Tariff Bindings and the Dynamic Formation of Preferential Trade Agreements

James Lake*
Southern Methodist University

Moïse Nken†
Ryerson University

Halis Murat Yildiz‡
Ryerson University

August 30, 2018

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.

Keywords: Tariff bindings, Preferential Trade Agreement, Free Trade Agreement, Customs Union, global free trade, dynamic.

JEL Classifications: C72, F12, F13.

*Department of Economics, Southern Methodist University. Email: jlake@smu.edu. We would like to thank Hassan Benchekroun, Tilman Klump, Ngo van Long, Devashish Mitra, Paul Missios, German Pupato, Kamal Saggi, Andrey Stoyanov, Ben Zissimos as well as seminar and conference participants at McGill University, Ryerson University, York University, University of Alberta and the Midwest Trade Meetings for useful comments and discussion.

†Department of Economics, Ryerson University. Email: moise.nken@ryerson.ca

‡Department of Economics, Ryerson University. Email: hyildiz@ryerson.ca

1 Introduction

Since 1948, the General Agreement on Tariffs and Trade (GATT), codified as part of the World Trade Organization (WTO) at its inception in 1995, has governed global trade liberalization. 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 tariff bindings on a range of IT products via the Information Technology Agreement (ITA). The set of ITA countries and products has grown over time and this plurilateral agreement for product-specific 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 role of FTAs and CUs in helping or hindering the attainment of global free trade?

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 and how does the answer depend on tariff binding liberalization? This is the second key question of our paper.

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.

To address how continual tariff binding reductions impact whether FTAs help or hinder global free trade, we analyze an "FTA game" where countries can only form FTAs. With relatively high tariff bindings, the key intuition revolves around free riding by the FTA outsider. Intuitively, despite facing discrimination, the FTA outsider benefits from the well known tariff complementarity phenomena whereby FTA members lower their MFN applied tariff upon FTA formation. Indeed, the FTA outsider becomes worse off through a subsequent FTA with an FTA insider. In this sense, the FTA outsider holds a *myopic free riding incentive*. However, by eliminating the discrimination faced in both FTA insider markets, the FTA outsider benefits from global free trade. The tension between this farsighted benefit of global free trade and the myopic free riding incentive generates a dynamic trade-off. A sufficiently patient FTA outsider becomes the spoke because of the farsighted benefit of global free trade. But, a sufficiently myopic FTA outsider holds a *dynamic free riding incentive*: it refuses subsequent FTA formation because of the myopic free riding incentive.

However, continual tariff binding reductions eventually eliminate the myopic free riding incentive by constraining the FTA outsider's ability to levy its optimal tariff. With relatively low tariff bindings, the key intuition revolves around an *exclusion incentive* of FTA insiders. Intuitively, FTA insiders have already extracted tariff concessions from the FTA outsider via relatively low tariff bindings and benefit from maintaining their preferential access as FTA insiders by excluding the FTA outsider from global free trade. Nevertheless, an FTA insider benefits myopically from forming its own FTA with the FTA outsider and thus becoming

the "hub" with preferential access to both of the other "spoke" countries. The tension between this myopic benefit of becoming the hub and the farsighted nature of the exclusion incentive generates a dynamic trade off. A sufficiently myopic FTA insider becomes the hub because of the benefits associated with preferential access to both spoke markets. But, a sufficiently patient FTA insider holds a *dynamic exclusion incentive*: it refuses subsequent FTA formation because of the farsighted benefit of not precipitating global free trade.

Two main insights emerge when analyzing how continual tariff binding reductions change whether FTA formation helps or hinders global free trade. First, when high tariff bindings prevent FTA expansion to global free trade, continual tariff binding reductions facilitate FTA formation that attains global free trade. Here, tariff binding reductions constrain the FTA outsider's ability to impose optimal tariffs on the FTA insiders which weaken its myopic free riding incentive and relax its dynamic free riding incentive.

Second, when high tariffs bindings facilitate FTA expansion to global free trade, continual tariff binding reductions can lead to FTA formation that constrains expansion to global free trade. This insight may be especially relevant given the literature documents that FTA formation typically takes many years. Thus, in practice, tariff binding reductions may have occurred before FTA expansion could reach global free trade. Here, tariff binding reductions effectively increase concessions extracted by FTA insiders from the FTA outsider and tighten the FTA insiders' dynamic exclusion incentive.

Unlike our "FTA game" which features tensions between myopic and farsighted incentives, our "CU game" is much simpler. Crucially, bilateral CU expansion must expand directly to global free trade and, in doing so, bilateral CU members have veto power. While the CU non-member always benefits from CU expansion to global free trade, CU insiders want to exclude the CU non-member from such expansion when the tariff binding is relatively low. Intuitively, a relatively low tariff binding implies the CU members have extracted substantial tariff concessions from the CU non-member without giving concessions to the CU non-member via CU expansion. Thus, CU formation proceeds to global free trade only for relatively high tariff bindings.

As described above, the second key question of our paper is whether a given type of PTA (i.e. FTA or CU) improves or hurts the prospects of global free trade relative to the outcome if this type of PTA was banned? To this end, we analyze our "PTA game" where countries can choose between FTA and CU formation and 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).

A dynamic trade-off drives whether FTAs or CUs emerge in equilibrium. On one hand, a CU confers coordination benefits on CU members. From a myopic perspective, CU members benefit from coordination of their external tariffs internalizing the negative intra-PTA externality of tariff complementarity. From a farsighted perspective, CU members benefit from the implication that tariff coordination confers veto power on each CU member regarding subsequent CU expansion to global free trade. This veto power is valuable in the presence of a CU exclusion incentive because, in contrast, each FTA member can form their own subsequent FTA with the FTA non-member and thus precipitate FTA expansion to global free trade. On the other hand, the ability of each FTA member to form their own subsequent FTA with the non-member confers an FTA flexibility benefit on FTA members. This FTA flexibility benefit is valuable because it allows a member of an initial FTA to then become the "hub" and have sole preferential access with the other two "spoke" countries.

Ultimately, FTAs and CUs play very different roles in helping or hurting the prospects for global free trade. On one hand, FTAs can be PTA building blocs but never PTA stumbling blocs. That is, when FTAs rather than CUs emerge in equilibrium then (i) FTAs can lead to global free trade that would not arise in their absence but (ii) if FTAs do does not lead to global free trade then neither do CUs. On the other hand, CUs can be PTA stumbling blocs but never PTA building blocs. That is, when CUs rather than FTAs emerge in equilibrium then (i) there are conditions where CUs will not, but FTAs will, lead to global free trade and (ii) when CUs lead to global free trade then so do FTAs. In particular, this PTA building bloc role of FTAs and PTA stumbling bloc role of CUs emerges for an intermediate degree of tariff bindings. This suggests that the asymmetric impact of FTAs versus CUs may have become more prevalent with the phase in of Uruguay Round multilateral tariff binding liberalization and plurilateral tariff binding agreements like the Information Technology Agreement.

