A-B$ FTA hold. Thus, once again, we find that the FTAs act as a viable instrument for trade creation and welfare enhancement only within a small range of parametric values. What's more crucial to note is that now θ belongs to the range $(1.204, 2.257)$ irrespective of whether or not we assume the arbitrage-free bounds. This finding, which is specific to the present case, implies that if A is small vis-à-vis B and R, or if the two FTA partners are of similar sizes but engage in exports of different products (i.e., when one supplies only the inputs to the other, and imports the final good in return from the FTA partner), then such an FTA is not necessarily welfare-enhancing for the two partners in the context of our model framework. In each of the two cases, we find that country B necessarily loses in terms of lower welfare in the post-FTA scenario vis-à-vis the pre-FTA case. Put differently, even when we control for the so-called size-effect by assuming $\theta = 1$, we find that the FTA is detrimental to country B's overall welfare,

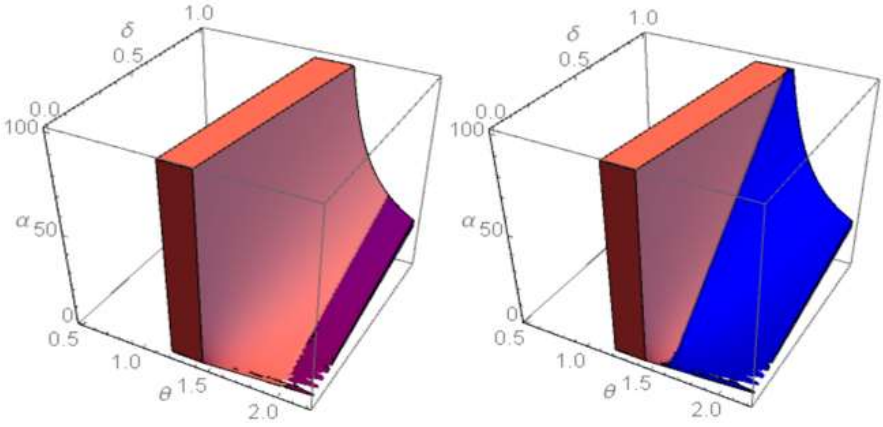
which is the exporter of intermediate input within the FTA region. We demonstrate these results using Figure 24.

Figure 24: Welfare-improving effects of the A-B FTA, Case 6



Here, the left-panel (pink-coloured region) shows all the feasible parametric values where A necessarily gains post the conclusion of the $A-B$ FTA, whereas the right panel plots such a region for country B. The two panels of Figure 24, thus, show that regardless of whether country A is small or large, or even similar in size vis-à-vis country B, it gains from the $A-B$ FTA, given the restrictions on the values of α and δ. However, such is not the case for country B. As shown in the right panel of the Figure, only when θ takes a value greater than 1, country B gains from it (under certain conditions), otherwise not. This shows the importance of commodity baskets while measuring gains from an FTA. Furthermore, we also find that, for the majority of the feasible combinations of the values of the three parameters (as in Equation (124)), the change in welfare for country A is more than the rise in the welfare of country B. This has been shown by the pink-coloured region in the left panel of Figure 25.

Figure 25: Comparison of gains from the A-B FTA, Case 6



In the purple region (left panel of Figure 25), however, the welfare increase is more for B than for A. This happens only at very high values of θ (within the feasible range), specifically, when it takes a value greater than 1.985, and very low values of α. This implies that higher FTA gains could be accrued if a country signs an FTA with a partner from whom it mostly imports intermediates, and, in return, exports its final goods. To intuitively interpret these findings, we compare and contrast the gains and losses for the two partners in terms of the four components of their total welfare function in Table 3. Nevertheless, it is worth pointing out that this result contrasts with the findings in subsections 2.3 and 4.3, in which case, we found that the smaller partner (mostly) profits more within a free trade area due to higher market access for its products, vis-à-vis the pre-FTA scenario.[39]

