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Tariff Bindings and the Dynamic Formation of Preferential Trade Agreements

Abstract

We show that multilateral tariff binding liberalization substantially impacts the nature and extent of Preferential Trade Agreement (PTA) formation. First, it shapes the nature of forces constraining expansion of Free Trade Agreements (FTAs). The constraining force is a free riding incentive of FTA non-members under relatively high bindings but an exclusion incentive of FTA members under relatively low bindings. Second, multilateral tariff binding liberalization shapes the role played by PTAs in the attainment of global free trade. Initially, tariff binding liberalization leads to Custom Union (CU) formation in equilibrium but in a way that undermines the pursuit of global free trade. However, further tariff binding liberalization leads to FTA formation in equilibrium and in a way that facilitates the attainment of global free trade. Our theoretical analysis also has implications regarding recent empirical discussions over the relative merits of FTAs versus CUs.

JEL-Codes: C720, F120, F130.

Keywords: tariff bindings, preferential trade agreement, free trade agreement, customs union, global free trade, dynamic.

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1 Introduction

The General Agreement on Tariffs and Trade (GATT), codified as part of the World Trade Organization (WTO) at its inception, has governed global trade liberalization since 1948. A key pillar of GATT is the Most Favored Nation (MFN) principle. This nondiscrimination principle requires a country levy the same tariff, the so-called MFN *applied tariff*, on other GATT/WTO members. Most prominently, various GATT negotiation rounds from the 1947 Geneva Round through the 1994 Uruguay Round generated substantial MFN tariff concessions with countries committing to MFN *tariff bindings* that cap their maximum MFN applied tariff. While less prominent, a large subset of WTO members have also committed to zero MFN tariff bindings on a range of IT products via the Information Technology Agreement (ITA).[1] The set of ITA countries and products has grown over time and this plurilateral agreement for product-specific MFN tariff binding concessions is a prototype for current negotiations on an Environmental Goods Agreement. Ultimately, MFN tariff binding concessions have been and continue to be a cornerstone of global trade liberalization.

Nevertheless, directly contravening its non-discrimination pillar, GATT allows discriminatory liberalization through Preferential Trade Agreements (PTAs). Specifically, GATT Article XXIV allows countries to eliminate tariffs between themselves if they do not raise barriers on other countries. Countries can form Free Trade Agreements (FTAs) and keep sovereign discretion over "external tariffs" on non-members or form Customs Unions (CUs) and set a common external tariff on non-members. Although relatively rare before the Uruguay Round, PTAs have proliferated thereafter. The tension between these discriminatory and non-discriminatory modes of liberalization spawned and, through failure of the current Doha Round, has sustained a large literature. In particular, this literature focuses on understanding how the discriminatory nature of PTAs impacts the degree of global trade liberalization that would otherwise arise in terms of non-discriminatory MFN applied tariffs set by countries either individually or through global negotiation rounds.

The literature has long understood that PTAs impact the extent of MFN tariff liberalization and hence the ultimate degree of global liberalization. Yet, it has largely ignored that the extent of MFN tariff liberalization can impact PTA formation and hence the ultimate degree of global tariff liberalization. This is despite real world tariff liberalization often occurring through tariff binding reductions that directly impact PTA formation incentives by changing the MFN applied tariffs levied in the absence of a PTA. This observation raises the first key question of our paper: how does a continual worldwide reduction in tariff bindings impact the equilibrium path of PTA formation?

[1] For more information on the ITA, see https://www.wto.org/english/tratop_e/inftec_e/itaintro_e.htm

The literature typically views the classic building bloc-stumbling bloc issue as whether PTA formation improves or hurts the prospects of global free trade *relative* to the outcome under multilateral liberalization. However, in practice, multilateral liberalization happens in short background bursts via various global negotiation rounds or plurilateral agreements like the ITA. Conversely, countries continuously form PTAs, choosing between FTAs and CUs, on the surface of the global trade policy landscape. Thus, an alternative view of the building bloc-stumbling bloc issue, and perhaps a more informative view, asks the following question: does a given type of PTA help or hurt the prospects of global free trade relative to the outcome if this type of PTA was banned? The second key question of our paper asks how this answer depends on tariff binding liberalization.

We build a three country dynamic model of PTA formation where countries form PTAs over time. For our underlying trade model, we use a competing exporters model where each country imports one good from the other two countries and production technologies exhibit increasing cost. To focus on the impact of continual reductions in tariff bindings, our model features symmetric countries and a symmetric tariff binding. In turn, we investigate how equilibrium PTA formation, and specifically the attainment of global free trade, changes with continual reductions in the symmetric tariff binding.

A dynamic trade-off drives the equilibrium type of PTA (i.e. FTA or CU). On one hand, CU members benefit from coordinating their external tariffs. Myopically, CU members, or "CU insiders" in the terminology of Figure 1 used hereafter, benefit from internalizing the well known negative intra-PTA externality of tariff complementarity.[2,3] And, from a farsighted perspective, each CU insider has veto power over expanding the CU to include the CU outsider and thereby reaching global free trade. CU members value this veto power when they hold a *CU exclusion incentive* or, in other words, benefit from excluding the CU outsider from expansion to global free trade. They value this veto power because, in contrast, each "FTA insider" can form their own subsequent FTA with the "FTA outsider" and precipitate FTA expansion to global free trade. Thus, the benefits of coordinating CU external tariffs consist of both myopic and farsighted CU coordination benefits.

On the other hand, FTA formation affords an FTA flexibility benefit. Unlike CU formation that gives veto power over subsequent PTA formation to both CU insiders, each FTA insider has the flexibility to form their own subsequent FTA with the "FTA outsider" and become the "hub" with sole preferential access to the other two "spoke" countries. Ultimately, the discount factor mediates the dynamic trade-off between the CU coordination

[2]Tariff complementarity is the phenomenon whereby PTA formation induces the PTA members to lower their external tariff on non-members.

[3]Section 2.2 discusses Figure 1 in more detail.

and FTA flexibility benefits.

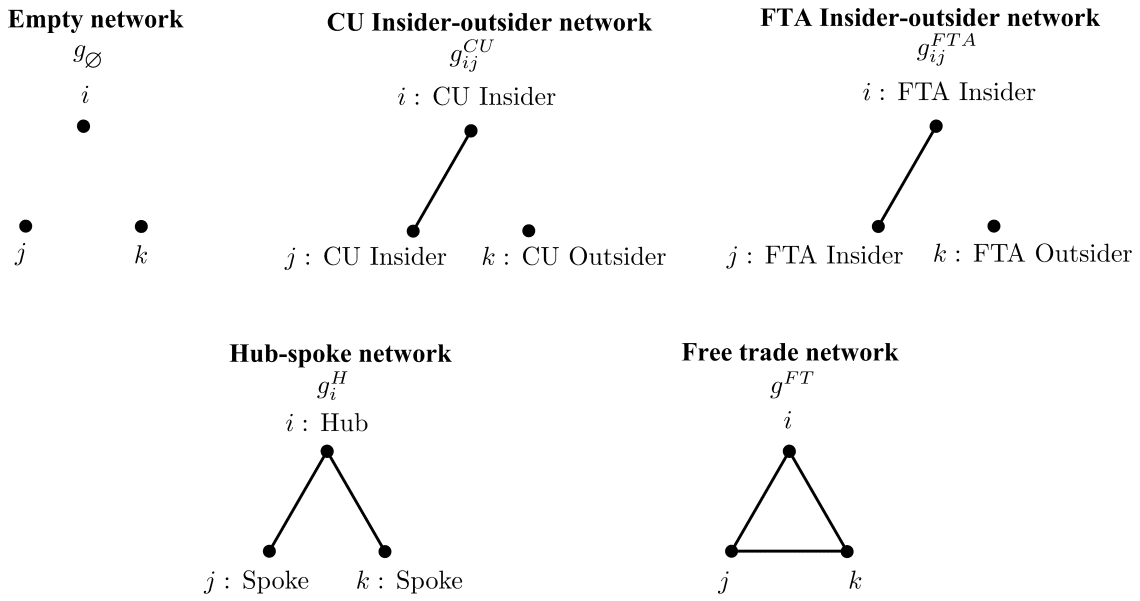

Figure 1: Network positions

Our first main insight is that tariff binding liberalization fundamentally shapes the equilibrium path of PTA formation. With high tariff bindings, PTA formation leads to global free trade with the discount factor determining whether this happens via CUs or FTAs. Intuitively, CU insiders do not hold a CU exclusion incentive under high tariff bindings, and hence no farsighted CU coordination benefit, because the CU outsider's high tariffs make CU expansion to global free trade attractive for CU insiders.[4] Thus, the FTA flexibility benefit outweighs (is outweighed by) the myopic CU coordination benefit and FTAs (CUs) emerge in equilibrium for relatively patient (impatient) countries.

Once tariff binding liberalization produces intermediate tariff bindings then, regardless of the discount factor, CU formation emerges in equilibrium but does not lead to global free trade. Because the CU outsider must lower their tariffs once tariff binding liberalization pushes below the unilaterally optimal Nash tariffs, CU insiders receive tariff concessions from the CU outsider. This soon generates a CU exclusion incentive, and hence a farsighted CU coordination benefit, with CU insiders permanently excluding the CU outsider. Moreover, this farsighted CU coordination benefit is sufficiently strong that the myopic and farsighted CU coordination benefits always outweigh the FTA flexibility benefit.

Nevertheless, further tariff binding liberalization leads to an equilibrium re-emergence of FTAs and the attainment of global free trade. Eventually, relatively low tariff bindings impinge on the CU insiders' ability to coordinate external tariffs and thereby shrinks their

[4]We hereafter refer to MFN applied tariffs as "tariffs" and MFN bound tariffs as "tariff bindings".

myopic CU coordination benefit. Now, the FTA flexibility benefit outweighs the myopic and farsighted CU coordination benefits for intermediate degrees of patience and, unlike CU formation, equilibrium FTA formation expands to global free trade.

Our second main insight is that tariff binding liberalization influences the role played by the equilibrium type of PTA in attaining global free trade relative to the outcome if this type of PTA was banned. To this end, we introduce the terminology of "PTA stumbling bloc" and "PTA building bloc". CUs (FTAs) are a "PTA stumbling bloc" if CU (FTA) formation emerges in equilibrium and does not lead to global free trade yet FTA (CU) formation would lead to global free trade in the absence of CUs (FTAs). Similarly, CUs (FTAs) are a "PTA building bloc" if CU (FTA) formation emerges in equilibrium and leads to global free trade yet FTA (CU) formation would not lead to global free trade in the absence of CUs (FTAs). Our key result here is that FTAs can only be PTA building blocs but tariff binding liberalization morphs CUs from PTA building blocs into PTA stumbling blocs.

When FTAs emerge in equilibrium, FTA formation always expands to global free trade and, hence, FTAs cannot be PTA stumbling blocs. Moreover, given CU formation does not expand to global free trade for tariff bindings that generate the CU exclusion incentive, FTAs are PTA building blocs here when they emerge in equilibrium. Two forces constrain the equilibrium emergence of FTAs and, hence, the extent that FTAs are PTA building blocs. For relatively high tariff bindings, a sufficiently impatient FTA outsider holds a *dynamic free riding incentive* and refuses FTA formation: despite global free trade eliminating future discrimination, this is outweighed by the myopic benefit the FTA outsider receives from the tariff complementarity of FTA insiders. But, for relatively low tariff bindings, sufficiently patient FTA insiders hold a *dynamic exclusion incentive* and permanently exclude the FTA outsider: despite the myopic benefit of becoming the hub, FTA insiders prefer permanently excluding the FTA outsider in order to avoid the future attainment of global free trade.[5] Thus, despite FTAs never acting as PTA stumbling blocs, tariff binding liberalization still shapes the forces that constrain FTA expansion to global free trade.

Like FTAs, CUs can be a PTA building bloc. With high tariff bindings, CU insiders do not hold a CU exclusion incentive and CU formation expands to global free trade. When CUs emerge in equilibrium here, which happens when countries are sufficiently impatient, the FTA outsider holds a dynamic free riding incentive. Thus, CUs are PTA building blocs because FTA formation would not lead to global free trade. However, tariff binding liberalization morphs CUs into PTA stumbling blocs. For the intermediate range of tariff bindings

[5] Although not exactly analogous, one could look at the renegotiated NAFTA, i.e. USMCA, to illustrate the practical importance of an FTA exclusion incentive. There, a provision gives the US veto power over other USMCA members forming FTAs with non-members that are non-market economies.

generating a CU exclusion incentive and an equilibrium CU, CUs are PTA stumbling blocs when FTAs would lead to global free trade. For relatively high tariff bindings, this happens when the FTA outsider does not hold a dynamic free riding incentive. And for relatively low tariff bindings, this happens when FTA insiders do not hold a dynamic exclusion incentive.

A possible drawback of our analysis is our exogenous treatment of tariff bindings. Indeed, the literature has theoretical explanations for endogenous tariff bindings. Horn et al. (2010) argue that costly contracting makes a state-contingent agreement unattractive. Also, uncertainty over future political economy concerns can motivate a demand for flexibility over future applied tariff setting (e.g. Bagwell and Staiger (2005), Amador and Bagwell (2013), Beshkar et al. (2015) and Nicita et al. (2018)). In contrast to these non-PTA based explanations, Lake and Roy (2017) show how tariff bindings negotiated by forward-looking governments bear the imprint of subsequent FTA formation. Nevertheless, as a whole, the literature views tariff binding determination and PTA formation as distinct issues and, moreover, has not provided explanations for continual rounds of multilateral tariff binding liberalization. Thus, our tractable analysis seems reasonable in motivating the importance of tariff binding liberalization for the endogenous choice between FTAs and CUs.

Surprisingly few papers have addressed how multilateral tariff liberalization impacts the extent of PTA formation (Freund and Ornelas (2010)). Ethier (1998) argues countries use PTAs as a benign consequence of being left out of earlier rounds of multilateral tariff liberalization. In a repeated game setting, Freund (2000) shows how multilateral tariff liberalization can make an FTA "self-enforcing".

Lake and Roy (2017) and Nken and Yildiz (2018) represent two recent contributions. Like our paper, Nken and Yildiz (2018) find tariff binding liberalization weakens the FTA non-member free riding incentive. Hence, multilateral tariff liberalization again facilitates FTA expansion. But, unlike our paper, their static framework prevents the exclusion incentive from playing a meaningful role in equilibrium. Contrary to these positive views of multilateral tariff liberalization, Lake and Roy (2017) show how endogenous multilateral tariff bindings generate an FTA exclusion incentive because, like our paper, relatively tight tariff bindings deliver tariff concessions from FTA non-members to FTA members. Ultimately, multilateralism acts as a stumbling bloc to global free trade for Lake and Roy (2017). Unlike our paper, neither Lake and Roy (2017) nor Nken and Yildiz (2018) endogenize countries choice between FTAs and CUs and hence do not analyze the PTA building bloc and PTA stumbling bloc properties of FTAs and CUs.

A small, but growing, literature investigates the endogenous choice between FTAs and CUs. Riezman (1999) finds CUs can emerge in equilibrium when CU insiders have a CU exclusion incentive but, unlike our analysis, FTAs cannot emerge in equilibrium. Melatos and

Woodland (2007) find a similar result even with preference or endowment asymmetries. For Seidmann (2009), the FTA versus CU choice influences how countries bargain over surplus division under global free trade. Melatos and Dunn (2013) and Appelbaum and Melatos (2016) analyze the FTA versus CU choice in, respectively, evolving and uncertain trading environments and Facchini et al. (2012) focus on the role played by income inequality and production structures.[6] Lake (2019) shows how the dynamic trade off between FTA flexibility and CU coordination benefits can help explain the prevalence of FTAs over CUs and Lake and Yildiz (2016) show how this trade off can help explain why, in practice, FTAs are intra- and inter-regional while CUs are always intra-regional.

PTA member exclusion incentives and PTA non-member free riding incentives have long been important for theoretical analyses of PTAs and their impact on attaining global free trade.[7] However, a given analysis typically relies on one incentive or the other. In Saggi and Yildiz (2010), the FTA non-member free riding incentive is weaker than the incentive to free ride on MFN liberalization and, hence, FTAs can be a "building bloc" to global free trade. In Saggi et al. (2013), CU member exclusion incentives can be stronger than the MFN free riding incentive and, hence, CUs can be a "stumbling bloc" to global free trade. Based on these two papers, Maggi (2014) hypothesizes that CUs, but not FTAs, constrain the prospects of global free trade. But, he argues this conclusion requires a model where countries endogenously choose between CUs and FTAs.

Our model can directly address Maggi's hypothesis. Rather than tie exclusion and free riding incentives to country asymmetries, which are somewhat nebulous in real world applications, we tie them to tariff binding liberalization which has concrete real world interpretations. Further, we build a dynamic model because static models often have difficulty generating FTAs in equilibrium; e.g. countries always choose CUs over FTAs in the static model of Missios et al. (2016). In our dynamic setting, the dynamic trade off between the FTA flexibility and CU coordination benefits drive determine whether FTAs or CUs emerge in equilibrium. Ultimately, we add nuance to Maggi's hypothesis: in our own terminology, FTAs can only act as a "PTA building bloc" but CUs act as either a "PTA stumbling bloc" or "PTA building bloc". The overlooked nuance of CUs as a PTA building bloc comes from the weaker free riding incentive for a CU outsider than an FTA outsider due to stronger discrimination and weaker tariff complementarity benefits.