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)). While these two explanations ignore the role of PTAs, Lake and Roy (2017) provide a third explanation. Here, a "multilateral" tariff complementarity effect implies a country's tariff binding should fall upon FTA formation. Assuming, as in practice, this does not happen, global tariff binding negotiations can yield tariff bindings for eventual FTA members whereby they still practice tariff complementarity

and, hence, binding overhang. But, 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 analysis seems reasonable in motivating the importance of tariff binding liberalization for PTA formation and the promise of future work in this area.

Surprisingly few papers have addressed how multilateral tariff liberalization impacts the extent of PTA formation (Freund and Ornelas (2010)). Ethier (1998) and Freund (2000) represent two early contributions. 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 free riding incentive of FTA non-members. Hence, like Freund (2000), multilateral tariff liberalization facilitates FTA expansion. However, unlike our paper, the static framework of Nken and Yildiz (2018) 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 determination of tariff bindings generates an FTA exclusion incentive. Like our paper, relatively tight tariff bindings deliver tariff concessions from FTA non-members to FTA members without FTA members forming FTAs with non-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) allow countries to endogenously choose between FTAs and CUs and hence do not analyze the PTA building bloc and PTA stumbling bloc properties of FTAs and CUs.

Exclusion incentives for PTA members and free riding incentives for PTA non-members have long been important for theoretical analyses of PTA formation and their role in the attainment of global free trade.[1] However, a given analysis typically only relies on either a PTA member exclusion incentive or a PTA non-member free riding incentive. Saggi and Yildiz (2010) show the FTA non-member free riding incentive is weaker than the incentive to free ride on MFN liberalization of other countries and, hence, FTAs can be a "building bloc" to global free trade. In contrast, Saggi et al. (2013) show CU member incentives to exclude the non-member 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

[1]Indeed, 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 exclusion incentives and free riding incentives in the theoretical PTA literature.

(2014) hypothesizes that CUs constrain the prospects of global free trade but argues such a conclusion requires a model where countries endogenously choose between CUs and FTAs.

We address Maggi's hypothesis by developing a model where (i) countries endogenously choose between FTAs and CUs and (ii) PTA members can hold exclusion incentives and PTA non-members can hold free riding incentives. Rather than tie the existence of these incentives to country asymmetries, which are somewhat nebulous in terms of real world application of theoretical PTA models, 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 in generating FTAs in equilibrium; for example, in the static model of Missios et al. (2016), countries always choose CUs over FTAs. As in Lake and Yildiz (2016) and Lake (2018), our dynamic setting allows the dynamic trade off between the FTA flexibility benefit and the CU coordination benefits to determine whether FTAs or CUs emerge in equilibrium. Ultimately, we confirm Maggi's hypothesis based on the different models of Saggi and Yildiz (2010) and Saggi et al. (2013): in our own terminology, FTAs act as a "PTA building bloc" but CUs act as a "PTA stumbling bloc".

Finally, our paper relates to recent empirical evidence of Felbermayr et al. (2018). While not subject to a common external tariff, they document little difference in the external tariffs of FTA members. Further, given the potentially sizable resource misallocation costs associated with FTA rules of origin (see, e.g., Conconi et al. (2018)), they make policy recommendations so that FTAs can emulate CUs. However, our analysis makes three points in this regard. First, even though FTA members set the same external tariffs in our model, they do not coordinate tariffs like CU members and this coordination reduces world welfare. Second, one reason that helps explain why FTAs remain so popular, and thus distinguishes FTAs and CUs in the real world, is the flexibility benefit of FTA members to form their own subsequent PTAs. Indeed, third, our result that FTAs are PTA building blocs while CUs are PTA stumbling blocs highlights that the flexibility benefit of FTAs can propel the degree of global trade liberalization far beyond the degree that can be achieved by CUs. Ultimately, our analysis emphasizes the importance of the FTA flexibility benefit on the process of PTA formation.

The paper proceeds as follows. Section 2 describes our model, both the underlying trade model and the game theoretic model of PTA formation. Section 3 analyzes the "FTA game" where countries can only form FTAs. Section 4 analyzes the "CU game" where countries can only form CUs. Section 5 analyzes the "PTA game" where countries endogenously choose between FTAs and CUs. Section 6 concludes. The Appendix contains all proofs.

2 Model

Our model allows 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 international trade emerge given the network of PTAs and the applied tariffs chosen by countries. Section 2.1 details the underlying trade model that determines the patterns of production, consumption and international trade. Sections 2.2 and 2.3 describe how countries choose applied tariffs given the existing network of PTAs and the existing tariff bindings. Section 2.4 details our dynamic game theoretic model of PTA formation.

2.1 Underlying trade model

We modify the two-country competing exporters model of Horn et al. (2010) to a model 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 $u(\mathbf{v})$ both 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, labour (l) is the only factor of production. The numeraire good is produced one-for-one from labor.[2] In contrast, production Q_i^Z of a non-numeraire good Z in country i follows the diminishing returns production function

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

where l_i^Z denotes labor used to produce good Z in country i and λ_i^Z depends on the structure

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

on comparative advantage. In turn, supply and producer surplus of good Z in country i 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 across countries. Specifically, $\lambda_i^I = 1$ while $\lambda_i^Z = 1 + \lambda > 1$ for $Z \neq I$ so that each country i has a comparative advantage in the two goods $Z \neq I$ but a comparative disadvantage in good I. Thus, countries j and k compete with each other when exporting good I to country i. That is, each country imports a non-numeraire good and two *competing exporters* serve this destination market.

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

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

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

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

$$m_i^I = \alpha - 2p_i^I \tag{7}$$

$$x_z^I = (1+\lambda)p_z^I - \left[\alpha - p_z^I\right]. \tag{8}$$

Substituting trade flows (7)-(8) and the no-arbitrage condition (5) into the world market clearing condition (6) yields the equilibrium prices of good I in the importing country i and an exporting country j:

$$p_i^I = \frac{3\alpha + (2+\lambda)\sum_{z\neq i} t_{iz}}{2(3+\lambda)} \text{ and } p_j^I = \frac{3\alpha + (2+\lambda)t_{ik} - (4+\lambda)t_{ij}}{2(3+\lambda)}. \tag{9}$$

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

$$x_j^I = \frac{\alpha\lambda\left[t_{ik}(\lambda^2 + 4(1+\lambda)) - t_{ij}(\lambda^2 + 2(3\lambda+4))\right]}{2\lambda+3}. \tag{10}$$

Three observations follow from (9)-(10). 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 a fraction $\frac{2+\lambda}{2\lambda+6}$ of country i's tariff on country j passes through to a higher local price p_i^I, the remaining fraction $\frac{4+\lambda}{2\lambda+6}$ passes through to a lower local price p_j^I which represents a terms of trade improvement for country i vis-à-vis country j. Third, the tariff on country j also diverts trade between the competing exporters: country k's exports to country i rise on account of the higher price p_k^I while country j's exports to country i fall on account of the lower price p_j^I.