Table 3: Comparison of Outcomes, Country A Vs. Country B (Case 6)

S. No.	Basis for Comparison	Observations (Country A Vs. Country B)
1	Consumer Surplus	Both the countries' consumers gain after the formation of the $A-B$ FTA, however, the gain is higher in B than in country A. This could be because the price of final good decreases in country B due to duty-free imports from country A. As a result, the direct effect is stronger than the indirect gains to A's consumers due to a fall in input cost for its downstream firm.
2	Producer Surplus (Final + Intermediates)	Gains: We find that the downstream firm in country A and the upstream firm in country B profit from the $A-B$ FTA, however, the gains are higher for the former vis-à-vis the latter. This is because, with lower input cost (due to the elimination of input tariffs on imports from B, and an overall reduction of external tariffs on imports of inputs from R), the cost of production decreases for the downstream firm in country A. Further, its exports also become more cost-competitive with a fall in trade cost imposed by country B as well as R (in the case of country B, the tariffs are eliminated). This could be referred to as the positive 'forward-linkage' effect. On the contrary, country B's upstream firm gains only because of zero tariffs imposed on its exports to country A as well as higher demand by the latter's downstream firm (or, the 'backward-linkage' effect). In the present case, thus, the forward-linkage effect is stronger vis-à-vis the backward-linkage effect (unlike Cases 4 and 5).
3		Losses: The other two producers within the FTA, viz. the upstream firm in country A, and the downstream firm in country B, necessarily lose from the $A-B$ FTA. Further, the losses are more for the latter than the former. Intuitively, this happens because country B's downstream firm now faces a higher competition from relatively cheaper imports from country A (and more efficient too due to a fall in A's downstream firm's input cost). On the other hand, higher imports of inputs

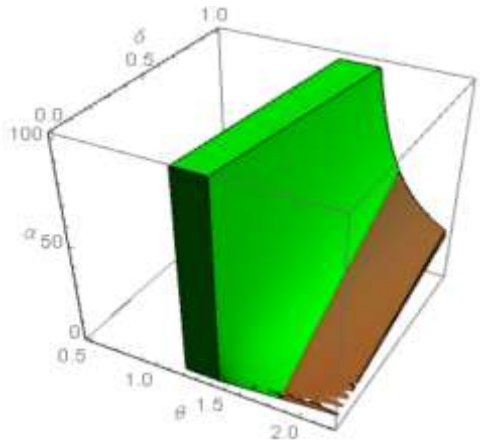
[39] This finding also highlights the crucial role played by the composition of commodity baskets while determining the heterogenous effects of FTAs across the participating economies.

		from B (due to duty free access within the FTA) affects the upstream firm in country A negatively (some effect of which gets nullified to an overall rise in the production of final good by its downstream firm, as explained in point 2 above). Therefore, on the whole, we find that the total gain in producer surplus is more in country A than B. These results, along with the previous one, imply that in the case of vertical FTAs, the partner countries' exporters gain while the importers of goods (final or intermediate) lose from the FTA. This is important to note because in the previous sub-sections, where we were considering the dominance of (horizontal) intra-industry trade, in the case of final goods' FTA (Cases 2 and 4), downstream firms' surplus declined compared to the pre-FTA scenario, while in the other Case (5), the upstream firms suffered due to lower surplus.
4	Tariff Revenue	Not only the external input tariff of country A, and the external output-tariff of country B fall post the FTA, in fact, the external output-tariff of A along with the optimal input-tariff of B also decline. What this implies is that the A -B FTA does act a building block for multilateral free trade, at least as far as the partner countries are concerned. As a consequence, the tariff revenue in country A and B necessarily fall in both countries. Once again, we find that for most of the feasible parametric values, the loss to B exceeds the loss to A. This is shown by the green coloured region in Figure 26, while in the brown coloured region (which is almost similar to the region where the welfare gains from FTA are higher for B than for A), the loss of tariff revenue is higher in country A and lower in B.