Finally, our paper relates to Felbermayr et al. (2018) who document little difference in FTA member external tariffs despite no imposition of a common external tariff. And, given

[6] See Lake (2019) for a more detailed discussion of the papers discussed so far in this paragraph.

[7] The seminal contributions of Levy (1997) and Krishna (1998) relied on exclusion incentives. Ornelas (2005) represents an early analysis relying on a free riding incentive. In a recent survey chapter, Lake and Krishna (2018) emphasize the role played by these incentives.

the sizeable misallocation costs of FTA rules of origin (e.g., Conconi et al. (2018)), they make policy recommendations so that FTAs can emulate CUs. However, our analysis makes three points. First, unlike FTA members, CU members *coordinate* higher tariffs that reduce world welfare. Second, one reason FTAs may remain so popular in practice is the flexibility benefit of FTA members to form their own subsequent FTAs. Indeed, third, that FTAs are only PTA building blocs while CUs can be PTA stumbling blocs shows how the FTA flexibility benefit can propel the degree of global trade liberalization beyond that achieved by CUs.

Next, Section 2 describes our model. Sections 3 and 4 analyze the "FTA game" and "CU game" where, respectively, countries can only form FTAs or CUs. Section 5 analyzes the "PTA game" that endogenizes countries' choice between FTAs and CUs. Section 6 presents extensions and Section 7 concludes. The Appendix contains all proofs.

2 Model

We allow countries to form PTAs over time. In each period, countries choose optimal applied tariffs given the network of PTAs and existing tariff bindings. In turn, production, consumption and trade emerge. Section 2.1 details the underlying trade model. Sections 2.2 and 2.3 describe how countries choose applied tariffs. Section 2.4 details our dynamic game theoretic model of PTA formation.

2.1 Underlying trade model

We modify Horn et al. (2010) to a competing exporters setup with three countries a, b, c, three non-numeraire goods A, B, C and, a numeraire good v_0. When appropriate, we hereafter use $z = i, j, k$ as generic notation for countries and $Z = I,\ J,\ K$ as generic notation for non-numeraire goods.

On the demand side, the representative consumer's utility function is quasi-linear

$$U(\mathbf{v}, v_0) = u(\mathbf{v}) + v_0$$

with $u(\mathbf{v})$ quadratic and additively separable in the vector of non-numeraire good consumption $\mathbf{v}$. Thus, a representative consumer from country i has demand for good Z of

$$d_i^Z(p_i^Z) = \alpha - p_i^Z \tag{1}$$

where p_i^Z denotes the price of good Z in country i. In turn, country i's consumer surplus

from good Z is

$$CS_i^Z(p_i^Z) = u_i^Z[d_i^Z(p_i^Z)] - p_i^Z d_i^Z(p_i^Z) = \frac{1}{2}\left(\alpha - p_i^Z\right)^2. \tag{2}$$

On the supply side, the numeraire good is produced one-for-one from labor.[8] Focusing on non-numeraire good Z in country i, diminishing returns characterizes production:

$$Q_i^Z = \sqrt{2\lambda_i^Z l_i^Z}$$

where l_i^Z denotes labor use and λ_i^Z depends on the structure of comparative advantage. Supply and producer surplus are

$$s_i^Z(p_i^Z) = \lambda_i^Z p_i^Z \tag{3}$$

$$PS_i^Z(p_i^Z) = \int s_i^Z(p_i^Z)dp_i^Z = \frac{1}{2}\lambda_i^Z(p_i^Z)^2. \tag{4}$$

We assume a symmetric comparative advantage structure: $\lambda_i^I = 1$ while $\lambda_i^Z = 1 + \lambda > 1$ for $Z \neq I$. Thus, each country i has a comparative advantage in the two goods $Z \neq I$ but a comparative disadvantage in good I. That is, each country i imports good a single non-numeraire good i from two competing exporters j and k.

No-arbitrage conditions link non-numeraire goods prices across countries and world market clearing conditions for non-numeraire goods deliver equilibrium prices. Ruling out prohibitive tariffs and letting t_{iz} denote country i's tariff on imports of good I from country $z = j, k$, the no-arbitrage and world market clearing conditions for good I are

$$p_i^I = p_j^I + t_{ij} = p_k^I + t_{ik} \tag{5}$$

$$m_i^I = \sum_{z \neq i} x_z^I \tag{6}$$

where $m_i^I = d(p_i^I) - s_i^I(p_i^I)$ denotes country i's imports of good I and $x_z^I = s_z^I(p_z^I) - d(p_z^I)$ denotes the exports of good I by country $z = j, k$. Specifically, given (1) and (3), we have

$$m_i^I = \alpha - 2p_i^I \text{ and } x_z^I = (2 + \lambda)p_z^I - \alpha. \tag{7}$$

Substituting trade flows (7) and the no-arbitrage condition (5) into the world market clearing

[8] This pins wages to 1 given we also assume the supply of labor is large enough to ensure positive production of the numéraire good.

condition (6) yields equilibrium prices of good I:

$$p_i^I = \frac{3\alpha + (2+\lambda)\sum_{z\neq i} t_{iz}}{2(3+\lambda)} \text{ and } p_j^I = \frac{3\alpha + (2+\lambda)t_{ik} - (4+\lambda)t_{ij}}{2(3+\lambda)}. \tag{8}$$

We can now see how tariffs and the degree of comparative advantage impact prices and trade flows. Given equilibrium prices, country j's exports of good I to country i are

$$x_j^I = \frac{\alpha\lambda\left[t_{ik}(\lambda^2 + 4(1+\lambda)) - t_{ij}(\lambda^2 + 2(3\lambda+4))\right]}{2\lambda+3}. \tag{9}$$

Three observations follow from (8)-(9). First, a stronger degree of comparative advantage (i.e. higher λ) increases trade flows between countries (i.e. higher x_z^I for $z = j, k$) and lowers prices across the world (i.e. lower p_i^I and p_z^I for $z = j, k$). Second, while part of country i's tariff on country j passes through to a higher local price p_i^I, country i also receives a terms of trade improvement vis-à-vis country j through a lower local price p_j^I. Third, this tariff on country j also diverts trade between the competing exporters: country k's exports to country i rise, but those of country j to country i fall.

Finally, given the partial equilibrium nature of the model, trade policy has welfare implications only for non-numeraire goods. A country's welfare is defined as the sum of consumer surplus, producer surplus, and tariff revenue over these goods:[9]

$$w_i = \sum_Z CS_i^Z\left(p_i^Z\right) + \sum_Z PS_i^Z\left(p_i^Z\right) + \sum_{z\neq i} t_{iz}x_z^I\left(p_z^I\right). \tag{10}$$

2.2 Optimal applied tariffs

Here, we focus on optimal applied tariffs and ignore tariff bindings. Section 2.3 considers the implications of tariff bindings for applied tariffs. To begin, we introduce terminology describing the network of PTAs. A growing number of papers in the recent PTA literature (e.g. Goyal and Joshi (2006), Furusawa and Konishi (2007), Zhang et al. (2013), Lake and Yildiz (2016) and Lake (2017)) borrow terminology from the network literature by viewing countries as nodes on a "graph" and edges between nodes as bilateral "links" between countries. The graph g then describes the set of bilateral links between players and we henceforth refer to g as the network of PTAs.

Figure 1 illustrates these possible networks. The "empty network" $g_\varnothing$ emerges in the absence of any PTAs. g_{ij}^{FTA} is the "FTA insider-outsider network" where the FTA non-member

[9] Substituting (8) in (10) gives a closed form expression for country i's welfare as a function of an arbitrary vector of tariffs $(t_{ij}, t_{ik}, t_{ji}, t_{jk}, t_{ki}, t_{kj})$ and, hence, for any network of PTAs.

k is the "FTA outsider" and the FTA members i and j are "FTA insiders". Analogously, g_{ij}^{CU} is the "CU insider-outsider network" where the CU non-member k is the "CU outsider" and the CU members i and j are "CU insiders". g_i^H is the "hub-spoke" network where countries j and k are "spokes" and each have an FTA with country i who is the "hub". g^{FT} is the "free trade network" where all countries are linked through FTAs or CUs.

Without any PTAs, country i imposes a non-discriminatory tariff (per GATT Article I). Letting $t_{ij}(g_\varnothing) = t_{ik}(g_\varnothing) = t_i(g_\varnothing)$, country i's optimal applied MFN tariff is:

$$t_\varnothing \equiv \underset{t_i(g_\varnothing)}{\arg\max} w_i(g_\varnothing) = \frac{\alpha\lambda}{2(2+\lambda)(4+\lambda)}. \tag{11}$$

By increasing its import volume, a country's optimal tariff increases with its own market size (α) and the exporters' degree of comparative advantage (λ).

FTA members remove internal tariffs on each other and impose individually optimal external tariffs on the non-member. Under a single FTA, say between i and j, this individually optimal external tariff is

$$t_{FTA} \equiv \underset{t_{ik}\left(g_{ij}^{FTA}\right)}{\arg\max} w_i(g_{ij}^{FTA}) = \frac{\alpha\lambda}{2(2+\lambda)(2\lambda^2+13\lambda+22)}. \tag{12}$$

Given $t_\varnothing > t_{FTA}$, FTA insiders practice "tariff complementarity" by lowering their tariff on the FTA outsider.[10] But, market separability implies the FTA non-member's optimal MFN tariff remains unchanged: $t_{ki}\left(g_{ij}^{FTA}\right) = t_{kj}\left(g_{ij}^{FTA}\right) = t_k(g_\varnothing)$ and $t_{jk}\left(g_i^H\right) = t_{jk}\left(g_{ij}^{FTA}\right)$.

Like FTA insiders, CU insiders remove internal tariffs and practice tariff complementarity. But, unlike FTA insiders, CU insiders coordinate external tariffs. Maximizing joint welfare, their optimal external tariff is

$$t_{CU} \equiv \underset{t_{ik}\left(g_{ij}^{CU}\right)}{\arg\max}\ w_i(g_{ij}^{CU}) + w_j(g_{ij}^{CU}) \text{ subject to } t_{jk}\left(g_{ij}^{CU}\right) = t_{ik}\left(g_{ij}^{CU}\right) \tag{13}$$

$$= \frac{\alpha\lambda}{(\lambda+2)(3\lambda+10)}. \tag{14}$$

When setting external tariffs individually, each FTA member ignores the negative intra-PTA externality of tariff complementarity due to the lower tariff on the PTA non-member lowering the FTA partner's export surplus. By coordinating external tariffs, CU insiders benefit from internalizing this negative externality, i.e. $t_{CU} > t_{FTA}$, and thereby practice a lower degree of tariff complementarity than FTA insiders.[11]

[10] For tariff complementarity discussions, see Bagwell and Staiger (1997, 1999), Bond et al. (2004), Estevadeordal et al. (2008) and Saggi and Yildiz (2009).

[11] In contrast, see Mrázová et al. (2012) for a setting, and the implications thereof, where CU members

2.3 Implications of tariff bindings

Countries cannot raise their applied tariff above the tariff binding. In this paper, we consider exogenous tariff bindings and, given our symmetric countries, a symmetric tariff binding τ.

Figure 2 illustrates four possible ranges of tariff bindings. The tariff binding never binds in the "No binding region"; regardless of PTA formation, the tariff binding τ exceeds the optimal applied tariff of all countries: $\tau > t_{\varnothing} > t_{CU} > t_{FTA}$. This is the range typically considered by the existing PTA literature that ignores tariff bindings.

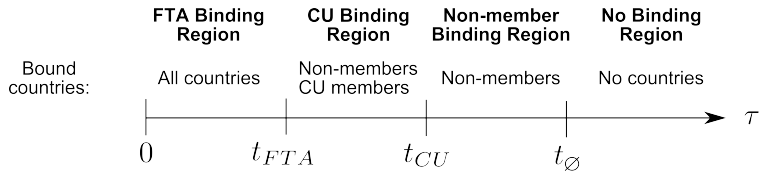

Figure 2: Tariff binding regions

However, the tariff binding binds once $\tau < t_{\varnothing}$. In the "Non-member binding region", $t_{CU} < \tau < t_{\varnothing}$, the FTA and CU outsiders are bound and levy an applied tariff τ below their optimal applied tariff $t_{\varnothing}$. Further, once in the "CU binding region" $t_{FTA} < \tau < t_{CU}$, CU insiders are bound and levy an applied tariff τ below their optimal applied tariff t_{CU}. Finally, once in the "FTA binding region" $\tau < t_{FTA}$, the FTA insiders, and hence all countries, are bound and all levy an applied tariff τ below their optimal applied tariff.

2.4 Strategies and equilibrium concept

Our dynamic model follows Lake and Yildiz (2016) and Lake (2019), and is similar to Seidmann (2009). We assume at most one PTA can form in a period and that PTAs formed in previous periods cannot be severed.[12,13] Given a network g_{t-1} at the beginning of the current period t, we say the current period t is the subgame at g_{t-1}. Table 1 illustrates the

are indeed bound by the GATT Article XXIV constraint that they do not raise their tariffs on non-members.

[12] Ornelas (2008) and Ornelas and Liu (2012), among others, argue the binding nature of trade agreements is pervasive in the literature and, nothwithstanding Brexit, realistic in terms of real world observation. They also argue the assumption can represent a reduced form for more structural justifications such as sunk costs (see McLaren (2002) and, for empirical support, Freund and McLaren (1999)). Nevertheless, as argued in more detail by Lake and Krishna (2018), the possibility of countries backing out of PTAs is a ripe area for future research. For example, President Trump has repeatedly threatened to take the US out of NAFTA.

[13] Because negotiations often take many years to complete we essentially interpret a period as the required time to negotiate an agreement. Empirically, for example, Odell (2006, p.193) documents NAFTA negotiations dating back to 1986 despite not being signed until 1992. Mölders (2012, 2015) and Freund and McDaniel (2016) document similar results covering many more FTAs. Dent (2006) and US Government Accountability Office (2004, p.3, p.27) document the high diplomatic resource-intensity of FTA negotiations in developing and developed countries.

Network at beginning of current period	**Network at end of current period**
$g_{\varnothing}$	$g_{\varnothing}, g_{ij}^{FTA}, g_{ik}^{FTA}, g_{jk}^{FTA}, g_{ij}^{CU}, g_{ik}^{CU}, g_{jk}^{CU}$
g_{ij}^{FTA}	$g_{ij}^{FTA}, g_{i}^{H}, g_{j}^{H}$
g_{ij}^{CU}	g_{ij}^{CU}, g^{FT}
g_{i}^{H}	g_{i}^{H}, g^{FT}
g^{FT}	g^{FT}

Table 1: Feasible network transitions

current period feasible transitions $g_{t-1} \rightarrow g_t$ where g_t denotes the network at the end of the current period.

A network remains permanently upon one of two conditions which happens no later than the third period. First, when no agreement forms in a given period, the assumption below of Markov strategies implies no agreement forms in any subsequent period. Second, once global free trade emerges, the assumption that previously formed agreements cannot be severed implies global free trade remains forever. Because the network remains unchanged from no later than the third period onwards, we let the last network in a path of networks denote the network that remains forever: e.g., $g_{t-1} \rightarrow g_t \rightarrow g_{t+1}$ describes the path of networks that begins at g_{t-1}, then passes through g_t, and then remains at g_{t+1} forever; alternatively, the *path* of networks $g_{\varnothing} \rightarrow g_{\varnothing}$ indicates no PTA ever forms.

Countries have preferences over paths of PTA networks captured by continuation payoffs. Given a feasible transition $g_{t-1} \rightarrow g_t$ from the network g_{t-1} at the beginning of the current period to the network g_t at the end of the current period, the context often makes clear the path of networks $g_{t+1} \rightarrow g_{t+2} \rightarrow ...$ that follow this current period transition. Thus, we simply let $V_i(g_t)$ be the continuation payoff from the path of networks $g_{t-1} \rightarrow g_t \rightarrow g_{t+1} \rightarrow g_{t+2} \rightarrow ....$ Specifically, suppose the network at the beginning of the current period is the empty network $g_{\varnothing}$. Then, assuming country i's one period payoff is national welfare $w_i(g)$ and letting β denote the discount factor, country i's continuation payoff from the path of networks $g_{\varnothing} \rightarrow g_{ij}^{CU} \rightarrow g^{FT}$ is $V_i\left(g_{ij}^{CU}\right) = w_i\left(g_{ij}^{CU}\right) + \frac{\beta}{1-\beta} w_i\left(g^{FT}\right)$. Alternatively, given the empty network $g_{\varnothing}$ remains forever if no PTA forms in the current period, country i's continuation payoff from the path of networks $g_{\varnothing} \rightarrow g_{\varnothing}$ is $V_i(g_{\varnothing}) = \frac{1}{1-\beta} w_i(g_{\varnothing})$.