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

$$w_i = \sum_Z CS_i^Z + \sum_Z PS_i^Z + \sum_{z \neq i} t_{iz} x_z^I \tag{11}$$

Using (9) with (2), (4) and (10) yields closed form expressions for national welfare as a function of tariffs and the degree of comparative advantage.[3]

2.2 Optimal applied tariffs

In this section, we focus on optimal applied tariffs and ignore tariff bindings. Section 2.3 considers the implications of tariff bindings for the applied tariffs imposed by countries.

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.

Figure 1 illustrates the 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 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.

In the absence of having any PTAs, country i imposes a non-discriminatory tariff on its trading partners (in accordance with GATT Article I). Letting $t_{ij}(g_\varnothing) = t_{ik}(g_\varnothing) = t_i(g_\varnothing)$,

[3] Appendix A expresses welfare as a function of prices and arbitrary tariffs.

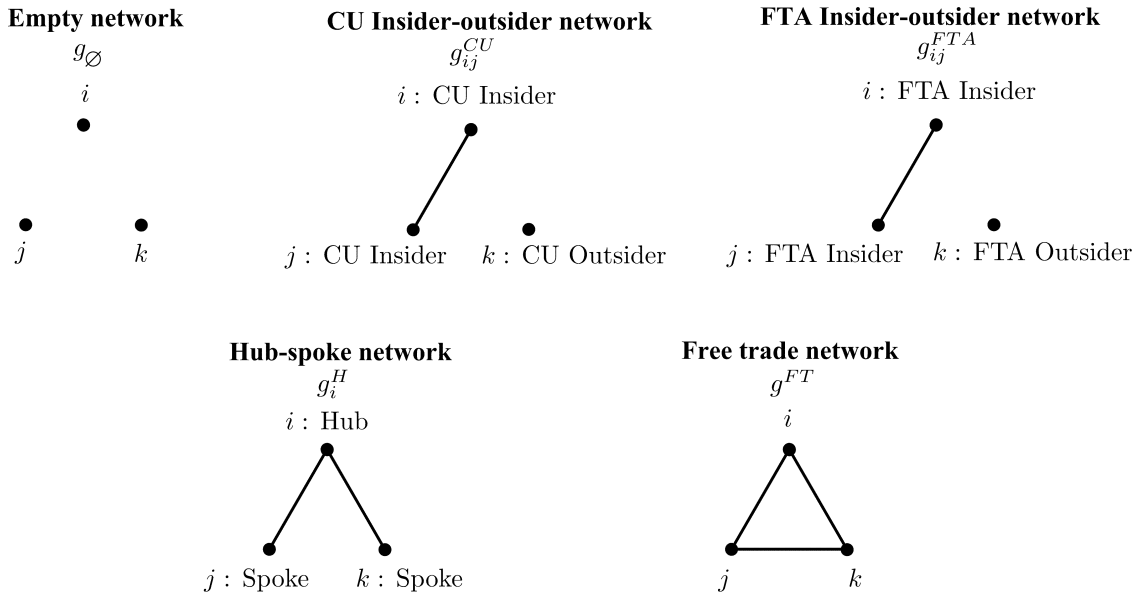

Figure 1: Network positions

country i's optimal MFN tariff is:

$$t_{\varnothing} \equiv \underset{t_i(g_{\varnothing})}{\arg\max} w_i(g_{\varnothing}) = \frac{\alpha\lambda}{2(2+\lambda)(4+\lambda)}. \tag{12}$$

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

Upon FTA formation, member countries remove their internal tariffs on each other and impose an individually optimal external tariff on the non-member. Under a single FTA, say between i and j, the optimal external tariff of each FTA insider is

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

Comparing t_{FTA} and $t_{\varnothing}$ reveals that $t_{\varnothing} > t_{FTA}$. That is, FTA insiders practice "tariff complementarity": FTA formation induces them to lower their tariff on the FTA outsider.[4] Conversely, market separability implies that FTA formation leaves the FTA non-member's optimal MFN tariff unchanged: $t_{ki}\left(g_{ij}^{FTA}\right) = t_{kj}\left(g_{ij}^{FTA}\right) = t_k\left(g_{\varnothing}\right)$ and $t_{jk}\left(g_i^H\right) = t_{jk}\left(g_{ij}^{FTA}\right)$.

CU members also practice tariff complementarity. Like FTA insiders, CU insiders remove internal tariffs: $t_{ij}\left(g_{ij}^{CU}\right) = t_{ji}\left(g_{ij}^{CU}\right) = 0$. But, unlike FTA insiders, CU insiders coordinate

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

external tariffs. Maximizing their joint welfare, their optimal external tariff is

$$t_{CU} \equiv \underset{t_{ik}\left(g_{ij}^{CU}\right)}{\arg\max}\, w_i(g_{ij}^{CU}) + w_j(g_{ij}^{CU}) \text{ subject to } t_{jk}\left(g_{ij}^{CU}\right) = t_{ik}\left(g_{ij}^{CU}\right) \tag{14}$$

$$= \frac{\alpha\lambda}{(\lambda+2)(3\lambda+10)}. \tag{15}$$

While CU insiders also practice tariff complementarity, i.e. $t_{\varnothing} > t_{CU}$, their degree of tariff complementarity is less than FTA insiders: $t_{\varnothing} - t_{CU} < t_{\varnothing} - t_{FTA}$.[5] Intuitively, when setting external tariffs individually, each FTA member ignores the negative externality imposed on the export surplus of its FTA partner by lowering its tariff on the FTA non-member. By coordinating their external tariffs, CU members internalize this negative externality, i.e. $t_{CU} > t_{FTA}$, and thereby benefit from tariff coordination.[6]

2.3 Implications of tariff bindings

Naturally, countries cannot raise their applied tariff above the tariff binding they have agreed during multilateral negotiations. In this paper, we take the tariff bindings as exogenous. Further, given our symmetric countries, we consider a symmetric tariff binding τ.

Given the optimal tariffs in Section 2.2 and an exogenous tariff binding τ, Figure 2 illustrates four possible ranges. In the "No binding region", the tariff binding never binds because, 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 the implications of multilaterally negotiated tariff bindings.