Thus, with lower value-addition in stage 2 vis-à-vis stage 3 of the game, we find that (within the feasible region), most of the combinations of the values of the three parameters show higher gains for the larger country A (i.e., the exporter of final goods), vis-à-vis the smaller partner B (who exports intermediates to and imports final good from the FTA partner).[40] However, the terms of trade for the latter (with the rest of the world or country R), necessarily improve, while that of country A deteriorate in comparison to the pre-FTA case. This is despite the fact that after the conclusion of the FTA, gains to country B are less than for country R.

Figure 26: Loss in Tariff Revenue, Country A Vs. Country B

[40] Our findings also highlight the crucial role of market sizes in the determination of gains from an FTA. In fact, in a recent article in the Hindu Business Line, Srivastav (2019) also argued that it is easier to harmonise trade deals between countries that are at similar level of development.



Further, we find that R necessarily gains within the feasible region due to an increase in its consumer surplus, surplus for the upstream firm, and the government revenue, the total of which exceeds the loss to its downstream firm with the formation of the $A-B$ FTA. As with country B, this could be because of the rise in competition from A's downstream firm, specifically when R also reduces its external output-tariff in response to the reduction of nominal duties by A and B. However, its optimal input tariff unambiguously rises. Nonetheless, an important observation is that, for a comparatively higher value of θ, i.e., when it takes a value greater than 1.5, then the welfare gains for A are less than the FTA's welfare gains for country R. This is shown by the blue-coloured region in the right panel of Figure 25. On the contrary, the pink coloured region bounds those feasible parametric values, which support higher welfare gains for A than for R. This is because, given the values of δ and α, the welfare gains for A reduces as the degree of market size asymmetry increases, and it becomes larger vis-à-vis B or R.

We also cross-verify our results by considering that the governments of the two FTA members impose different ROO requirements on each other's imports of final goods/intermediate inputs. In particular, we assume that country A's government imposes a per-unit trade cost of γ on imports of intermediate inputs from country B, while the latter imposes a cost worth δ per-unit of its imports of final goods from A. Even in such a case, we find that (i). when we do not impose any restriction on the two costs, i.e., when $\delta \gtrless \gamma$, then, in most of the region covered by the feasible parametric values, welfare gains for A are more than for B (due to the $A-B$ FTA), (ii). similar result holds when we assume $\delta > \gamma$, and (iii). when $\delta \leq \gamma$, then, B's welfare gains are always lower than A's gains from the FTA.

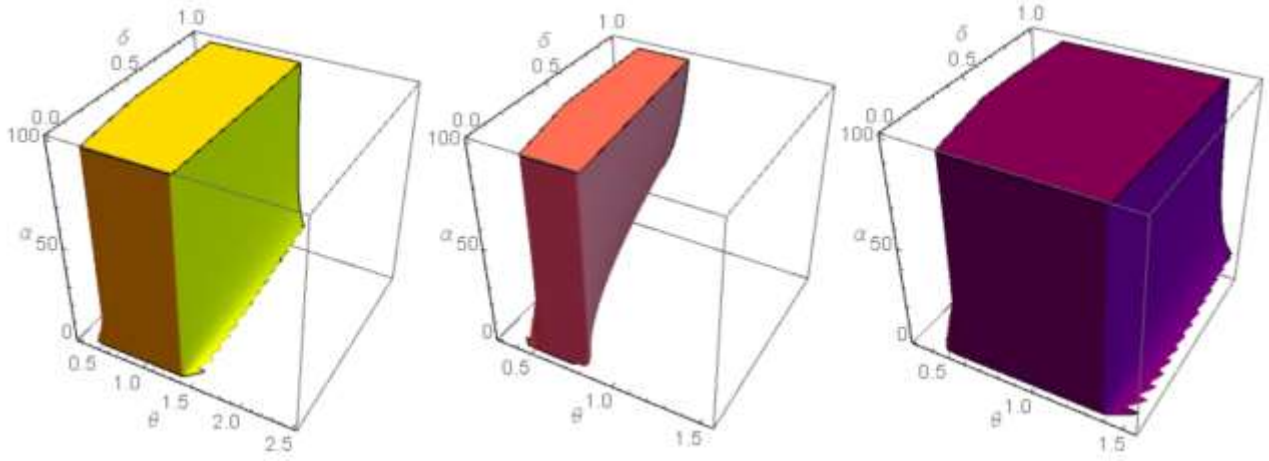
Therefore, the following two propositions are noteworthy.