Like Lake and Yildiz (2016) and Lake (2019), we assume a deterministic protocol where a "leader" country (country a) has the first opportunity in each period to propose a PTA that has not yet formed. Naturally, the leader country must be a member of this PTA and the associated transition must be feasible (see Table 1). The proposed PTA forms if and only if all "recipient" countries (countries b and/or c) accept the proposal. If the leader country's proposal is not accepted by the follower countries, one of the follower countries can propose a PTA. The proposal ability of the follower countries distinguishes our protocol from Aghion

	$P_i(g)$	$P_j(g)$	$P_k(g)$
$g_\varnothing$	$\{\phi, ij^{FTA}, ik^{FTA}, ij^{CU}, ik^{CU}\}$	$\{\phi, ij^{FTA}, jk^{FTA}, ij^{CU}, jk^{CU}\}$	$\{\phi, ik^{FTA}, jk^{FTA}, ik^{CU}, jk^{CU}\}$
g_{ij}^{FTA}	$\{\phi, ik^{FTA}\}$	$\{\phi, jk^{FTA}\}$	$\{\phi, ik^{FTA}, jk^{FTA}\}$
g_{ij}^{CU}	$\{\phi, ijk^{CU}\}$	$\{\phi, ijk^{CU}\}$	$\{\phi, ijk^{CU}\}$
g_i^H	$\{\phi\}$	$\{\phi, jk^{FTA}\}$	$\{\phi, jk^{FTA}\}$
g^{FT}	$\{\phi\}$	$\{\phi\}$	$\{\phi\}$

Table 2: Proposer country's action space for each subgame in PTA game

et al. (2007) where only the leader country can make proposals and hence, for example, the two follower countries could not form their own FTA.

Formally, Stages 1-2 describe the protocol in every period:

Stage 1(a). Country a has the opportunity to propose a PTA. If the PTA forms then the period ends. If one recipient country rejects the proposal then the game moves to Stage 1(b). Otherwise, the game moves to Stage 2.[14]

Stage 1(b). Country a has the opportunity to propose a PTA with the country who did not reject its proposal in Stage 1(a). If the PTA forms then the period ends. Otherwise, the game moves to Stage 2.

Stage 2. Country b has the opportunity to propose a PTA. No matter what happens, the period ends.

As described earlier, this protocol implies that the network remains unchanged upon the attainment of global free trade or when no agreement forms in a period. Thus, the network remains unchanged from at most the third period onwards.

In our "PTA game", countries can propose FTAs or CUs. Thus, Table 2 specifies the available proposals for each country as the proposer in the "PTA game" where, e.g., $P_i(g)$ is the set of proposals for country i and $\rho_i(g) \in P_i(g)$ is a proposal. More specifically, ij^{FTA} (ij^{CU}) denotes the FTA (CU) between i and j while ijk^{CU} denotes the three country CU and ϕ denotes the proposal of no PTA. Naturally, our "FTA game" and "CU game" restrict the proposals in Table 2, respectively, by ruling out CU proposals and FTA proposals. Having received a proposal $\rho_i(g)$ from country i, each recipient country j (i.e., a country of the proposed agreement) announces a response $r_j(g, \rho_i(g)) \in \{Y, N\}$ where $Y(N)$ denotes the acceptance (rejection) of the proposal by country j.

For each subgame at a network g, the Markov strategy of each country i must do two things: (i) specify a proposal $\rho_i(g) \in P_i(g)$ for the stage(s) where it is the proposer and (ii) assign a response $r_i\left(g, \rho_j(g)\right) \in \{Y, N\}$ to any proposal it may receive from some other

[14] As specified in Table 1, FTA proposals involve a single recipient country. In particular, expansion from g_{ij}^{FTA} to g^{FT} proceeds via a hub-spoke network g_i^H or g_j^H. However, also as specified in Table 1, CU expansion from g_{ij}^{CU} proceeds directly to g^{FT} and hence involves two recipient countries.

country j. We solve for a type of pure strategy Markov perfect equilibrium. Specifically, using backward induction, we solve for a pure strategy subgame perfect equilibrium where the proposal by the proposer and the response by the respondent in the current period only depend on history via the network in place at the end of the previous period.[15]

Absent further structure, symmetry in country characteristics generate multiple equilibria. Thus, we assume country b (c) has an arbitrarily small non-economic benefit $\varepsilon > 0$ of bilateral PTA formation with country a rather than country c (b) and country a has an arbitrarily small non-economic benefit $\varepsilon > 0$ of bilateral PTA formation with country b rather than country c. These non-economic benefits can motivate our protocol ordering.[16]

Next, we use backward induction to solve for the equilibrium path of PTA networks. Section 3 analyzes the "FTA game" where countries can only form FTAs and Section 4 analyzes the "CU game" where countries can only form CUs. Finally, Section 5 analyzes the "PTA game" where countries can form either FTAs or CUs.

3 Equilibrium path of networks: FTA game

In this section, we analyze the "FTA game" where countries can only form FTAs. This helps isolate the driving forces behind FTA formation. Table 3 shows how our FTA game restricts the proposals in Table 2.

	$P_i(g)$	$P_j(g)$	$P_k(g)$
$g_\varnothing$	$\left\{\phi, ij^{FTA}, ik^{FTA}\right\}$	$\left\{\phi, ij^{FTA}, jk^{FTA}\right\}$	$\left\{\phi, ik^{FTA}, jk^{FTA}\right\}$
g_{ij}^{FTA}	$\left\{\phi, ik^{FTA}\right\}$	$\left\{\phi, jk^{FTA}\right\}$	$\left\{\phi, ik^{FTA}, jk^{FTA}\right\}$
g_i^H	$\{\phi\}$	$\left\{\phi, jk^{FTA}\right\}$	$\left\{\phi, jk^{FTA}\right\}$
g^{FT}	$\{\phi\}$	$\{\phi\}$	$\{\phi\}$

Table 3: Proposer country's action space for each subgame in FTA game

In our dynamic model, both myopic and farsighted FTA formation incentives drive the equilibrium path of networks. In turn, comparing a country's continuation payoffs across paths of FTA networks often reveals tensions between myopic and farsighted incentives. We now discuss the key incentives and tensions.

[15] We make two assumptions that conveniently restrict attention to certain Markov perfect equilibria. First, given the simultaneity of responses to a proposal for CU expansion to include the CU outsider, recipient countries accept such proposals if they prefer global free trade over the status quo: $r_k\left(g_{ij}^{CU}, ijk^{CU}\right) = Y$ if and only if $w_k\left(g^{FT}\right) > w_k\left(g_{ij}^{CU}\right)$. Second, when a response $r_j(g, \rho_i(g)) = N$ merely delays formation of the PTA to a later stage of the same period, the recipient country responds with $r_j(g, \rho_i(g)) = Y$. An arbitrarily small cost of making a proposal motivates this assumption.

[16] To be clear, country i's one period payoff $w_i(g)$ and continuation payoff $V_i(g)$ exclude these non-economic benefits.

3.1 FTA formation incentives

3.1.1 Myopic incentives

Notationally, we let $\Delta w_i(g' - g) \equiv w_i(g') - w_i(g)$ and also let $g + ij^{FTA}$ denote the network where an FTA between countries i and j is added to network g. In turn, Lemma 1 describes the myopic incentives driving the equilibrium path of networks and, in doing so, uses two threshold tariff bindings: $\Delta w_i(g_{jk}^{FTA} - g_j^H) > 0$ if and only if $\tau > \bar{\tau}_{OUT}^{FTA}$ and $\Delta w_i(g_{jk}^{FTA} - g_{ij}^{FTA}) > 0$ if and only if $\tau > \tilde{\tau}$.

Lemma 1 *(i) A country benefits from becoming an FTA insider, becoming the hub or forming a spoke-spoke FTA:* $\Delta w_i(g_{ij}^{FTA} - g_\varnothing) > 0, \Delta w_i(g_i^H - g_{ij}^{FTA}) > 0$ *and* $\Delta w_i(g^{FT} - g_j^H) > 0$.

(ii) For sufficiently lax tariff bindings, an FTA outsider does not benefit from becoming a spoke: $\Delta w_i(g_{jk}^{FTA} - g_j^H) > 0$ *if and only if* $\tau > \bar{\tau}_{OUT}^{FTA}$ *where* $\bar{\tau}_{OUT}^{FTA} \in (t_{FTA}, t_\varnothing)$.

(iii) For sufficiently lax tariff bindings, a country prefers being an FTA outsider rather than an FTA insider: $\Delta w_i(g_{jk}^{FTA} - g_{ij}^{FTA}) > 0$ *if and only if* $\tau > \tilde{\tau}$ *where* $\tilde{\tau} \in \left(\bar{\tau}_{OUT}^{FTA}, t_\varnothing\right)$.

Parts (i) says, with one exception, bilateral FTAs are attractive for members. Intuitively, the mutual exchange of preferential access drives this attractiveness.

However, part (ii) says becoming a spoke via an FTA may not be attractive for an FTA outsider. On one hand, becoming a spoke eliminates the discrimination faced by the FTA outsider in the hub's market. On the other hand, the FTA outsider benefits both from levying its own optimal tariff on the FTA insiders and also from the lower tariffs faced when exporting to the FTA insiders due to tariff complementarity. These benefits are maximized when the tariff binding does not bind non-member tariffs and, in this case of $\tau > t_\varnothing$, the FTA outsider has a *myopic free riding incentive* whereby it actually benefits from not becoming a spoke. Because these benefits shrink with tariff binding liberalization once the tariff binding actually binds non-members (i.e. $\tau < t_\varnothing$), the FTA outsider's myopic free riding incentive disappears once the tariff binding is sufficiently tight (i.e. $\tau < \bar{\tau}_{OUT}^{FTA}$).

Part (iii) says the benefits of being an FTA outsider, i.e. setting its own optimal tariff and the tariff complementarity practiced by FTA insiders, can be so large that a country prefers being an FTA outsider over an FTA insider. This happens when the FTA outsider has a myopic free riding incentive and the tariff binding is sufficiently lax, $\tau > \tilde{\tau} > \bar{\tau}_{OUT}^{FTA}$.

We now move on to discuss the farsighted incentives that drive FTA formation.

3.1.2 Farsighted incentives

Lemma 2 describes the farsighted incentives that drive the equilibrium path of networks.

Lemma 2 *(i) An FTA outsider benefits from global free trade:* $\Delta w_i(g^{FT} - g^{FTA}_{jk}) > 0$.

(ii) The hub suffers from a spoke-spoke FTA: $\Delta w_i \left(g^H_i - g^{FT}\right) > 0$.

(iii) For sufficiently tight tariff bindings, FTA insiders benefit by excluding the FTA outsider from global free trade : $\Delta w_i(g^{FTA}_{ij} - g^{FT}) > 0$ *if and only if* $\tau < \bar{\tau}^{FTA}_{IN}$ *where* $\bar{\tau}^{FTA}_{IN} \in (t_{FTA}, t_{\varnothing})$.

Part (i) says the FTA outsider has a farsighted incentive to participate in FTA expansion that ultimately yields global free trade. Intuitively, while the FTA outsider may have a myopic free riding incentive, it benefits from eliminating the discrimination faced in *both* FTA insider markets. Later, the tension between the FTA outsider's myopic free riding incentive and its farsighted incentive to participate in FTA expansion determines whether it has a dynamic free riding incentive.

Given Lemma 1(i) said spokes have a myopic incentive to form the final FTA leading to global free trade, Lemma 2(ii) highlights a farsighted cost for an FTA insider when becoming the hub. Specifically, the hub loses the sole preferential access it enjoys in both spoke markets upon the spoke-spoke FTA that leads to global free trade.

In turn, part (iii) describes whether FTA insiders have a farsighted benefit of permanently excluding the FTA outsider from subsequent FTA formation that delivers global free trade. Ultimately, global free trade benefits the FTA insiders by removing the FTA outsider's tariff barriers. This benefit is relatively high (low) with a sufficiently lax (tight) tariff binding. As such, Lemma 2(iii) says FTA insiders have an *exclusion incentive* when the tariff binding is sufficiently tight (i.e. $\tau < \bar{\tau}^{FTA}_{IN}$); intuitively, they have already extracted tariff concessions from the FTA outsider without engaging in FTA expansion. Later, the tension between the myopic incentive to become the hub and the farsighted nature of the exclusion incentive determines whether FTA insiders hold a dynamic exclusion incentive.

We now solve the equilibrium path of networks in the FTA game by backward induction.

3.2 Subgames at hub-spoke networks

To begin the backward induction, consider a subgame at a hub-spoke network g^H_i. The following lemma follows directly from Lemma 1(i).

Lemma 3 *In the subgame at a hub-spoke network* g^H_i*, spoke countries form the final FTA that leads to global free trade:* $g^H_i \to g^{FT}$.

3.3 Subgames at FTA insider-outsider networks

We now roll back to a subgame at an insider-outsider network g_{ij}^{FTA}. As discussed above, tensions between myopic and farsighted FTA formation incentives exist for both the FTA outsider and FTA insiders. We first explore this tension facing the FTA outsider.

3.3.1 Dynamic free riding incentive

A tension between myopic and farsighted incentives for the FTA outsider creates the possibility of a dynamic free riding incentive. Per Lemma 2(i), eliminating discrimination drives the FTA outsider's farsighted incentive to participate in FTA expansion to global free trade: $\Delta w_k(g^{FT} - g_{ij}^{FTA}) > 0$. However, Lemma 1(ii) said an FTA outsider has a myopic free riding incentive, and hence a myopic incentive to refuse subsequent FTA formation, with a sufficiently lax tariff binding: $\Delta w_k(g_i^H - g_{ij}^{FTA}) < 0$ if and only if $\tau > \bar{\tau}_{OUT}^{FTA}$. That is, an FTA outsider does not hold a myopic free riding incentive for sufficiently tight tariff bindings because this severely constrains its ability to impose optimal tariffs on the FTA insiders. In this case, no dynamic free riding incentive exists: forming its own FTAs benefits the FTA outsider from myopic and farsighted perspectives.

However, a sufficiently lax tariff binding $\tau > \bar{\tau}_{OUT}^{FTA}$ generates a myopic free riding incentive and the possibility of a dynamic free riding incentive. Here, the discount factor mediates the tension between the FTA outsider's farsighted incentive to become a spoke and its myopic free riding incentive. Specifically, the FTA outsider prefers becoming a spoke rather than remaining a permanent FTA outsider when

$$w_k\left(g_i^H\right) + \frac{\beta}{1-\beta} w_k\left(g^{FT}\right) > \frac{1}{1-\beta} w_k\left(g_{ij}^{FTA}\right). \tag{15}$$

Naturally, this can only fail if the FTA outsider holds a myopic free riding incentive $\Delta w_k(g_{ij}^{FTA} - g_i^H) > 0$. Further, (15) reduces to

$$\beta > \bar{\beta}_{OUT}(\tau) \equiv \left[1 + \frac{\Delta w_k\left(g^{FT} - g_{ij}^{FTA}\right)}{\Delta w_k\left(g_{ij}^{FTA} - g_i^H\right)}\right]^{-1} \tag{16}$$

which says a sufficiently patient FTA outsider becomes a spoke or, alternatively, a sufficiently impatient FTA outsider refuses subsequent FTA formation. In this latter case, i.e. $\beta < \bar{\beta}_{OUT}(\tau)$, the FTA outsider has a *dynamic free riding incentive*. Moreover, the extent that the FTA outsider holds a dynamic free riding incentive rises (i.e. $\bar{\beta}_{OUT}(\tau)$ rises) as the myopic free riding incentive $\Delta w_k\left(g_{ij}^{FTA} - g_i^H\right)$ increases relative to the farsighted incentive of becoming a spoke $\Delta w_k\left(g^{FT} - g_{ij}^{FTA}\right)$.

Figure 3 illustrates the dynamic free riding incentive. An FTA outsider has a dynamic free riding incentive when $\beta < \bar{\beta}_{OUT}(\tau)$. Here, the FTA outsider is sufficiently impatient that the myopic free riding incentive dominates the farsighted incentive to become a spoke and, hence, the FTA outsider refuses subsequent FTA formation. In the "no binding region" of $\tau > t_{\varnothing}$, the FTA outsider's optimal tariff remains unbound and, in turn, stays unchanged. Thus, $\bar{\beta}_{OUT}(\tau)$ remains constant. However, the FTA outsider's optimal tariff becomes bound once in the "non-member binding region" where $\tau < t_{\varnothing}$. By reducing the FTA outsider's ability to impose optimal tariffs on FTA insiders, the myopic free riding incentive weakens and the farsighted incentive to become a spoke strengthens. In turn, the dynamic free riding incentive weakens, i.e. $\bar{\beta}_{OUT}(\tau)$ falls, as the tariff binding continues falling below $t_{\varnothing}$. Indeed, the dynamic free riding incentive disappears once the tariff binding falls below $\bar{\tau}_{OUT}^{FTA}$ (i.e. $\bar{\beta}_{OUT}(\tau)$ becomes negative) because the myopic free riding incentive disappears and, hence, regardless of β, the FTA outsider becomes a spoke.