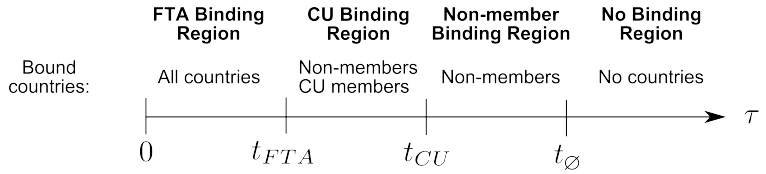

Figure 2: Tariff binding regions

However, the tariff binding binds once $\tau < t_{\varnothing}$. In the "Non-member binding region", $t_{CU} < \tau < t_{\varnothing}$, the tariff binding binds the applied tariffs of the FTA and CU outsider who thus levy an applied tariff τ that lies below their optimal applied tariff $t_{\varnothing}$. Further, once in

[5] In contrast, see Mrázová et al. (2012) for a setting, and the implications thereof, where CU members are indeed bound by the GATT Article XXIV constraint that they do not raise their tariffs on non-members.

[6] In contrast to competing exporter models, the coordination of external tariffs by CU members benefits CU members in competing importer models like Bagwell and Staiger (1997a) because they pool their market power and extract larger terms of trade gains from non-members.

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

the "CU binding region" $t_{FTA} < \tau < t_{CU}$, the tariff binding binds CU insiders who levy an applied tariff τ that lies below their optimal applied tariff t_{CU}. Finally, once in the "FTA binding region" $\tau < t_{FTA}$, the tariff binding also binds FTA insiders, and hence all countries, who all levy an applied tariff τ that lies below their optimal applied tariff.

2.4 Strategies and equilibrium concept

Our dynamic model follows Lake and Yildiz (2016) and Lake (2018), and is similar to Seidmann (2009). We assume at most one PTA can form in a period and that PTAs formed in previous periods are binding and hence cannot be severed.[7,8] Given a network g_{t-1} at the beginning of the current period t, we refer to the current period t as the subgame at g_{t-1}. Table 1 illustrates the current period feasible transitions $g_{t-1} \to g_t$ 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: for example, $g_{t-1} \to g_t \to g_{t+1}$ describes the path of networks that begins at g_{t-1}, and then passes through g_t, and then remains at g_{t+1} forever; alternatively, the *path* of networks $g_{\varnothing} \to g_{\varnothing}$ indicates that no PTA ever forms.

Ultimately, countries have preferences over paths of PTA networks and continuation

[7]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)).

[8]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. Also see Mölders (2012, 2015) and Freund and McDaniel (2016).

payoffs capture such preferences. Given a feasible transition $g_{t-1} \to g_t$ 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 will often make clear the path of networks $g_{t+1} \to g_{t+2} \to ...$ that follow this current period transition. Thus, we simply let $V_i(g_t)$ represent the continuation payoff from the path of networks $g_{t-1} \to g_t \to g_{t+1} \to g_{t+2} \to ....$ For concreteness, suppose the network at the beginning of the current period is the empty network $g_\varnothing$. Then, assuming country i's one period is national welfare $w_i(g)$ and letting β denote the discount factor, country i's continuation payoff from the path of networks $g_\varnothing \to g_{ij}^{CU} \to g^{FT}$ 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 $g_\varnothing \to g_\varnothing$ is $V_i(g_\varnothing) = \frac{1}{1-\beta} w_i(g_\varnothing)$.

Like Lake and Yildiz (2016) and Lake (2018), 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 does not have a proposal accepted by the follower countries, one of the follower countries has the opportunity to propose a PTA. The proposal ability of the follower countries distinguishes our protocol from Aghion 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 as spokes.

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.[9]

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 here, 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

[9] 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.

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

available proposals for each country as the proposer in the "PTA game" where, for example, $P_i(g)$ denotes the set of such proposals for country i and $\rho_i(g) \in P_i(g)$ denotes 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. However, we will also consider an "FTA game" where countries can only propose FTAs and a "CU game" where countries can only propose CUs. Naturally, as discussed in detail later, the "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 $r_i(g, \rho_j(g)) \in \{Y, N\}$ to any proposal it may receive from some other 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.[10]

Absent any further structure, the symmetry in country characteristics would generate multiple equilibria. Thus, we assume country b (c) receives an arbitrarily small non-economic benefit $\varepsilon > 0$ from bilateral PTA formation with country a rather than country c (b) and country a receives an arbitrarily small non-economic benefit $\varepsilon > 0$ from bilateral PTA formation with country b rather than country c. Indeed, these non-economic benefits can motivate our protocol ordering.[11]

[10]We make two assumptions that conveniently restrict attention to certain Markov Perfect Equilibria. Given the simultaneity of responses to a proposal for CU expansion to include the CU outsider, we assume 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 $w_k\left(g^{FT}\right) > w_k\left(g_{ij}^{CU}\right)$. When a response $r_j(g, \rho_i(g)) = N$ merely delays formation of the PTA to a later stage of the same period, we assume the recipient country responds with $r_j(g, \rho_i(g)) = Y$. An arbitrarily small cost of making a proposal motivates this assumption.

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

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

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

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. As specified in Table 3, our "FTA game" restricts the proposals in Table 2 by ruling out CU proposals.

Naturally, FTA formation incentives drive the equilibrium path of networks. In our dynamic model, these incentives include both myopic and farsighted incentives. In turn, tensions between myopic and farsighted incentives often govern a country's preference over paths of FTA networks as captured by a comparison of their continuation payoff across paths of FTA networks. We now discuss the key myopic and farsighted incentives.

3.1 FTA formation incentives

3.1.1 Myopic incentives

Lemma 1 describes the myopic incentives driving the equilibrium path of networks. For notational convenience, we let $\Delta w_i(g' - g) \equiv w_i(g') - w_i(g)$ and also let $g + ij^{FTA}$ denote the network that results when an FTA between countries i and j is added to network g.

Lemma 1 *(i)* $\Delta w_i(g' - g) > 0$ *for* $g' = g + ij^{FTA}$ *and* $g \neq g_{jk}^{FTA}$.
(ii) $\Delta w_i(g_j^H - g_{jk}^{FTA}) > 0$ *if and only if* $\tau < \bar{\tau}_{OUT}^{FTA}$ *where* $\bar{\tau}_{OUT}^{FTA} \in (t_{FTA}, t_{\varnothing})$
(iii) $\Delta w_i(g_{ij}^{FTA} - g_{jk}^{FTA}) > 0$ *for* $\tau < \tilde{\tau}$ *where* $\tilde{\tau} \in \left(\bar{\tau}_{OUT}^{FTA}, t_{\varnothing}\right)$.