Proposition 8. *In our 3-country, 2 (imperfectly-competitive) industry model, a (vertical) FTA between two trading partners mostly leads to a higher welfare gain for the larger partner exporting final good, vis-à-vis the smaller partner, who exports intermediate inputs to the larger partner.*

Proposition 9. *In our 3-country, 2 (imperfectly-competitive) industry model, a (vertical) FTA between two partners is feasible only when the larger partner is an exporter of final goods and an importer of intermediate inputs, vis-à-vis the smaller partner. In other cases, when the two partners are of similar sizes vis-à-vis the rest of the world, or if the larger partner exports intermediate inputs to, and imports final good from the smaller partner, then the FTA is not welfare-improving for both the partners within the feasible range.*

While we have already proved Proposition 8, we now consider an alternative trade regime to verify our assertion in Proposition 9. Since our model specifically assumes that countries B and R are of similar sizes, and the size of A differs from the two whenever $\theta \gtrless 1$, we re-assess the welfare effects of the $A - B$ FTA by assuming that now A exports intermediate inputs to B, while B becomes the final good exporter. We refer to this trade regime as Case 7. Figure 27 demonstrates our results in this case. Here, we assume that $\delta = \gamma$, i.e., the two partners impose the same ROO-cost on each other's imports, while continuing to maintain their independence in setting up of the external tariff rates imposed on imports from country R.[41]

Figure 27: Region bounded by the (effective) welfare-improving A-B FTA, Case 7

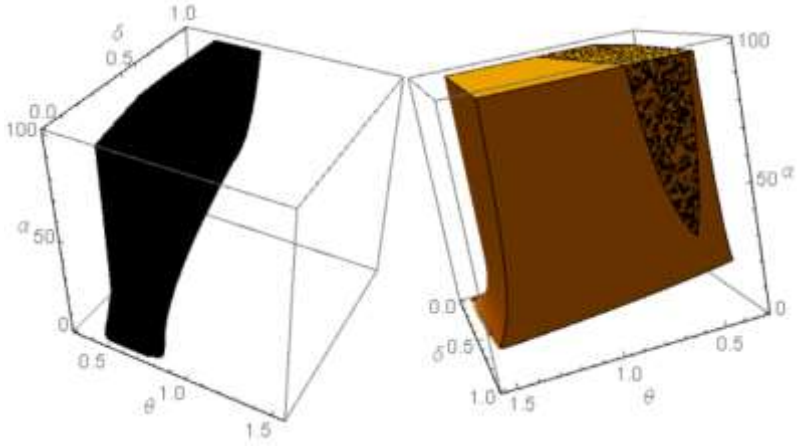


In Figure 27, the leftmost panel shows the feasible region (in yellow), where we do not consider the welfare-improving condition for the two FTA partners. The crucial point to note is that, in this region, θ lies in the range $(0.409, 1.547)$. However, when we use the welfare-improving constraint for country A, then the feasible range for θ becomes $(0.413, 0.865)$. This is shown in the middle panel (pink-coloured region) of Figure 27, and while considering the same constraint for B, feasible values of $\theta \in (0.454, 1.547)$. This implies that, akin to the previous subcase, the effective formation of the $A - B$ FTA is possible only if the larger partner (i.e., country B) exports the final good whereas the smaller partner is an exporter of intermediate input within the FTA. For any value of $\theta \geq 1$, such an