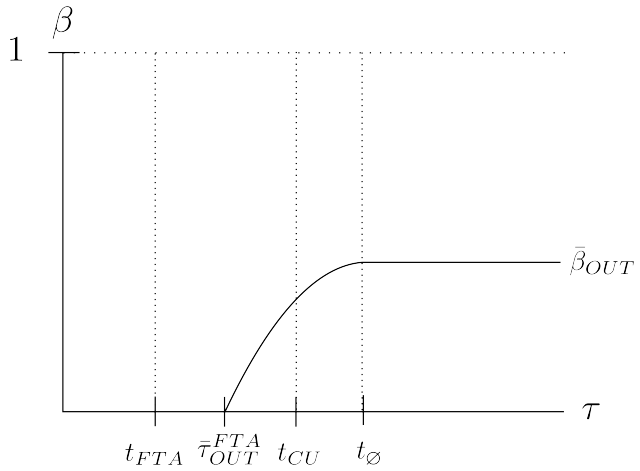

Figure 3: Dynamic free riding incentive

Next, we examine the myopic and farsighted incentives of FTA insiders.

3.3.2 Dynamic exclusion incentive

A tension between myopic and farsighted incentives for FTA insiders creates the possibility of a dynamic exclusion incentive. Myopically, sole preferential access in both spoke markets makes becoming the hub attractive for an FTA insider: $\Delta w_i(g_i^H - g_{ij}^{FTA}) > 0$. However, from a farsighted view, an FTA insider anticipates erosion of this preferential access via the spoke-spoke FTA that yields global free trade. Indeed, Lemma 2(iii) said an FTA insider holds an exclusion incentive, and thus benefits from permanently excluding the FTA outsider, with a sufficiently tight tariff binding: $\Delta w_i(g_{ij}^{FTA} - g^{FT}) > 0$ if and only if $\tau < \bar{\tau}_{IN}^{FTA}$. That

is, an FTA insider does not hold an exclusion incentive when the binding is sufficiently lax because the relatively high FTA outsider tariffs make FTA formation with the FTA outsider attractive. In this case, there is no dynamic exclusion incentive because an FTA with the FTA outsider is attractive from both myopic and farsighted perspectives.

However, an FTA insider holds an exclusion incentive with a sufficiently tight tariff binding ($\tau < \bar{\tau}_{IN}^{FTA}$). Here, by constraining the FTA outsider's applied tariff, the FTA insiders extract substantial tariff concessions from the FTA outsider without FTA expansion. In turn, the discount factor mediates the myopic incentive to become the hub and the farsighted incentive to exclude the FTA outsider. Specifically, an FTA insider prefers to become the hub rather than remain a permanent FTA insider when

$$w_i\left(g_i^H\right) + \frac{\beta}{1-\beta} w_i\left(g^{FT}\right) > \frac{1}{1-\beta} w_i\left(g_{ij}^{FTA}\right). \tag{17}$$

Naturally, this can only fail if the FTA insider holds an exclusion incentive $\Delta w_i(g_{ij}^{FTA} - g^{FT}) > 0$. Further, (17) reduces to

$$\beta < \bar{\beta}_{IN}(\tau) \equiv \left[1 + \frac{\Delta w_i\left(g_{ij}^{FTA} - g^{FT}\right)}{\Delta w_i\left(g_i^H - g_{ij}^{FT}\right)}\right]^{-1}. \tag{18}$$

which says a sufficiently impatient FTA insider becomes the hub or, alternatively, a sufficiently patient FTA insider refuses a subsequent FTA with the FTA outsider. In this latter case, i.e. $\beta > \bar{\beta}_{IN}(\tau)$, the FTA insider has a *dynamic exclusion incentive*. Moreover, the extent that the FTA insider holds a dynamic exclusion incentive rises (i.e. $\bar{\beta}_{IN}(\tau)$ falls) as the exclusion incentive $\Delta w_i\left(g_{ij}^{FTA} - g^{FT}\right)$ increases relative to the myopic incentive of becoming the hub $\Delta w_i\left(g_i^H - g_{ij}^{FTA}\right)$.

Figure 4 illustrates the dynamic exclusion incentive. An FTA insider has a dynamic exclusion incentive when $\beta > \bar{\beta}_{IN}(\tau)$. Here, an FTA insider is sufficiently patient that the farsighted nature of the exclusion incentive dominates the myopic incentive to become the hub and, hence, the FTA insider refuses a subsequent FTA with the FTA outsider. Naturally, a pre-requisite for the dynamic exclusion incentive, i.e. $\bar{\beta}_{IN}(\tau) < 1$, is that the FTA insider actually holds an exclusion incentive. As discussed above, this requires sufficiently tight tariff bindings, $\Delta w_i\left(g_{ij}^{FTA} - g^{FT}\right) > 0$ if and only if $\tau < \bar{\tau}_{IN}^{FTA}$, so that the FTA insider extracts substantial tariff concessions from the FTA outsider. As Figure 4 shows, the dynamic exclusion continues strengthening, i.e. $\bar{\beta}_{IN}(\tau)$ falls, as the tariff binding falls through the FTA binding region $\tau < \bar{\tau}_{IN}^{FTA}$.

Ultimately, subsequent FTA formation takes place between an FTA insider and the FTA outsider if and only if the FTA outsider does not hold a dynamic free riding incentive and

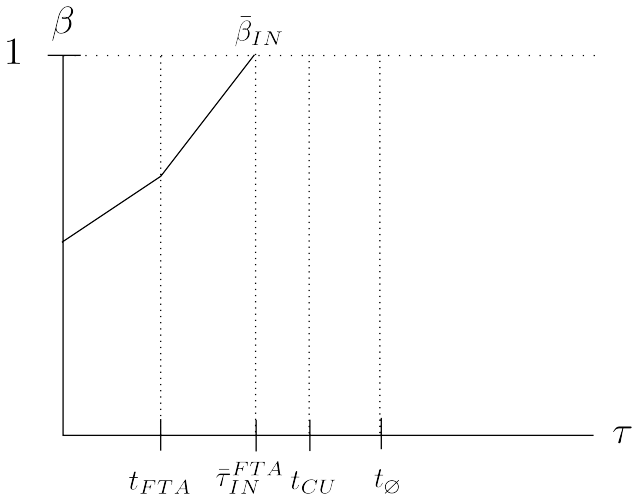

Figure 4: Dynamic exclusion incentive

the FTA insiders do not hold a dynamic exclusion incentive. Otherwise, the FTA outsider exploits its dynamic free riding incentive and free rides on FTA formation by the FTA insiders or the FTA insiders exploit their dynamic exclusion incentive and exclude the FTA outsider from subsequent FTA formation. Lemma 4 summarizes these findings.

Lemma 4 *Consider a subgame at an FTA insider-outsider network g_{ij}^{FTA} where country i proposes before country j. Then, the equilibrium outcome in the subgame is*

(i) An FTA between the FTA outsider and the FTA insider i, i.e. $g_{ij}^{FTA} \rightarrow g_i^H$, if $\beta \in \left(\bar{\beta}_{OUT}(\tau), \bar{\beta}_{IN}(\tau)\right)$

(ii) No FTA, i.e. $g_{ij}^{FTA} \rightarrow g_{ij}^{FTA}$, if $\beta \notin \left(\bar{\beta}_{OUT}(\tau), \bar{\beta}_{IN}(\tau)\right)$.

3.4 Subgame at empty network

Rolling back to the subgame at the empty network $g_{\varnothing}$ and solving the equilibrium outcome in this subgame reveals the equilibrium path of networks. The key intuition revolves around the dynamic free riding incentive of the FTA outsider and the dynamic exclusion incentive of FTA insiders, and how these vary with the tariff binding. However, the equilibrium path of networks also relies on two additional dynamic properties summarized by Lemma 5.

Lemma 5 *(i) $V_z\left(g_{ij}^{FTA}\right) > V_z\left(g_{\varnothing}\right)$ for $z = i, j$.*

(ii) $V_i\left(g_{ij}^{FTA}\right) > V_i\left(g_{jk}^{FTA}\right)$ when $g_{ij}^{FTA} \rightarrow g_i^H \rightarrow g^{FT}$ and $g_{jk}^{FTA} \rightarrow g_j^H \rightarrow g^{FT}$.

Part (i) specifies participation constraints for FTA insiders. Given Lemma 1(i), these really govern situations where FTA formation expands to global free trade and say that the associated continuation payoffs for FTA insiders exceeds their continuation payoff in a

world without PTAs. Further, the benefit of being the hub implies the tightest participation constraint is for the FTA insider-turned-spoke.

Given the benefits of tariff complementarity for an FTA outsider, a country may myopically prefer being an FTA outsider over an FTA insider. Nevertheless, part (ii) says that, when FTAs lead to global free trade, a country's continuation payoff as an FTA insider-turned-hub exceeds that as an FTA outsider-turned-spoke. Intuitively, if a country participates in FTA expansion to global free trade as an FTA outsider then the myopic free riding incentive is sufficiently weak that the benefit of being the hub ensures it prefers being the FTA insider-turned-hub over the FTA outsider-turned-spoke.

Proposition 1 now summarizes the equilibrium path of networks.

Proposition 1 *The equilibrium path of networks in the FTA game is*
(i) $g_{\varnothing} \rightarrow g_{ac}^{FTA} \rightarrow g_{a}^{H} \rightarrow g^{FT}$ *when* $\beta \in \left(\bar{\beta}_{OUT}(\tau), \bar{\beta}_{IN}(\tau)\right)$ *and* $\tau \geq \tilde{\tau}$
(ii) $g_{\varnothing} \rightarrow g_{ab}^{FTA} \rightarrow g_{a}^{H} \rightarrow g^{FT}$ *when* $\beta \in \left(\bar{\beta}_{OUT}(\tau), \bar{\beta}_{IN}(\tau)\right)$ *and* $\tau < \tilde{\tau}$
(iii) $g_{\varnothing} \rightarrow g_{ab}^{FTA}$ *when* $\beta \notin \left(\bar{\beta}_{OUT}(\tau), \bar{\beta}_{IN}(\tau)\right)$.

The equilibrium path of networks revolves around the FTA outsider's dynamic free riding incentive and the FTA insiders' dynamic exclusion incentive. If neither the FTA outsider holds a dynamic free riding incentive (i.e. $\beta > \bar{\beta}_{OUT}(\tau)$) nor does an FTA insider hold a dynamic exclusion incentive (i.e. $\beta < \bar{\beta}_{IN}(\tau)$), the leader country a becomes the hub on a path of FTAs leading to global free trade. However, the leader country is a member of a permanent FTA in the presence of either an FTA outsider dynamic free riding incentive or an FTA insider dynamic exclusion incentive (i.e. $\beta \notin \left(\bar{\beta}_{OUT}(\tau), \bar{\beta}_{IN}(\tau)\right)$). Thus, these dynamic incentives drive the equilibrium.

One subtlety emerges regarding the equilibrium path of networks. When $\tau \geq \tilde{\tau}$, the tariff binding is so lax that the myopic free riding incentive is sufficiently strong that countries myopically prefer being an FTA outsider than an FTA insider. Thus, when FTA formation leads to global free trade, country b prefers being an FTA outsider-turned spoke over an FTA insider-turned-spoke. Indeed, if country b makes an FTA proposal in stage 2 of the protocol, the attractiveness of being the hub implies it proposes an FTA with country c and becomes the FTA insider-turned-hub. Hence, country b can credibly threaten to reject country a's FTA proposal (in stage 1a) knowing that such rejection will force country a to propose an FTA with country c (in stage 1b) and leave country b as the FTA outsider-turned-spoke. However, when FTA formation does not expand to global free trade, the non-economic benefits imply country b proposes an FTA with country a if it makes an FTA proposal in stage 2. Hence, country b cannot credibly reject an FTA proposal from country a in stage 1a because it will eventually accept such a proposal.

Figure 5 shows how tariff binding liberalization changes the incentives that constrain FTA formation from reaching global free trade. For sufficiently high tariff bindings $\tau > \bar{\tau}_{IN}^{FTA}$, FTA insiders do not hold an exclusion incentive (i.e. $\Delta w_i \left(g^{FT} - g_{ij}^{FTA}\right) > 0$) because the FTA outsider's relatively high applied tariffs create strong incentives for an FTA with the FTA outsider. In turn, a dynamic exclusion incentive does not exist. However, an FTA outsider holds a myopic free riding incentive. Forming an FTA is myopically unattractive for the FTA outsider because the relatively lax tariff bindings ($\tau > \bar{\tau}_{OUT}^{FTA}$) imply it would give relatively large tariff concessions via FTA formation but receive relatively small concessions because of the tariff complementarity practiced by FTA insiders. In turn, a sufficiently impatient FTA outsider holds a dynamic free riding incentive and thus refuses an FTA with an FTA insider. Ultimately, with relatively high tariff bindings, the dynamic free riding incentive constrains the attainment of global free trade.

However, as tariff bindings continually fall, the dynamic free riding incentive eventually disappears and the dynamic exclusion incentive now constrains the attainment of global free trade. Once the tariff binding falls below $\bar{\tau}_{OUT}^{FTA}$, the tariff binding constrains the FTA outsider such that its tariffs on the FTA insiders differ little from those imposed on the FTA outsider. This makes the discrimination faced by the FTA outsider more prominent and eliminates any dynamic free riding incentive. However, the relatively low tariff binding means the FTA insiders have already extracted substantial tariff concessions from the FTA outsider and this generates an exclusion incentive for FTA insiders. In turn, despite the myopic incentive to become the hub, a sufficiently patient FTA insider holds a dynamic exclusion incentive and thus refuses subsequent FTA formation with the FTA outsider. Ultimately, with relatively low tariff bindings, the dynamic exclusion incentive of FTA insiders constrains the attainment of global free trade.

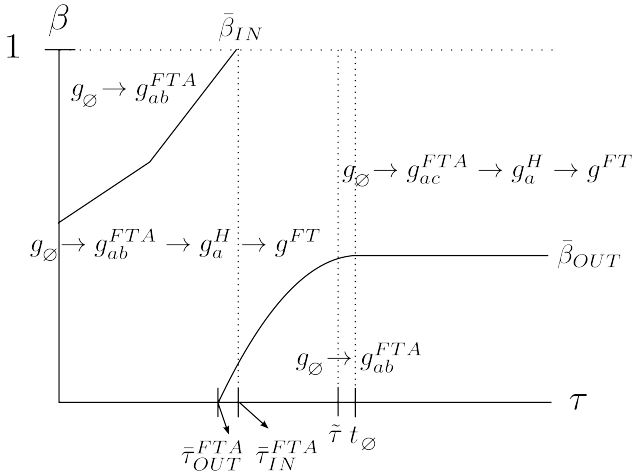

Figure 5: Equilibrium path of networks: FTA game

Based on these forces constraining FTA expansion, Corollary 1 highlights the fundamental importance of multilateral tariff binding liberalization for the prospect of FTA expansion leading to global free trade.

Corollary 1 *(i) If global free trade would not be attained for $\tau > \bar{\tau}_{IN}^{FTA}$, then multilateral tariff binding liberalization facilitates FTA formation in achieving global free trade.*

(ii) If global free trade would be attained for $\tau > \bar{\tau}_{IN}^{FTA}$, then multilateral tariff binding liberalization never facilitates but can impede FTA formation in achieving global free trade.

With sufficiently high tariff bindings, the dynamic free riding incentive constrains the attainment of global free trade. In particular, when global free trade is not attained for $\tau > \bar{\tau}_{IN}^{FTA}$ then countries are sufficiently impatient, $\beta < \bar{\beta}_{OUT}(t_{\varnothing})$, that the myopic free riding incentive can generate the dynamic free riding incentive. Specifically, for any tariff binding $\tau > \bar{\tau}_{IN}^{FTA}$, the FTA outsider has a dynamic free riding incentive when $\beta < \bar{\beta}_{OUT}(\tau)$ and this prevents FTA expansion to global free trade. Nevertheless, tariff binding liberalization weakens the dynamic free riding incentive by constraining the FTA outsider's ability to impose tariffs on the FTA insiders. Formally, this raises the extent that global free trade is attained by reducing $\bar{\beta}_{OUT}(\tau)$ and implies that multilateral tariff binding liberalization facilitates FTA formation in attaining global free trade.

Conversely, the dynamic exclusion incentive constrains the attainment of global free trade with sufficiently low tariff bindings and more so with further multilateral tariff binding liberalization. In particular, when global free trade is attained for $\tau > \bar{\tau}_{IN}^{FTA}$ then countries are sufficiently patient, $\beta > \bar{\beta}_{OUT}(\tau)$, that they do not hold a dynamic exclusion incentive nor a dynamic free riding incentive. However, for any tariff binding $\tau < \bar{\tau}_{IN}^{FTA}$, FTA insiders hold a dynamic exclusion incentive when sufficiently patient, $\beta > \bar{\beta}_{IN}(\tau)$, and this prevents FTA expansion to global free trade. Moreover, further liberalization increases the magnitude of tariff concessions that FTA insiders extract from the FTA outsider without having to reciprocate. This strengthens the dynamic exclusion incentive. Formally, multilateral tariff binding liberalization reduces the extent that global free trade is attained by reducing $\bar{\beta}_{IN}(\tau)$ and implies that multilateral tariff binding liberalization impedes FTA formation in achieving global free trade.[17]

[17] When β lies in the intermediate range $\beta \in \left(\bar{\beta}_{OUT}(\tau = t_{\varnothing}), \bar{\beta}_{IN}(\tau = 0)\right)$, Figure 5 shows that tariff binding liberalization neither facilitates nor impedes FTA expansion to global free trade.