Part (i) governs the attractiveness of bilateral FTAs. Intuitively, the exchange of preferential access makes bilateral FTA formation myopically attractive. Two particularly important instances are that an FTA insider benefits from becoming the hub via an FTA with the

FTA outsider, $\Delta w_i(g_i^H - g_{ij}^{FTA}) > 0$, and that spokes benefit from forming the final FTA that yields global free trade, $\Delta w_i(g_i^{FT} - g_j^H) > 0$. However, part (i) allows an exception. Specifically, despite the discrimination faced as an FTA outsider, the FTA outsider benefits from tariff complementarity which lowers the external tariffs faced when exporting to the FTA insiders. Thus, an FTA outsider *might* not benefit from becoming a spoke.

Parts (ii)-(iii) describe the FTA outsider's "free riding" incentives. When the tariff binding does not bind the FTA outsider, i.e. $\tau > t_\varnothing$, the FTA outsider benefits from the tariff complementarity practiced by FTA insiders and from imposing its optimal tariff on both FTA insiders. Indeed, these benefits are large enough that a country prefers being an FTA outsider than an FTA insider. However, the tariff binding constrains this ability to impose optimal tariffs on the FTA insiders once $\tau < t_\varnothing$. Once the tariff binding falls below $\tilde{\tau}$, part (iii) says a country prefers being an FTA insider over an FTA outsider. But, as long as the tariff binding does not bind too tightly, i.e. $\tau > \bar{\tau}_{OUT}^{FTA}$, part (ii) says the FTA outsider still prefers remaining an FTA outsider over becoming a spoke. Here, we say the FTA outsider has a *myopic free riding incentive*. Once the tariff binding is sufficiently tight, $\tau < \bar{\tau}_{OUT}^{FTA}$, this myopic free riding incentive disappears.

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)* $\Delta w_i(g^{FT} - g_{jk}^{FTA}) > 0$.
(ii) $\Delta w_i(g_i^{FT} - g_{ij}^{FTA}) > 0$ *if and only if* $\tau > \bar{\tau}_{IN}^{FTA}$ *where* $\bar{\tau}_{IN}^{FTA} \in (t_{FTA}, t_\varnothing)$.
(iii) $\Delta w_i\left(g_i^H - g^{FT}\right) > 0$.

Part (i) addresses the possibility of a farsighted free riding incentive for the FTA outsider. However, it says that an FTA outsider always benefits from global free trade via eliminating the discrimination faced in both FTA insider markets. That is, from a farsighted perspective, an FTA outsider has an incentive to participate in FTA expansion that yields global free trade. Thus, an FTA outsider does not hold a farsighted free riding incentive. Later, the tension between the myopic free riding incentive and the absence of a farsighted free riding incentive determines whether the FTA outsider has a dynamic free riding incentive.

Lemma 1 described how an FTA insider myopically benefits from becoming the hub. However, Lemma 1 also described how spokes have a myopic incentive to form the final FTA leading to global free trade. Thus, from a farsighted perspective, an FTA insider understands that becoming the hub will precipitate global free trade. To this end, Lemma 2(ii) addresses the farsighted incentive of whether FTA insiders benefit from permanently excluding the

FTA outsider from subsequent FTA formation that delivers global free trade. Global free trade benefits the FTA insiders by removing the FTA outsider's tariff barriers. This benefit is relatively high with a sufficiently lax tariff binding but relatively low with a sufficiently tight tariff binding. As such, Lemma 2(ii) says FTA insiders have an *exclusion incentive* when the tariff binding is sufficiently tight; 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.[12]

Part (iii) represents the "flexibility benefit" of FTAs relative to CUs. As such, its relevance emerges later when analyzing the PTA game where countries endogenously choose between FTAs and CUs. Because of the sovereign discretion over external tariffs, each FTA insider has the flexibility to form its own *future* FTA and become the hub. In contrast, CU formation proceeds directly to global free trade. Thus, the flexibility of FTAs poses a farsighted benefit of FTA formation relative to CU formation. This FTA flexibility benefit is valuable, i.e. $\Delta w_i \left(g_i^H - g^{FT}\right) > 0$, because of the preferential access enjoyed by the hub country in the spoke markets.

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_i^H. The following lemma follows directly from Lemma 1(i).

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

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.

[12]Note that, regardless of the tariff binding, FTA insiders always hold an exclusion incentive while FTA outsiders never hold a free riding incentive in the competing importer model of Missios et al. (2016) (which is a three-country extension of Horn et al. (2010)). Thus, our competing exporters setup captures a more general class of interactions between tariff bindings and the substantive economic forces shaping PTA formation.

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. Lemma 2(i) said the elimination of discrimination drives the farsighted incentive of an FTA outsider to participate in FTA expansion that yields 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 when the tariff binding is sufficiently tight because this severely constrains its ability to impose optimal tariffs on the FTA insiders. In this case, no dynamic free riding incentive exists because an FTA outsider happily participates in subsequent FTA formation 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

$$w_k\left(g_i^H\right) + \frac{\beta}{1-\beta} w_k\left(g^{FT}\right) > \frac{1}{1-\beta} w_k\left(g_{ij}^{FTA}\right). \tag{16}$$

As one would expect from our above discussion, 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, (16) reduces to

$$\beta > \bar{\beta}_{OUT}(\tau) \equiv \left[1 + \frac{\Delta w_k\left(g^{FT} - g_{ij}^{FTA}\right)}{\Delta w_k\left(g_{ij}^{FTA} - g_i^H\right)}\right]^{-1} \tag{17}$$

which says a sufficiently patient FTA outsider becomes a spoke or, alternatively, a sufficiently myopic FTA outsider refuses subsequent FTA formation. In this latter case, i.e. $\beta < \bar{\beta}_{OUT}(\tau)$, we say 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 and how it varies with the tariff binding. An FTA outsider has a dynamic free riding incentive when $\beta < \bar{\beta}_{OUT}(\tau)$. In this case, the FTA outsider is sufficiently myopic 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 applied 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 we move into 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 the discount factor, the FTA outsider becomes a spoke.