[41] We have also verified our results by re-solving the model and assuming that $\delta \gtrless \gamma$

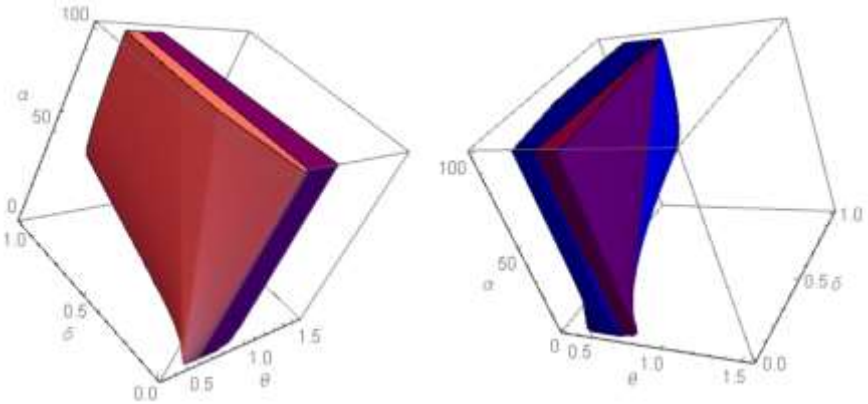
FTA is not welfare improving for country A. This could be because as the relative size of country A rises vis-à-vis country B, then it gains less in terms of market access for its exportable good than when B is comparatively larger vis-à-vis country A. As a consequence, once again, we find that the feasible region for the effective formation of the $A-B$ FTA squeezes, and now it is shown by the black coloured area in the left and right panel of Figure 28.

Figure 28: Area bounded by the (effective) welfare-improving A-B FTA, Case 7



Here, the right panel shows the back-view of the 3-dimensional region plot in the left panel. It also shows the feasible region when the welfare-improving condition is not considered for the two FTA members (represented in yellow). Further, we find that within this region, for the majority of the combinations of the parametric values, change in welfare for country B (i.e., the exporter of final good) is higher vis-à-vis welfare gains accrued by country A. This has been demonstrated in the left panel of Figure 29.

Figure 29: Comparison of gains from the A-B FTA, Case 7



Given the feasible values of δ and α, the left panel of Figure 29 shows that for comparatively lower values of θ, i.e., when the degree of market size asymmetry is high, country A gains more from the $A-B$ FTA (as represented by the pink region). On the contrary, as the value of θ rises (but remains

less than 1), the welfare-gains for the final good exporter become more than the exporter of intermediate inputs. Although this result is quite similar to the one we observed in Case 6, there does exist some difference. As we can see from Figures 25 and 29, the region supporting higher welfare-gain for the input exporter is more in the case of the latter than the former. This difference arises because of the size of country R, which is similar to country B, and also because of its response to the changes in A's and B's optimal tariff rates. In particular, we find that in the present case, country R's input tariff necessarily increases (as in the previous Case 6), but its output-tariff also rises under certain conditions. This, in turn, reduces the potential gains for country B's downstream firm, whose input cost reduces with the formation of the $A-B$ FTA.

Nonetheless, it is crucial to point out that in the absence of any market size asymmetry (between A and B, or A and R), the $A-B$ FTA necessarily reduces the welfare of the intermediate input exporter within the FTA region, while benefitting both the final goods exporter as well as the rest of the world. In fact, the latter (i.e., country R) profits in the entire yellow region shown in the leftmost panel of Figure 27 or in the right panel of figure 28. While this FTA turns out to be more beneficial for R than for A, the former gains less than B in the purple region shown in the right panel of Figure 29. The blue coloured region in the same figure, however, shows all those combinations of the feasible values of α, θ, and δ where R gains the most. One reason for such a result could be that with lower market-size asymmetry, country B's tariff (and, hence, tariff revenue) reduces by a smaller amount post the conclusion of the $A-B$ FTA than when B is much larger than A. This is because as observed from Case 1, a country's tariff rate is directly proportional to its market size. On the contrary, country R gains in terms of tariff revenue with higher input as well output tariff under certain conditions. Proposition 10 summarises the findings for country R.