4 Equilibrium path of networks: CU game

We now analyze our "CU game" where countries can only propose CUs. Table 4 shows how this restricts the proposals in Table 2.

	$P_i(g)$	$P_j(g)$	$P_k(g)$
$g_\varnothing$	$\{\phi, ij^{CU}, ik^{CU}\}$	$\{\phi, ij^{CU}, jk^{CU}\}$	$\{\phi, ik^{CU}, jk^{CU}\}$
g_{ij}^{CU}	$\{\phi, ijk^{FTA}\}$	$\{\phi, ijk^{CU}\}$	$\{\phi, ijk^{CU}\}$
g^{FT}	$\{\phi\}$	$\{\phi\}$	$\{\phi\}$

Table 4: Proposer country's action space for each subgame in CU game

The different tariff setting behavior of FTA and CU insiders fundamentally impacts PTA formation. Specifically, because CU insiders impose common external tariffs on non-members, they cannot individually form their own subsequent PTA. Rather, CU insiders can only engage in subsequent PTA formation jointly with, and with the consent of, its CU insider partner. When Section 5 analyzes the "PTA game" where countries can form FTAs or CUs, this has important implications on PTA formation incentives.

4.1 CU formation incentives

CU formation does not generate a tension between myopic and farsighted incentives because CU expansion must move directly from the CU insider-outsider network to global free trade and CU insiders have veto power over such CU expansion. Lemma 6 describes the myopic incentives driving the equilibrium path of networks.

Lemma 6 *(i) Bilateral CU formation benefits CU insiders but hurts the CU outsider:* $\Delta w_i(g_{ij}^{CU} - g_\varnothing) > 0$ *but* $\Delta w_k(g_{ij}^{CU} - g_\varnothing) < 0$.

(ii) CU expansion to global free trade benefits the CU outsider but only benefits CU insiders when tariff bindings are sufficiently lax: $\Delta w_k(g^{FT} - g_{ij}^{CU}) > 0$ *for all* τ *but* $\Delta w_i(g^{FT} - g_{ij}^{CU}) > 0$ *if and only if* $\tau > \bar{\tau}_{IN}^{CU}$ *where* $\bar{\tau}_{IN}^{CU} \in (t_{CU}, t_\varnothing)$.

(iii) A country weakly prefers being a CU insider over an FTA insider and strictly prefers this when the tariff binding does not bind FTA insiders: $\Delta w_i(g_{ij}^{CU} - g_{ij}^{FTA}) \geq 0$ *for all* τ *and with strict inequality only when* $\tau > t_{FTA}$.

The key difference between a bilateral FTA and a bilateral CU is that CU insiders coordinate their common external tariff and this internalizes the negative intra-PTA externality of tariff complementarity. Thus, being a CU insider is more attractive than being an FTA insider, which plays a crucial role in the PTA game in Section 5. Part (iii) describes this CU *myopic coordination benefit* which naturally disappears in the "FTA binding region" of

$\tau \leq t_{FTA}$ because then FTA and CU insiders are both bound by the tariff binding τ. Moreover, given the payoff properties in the FTA game, the attractiveness of being a CU insider implies that CU insiders benefit from bilateral CU formation (part (i)) and that they hold a CU exclusion incentive for sufficiently lax bindings $\tau < \bar{\tau}_{IN}^{CU}$ (part (ii)) that is stronger than the FTA exclusion incentive (i.e. $\bar{\tau}_{IN}^{FTA} < \bar{\tau}_{IN}^{CU}$).[18]

While CU insiders benefit from coordinating external tariffs to internalize the negative intra-PTA externality of tariff complementarity, the CU outsider suffers from stronger discrimination in the CU insider markets. Thus, like an FTA outsider, a CU outsider benefits from global free trade (part (ii)). But, unlike an FTA outsider, this stronger discrimination means the CU outsider always suffers from CU formation by the CU insiders (part (i)).

Ultimately, there is no tension between myopic and farsighted CU formation incentives because CU expansion proceeds directly from the CU insider-outsider network to global free trade. Moreover, given the CU outsider always benefits from global free trade, the CU insiders' exclusion incentive is the incentive that constrains the attainment of global free trade. Thus, CU expansion takes place if and only if CU insiders do not hold an exclusion incentive with the leader country always proposing CU formation and being a CU insider. Proposition 2 summarizes this result and Figure 6 illustrates.

Proposition 2 *The equilibrium path of networks in the CU game is*
(i) $g_{\varnothing} \rightarrow g_{ab}^{CU} \rightarrow g^{FT}$ *when* $\tau > \bar{\tau}_{IN}^{CU}$
(ii) $g_{\varnothing} \rightarrow g_{ab}^{CU}$ *when* $\tau < \bar{\tau}_{IN}^{CU}$.

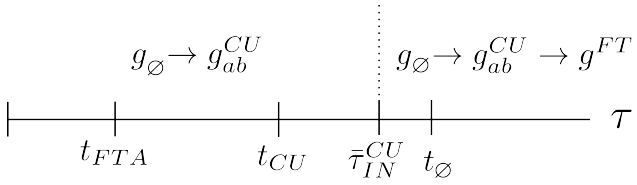

Figure 6: Equilibrium path of networks: CU game

We next endogenize the choice between FTAs and CUs in our "PTA game".

5 Equilibrium path of networks: PTA game

Earlier sections allowed countries to only form FTAs (the "FTA game") or only form CUs (the "CU game"). The key trade-off introduced by endogenizing the choice between FTAs and CUs is between the flexibility benefit of FTAs and the coordination benefits of CUs.

[18] Note that $\bar{\tau}_{IN}^{CU} < \infty$ if and only if $\lambda \lesssim 0.58$.

5.1 FTA flexibility benefit

Fundamentally, FTAs and CUs differ because CU members impose common external tariffs on non-members but FTA members impose individually optimal external tariffs. This has an important implication for subsequent PTA formation: while an FTA member can freely form additional FTAs with non-member countries without the consent of existing FTA partners, CU members must form additional CUs together and any initial CU member has veto power. Thus, unlike CU members who must jointly form a subsequent PTA with the CU outsider, FTA members have the *flexibility* to form their own individual FTAs with the FTA outsider.

FTA insiders value this flexibility benefit. Unlike CU insiders who forego preferential access upon CU expansion to global free trade, an FTA insider enjoys sole preferential access to both spoke markets upon becoming the hub. That is, the FTA flexibility benefit for a PTA insider captures the higher payoff from becoming the hub via a subsequent FTA relative to subsequent CU formation that proceeds directly to global free trade: $w_i\left(g_i^H - g^{FT}\right) > 0$ as stated in Lemma 2(ii).

5.2 Myopic and farsighted CU coordination benefits

By coordinating their external tariffs, CU insiders reap myopic and farsighted coordination benefits. Myopically, coordinating external tariffs internalizes any negative intra-PTA externality of tariff complementarity: $w_i\left(g_{ij}^{CU} - g_{ij}^{FTA}\right) \geq 0$ if $\tau \geq t_{FTA}$ with strict inequality when $\tau > t_{FTA}$. Moreover, given the common external tariff implies CU expansion requires joint CU insider approval, a farsighted CU coordination benefit can emerge. Specifically, while each CU insider can *veto* CU expansion to global free trade, each FTA insider can *precipitate* global free trade by exploiting the FTA flexibility benefit to become the hub. Thus, $w_i\left(g_{ij}^{CU} - g^{FT}\right) > 0$ not only represents the CU exclusion incentive but also the farsighted CU coordination benefit in that external tariff coordination confers veto power over CU expansion on each CU insider. As discussed above, this CU exclusion incentive, and hence farsighted CU coordination benefit, emerges for sufficiently tight tariff bindings $\tau < \bar{\tau}_{IN}^{CU}$.

5.3 Trade-off: FTA flexibility and CU coordination benefits

Tensions between the FTA flexibility and CU coordination benefits generate a dynamic trade off. The nature of this trade off depends on whether CU insiders hold an exclusion incentive.

In general, country i prefers being an FTA insider and then the hub on the path to global

free trade over being a permanent CU insider when[19]

$$V_i\left(g_{ij}^{FTA}\right) = w_i\left(g_{ij}^{FTA}\right) + \beta w_i\left(g_i^H\right) + \frac{\beta^2}{1-\beta} w_i\left(g^{FT}\right) > V_i\left(g_{ij}^{CU}\right). \tag{19}$$

When CU insiders do not hold a CU exclusion incentive, and hence there is no farsighted CU coordination benefit, CU formation expands to global free trade. Thus, $V_i\left(g_{ij}^{CU}\right) = w_i\left(g_{ij}^{CU}\right) + \frac{\beta}{1-\beta} w_i\left(g^{FT}\right)$ and (19) becomes

$$\beta \underbrace{\Delta w_i\left(g_i^H - g^{FT}\right)}_{\text{FTA flexibility benefit}} > \underbrace{\Delta w_i\left(g_{ij}^{CU} - g_{ij}^{FTA}\right)}_{\text{myopic CU coordination benefit}}. \tag{20}$$

That is, a country prefers FTA over CU formation if and only if the discounted FTA flexibility benefit dominates the myopic CU coordination benefit. In terms of the threshold discount factor, this requires sufficient patience:

$$\beta > \underline{\beta}^{Flex}(\tau) \equiv \frac{\Delta w_i\left(g_{ij}^{CU} - g_{ij}^{FTA}\right)}{\Delta w_i\left(g_i^H - g^{FT}\right)}. \tag{21}$$

Intuitively, $\underline{\beta}^{Flex}(\tau)$ measures the size of the myopic CU coordination benefit relative to the FTA flexibility benefit. As the FTA flexibility benefit grows relative to the myopic CU coordination benefit then $\underline{\beta}^{Flex}(\tau)$ falls and, thus, the extent of FTA formation expands.

However, when CU insiders hold a CU exclusion incentive, i.e. $\tau < \bar{\tau}_{IN}^{CU}$, they hold a farsighted CU coordination benefit and this modifies the flexibility-coordination trade off. Given CU insiders exclude the CU outsider from CU expansion, $V_i\left(g_{ij}^{CU}\right) = \frac{1}{1-\beta} w_i\left(g_{ij}^{CU}\right)$ and $V_i\left(g_{ij}^{FTA}\right) > V_i\left(g_{ij}^{CU}\right)$ in (19) reduces to

$$\beta \underbrace{\Delta w_i\left(g_i^H - g^{FT}\right)}_{\text{FTA flexibility benefit}} > \underbrace{\Delta w_i\left(g_{ij}^{CU} - g_{ij}^{FTA}\right)}_{\text{myopic CU coordination benefit}} + \frac{\beta}{1-\beta} \underbrace{\Delta w_i\left(g_{ij}^{CU} - g^{FT}\right)}_{\text{farsighted CU coordination benefit}}. \tag{22}$$

That is, a country prefers FTA over CU formation if and only if the discounted FTA flexibility benefit dominates the myopic CU coordination benefit and the discounted farsighted CU coordination benefit. Using the quadratic formula, this holds for intermediate degrees of

[19] A meaningful trade-off emerges here because our protocol assumes that completion of PTA negotiations take a non-trivial length of time (see footnote 13 for empirical justification). If multiple FTAs could form in a single period, spokes would immediately form their own FTA and thereby eliminate the value of the FTA flexibility benefit. In turn, PTA insiders would always (weakly) prefer CU over FTA formation.

patience:[20]

$$V_i\left(g_{ij}^{FTA}\right) > V_i\left(g_{ij}^{CU}\right) \Leftrightarrow \beta \in \left(\underline{\beta}^{Flex}\left(\tau\right), \bar{\beta}^{Flex}\left(\tau\right)\right). \tag{23}$$

On one hand, by relaxing the inequality in (22), the extent of FTA formation expands when the FTA flexibility benefit strengthens.[21] On the other hand, by tightening the inequality in (22), a stronger myopic CU coordination benefit constrains the extent of FTA formation. And, given the presence of the CU exclusion incentive, the farsighted CU coordination benefit also tightens the inequality in (22). Thus, as either the myopic or farsighted part of the CU coordination benefit become stronger then the extent of FTA formation falls.

Figure 7 illustrates the trade off between the FTA flexibility benefit and CU coordination benefit. In general, the CU coordination benefits consist of a myopic component, via CU insiders internalizing tariff complementarity, and a farsighted component, via CU insiders wanting to exclude the CU outsider. However, CU insiders do not hold an exclusion incentive for tariff bindings above $\bar{\tau}_{IN}^{CU}$. Thus, for $\tau > \bar{\tau}_{IN}^{CU}$, the CU coordination benefit is merely the myopic CU coordination benefit. As described by (21), sufficient patience, i.e. $\beta > \underline{\beta}^{Flex}\left(\tau\right)$, implies the farsighted nature of the FTA flexibility benefit dominates the myopic CU coordination benefit. Two reasons explain why $\underline{\beta}^{Flex}\left(\tau\right)$ remains constant for $\tau > \bar{\tau}_{IN}^{CU}$. First, $t_{FTA} < t_{CU} < \bar{\tau}_{IN}^{CU}$ implies a tariff binding above $\bar{\tau}_{IN}^{CU}$ does not bind the applied tariffs of FTA nor CU insiders. Second, while $\bar{\tau}_{IN}^{CU} < t_{\varnothing}$ implies a tariff binding above $\bar{\tau}_{IN}^{CU}$ could bind the FTA and CU outsider, they have the same optimal applied tariff. Thus, the myopic CU coordination benefit and the FTA flexibility benefit underlying $\underline{\beta}^{Flex}\left(\tau\right)$ in (21) remain constant for tariff bindings above $\bar{\tau}_{IN}^{CU}$.

While only the myopic CU coordination benefit exists when $\tau > \bar{\tau}_{IN}^{CU}$, only the farsighted CU coordination benefit exists once $\tau \leq t_{FTA}$. Here, the tariff binding binds PTA insiders and PTA outsiders and, hence, eliminates the myopic CU coordination benefit: $\Delta w_i\left(g_{ij}^{CU} - g_{ij}^{FTA}\right) = 0$. But, the relatively strict tariff binding generates the CU exclusion incentive $\Delta w_i\left(g_{ij}^{CU} - g^{FT}\right) > 0$. In turn, the farsighted CU coordination benefit emerges whereby, unlike FTA insiders who precipitate global free trade by becoming the hub, CU insiders have veto power over subsequent CU expansion. As such, $\beta \in \left(\underline{\beta}^{Flex}\left(\tau\right), \bar{\beta}^{Flex}\left(\tau\right)\right)$

[20] Using typical notation for the quadratic formula, (22) can be rewritten as $a\beta^2 + b\beta + c$ where $a \equiv \Delta w_i\left(g^{FT} - g_i^H\right) < 0$, $b \equiv \Delta w_i\left(g_i^H - g_{ij}^{FTA}\right) > 0$ and $c \equiv -\Delta w_i\left(g_{ij}^{CU} - g_{ij}^{FTA}\right) \leq 0$. Thus, given $a < 0$, $\underline{\beta}^{Flex}\left(\tau\right) = \frac{1}{2a}\left\{-b + \left[b^2 - 4ac\right]^{1/2}\right\}$ and $\bar{\beta}^{Flex}\left(\tau\right) = \frac{1}{2a}\left\{-b - \left[b^2 - 4ac\right]^{1/2}\right\}$.

[21] To see this, let $\beta = \tilde{\beta} \in \left\{\underline{\beta}^{Flex}\left(\tau\right), \bar{\beta}^{Flex}\left(\tau\right)\right\}$. Then, by construction, (22) fails because the left hand side equals the right hand. So, $\tilde{\beta} \notin \left(\underline{\beta}^{Flex}\left(\tau\right), \bar{\beta}^{Flex}\left(\tau\right)\right)$. But, (22) holds for $\beta = \tilde{\beta}$ with an arbitrarily small increase in $\Delta w_i\left(g_i^H - g^{FT}\right)$. Thus, now $\tilde{\beta} \in \left(\underline{\beta}^{Flex}\left(\tau\right), \bar{\beta}^{Flex}\left(\tau\right)\right)$. That is, $\underline{\beta}^{Flex}\left(\tau\right)$ has decreased and $\bar{\beta}^{Flex}\left(\tau\right)$ has increased.