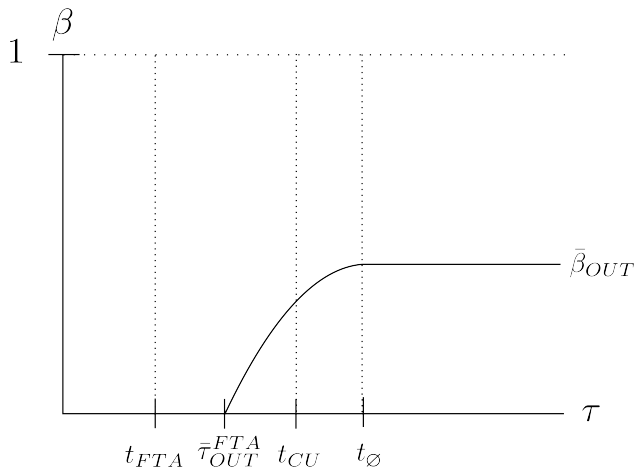

Figure 3: Dynamic free riding incentive

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, having sole preferential access in both spoke markets makes FTA formation with the FTA outsider attractive for an FTA insider: $\Delta w_i(g_i^H - g_{ij}^{FTA}) > 0$. However, from a farsighted view, an FTA insider anticipates the subsequent erosion of this preferential access via the spoke-spoke FTA that precipitates global free trade. Indeed, Lemma 2(ii) said an FTA insider holds an exclusion incentive, and thus benefits from permanently excluding the FTA outsider from subsequent FTA formation, 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 FTA formation 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 any reciprocal concessions to the FTA outsider. 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

$$w_i\left(g_i^H\right) + \frac{\beta}{1-\beta} w_i\left(g^{FT}\right) > \frac{1}{1-\beta} w_i\left(g_{ij}^{FTA}\right). \tag{18}$$

As one would expect from our above discussion, this can only fail if the FTA insider holds an exclusion incentive $\Delta w_i(g_{ij}^{FTA} - g^{FT}) > 0$. Further, (18) reduces to

$$\beta < \bar{\beta}_{IN}(\tau) \equiv \left[1 + \frac{\Delta w_i\left(g_{ij}^{FTA} - g^{FT}\right)}{\Delta w_i\left(g_i^H - g_{ij}^{FT}\right)}\right]^{-1}. \tag{19}$$

which says a sufficiently myopic FTA insider becomes the hub or, alternatively, a sufficiently patient FTA insider refuses subsequent FTA formation with the FTA outsider. In this latter case, i.e. $\beta > \bar{\beta}_{IN}(\tau)$, we say 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 $\Delta w_i\left(g_{ij}^{FTA} - g_i^{FT}\right)$ 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 and how it varies with the tariff binding τ. An FTA insider has a dynamic exclusion incentive when $\beta > \bar{\beta}_{IN}(\tau)$. In this case, 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 subsequent FTA formation 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 without engaging in FTA formation with 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 FTA binding region $\tau < \bar{\tau}_{IN}^{FTA}$.

The dynamic free riding incentive faced by the FTA outsider and the dynamic exclusion incentive faced by the FTA insiders interact in determining whether subsequent FTA formation takes place. Put simply, 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 the FTA insiders do not hold a dynamic exclusion incentive. Otherwise, the

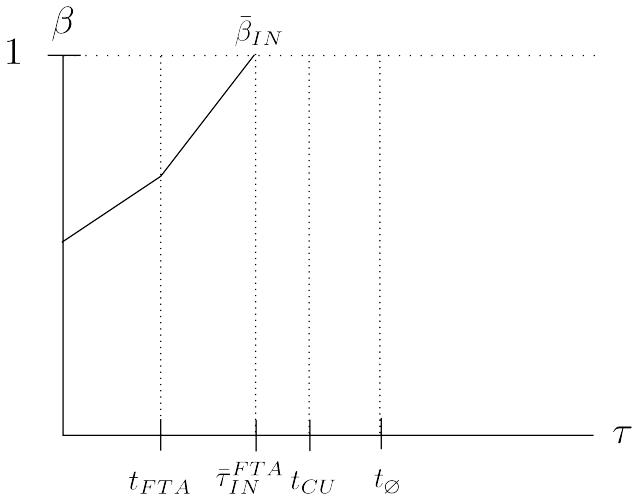

Figure 4: Dynamic exclusion incentive

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

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

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 $g_{ij}^{FTA} \to g_i^H \to g^{FT}$ and $g_{jk}^{FTA} \to g_j^H \to g^{FT}$.

Part (i) reflects a participation constraint for FTA insiders. Given Lemma 1(i), these participation constraints really govern situations where FTA formation expands to global free trade and say that the associated continuation payoffs for an FTA insider 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 and says this is better than the world without any PTAs.

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 FTA formation expands 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.[13]

Proposition 1 now summarizes the equilibrium path of networks.

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

Proposition 1 says the equilibrium path of networks revolves around the dynamic free riding incentive of an FTA outsider and the dynamic exclusion incentive of an FTA insider. If neither the FTA outsider holds a dynamic exclusion incentive (i.e. $\beta > \bar{\beta}_{OUT}(\tau)$) nor an FTA insider holds a dynamic exclusion incentive (i.e. $\beta < \bar{\beta}_{IN}(\tau)$), the leader country, 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 if either the FTA outsider holds a dynamic free riding incentive or the FTA insiders hold a dynamic exclusion incentive (i.e. $\beta \notin \left(\bar{\beta}_{IN}(\tau), \bar{\beta}_{OUT}(\tau)\right)$). Thus, the dynamic free riding incentive and the dynamic exclusion incentive 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 expands to global free trade, country b prefers being an FTA outsider-turned spoke over an FTA insider-turned-spoke. Indeed, if country b were to make an FTA proposal in stage 2 of the protocol, the attractiveness of being the hub implies it would propose an FTA with country c and be the FTA insider-turned-hub on the path to global free trade. Hence, country b can credibly threaten to reject an FTA proposal from country a (in stage 1a)

[13]Note that whether a country prefers being an FTA insider-turned-spoke or an FTA outsider-turned-spoke on the path to global free trade merely depends on whether a country myopically prefers being an FTA insider or an FTA outsider. That is, when $g_{ij}^{FTA} \to g_j^H \to g^{FT}$ and $g_{jk}^{FTA} \to g_j^H \to g^{FT}$ then $V_i\left(g_{ij}^{FTA}\right) > V_i\left(g_{jk}^{FTA}\right)$ if and only if $\Delta w_i\left(g_{ij}^{FTA} - g_{jk}^{FTA}\right) > 0$.

knowing that such rejection will force country a to propose FTA formation 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 FTA formation 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 knows 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 relatively high applied tariffs of the FTA outsider create strong incentives for FTA formation with the FTA outsider. In turn, a dynamic exclusion incentive does not exist. However, an FTA outsider holds a myopic free riding incentive whereby subsequent FTA formation is myopically unattractive. The relatively lax tariff bindings ($\tau > \bar{\tau}_{OUT}^{FTA}$) imply the FTA outsider would give relatively large tariff concessions via FTA formation but receive relatively small concessions due to the tariff complementarity practiced by FTA insiders. In turn, a sufficiently myopic FTA outsider holds a dynamic free riding incentive and thus refuses subsequent FTA formation 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 becomes the force constraining 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 the tariffs it imposes on the FTA insiders differ little from those faced by 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.