Proposition 10. *Regardless of the feasible range of the parametric values and the composition of trade baskets of the FTA partners, in our 3-country vertical industry set up, country R, i.e., the rest of the world unambiguously gains from the formation of the A-B FTA. In fact, in some of the cases, welfare gains are higher for country R, vis-à-vis the two FTA partners, though its terms of trade deteriorate in comparison to the pre-FTA scenario.*

This has already been proved in Cases 2, 4, 5, 6, and 7 of our analysis. It is also important to note that this result is independent of whether or not R raises its input/output tariffs after the formation of the $A-B$ FTA. In fact, in each of the five cases, R's trade balance improved vis-à-vis country A and B. However, wherever the gains from FTA are more for B than for R, it seems plausible to conclude that under certain conditions, the trade-creation and diversion effects of free trade agreements can induce non-members (that were previously against the membership) to join the block.

5. Summary and Concluding Remarks

One of the fundamental principles of the international trade theory is that lowering trade barriers leads to increased welfare. Regional trade agreements represent one such policy mechanism, via which the participating economies offer preferential market access to each other's goods and services, and hence aim to enhance their welfares via increased trade volumes. The existing literature abounds with various theoretical studies that anticipate and advocate the benefits of such arrangements. But, the question regarding their heterogeneous effects on member countries has not been explicitly studied in any of them. In fact, barring a few, most of the empirical studies, to date, have also estimated a common average effect across all the RTAs or assume that the impact of a trade agreement is the same for all the participating economies (Baier, Yotov and Zylkin 2019). However, recently, it has been argued by trade negotiators of many countries that while some partners gain more from an RTA, others gain less or, at times, suffer from a rise in their current account deficits and overall economic losses as well. Even the Indian scenario is not an outlier in such a case. In this backdrop, the objective of this essay has been to address this ongoing debate regarding the uneven benefits from RTAs by specifically focussing on the type of commodities (intermediate inputs or final goods) that countries trade with each other, and show how the composition of their trade baskets leads to asymmetric effects on their imports and exports (and hence, overall social welfare).

We have built on a simple 3-country and 2-vertically related (imperfectly-competitive) industry framework to study the effects of free trade agreements (in particular) and analyse the conditions under which they result in higher welfare for the participating economies in the presence of preferential rules of origin. To incorporate the role of commodity profiles, we have focussed on alternative trade regimes. In particular, we have assumed two different scenarios – a). where FTAs cover horizontal trade between the participating economies, either in final or intermediate goods, and b). where vertical trade dominates, i.e., where one of the FTA members exports intermediate inputs to the other, and imports the final good in return (like the South-South or North-South trade).

First of all, our findings suggest that not all FTAs are Pareto-improving (regardless of the trade profile of the two members), and they lead to higher welfare only under certain conditions. This essentially implies that any country, while designing its trade agreements, should very carefully consider looking at the economic gains from an FTA, and not the political aspect of signing those agreements. These conditions depend on the size of the participating economies, the degree of market size asymmetry between the two, and the ROO-induced trade cost. Here, the arbitrage-free bounds play an indispensable role in determining the effective formation of an FTA and excluding the possibility of trade deflection. In fact, when we considered the role of vertical FTAs, even the trade baskets of the two members assumed significant importance in establishing whether the free trade agreement will

be beneficial to them or not. This is an important observation as it highlights why most RTAs since 1990s have been of the S-S variety.