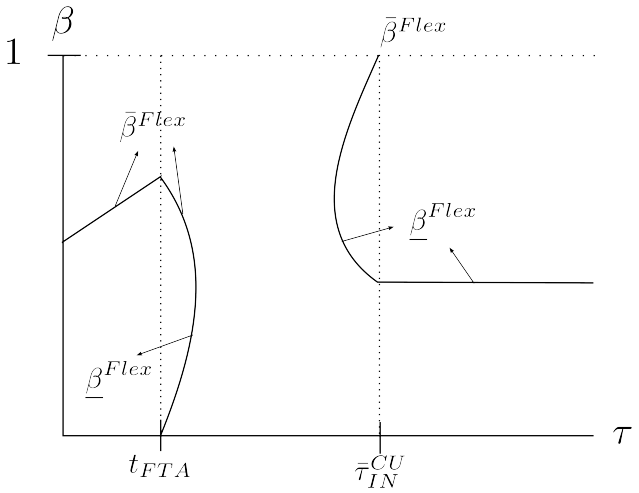

Figure 7: Flexibility benefit of FTAs versus coordination benefits of CUs

reduces to $\beta < \bar{\beta}^{Flex}(\tau) = \bar{\beta}_{IN}(\tau)$ (see (18)) with $\bar{\beta}^{Flex}(\tau)$ balancing the FTA flexibility benefit and farsighted CU coordination benefit with a sufficiently impatient country preferring FTA formation. Moreover, further tariff binding liberalization weakens the FTA flexibility benefit by shrinking the value of preferences enjoyed as the hub. Thus, the farsighted CU coordination benefit becomes more pronounced relative to the FTA flexibility benefit and, in turn, increases the attractiveness of CU over FTA formation by shrinking $\bar{\beta}^{Flex}(\tau)$.

In the bullet shaped regions, i.e. bindings just above t_{FTA} or just below $\bar{\tau}_{IN}^{CU}$, myopic and farsighted CU coordination benefits exist. Thus, sufficiently patient and sufficiently impatient countries prefer CU over FTA formation. As τ falls just below $\bar{\tau}_{IN}^{CU}$, the myopic CU coordination and FTA flexibility benefits remain constant because the tariff binding does not yet bind the PTA insiders nor spokes. However, the CU exclusion incentive strengthens because the tariff binding now binds the CU outsider, delivering concessions to CU insiders. This stronger farsighted CU coordination benefit increases the attractiveness of CU formation and, indeed, countries eventually prefer CU formation regardless of the discount factor. While the FTA flexibility benefit remains constant once $\tau \in (t_{FTA}, t_{CU})$, the myopic CU coordination benefit weakens as the tariff binding now binds CU insiders. Indeed, FTA formation again becomes attractive for an intermediate range of the discount factor as τ nears t_{FTA}.

Eventually, the myopic CU coordination benefit disappears once the tariff binding binds FTA and CU insiders, i.e. $\tau < t_{FTA}$. Now, a sufficiently impatient (patient) country sees the FTA flexibility benefit (farsighted CU coordination benefit) dominating the farsighted CU coordination benefit (FTA flexibility benefit).

Building on the trade off between the FTA flexibility and CU coordination benefits,

Proposition 3 characterizes the equilibrium path of networks. Here, we let $\underline{\beta}^{Flex}(\tau) \equiv 0$ when the myopic CU coordination benefit disappears (i.e. $\tau < t_{FTA}$) and, similarly, $\bar{\beta}^{Flex}(\tau) \equiv 1$ when the CU exclusion incentive disappears (i.e. $\tau > \bar{\tau}_{IN}^{CU}$).

Proposition 3 *In equilibrium, FTA formation emerges when* $\beta > \bar{\beta}_{OUT}(\tau)$ *and* $\beta \in \left(\underline{\beta}^{Flex}(\tau), \bar{\beta}^{Flex}(\tau)\right)$ *but CU formation emerges otherwise. When FTA formation emerges in equilibrium, the equilibrium path of networks is* $g_{\varnothing} \to g_{ab}^{FTA} \to g_a^H \to g^{FT}$ *if* $\tau < \tilde{\tau}$ *but* $g_{\varnothing} \to g_{ac}^{FTA} \to g_a^H \to g^{FT}$ *if* $\tau \geq \tilde{\tau}$. *When CU formation emerges in equilibrium, the equilibrium path of networks is* $g_{\varnothing} \to g_{ab}^{CU} \to g^{FT}$ *if* $\tau > \bar{\tau}_{IN}^{CU}$ *but* $g_{\varnothing} \to g_{ab}^{CU}$ *if* $\tau \leq \bar{\tau}_{IN}^{CU}$.

Figure 8 illustrates Proposition 3. One may have expected equilibrium FTAs if and only if $\beta \in \left(\underline{\beta}^{Flex}(\tau), \bar{\beta}^{Flex}(\tau)\right)$. However, this implicitly presumes FTA expansion yields global free trade. Yet, this only happens if the FTA outsider does not hold a dynamic free riding incentive and FTA insiders do not hold a dynamic exclusion incentive. First, the myopic CU coordination benefit implies an FTA insider cannot simultaneously hold a dynamic exclusion incentive and prefer FTA formation over CU formation (i.e. $\bar{\beta}^{Flex}(\tau) \leq \bar{\beta}_{IN}(\tau)$). Second, the FTA outsider may hold a dynamic free riding incentive when an FTA insider prefers FTA over CU formation; indeed, $\underline{\beta}^{Flex}(\tau) < \bar{\beta}_{OUT}(\tau)$ when $\tau > \bar{\tau}_{IN}^{CU}$. Thus, the equilibrium emergence of FTA formation requires not only that the FTA flexibility benefit dominate the CU coordination benefits but also that the FTA outsider does not hold a dynamic free riding incentive. In this case, FTAs expand to global free trade.

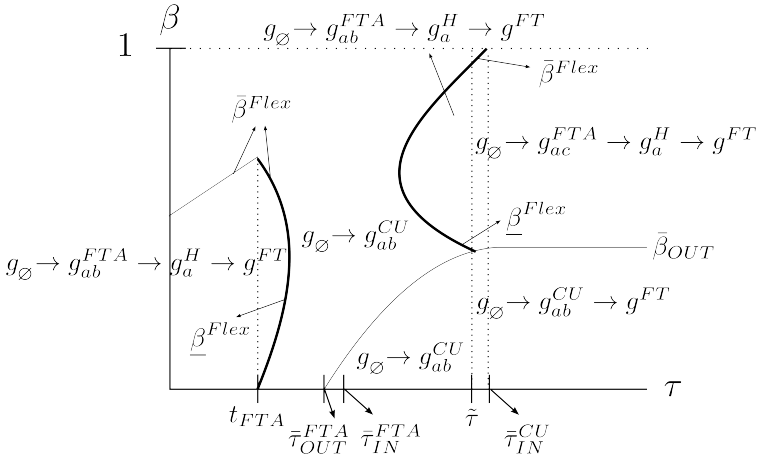

Figure 8: Equilibrium path of networks: PTA game

When FTAs do not emerge in equilibrium, either because the CU coordination benefits dominate the FTA flexibility benefit or because of the FTA outsider's dynamic free riding incentive, PTA insiders form a CU to exploit the CU coordination benefits. If the tariff binding exceeds $\bar{\tau}_{IN}^{CU}$ then CU insiders do not hold a CU exclusion incentive and the CU

coordination benefit consists entirely of the myopic CU coordination benefit. Here, CU formation expands to global free trade. However, if the tariff binding falls below $\bar{\tau}_{IN}^{CU}$ then CU insiders hold a CU exclusion incentive and permanently remain CU insiders by excluding the CU outsider from expansion to global free trade.

Typically, the PTA literature views the building bloc-stumbling bloc issue by comparing PTAs and multilateral liberalization in terms of whether PTAs improve or hurts the prospects of global free trade relative to the outcome under multilateral liberalization. However, in practice, multilateral liberalization happens in short background bursts either through rounds of global negotiations or plurilateral agreements such as the Information Technology Agreement. In contrast, countries are continuously forming PTAs on the surface of the global trade policy landscape and, in doing so, choosing between FTAs and CUs. Thus, an alternative view of the building bloc-stumbling bloc issue, and perhaps more informative, would compare different types of PTAs in terms of whether a given type of PTA improves the prospects of global free trade relative to the outcome when banning this type of PTA.

To this end, we introduce the terminology of a "PTA stumbling bloc" and a "PTA building bloc". We say that CUs (FTAs) are a "PTA stumbling bloc" if CU (FTA) formation emerges in equilibrium and does not lead to global free trade yet FTA (CU) formation would lead to global free trade in the absence of CUs (FTAs). Similarly, we say that CUs (FTAs) are a "PTA building bloc" if CU (FTA) formation emerges in equilibrium and leads to global free trade yet FTA (CU) formation would not lead to global free trade in the absence of CUs (FTAs). Comparing Proposition 3 with Propositions 1-2 reveals the following result.

Corollary 2 *FTAs can be a PTA building bloc but not a PTA stumbling bloc. For* $\tau > \bar{\tau}_{IN}^{CU}$*, CUs can be a PTA building bloc but not a PTA stumbling bloc. For* $\tau < \bar{\tau}_{IN}^{CU}$*, CUs can be a PTA stumbling bloc but not a PTA building bloc.*

FTAs cannot be a PTA stumbling bloc because equilibrium FTAs always expand to global free trade. To see FTAs as PTA building blocs, remember that the CU exclusion incentive prevents equilibrium CUs from expanding to global free trade once $\tau < \bar{\tau}_{IN}^{CU}$. Thus, for tariff bindings below $\tau < \bar{\tau}_{IN}^{CU}$, FTAs are PTA building blocs whenever they emerge in equilibrium.

While FTAs are never PTA stumbling blocs, CUs can be PTA stumbling blocs. When CUs emerge in equilibrium for the intermediate tariff bindings $\tau \in \left(t_{FTA}, \bar{\tau}_{IN}^{CU}\right)$, they do not expand to global free trade because of the CU exclusion incentive. But, FTAs expand to global free trade in this tariff binding range as long as FTA insiders do not hold a dynamic exclusion incentive (i.e. $\beta < \bar{\beta}_{IN}(\tau)$) and the FTA outsider does not hold a dynamic free riding incentive (i.e. $\beta > \bar{\beta}_{OUT}(\tau)$). Indeed, Figure 5 illustrates the existence of this range

for the FTA game. Thus, CUs are PTA stumbling blocs because FTAs would lead to global free trade here if CUs were banned.

Even though CUs are PTA stumbling blocs for an intermediate range of tariff bindings, they are PTA building blocs for sufficiently lax tariff bindings. Once $\tau > \bar{\tau}_{IN}^{CU}$, equilibrium CUs expand to global free trade because CU insiders do not hold a CU exclusion incentive. But, the FTA outsider holds a dynamic free riding incentive when $\beta < \bar{\beta}_{OUT}(\tau)$. Thus, when countries are sufficiently impatient, CUs are PTA building blocs because FTAs would not expand to global free trade if CUs were banned. Intuitively, the stronger discrimination faced by the CU outsider vis-à-vis the FTA outsider can mean CU formation expands to global free trade when FTA formation would not. Nevertheless, Corollary 2 shows that sufficient tariff binding liberalization morphs CUs from a PTA building bloc to a PTA stumbling bloc. Intuitively, this tariff binding liberalization weakens the dynamic FTA free riding incentive that was constraining FTA expansion while strengthening that CU exclusion incentive that eventually constrains CU expansion.

6 Discussion

6.1 Alternative protocols

Naturally, we could have used other protocols instead of that explained in Section 2.4. Of course, FTAs emerging in equilibrium when the FTA flexibility benefit outweighs the CU coordination benefits will not play out in every protocol one could impose. Nevertheless, our results are more general than our particular protocol.

For example, consider the type of protocol from Bloch (1996) used in the PTA literature by, e.g., Yi (1996) and Mrázová et al. (2012). Because this protocol is defined for settings with partitions of players, i.e. non-overlapping coalitions, it can be used for CU but not FTA settings. Nevertheless, the spirit is that a country becomes the new proposer if it rejects a proposal by the proposing country.

Thus, we now assume that, in each period, a leader country $L \in \{a, b, c\}$ makes an initial proposal. But, the country receiving the proposal becomes the proposer if it rejects the proposal. And, in turn, the country receiving this new proposal becomes the proposer if it rejects the new proposal, etc. To avoid never-ending rejection cycles and allow backward induction with Markov strategies, we assume the period ends with no agreement if a country becomes the proposer for a second time in a given period.

In general, this protocol weakens the power of the leader country. The leader country understands that each follower country can reject its proposal and, upon becoming the new

proposer, force the leader country to accept its proposal. Thus, the leader country looks at the ideal PTA that each follower country wants to form with the leader and proposes which of these two PTAs that it prefers. But, in the CU and FTA games, there is no choice about the type of PTA. As such, with country a as the leader country in our Bloch-style protocol, the equilibrium is the same as that in our earlier analysis. That is, the weaker power of the leader country does not impact the equilibrium of the CU or FTA game.

However, the weaker power of the leader country impacts the equilibrium when countries can choose the type of PTA. In fact, FTA formation no longer emerges when country a is the leader country. Understanding that countries b and c both prefer CU over FTA formation with country a, country a is forced to propose a CU with country b. Country b accepts even though it would prefer an FTA with country c because it understands country c can reject that proposal and then propose a CU of its own with country a. With our Bloch-style protocol, FTAs only emerge in equilibrium when country c is the leader country. Understanding that both country a and b prefer FTA over CU formation with country c, country c proposes an FTA with country a. Country a accepts because it knows country b would reject an FTA proposal from country a so it could form its own FTA with country c.

This discussion shows the identity of the leader country matters for the equilibrium emergence of FTAs. However, it also shows a more general idea drives the equilibrium emergence of FTAs across our Bloch-style protocol and our baseline protocol: the "most attractive" country a must have sufficient power in the protocol to force other countries to accept an FTA and thereby exploit the FTA flexibility benefit. Our baseline protocol expresses this power in a very transparent way: country a is the leader and can essentially play the follower countries against each other to get what it wants. The Bloch-style protocol expresses this power in a more subtle way because the follower countries now have more power. Indeed, country a has the most power over the equilibrium outcome when it is a *follower* country and country c is the leader country. Thus, what drives the equilibrium emergence of FTAs is that the protocol affords sufficient power to the most attractive country whether it be as the leader or as a follower country.

6.2 Competing importers model

Following Missios et al. (2016), we now modify the comparative advantage structure across countries so that $\lambda_i^I = 1 + \lambda > 1$ while $\lambda_i^Z = 1$ for goods $Z \neq I$. That is, we now consider a competing importers model: each country i has a comparative advantage in good I and exports this good to countries j and k who both have comparative disadvantage in good I

and hence compete with each other for imports from country i.[22]

Our baseline results rely on the PTA payoff properties described in Lemmas 1, 2, 5 and 6. That is, our results in apply in any trade model where the PTA payoff properties satisfy these lemmas. In particular, Lemma 7 below shows these lemmas are satisfied in the competing importers model of Missios et al. (2016). Moreover, by showing the competing importers model rules out certain PTA payoff possibilities allowed by the competing exporters model, it shows the competing importers model PTA payoff properties are actually a special case of those in the competing exporters model. In this sense, the nature of strategic interaction in the competing exporters model is more general than in the competing importers model.

Lemma 7 *Lemmas 1, 2, 5 and 6 from the competing exporters model hold in the competing importers model. Additionally, in the competing importers model,*

(i) $\Delta w_i(g' - g) > 0$ *for any* $g' = g + ij^{PTA}$ *and* $\Delta w_i(g_{ij}^{FTA} - g_{jk}^{FTA}) > 0$

(ii) $\Delta w_i(g_{ij}^{CU} - g^{FTA}) = 0$

(iii) $\Delta w_i(g_{ij}^{CU} - g^{FT}) = \Delta w_i(g_{ij}^{FTA} - g^{FT}) > 0.$

In the competing exporters model, the FTA outsider benefits from the tariff complementarity practiced by FTA insiders. Thus, Lemma 1(ii) allowed the possibility that an FTA outsider may not benefit myopically from forming an FTA and becoming a spoke. And, Lemma 1(iii) allowed the possibility that a country may myopically prefer being an FTA outsider over an FTA insider. However, Lemma 7(i) says these possibilities do not emerge in the competing importers model. Intuitively, the FTA insiders no longer practice tariff complementarity in the competing importers model and this increases the cost of discrimination faced as an FTA outsider so that the FTA outsider never holds any FTA free riding incentive. The key implication is that the dynamic free riding incentive cannot constrain FTA formation in the competing importers model.

In the competing exporters model, Lemma 2(iii) and Lemma 6(ii) said PTA insiders only hold exclusion incentives for sufficiently tight tariff bindings. Intuitively, the PTA insiders wanted to include the PTA outsider because the high tariff bindings imply they have not extracted significant tariff concessions from the PTA outsider. However, Lemma 7(iii) says PTA insiders always hold exclusion incentives. Intuitively, the tariff complementarity practiced by the PTA *outsider* in the competing importers model represents tariff concessions for PTA insiders and makes PTA expansion unattractive for the PTA insiders. The key implications in the competing importers model are twofold: (i) the dynamic exclusion incentive constrains FTA formation regardless of the tariff binding and (ii) CU formation

[22] Appendix A contains additional formal details for the competing importers model.

never expands to global free trade because CU insiders always exploit the farsighted CU coordination benefit and permanently exclude the CU outsider.