With an understanding of the forces constraining FTA expansion and how they vary with the tariff binding, we now ask how multilateral trade liberalization through lower tariff bindings impacts the extent of FTA formation. Corollary 1 answers this question.

Corollary 1 *Consider sufficiently high tariff bindings $\tau > \bar{\tau}_{IN}^{FTA}$. Then:*

(i) When global free trade is not attained, multilateral tariff binding liberalization facilitates FTA formation in achieving global free trade.

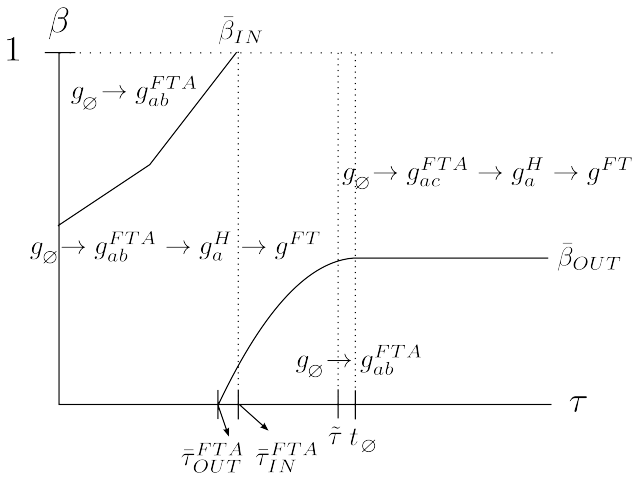

Figure 5: Equilibrium path of networks: FTA game

(ii) When global free trade is attained, multilateral tariff binding liberalization never facilitates but can impede FTA formation in achieving global free trade.

Corollary 1 highlights the fundamental importance of multilateral tariff binding liberalization for the prospect of FTA expansion leading to 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 myopic, $\beta < \bar{\beta}_{OUT}(t_{\varnothing})$, 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 global free trade with sufficiently low tariff bindings and further multilateral tariff binding liberalization further constrains the attainment of global free trade. 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 form FTAs with the outsider. This strengthens the dynamic exclusion incentive.

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

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.[14]

4 Equilibrium path of networks: CU game

We now analyze the "CU game" where countries can only form CUs. Analogous to our "FTA game" that restricted the proposals in Table 2 by ruling out CU proposals, Table 4 shows how our "CU game" restricts the proposals in Table 2 by ruling out FTA proposals.

The different tariff setting behavior of FTA insiders versus CU insiders fundamentally impacts the ability of PTA members to form subsequent PTAs. Specifically, because CU insiders impose a 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 for members and non-members.

4.1 CU formation incentives

Unlike FTA formation, 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)* $\Delta w_i(g_{ij}^{CU} - g_{\varnothing}) > 0$ *but* $\Delta w_k(g_{ij}^{CU} - g_{\varnothing}) < 0$.

(ii) $\Delta w_k(g^{FT} - g_{ij}^{CU}) > 0$ *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) $\Delta w_i(g_{ij}^{CU} - g_{ij}^{FTA}) \geq 0$ *for all* τ *and with strict inequality only when* $\tau > t_{FTA}$.

[14]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 formation in achieving global free trade.

Part (i) governs the impact of CU formation on CU insiders and the CU outsider. First, CU insiders benefit which is not surprising given that FTA insiders benefit from FTA formation and the coordination of external tariffs allows CU insiders to internalize the negative intra-PTA externality of tariff complementarity. Second, unlike the FTA outsider who could benefit from FTA formation, the CU outsider always suffers from CU formation. While CU insiders may practice tariff complementarity, they also internalize the negative intra-PTA externality of tariff complementarity. In turn, the discrimination faced by the CU outsider always dominates any tariff complementarity benefit.

Part (ii) governs the incentives of CU insiders and the CU outsider for CU expansion to global free trade. First, the CU outsider always benefits from such expansion. This is not surprising given that the FTA outsider always benefited from simultaneously eliminating the discrimination faced in *both* FTA insider markets and that the CU outsider faces stronger discrimination than the FTA outsider. Thus, the CU outsider does not hold any type of free riding incentive. Second, similar to FTA insiders, CU insiders have an incentive to exclude the CU outsider from global free trade under sufficiently tight tariff bindings: $\Delta w_i \left(g^{FT} - g_{ij}^{CU}\right) < 0$ when $\tau < \bar{\tau}_{IN}^{CU}$. Indeed, given CU insiders internalize the negative intra-PTA externality of tariff complementarity, this CU exclusion incentive is stronger than the FTA exclusion incentive so that $\bar{\tau}_{IN}^{FTA} < \bar{\tau}_{IN}^{CU}$.

Part (iii) captures an important incentive for the PTA game in Section 5. Unlike FTA insiders, CU insiders internalize the negative intra-PTA externality of tariff complementarity through coordinating their external tariffs. Thus, part (iii) describes the myopic coordination benefit of CU formation. Naturally, this benefit disappears in the "FTA binding region" of $\tau \leq t_{FTA}$ because FTA and CU insiders levy the same tariff given τ binds them both.

Ultimately, the fact that CU expansion proceeds directly from the CU insider-outsider network to global free trade, unlike FTA formation which proceeded through the hub-spoke network, implies there is no tension between myopic and farsighted CU formation incentives. Moreover, given the CU outsider always benefits from CU expansion to global free trade, the CU exclusion incentive of CU insiders 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) $g_{\varnothing} \longrightarrow g_{ab}^{CU} \longrightarrow g^{FT}$ *when* $\tau > \bar{\tau}_{IN}^{CU}$
(ii) $g_{\varnothing} \rightarrow g_{ab}^{CU}$ *when* $\tau < \bar{\tau}_{IN}^{CU}$.

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

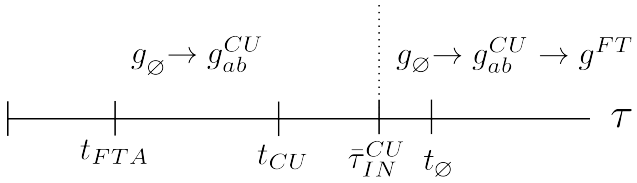

Figure 6: Equilibrium path of networks: CU game

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"). We now endogenize whether countries choose FTAs or CUs along the equilibrium path of networks. As explained below, the key trade-off introduced by endogenizing the choice between FTAs and CUs is a trade-off between the flexibility benefit of FTAs and the coordination benefits of CUs.