This is so far as the welfare-improving FTAs are concerned. We also examined the heterogeneity in FTAs effects on the two trading partners. We first focussed on what we referred to as 'horizontal FTAs', and compared and contrasted the benefits when such an agreement leads to bilateral free trade in final goods between the member countries, vis-à-vis the scenario where final goods become a part of the exclusion list, and the members agree to eliminate tariffs on each other's imports of intermediate inputs. Our findings suggest that contrary to the widely held view that a country's primary focus should always be on bringing down its input-tariffs so as to improve the competitiveness of its downstream products, bilateral free trade in final goods (when the countries also trade in intermediates) leads to higher welfare for both the member countries.[42] This result could be interpreted in terms of what is referred to as the 'backward-linkage' effect in the GVC literature – zero tariffs on imports of final goods improve their tradability within the FTA, which not only benefits the consumers due to lower prices, but also raise the demand for intermediate inputs. In fact, in our model, we found that the optimal response of the two governments to the elimination of their (bilateral) output-tariffs has been to reduce their input-tariffs too, which not only reduces the cost of producing their final goods (and induce (positive) forward-linkage effect onto the downstream firms), but also positively affects the downstream firm in the rest of the world, and raise the overall welfare of the world economy. As a consequence, even the non-member country profits more in this case.

Nevertheless, it is equally imperative to note that a comparatively larger range of feasible values of our model parameters (including market size asymmetry) supports the effective formation of the FTA in intermediate goods than in final goods. On the contrary, the conclusion of an FTA in final goods is most likely to emerge between countries that are not very different from each other in terms of their market sizes. Another important finding is that in each of the two cases, the exporters of the respective goods under consideration suffered from a loss in their profits due to the formation of the FTA. This did not happen because of a loss in their export sales or revenue, but because of a fall in their domestic sales due to intense competition from foreign goods. What this implies is that a country should simultaneously accelerate domestic market reforms (to improve the competitiveness of its local firms) while negotiating different FTAs to sufficiently leverage these arrangements to increase their presence in the world market.

Most of these findings, however, drastically changed when we considered the role of vertical FTAs. In particular, we found that if the final good exporter within the FTA is small vis-à-vis the input

[42] This result is independent of whether the two members' trade deficit with each other rises or falls after the establishment of the free trade agreement.

exporter and the non-member country, or if the two FTA members are of similar sizes (as the non-member country) but engage in exports of different products, then such a trade agreement is not potentially beneficial for both the partners in the context of our model framework. In each of the two cases, the intermediate input exporter unambiguously loses after establishing the FTA. This highlights the significance of selecting an appropriate FTA partner while negotiating such deals. Further, our analysis established that even when such an effective FTA is formed, it is mostly the final good exporting country, which gains more vis-à-vis the one who imports that. Here, the so-called 'forward-linkage' effect in terms of elimination of input-tariff by the final good exporter substantially offsets the direct impact of tariff reduction on the country's upstream firm as well as the tariff revenue and therefore, plays a crucial role in determining the net benefits to the two countries, apart from the role of market asymmetry or ROO induced trade cost. This finding relates with a recent study by Marjit, Basu and Veeramani (2019) on growth gains from trade, and shows that the distribution of gains from an FTA is highly skewed in favour of those involved in high value-added tasks (i.e., the production of final goods in our case). In other words, one potential policy implication from our analysis is that restricting imports of intermediate inputs could lead to a greater loss of welfare, vis-à-vis the case when governments announce tariff concessions on imports of final goods. This result, (though specific to the case of vertical trade), is independent of the degree of market size asymmetry between the two FTA partners.

However, since asymmetric gains are actually part and parcel of these arrangements because, in the world trading platform, some specialise in the production of higher value-added goods, while for others, the key specialisation lies in the production of low value-added tasks, what matters more is that the agreements should be such that they do not raise the welfare of one partner at the cost of others.

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