In the competing exporters model, PTA insiders practiced tariff complementarity. With each PTA insider importing the same good from the other PTA insider *and* the PTA outsider, giving tariff free access to their PTA partner induced them to also reduce their tariff on the PTA outsider. Moreover, by internalizing the negative externality of tariff complementarity through tariff coordination, PTA insiders myopically benefitted from CU rather than FTA formation. However, only one country exports a given good in the competing importers model. As such, PTA insiders do not practice tariff complementarity which implies, as recorded in Lemma 7(ii)-(iii), that the myopic CU coordination benefit disappears. The key implication in the competing importers model is that the trade off between the FTA flexibility benefit and CU coordination benefits reduces to that between the FTA flexibility benefit $\Delta w_i(g_{ij}^H - g^{FT})$ and the farsighted CU coordination benefit $\Delta w_i(g_{ij}^{PTA} - g^{FT})$:

$$w_i\left(g_{ij}^{FTA}\right)+\beta w_i\left(g_i^H\right)+\frac{\beta^2}{1-\beta}w_i\left(g^{FT}\right) > \frac{1}{1-\beta}w_i\left(g_{ij}^{PTA}\right) \Leftrightarrow \beta < \underline{\beta}^{Flex}(\tau) \equiv 1-\frac{\Delta w_i(g_{ij}^{PTA} - g^{FT})}{\Delta w_i(g_{ij}^H - g^{FT})}.$$

Proposition 4 shows these simpler PTA payoff properties in the competing importers generate a simpler equilibrium characterization.

Proposition 4 *In the competing importers model, the equilibrium path of networks in the PTA game is (i)* $g_\varnothing \to g_{ab}^{FTA} \to g_a^H \to g^{FT}$ *when* $\beta < \underline{\beta}^{Flex}(\tau)$ *but (ii)* $g_\varnothing \to g_{ab}^{PTA}$ *when* $\beta \geq \underline{\beta}^{Flex}(\tau)$.

Figure 9 illustrates. As described above, the dynamic free riding incentive does not exist and only the dynamic exclusion incentive constrains PTA formation. Whether PTAs expand to global free trade depends on the trade off between the FTA flexibility benefit, captured by $\Delta w_i(g_{ij}^H - g^{FT})$, and the farsighted CU coordination benefit, captured by the exclusion incentive $\Delta w_i(g_{ij}^{PTA} - g^{FT})$, with PTAs expanding to global free trade when countries are sufficiently impatient.

Naturally, tariff binding liberalization only affects this trade off once the tariff binding actually binds (i.e. $\tau < t_\varnothing$). When only PTA insiders are bound, i.e. $\tau \in (t_{PTA}, t_\varnothing)$, tariff binding liberalization increases the extent that PTAs expand to global free trade. Intuitively, the value of preferential market access protected by PTA insiders falls and mitigates the exclusion incentive. However, once the PTA outsider is also bound, further tariff binding liberalization reduces the extent that PTAs expand to global free trade. Intuitively, this strengthens the exclusion incentive by increasing concessions from the PTA outsider and, thus, lowering the cost of excluding the PTA outsider.

Not only does the competing importers model simplify the equilibrium characterization from the competing exporters model, it also simplifies the role played by PTAs in terms of attaining global free trade. Like the competing exporters model, FTAs can be PTA building blocs but never PTA stumbling while CUs can be PTA stumbling blocs. But, unlike the competing exporters model, CUs can never be PTA building blocs. This difference stems from CU insiders always holding a CU exclusion incentive in the competing importers model. Thus, CU formation never expands to global free trade and this differs from the competing exporters model where CU formation expanded to global free trade with sufficiently lax tariff bindings because, in this case, CU insiders did not hold a CU exclusion incentive.

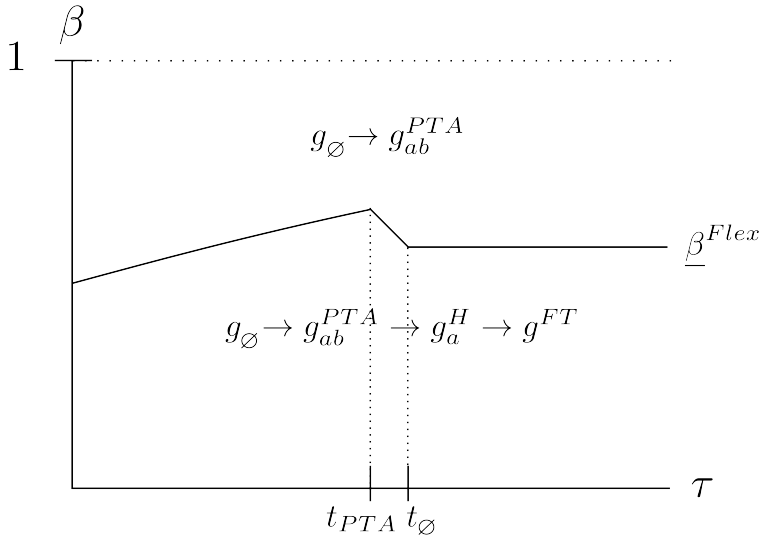

Figure 9: Equilibrium path of networks: PTA game

7 Conclusion

We investigate how multilateral tariff binding liberalization impacts the equilibrium extent of Preferential Trade Agreement (PTA) formation. While the 1994 Uruguay Round is the last successful round of multilateral negotiations, subsequent tariff binding liberalization has taken place on IT products through the large plurilateral agreement known as the Information Technology Agreement. Such an agreement has also been discussed as a template for future plurilateral agreements, including an Environmental Goods Agreement. Thus, multilateral tariff binding liberalization has taken place since the Uruguay Round and will likely take place moving forward regardless of the currently-stalled Doha Round of negotiations.

The key insight from our paper is that tariff binding liberalization has substantial implications for PTA formation. First, it changes the equilibrium path of PTA formation. For

relatively high tariff bindings, PTAs expand to global free trade with the trade off between the FTA flexibility and CU coordination benefits, mediated by the discount factor, determining whether this happens via FTAs or CUs. But, once tariff binding liberalization binds the CU outsider then such liberalization delivers concessions from the CU outsider to the CU insiders. This soon creates a CU exclusion incentive and a farsighted CU coordination benefit for CU, rather than FTA, formation so that each CU insider can exercise their veto power to permanently exclude the CU outsider. Indeed, for intermediate tariff bindings, the CU coordination benefits outweigh the FTA flexibility benefit regardless of the discount factor. But, tariff binding liberalization eventually constrains the tariffs of CU insiders and thereby reduces the myopic CU coordination benefit. This restores the equilibrium tradeoff, mediated by the discount factor, between the FTA flexibility and CU coordination benefits with FTAs again emerging in equilibrium.

Second, tariff binding liberalization impacts the nature of forces constraining FTA expansion and, hence, the extent that FTAs emerge in equilibrium. For relatively high tariff bindings, the constraining force is a dynamic free riding incentive. Here, a relatively impatient FTA outsider sees the myopic benefit of tariff complementarity practiced by FTA insiders, and its own ability to impose tariffs on FTA insiders, as outweighing the farsighted attractiveness of global free trade and it refuses subsequent FTA formation. For relatively low tariff bindings, the constraining force is a dynamic free riding incentive. Here, given the substantial tariff binding concessions of the FTA outsider, a relatively patient FTA insider sees the farsighted incentive to exclude the FTA outsider from FTA expansion as outweighing the myopic benefit of becoming the hub.

Third, tariff binding liberalization impacts the ability of FTAs and CUs to reach global free trade. On one hand, in our own terminology, FTAs can be PTA building blocs but never PTA stumbling blocs: equilibrium FTAs always lead to global free trade and, in such cases, CU insiders may actually exclude the CU outsider from global free trade. On the other hand, tariff binding liberalization morphs CUs from a PTA building bloc to a PTA stumbling bloc. With relatively high tariff bindings, CUs can be a PTA building bloc: CU insiders, in equilibrium, happily include the CU outsider in expansion to global free trade even though the FTA outsider's dynamic free riding incentive would prevent FTAs reaching global free trade. But, once tariff binding liberalization generates a CU exclusion incentive, CUs can no longer be a PTA building bloc. Yet, they can now be a PTA stumbling bloc: CU insiders, in equilibrium, permanently exclude the CU outsider even though FTA expansion would reach global free trade when the FTA insiders do not hold a dynamic free riding incentive. Ultimately, tariff binding liberalization casts a negative shadow over the impact of CUs but casts a positive shadow over the impact of FTAs.

The relative merits of FTAs versus CUs has begun to receive more empirical attention. Conconi et al. (2018) document substantial resource misallocation from NAFTA rules of origin (ROO). And, despite not being subject to a common external tariff, Felbermayr et al. (2018) document that the external tariffs of FTA members differ little. Hence, given the costs associated with FTA ROO, they suggest policies that could make FTAs emulate CUs. However, our analysis emphasizes that FTAs and CUs fundamentally differ in their dynamic properties and that the FTA flexibility benefit is an important feature of FTAs that can propel FTA expansion far past the degree of global liberalization that would be achieved via CUs. Indeed, our result that FTAs are PTA building blocs but never PTA stumbling blocs while CUs can be PTA stumbling blocs makes this exact point. And, this result is even stronger in our competing importers model extension where, additionally, CUs can never be PTA building blocs.

Our exogenous treatment of tariff bindings reflects, in our view, the broad issue of endogenous tariff binding determination remaining an important unresolved issue in the literature. Currently, the two standard approaches to modeling endogenous tariff bindings, costly contracting (Horn et al. (2010)) and political economy uncertainty (e.g. Bagwell and Staiger (2005), Amador and Bagwell (2013), Beshkar et al. (2015) and Nicita et al. (2018)) ignore any role played by PTA formation despite the flood of PTAs following the 1994 Uruguay Round of global tariff binding negotiations. While Lake and Roy (2017) model the impact of future FTA formation on global tariff binding negotiations, they do not analyze the implications for a subsequent round of global negotiations after FTA formation takes off. Thus, they analyze how post-Uruguay Round FTAs could impact Uruguay Round tariff bindings but do not consider any implications for the long-stalled Doha Round of global tariff binding negotiations. A model explaining the evolution of global tariff bindings in the presence of PTA formation would represent a substantial contribution to the literature.

Appendix

A Competing importers model

Given the competing importers structure described in Section 6.2, the modified no-arbitrage and market clearing conditions for good I are

$$p_j^I = p_i^I + t_{ji} \text{ and } p_k^I = p_i^I + t_{ki} \tag{24}$$

$$x_i^I = \sum_{z \neq i} m_z^I \tag{25}$$

where x^I is the exports by country of good I and m_z^I is the imports of good I by country $z \neq i$:

$$x_i^I = s_i^I(p_i^I) - d(p_i^I) \text{ and } m_z^I = d(p_z^I) - s_z^I(p_z^I). \tag{26}$$

Using (24)-(26), the equilibrium local prices of good I in the exporting country i and an importing country j are:

$$p_i^I = \frac{3\alpha - 2\sum_{z \neq i} t_{zi}}{\lambda + 6} \text{ and } p_j^I = \frac{3\alpha - 2t_{ki} + (4+\lambda)t_{ji}}{\lambda + 6}. \tag{27}$$

While tariff revenue takes a slightly different form than the competing exporters model in Section 2.1, consumer and producer surplus are still defined by (2) and (4). Thus, substituting (27) in the following expression delivers a closed form welfare expression for an arbitrary vector of tariffs $(t_{ij}, t_{ik}, t_{ji}, t_{jk}, t_{ki}, t_{kj})$ and, hence, for any network g of PTAs:

$$w_i = \sum_Z CS_i^Z\left(p_i^Z\right) + \sum_Z PS_i^Z\left(p_i^Z\right) + \left[t_{ij}x_j^J\left(p_j^J\right) + t_{ik}x_k^K\left(p_k^K\right)\right].$$

The optimal tariffs for country i are as follows:

$$t_{ik}\left(g_{ij}^{FTA}\right) = t_{ik}\left(g_{ij}^{CU}\right) = t_\varnothing \equiv \arg\max_{t_{ik}} w_i(g_\varnothing) = \frac{\alpha\lambda}{\lambda^2 + 12\lambda + 28} \tag{28}$$

$$t_i\left(g_{jk}^{FTA}\right) = t_i\left(g_{jk}^{CU}\right) = t_i\left(g_j^H\right) = \frac{\alpha\lambda}{(\lambda+4)(\lambda+8)} < t_\varnothing.$$

Note that, unconstrained by Article XXIV, we would have $t_{ik}\left(g_{ij}^{CU}\right) > t_\varnothing$. But, Article XXIV rules prohibit PTA members from increasing their applied MFN tariff on non-members. Thus, we impose $t_{ik}\left(g_{ij}^{CU}\right) = t_\varnothing$.

B Proofs

Before we present the proofs from the main text, we present an additional proof that will be used in Propositions 2-3.

Lemma 8 *Consider a subgame at g_{ij}^{CU}. The equilibrium outcome in the subgame is*
(i) $g_{ij}^{CU} \to g^{FT}$ if $\tau > \bar{\tau}_{IN}^{CU}$
(ii) $g_{ij}^{CU} \to g_{ij}^{CU}$ if $\tau \leq \bar{\tau}_{IN}^{CU}$.

Proof. Lemma 6(ii) implies $V_k\left(g^{FT}\right) > V_k\left(g_{ij}^{CU}\right)$. Moreover, by definition, $V_z\left(g^{FT}\right) > V_z\left(g_{ij}^{CU}\right)$ for $z = i, j$ if and only if $\tau > \bar{\tau}_{IN}^{CU}$. Thus, the first CU insider in the protocol, say i, proposes g^{FT} to j and k, who both accept, if $\tau > \bar{\tau}_{IN}^{CU}$. But, no CU insider accepts a proposal, and hence no CU insider makes a proposal, if $\tau \leq \bar{\tau}_{IN}^{CU}$. Thus, $g_{ij}^{CU} \to g^{FT}$ if $\tau > \bar{\tau}_{IN}^{CU}$ but $g_{ij}^{CU} \to g_{ij}^{CU}$ if $\tau \leq \bar{\tau}_{IN}^{CU}$. ■

We now present proofs of lemmas and propositions from the main text.

Proof of Lemma 1

The proof follows directly from using the welfare expressions in Section 2.1 and, subject to the tariff binding where relevant, the equilibrium prices and optimal tariffs reported in the text.■

Proof of Lemma 2

The proof follows directly from using the welfare expressions in Section 2.1 and, subject to the tariff binding, the equilibrium prices and optimal tariffs reported in the text.■

Proof of Lemma 3

Lemma 1(i) implies the first spoke in the protocol, say j, proposes an FTA with k who accepts. Thus, $g_i^H \to g^{FT}$.■

Proof of Lemma 4

Given i proposes before j in the protocol, then either i or k proposes in stage 1a. Moreover, Lemma 3 implies $g_z^H \to g^{FT}$ in any subgame at g_z^H. Thus, by definition, $V_i\left(g_i^H\right) > \frac{1}{1-\beta} w_i\left(g_{ij}^{FTA}\right) \Leftrightarrow \beta < \bar{\beta}_{IN}(\tau)$ and $V_k\left(g_i^H\right) > \frac{1}{1-\beta} w_k\left(g_{ij}^{FTA}\right) \Leftrightarrow \beta > \bar{\beta}_{OUT}(\tau)$. Moreover, Lemma 2(ii) and Lemma 1(i) imply $w_i\left(g_i^H\right) > w_i\left(g^{FT}\right) > w_i\left(g_j^H\right)$ so that $V_i\left(g_i^H\right) > V_i\left(g_j^H\right)$.

First, suppose $\beta \in \left(\bar{\beta}_{OUT}(\tau), \bar{\beta}_{IN}(\tau)\right)$. Then, in stage 1a, i (or k) proposes an FTA with k (or i) and k (or i) accepts. Hence, the equilibrium outcome in the subgame is $g_{ij}^{FTA} \to g_i^H$. Second, suppose $\beta \leq \bar{\beta}_{OUT}(\tau)$. Then, k rejects any FTA proposal received from i or j and chooses to make no proposal as the proposer. Hence, the equilibrium outcome in the subgame is $g_{ij}^{FTA} \to g_{ij}^{FTA}$. Third, suppose $\beta \geq \bar{\beta}_{IN}(\tau)$. Then, i and j choose to make no FTA proposal as the proposer and reject any proposal received from k. Hence, the equilibrium outcome in the subgame is $g_{ij}^{FTA} \to g_{ij}^{FTA}$.■

Proof of Lemma 5

Part (i): First, suppose $g_{ij}^{FTA} \to g_{ij}^{FTA}$. Then, Lemma 1(i) implies $V_z\left(g_{ij}^{FT}\right) - V_z\left(g_\varnothing\right) = \Delta w_z(g_{ij}^{FTA} - g_\varnothing) > 0$ for $z = i, j$. Second, suppose $g_{ij}^{FTA} \to g_i^H \to g^{FT}$. Then, by Lemma 1(i) and Lemma 2(iii), $V_i\left(g_{ij}^{FTA}\right) > V_j\left(g_{ij}^{FTA}\right)$. Further, $V_i\left(g_\varnothing\right) = V_j\left(g_\varnothing\right)$ and it is easily verified that $V_j\left(g_{ij}^{FTA}\right) = w_j\left(g_{ij}^{FTA}\right) + \beta w_j\left(g_i^H\right) + \frac{\beta^2}{1-\beta} w_j\left(g^{FT}\right) > V_j\left(g_\varnothing\right)$ for all β. Hence, $V_z\left(g_{ij}^{FTA}\right) > V_z\left(g_\varnothing\right)$ for $z = i, j$.

Part (ii): For any τ, consider the range of β such that $g_{ij}^{FTA} \to g_i^H \to g^{FT}$ and $g_{jk}^{FTA} \to g_j^H \to g^{FT}$. Noting that $V_i\left(g_{ij}^{FTA}\right) > V_i\left(g_{jk}^{FTA}\right)$ reduces to $w_i\left(g_{ij}^{FTA}\right) + \beta w_i\left(g_i^H\right) >$

$w_i\left(g_{jk}^{FTA}\right)+\beta w_i\left(g_j^H\right)$, it is easily verified that $V_i\left(g_{ij}^{FTA}\right)>V_i\left(g_{jk}^{FTA}\right)$ using using the welfare expressions in Section 2.1 and, subject to the tariff binding, the equilibrium prices and optimal tariffs reported in the text.■

PROOF OF PROPOSITION 1

Note throughout that country b (c) receives an arbitrarily small non-economic benefit $\varepsilon>0$ from FTA formation with country a rather than country c (b) and country a receives an arbitrarily small non-economic benefit $\varepsilon>0$ from FTA formation with country b rather than country c. Moreover, Lemmas 3-4 describe the equilibrium transitions from subgames at g_{ij}^{FTA} and g_i^H. In particular, letting i be the most attractive FTA insider, $g_{ij}^{FTA}\rightarrow g_i^H\rightarrow g^{FT}$ if and only if $\beta\in\left(\bar{\beta}_{OUT}(\tau),\bar{\beta}_{IN}(\tau)\right)$ but $g_{ij}^{FTA}\rightarrow g_{ij}^{FTA}$ otherwise.

Stage 2. Note that Lemma 4 implies $g_{ij}^{FTA}\rightarrow g_{ij}^{FTA}$ if $\beta\notin\left(\bar{\beta}_{OUT}(\tau),\bar{\beta}_{IN}(\tau)\right)$ but Lemmas 3-4 imply $g_{ij}^{FTA}\rightarrow g_i^H\rightarrow g^{FT}$ where country i is the more attractive FTA insider when $\beta\in\left(\bar{\beta}_{OUT}(\tau),\bar{\beta}_{IN}(\tau)\right)$. In turn, $V_z\left(g_{ij}^{FTA}\right)>V_z\left(g_\varnothing\right)$ for $z=i,j$ either by Lemma 1(i) or Lemma 5(i). Thus, when $\beta\notin\left(\bar{\beta}_{OUT}(\tau),\bar{\beta}_{IN}(\tau)\right)$, country b proposes an FTA with country a, who accepts, given the non-economic benefits. But, when $\beta\in\left(\bar{\beta}_{OUT}(\tau),\bar{\beta}_{IN}(\tau)\right)$, country b proposes an FTA with country c, who accepts, given Lemma 1(i) and Lemma 2(iii) imply $w_b\left(g_b^H\right)>w_b\left(g^{FT}\right)>w_b\left(g_a^H\right)$ and, in turn, $V_b\left(g_{bc}^{FTA}\right)>V_b\left(g_{ab}^{FTA}\right)$.

Stage 1b. Note the equilibrium outcome in Stage 2 is g_{ab} if $\beta\notin\left(\bar{\beta}_{OUT}(\tau),\bar{\beta}_{IN}(\tau)\right)$ but g_{bc} if $\beta\in\left(\bar{\beta}_{OUT}(\tau),\bar{\beta}_{IN}(\tau)\right)$. Further, $V_a\left(g_{ab}^{FTA}\right)=V_a\left(g_{ac}^{FTA}\right)$ by symmetry.

First, let $\beta\notin\left(\bar{\beta}_{OUT}(\tau),\bar{\beta}_{IN}(\tau)\right)$. Then, country a proposes FTA formation with country b, who accepts, if country c rejected country a's proposal in Stage 1a. But, given the non-economic benefits, country a makes no proposal if country b rejected country a's proposal in Stage 1a.

Second, let $\beta\in\left(\bar{\beta}_{OUT}(\tau),\bar{\beta}_{IN}(\tau)\right)$. Suppose country b rejected country a's proposal in Stage 1a. Then, given Lemma 5(ii), country a proposes FTA formation with country c, who accepts given the non-economic benefits. Now suppose country c rejected country a's proposal in Stage 1a. Then, in anticipation of the equilibrium outcome g_{bc}^{FTA} in Stage 2, country b rejects any FTA proposal from country a and hence country a makes no proposal.

Stage 1a. First, let $\beta\in\left(\bar{\beta}_{OUT}(\tau),\bar{\beta}_{IN}(\tau)\right)$ noting that country b rejects an FTA proposal from country a in Stage 1b. Further, $V_a\left(g_{az}^{FTA}\right)>V_a\left(g_{bc}^{FTA}\right)$ for $z=b,c$ by Lemma 5(ii) but $V_b\left(g_{ac}^{FTA}\right)\lesseqgtr V_b\left(g_{ab}^{FTA}\right)$ reduces to $w_b\left(g_{ac}^{FTA}\right)\lesseqgtr w_b\left(g_{ab}^{FTA}\right)$ and, in turn, $\tau\lesseqgtr\tilde{\tau}$. Let $\tau<\tilde{\tau}$. Then, the non-economic benefits imply country a proposes an FTA with country b who accepts given the equilibrium outcome of g_{ac}^{FTA} in Stage 1b upon its rejection in Stage 1a. Now let $\tau\geq\tilde{\tau}$. Then, country b will reject an FTA proposal from country a in anticipation of the equilibrium outcome g_{ac}^{FTA} in Stage 1b. Hence, country a proposes an FTA to country c, who accepts given the non-economic benefits and anticipation of rejection

leading to an equilibrium outcome of g_{bc}^{FTA} in Stage 2. Thus, the equilibrium path of networks is $g_{\varnothing} \to g_{ab}^{FTA} \to g_a^H \to g^{FT}$ if $\tau < \tilde{\tau}$ but $g_{\varnothing} \to g_{ac}^{FTA} \to g_a^H \to g^{FT}$ if $\tau \geq \tilde{\tau}$.

Second, let $\beta \notin \left(\bar{\beta}_{OUT}(\tau), \bar{\beta}_{IN}(\tau)\right)$ noting that the equilibrium outcome in either Stage 1b or Stage 2 is g_{ab}^{FTA}. Then, the non-economic benefits imply country a proposes an FTA with country b who accepts. Thus, the equilibrium path of networks is $g_{\varnothing} \to g_{ab}^{FTA}$ if $\beta \notin \left(\bar{\beta}_{OUT}(\tau), \bar{\beta}_{IN}(\tau)\right)$.■

Proof of Lemma 6

Parts (i)-(iii) follow from using the welfare expressions in Section 2.1 and, subject to the tariff binding, the equilibrium prices and optimal tariffs reported in the text.■

Proof of Proposition 2

Note throughout that country b (c) receives an arbitrarily small non-economic benefit $\varepsilon > 0$ from CU formation with country a rather than country c (b) and country a receives an arbitrarily small non-economic benefit $\varepsilon > 0$ from CU formation with country b rather than country c. Moreover, Lemma 8 describes the equilibrium transitions from CU insider-outsider networks with $g_{ij}^{CU} \to g^{FT}$ if $\tau > \bar{\tau}_{IN}^{CU}$ but $g_{ij}^{CU} \to g_{ij}^{CU}$ if $\tau \leq \bar{\tau}_{IN}^{CU}$.

Stage 2. Lemma 6(i) and, given the veto power of CU members, Lemma 8 imply that $V_i\left(g_{ij}^{CU}\right) > V_i\left(g_{\varnothing}\right)$ regardless of the equilibrium transition in the subgame at g_{ij}^{CU}. Thus, given the non-economic benefits, country b proposes a CU with country a and country a accepts.

Stage 1b. Given the equilibrium outcome in Stage 2 of g_{ab}^{CU} and the non-economic benefits, country a makes no proposal to country c if country b rejected country a's proposal in Stage 1a but country a proposes a CU with country b, and country b accepts, if country c rejected country a's proposal in Stage 1a.

Stage 1a. Given g_{ab}^{CU} is the equilibrium outcome either in Sage 1b or Stage 2, country a proposes a CU with country b who accepts. Thus, using Lemma 8, the equilibrium path of networks is $g_{\varnothing} \to g_{ab}^{CU} \to g^{FT}$ if $\tau > \bar{\tau}_{IN}^{CU}$ but $g_{\varnothing} \to g_{ab}^{CU}$ if $\tau \leq \bar{\tau}_{IN}^{CU}$.■

Proof of Proposition 3

Note throughout that country b (c) receives an arbitrarily small non-economic benefit $\varepsilon > 0$ from PTA formation with country a rather than country c (b) and country a receives an arbitrarily small non-economic benefit $\varepsilon > 0$ from PTA formation with country b rather than country c. Moreover, Lemmas 3, 4 and 8 describe the equilibrium transitions from, respectively, hub-spoke, FTA insider-outsider and CU insider-outsider networks.

First, suppose $\beta \notin \left(\bar{\beta}_{OUT}(\tau), \bar{\beta}_{IN}(\tau)\right)$ so that $g_{ij}^{FTA} \to g_{ij}^{FTA}$. Then, $V_i\left(g_{ij}^{CU}\right) \geq V_i\left(g_{ij}^{FTA}\right) > V_i\left(g_{\varnothing}\right)$ follows from the veto power held by CU insiders over CU expansion together with Lemma 6(iii) and Lemma 1(i).

Stage 2. Given the non-economic benefits, country b proposes CU formation with a who accepts.

Stage 1b. Given the equilibrium outcome in Stage 2 of g_{ab}^{CU}, country b accepts a CU proposal from country a. Two implications follow from the non-economic benefits. First, if country c rejected country a's proposal in Stage 1a then country a proposes CU formation with country b who accepts. Second, if country b rejected country a's proposal in Stage 1a then country a makes no proposal.

Stage 1a. Given the equilibrium outcome is g_{ab}^{CU} in either Stage 1b or Stage 2, the non-economic benefits imply country a proposes CU formation with country b who accepts. Thus, the equilibrium path of networks when $\beta \notin \left(\bar{\beta}_{OUT}(\tau), \bar{\beta}_{IN}(\tau)\right)$ is $g_{\varnothing} \to g_{ab}^{CU}$ if $\tau \leq \bar{\tau}_{IN}^{CU}$ but $g_{\varnothing} \to g_{ab}^{CU} \to g^{FT}$ if $\tau > \bar{\tau}_{IN}^{CU}$.

Second, suppose $\beta \in \left(\bar{\beta}_{OUT}(\tau), \bar{\beta}_{IN}(\tau)\right)$ so that $g_{ij}^{FTA} \to g_i^H \to g^{FT}$ where country i is the more attractive FTA insider in terms of non-economic benefits.

Stage 2. Note that $V_b\left(g_{bc}^{CU}\right) = V_b\left(g_{ab}^{CU}\right) \geq V_b\left(g_{ab}^{FTA}\right) > V_b\left(g_{\varnothing}\right)$ follows from Lemma 1(i), Lemma 6(iii), Lemma 5(i) and the veto power of CU insiders over CU expansion. Moreover, $V_b\left(g_{bc}^{FTA}\right) > V_b\left(g_{bc}^{CU}\right)$ if and only if $\beta \in \left(\underline{\beta}^{Flex}(\tau), \bar{\beta}^{Flex}(\tau)\right)$ but $V_c\left(g_{bc}^{FTA}\right) > V_c\left(g_{\varnothing}\right)$ by Lemma 5(i). Thus, country b proposes FTA formation with country c, who accepts, if $\beta \in \left(\underline{\beta}^{Flex}(\tau), \bar{\beta}^{Flex}(\tau)\right)$. But, given the non-economic benefits and $V_a\left(g_{ab}^{CU}\right) > V_a\left(g_{\varnothing}\right)$ by Lemma Lemma 1(i) and the veto power of CU insiders, country b proposes CU formation with country a, who accepts, if $\beta \notin \left(\underline{\beta}^{Flex}(\tau), \bar{\beta}^{Flex}(\tau)\right)$.

Stage 1b. Suppose country c rejected country a's proposal in Stage 1a so that country a can propose to country b. Given the equilibrium outcome in Stage 2 of either g_{ab}^{CU} or g_{bc}^{FTA}, country b will only accept country a's proposal if country a proposes CU formation and will only accept a CU proposal if $\beta \notin \left(\underline{\beta}^{Flex}(\tau), \bar{\beta}^{Flex}(\tau)\right)$. Thus, country a makes no proposal when $\beta \in \left(\underline{\beta}^{Flex}(\tau), \bar{\beta}^{Flex}(\tau)\right)$. In contrast, following similar logic to Stage 2, country a proposes CU formation with country b, who accepts, when $\beta \notin \left(\underline{\beta}^{Flex}(\tau), \bar{\beta}^{Flex}(\tau)\right)$.

Now suppose country b rejected country a's proposal in Stage 1a so that country a can propose to country c. Let $\beta \in \left(\underline{\beta}^{Flex}(\tau), \bar{\beta}^{Flex}(\tau)\right)$. Then, $V_i\left(g_{ij}^{FTA}\right) > V_i\left(g_{ij}^{CU}\right)$ where country i is more attractive than country j based on non-economic benefits. Thus, given the equilibrium outcome in Stage 2 of g_{bc}^{FTA} and the non-economic benefits, Lemma 5(ii) implies country a proposes FTA formation with country c who accepts. Now let $\beta \notin \left(\underline{\beta}^{Flex}(\tau), \bar{\beta}^{Flex}(\tau)\right)$. Then, $V_i\left(g_{ij}^{CU}\right) \geq V_i\left(g_{ij}^{FTA}\right)$ where country i is more attractive than country j based on non-economic benefits. Thus, given the equilibrium outcome in Stage 2 of g_{ab}^{CU} and the non-economic benefits, country a makes no proposal.

Stage 1a. First, suppose $\beta \notin \left(\underline{\beta}^{Flex}(\tau), \bar{\beta}^{Flex}(\tau)\right)$. Then, $V_a\left(g_{ab}^{CU}\right) = V_a\left(g_{ac}^{CU}\right) \geq V_a\left(g_{ab}^{FTA}\right) = V_a\left(g_{ac}^{FTA}\right)$. In turn, given the equilibrium outcome of g_{ab}^{CU} in either Stage 1b or Stage 2, the non-economic benefits imply country a proposes a CU with country b and country b accepts. Thus, the equilibrium path of networks is $g_{\varnothing} \to g_{ab}^{CU}$ if $\tau \leq \bar{\tau}_{IN}^{CU}$ but $g_{\varnothing} \to g_{ab}^{CU} \to g^{FT}$ if $\tau > \bar{\tau}_{IN}^{CU}$.

Second, suppose $\beta \in \left(\underline{\beta}^{Flex}(\tau), \bar{\beta}^{Flex}(\tau)\right)$. Then, $V_a\left(g_{ab}^{FTA}\right) = V_a\left(g_{ac}^{FTA}\right) > V_a\left(g_{ab}^{CU}\right) = V_a\left(g_{ac}^{CU}\right)$. However, $V_b\left(g_{ac}^{FTA}\right) \lesseqgtr V_b\left(g_{ab}^{FTA}\right)$ reduces to $w_b\left(g_{ac}^{FTA}\right) \lesseqgtr w_b\left(g_{ab}^{FTA}\right)$ and, in turn, $\tau \lesseqgtr \tilde{\tau}$. Let $\tau < \tilde{\tau}$. Then, the non-economic benefits imply country a proposes an FTA with country b who accepts given the equilibrium outcome of g_{ac}^{FTA} in Stage 1b upon its rejection in Stage 1a. Now let $\tau \geq \tilde{\tau}$. Then, country b will reject an FTA proposal from country a in anticipation of the equilibrium outcome g_{ac}^{FTA} in Stage 1b. Hence, country a proposes an FTA to country c, who accepts given the non-economic benefits and anticipation of an equilibrium outcome of g_{bc}^{FTA} in Stage 2 upon its rejection of country a's FTA proposal in Stage 1a. Thus, the equilibrium path of networks is $g_{\varnothing} \to g_{ab}^{FTA} \to g_a^H \to g^{FT}$ if $\tau < \tilde{\tau}$ but $g_{\varnothing} \to g_{ac}^{FTA} \to g_a^H \to g^{FT}$ if $\tau \geq \tilde{\tau}$.

Finally, the proof is complete upon noting that $\bar{\beta}_{IN}(\tau) \geq \bar{\beta}^{Flex}(\tau)$ and thus the constraint of Lemma 4 that $g_{ij}^{FTA} \to g_i^H \to g^{FT}$ requires $\beta < \bar{\beta}_{IN}(\tau)$ does not bind on the equilibrium path.■

Proof of Lemma 7

The proof follows directly from using the welfare expressions in Appenxix A and, subject to the tariff binding where relevant, the equilibrium prices and optimal tariffs reported therein.■

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