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 different tariff setting behavior 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. That is, 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 enjoy a flexibility benefit from FTA formation. 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 via FTA expansion. That is, the FTA flexibility benefit for a PTA insider captures the higher payoff from becoming the hub via subsequent FTA formation relative to subsequent CU formation which must proceed directly to global free trade: $w_i \left(g_i^H - g^{FT}\right) > 0$ as stated in Lemma 2(iii).

5.2 Myopic and farsighted CU coordination benefits

Unlike FTA members who retain sovereign discretion over their external tariffs, CU insiders coordinate their external tariffs. This coordination generates myopic and farsighted coordination benefits. Myopically, coordinating external tariffs internalizes the negative intra-PTA externality of tariff complementarity. Further, as long as the tariff binding lies above the

"FTA binding" region, i.e. $\tau > t_{FTA}$, CU insiders have the ability to actually internalize this externality: $w_i\left(g_{ij}^{CU} - g_{ij}^{FTA}\right) > 0$ if $\tau > t_{FTA}$.

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 PTA insiders can form CUs and, via external tariff coordination, ensure PTA expansion does not take place. As discussed above, CU insiders hold a CU exclusion incentive, and hence a farsighted CU coordination benefit emerges, when the tariff binding is sufficiently tight, $\tau < \bar{\tau}_{IN}^{CU}$.

5.3 Trade-off: FTA flexibility and CU coordination benefits

Tensions between the FTA flexibility benefit and CU coordination benefits generate a dynamic trade off. Further, 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 CU insider when

$$V_i\left(g_{ij}^{FTA}\right) = w_i\left(g_{ij}^{FTA}\right) + \beta w_i\left(g_i^H\right) + \frac{\beta^2}{1-\beta} w_i\left(g^{FT}\right) > V_i\left(g_{ij}^{CU}\right). \tag{20}$$

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 we can rewrite (20) as

$$\beta \underbrace{\left[w_i\left(g_i^H\right) - w_i\left(g^{FT}\right)\right]}_{\text{FTA flexibility benefit}} > \underbrace{\left[w_i\left(g_{ij}^{CU}\right) - w_i\left(g_{ij}^{FTA}\right)\right]}_{\text{myopic CU coordination benefit}}. \tag{21}$$

That is, a country prefers being an FTA insider and then the hub on the path to global free trade over a CU insider on the path to global free trade 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:

$$\beta > \underline{\beta}^{Flex}(\tau) \equiv \frac{w_i\left(g_{ij}^{CU} - g_{ij}^{FTA}\right)}{w_i\left(g_i^H - g^{FT}\right)}. \tag{22}$$

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 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 we can rewrite (20) as

$$\beta \underbrace{\left[w_i\left(g_i^H\right) - w_i\left(g^{FT}\right)\right]}_{\text{FTA flexibility benefit}} > \underbrace{\left[w_i\left(g_{ij}^{CU}\right) - w_i\left(g_{ij}^{FTA}\right)\right]}_{\text{myopic CU coordination benefit}} + \frac{\beta}{1-\beta} \underbrace{\left[w_i\left(g_{ij}^{CU}\right) - w_i\left(g^{FT}\right)\right]}_{\text{farsighted CU coordination benefit}} . \quad (23)$$

That is, a country prefers being an FTA insider and then the hub on the path to global free trade over a permanent CU insider if and only if the discounted FTA flexibility benefit dominates the myopic CU coordination benefit and the discounted farsighted CU coordination benefit. This requires an intermediate degree of patience:

$$\beta \in \left(\underline{\beta}^{Flex}(\tau), \bar{\beta}^{Flex}(\tau)\right). \quad (24)$$

Intuitively, a stronger FTA flexibility benefit relaxes the inequality in (23) and expands the extent of FTA formation while a stronger myopic CU coordination benefit tightens the inequality in (23) and constrains the extent of FTA formation. However, the farsighted CU coordination benefit, captured by the size of the CU exclusion incentive $w_i\left(g_{ij}^{CU} - g^{FT}\right) > 0$, also tightens the inequality in (23). 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 how the trade off between the FTA flexibility benefit and CU coordination benefits change with the tariff binding. 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 (22), sufficient patience, i.e. $\beta > \underline{\beta}_{Flex}(\tau)$, implies the farsighted nature of the FTA flexibility benefit dominates the myopic CU coordination benefit. Two reasons explain why $\underline{\beta}_{Flex}(\tau)$ 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 $\underline{\beta}_{Flex}(\tau)$ in (22) 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 far-

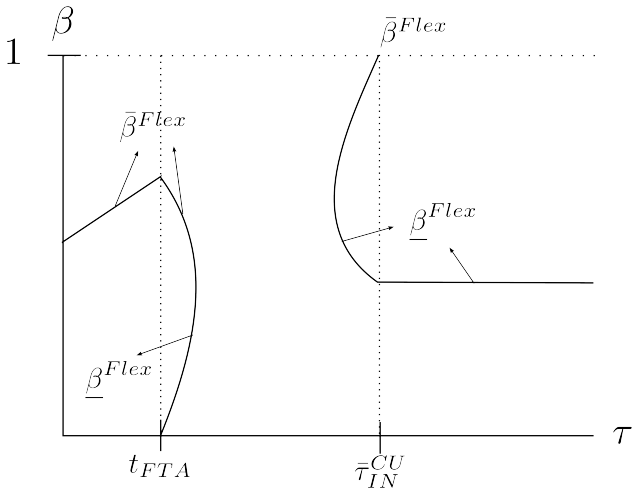

Figure 7: Flexibility benefit of FTAs versus coordination benefits of CUs

sighted 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: $\Delta w_i \left(g_{ij}^{CU} - g_{ij}^{FTA}\right) = 0$. Nevertheless, 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 can precipitate global free trade by exploiting the FTA flexibility benefit and becoming the hub, CU insiders have veto power over subsequent CU expansion. As such, $\beta \in \left(\underline{\beta}^{Flex}(\tau), \bar{\beta}^{Flex}(\tau)\right)$ reduces to $\beta < \bar{\beta}^{Flex}(\tau) = \bar{\beta}_{IN}(\tau)$ (see (19)) with $\bar{\beta}^{Flex}(\tau)$ balancing the FTA flexibility benefit and farsighted CU coordination benefit with a sufficiently myopic 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 myopic 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 myopic (patient) country sees the FTA flexibility benefit (farsighted CU coordination benefit) dominating the farsighted CU coordination benefit (FTA flexibility benefit).

With an understanding of the trade off between the FTA flexibility benefit and CU coordination benefits in place, Proposition 3 characterizes the equilibrium path of networks when countries endogenously choose between FTAs and CUs. Here, we let $\underline{\beta}_{Flex}(\tau) \equiv 0$ when the myopic CU coordination benefit disappears (i.e. $\tau < t_{FTA}$) and, similarly, we let $\bar{\beta}^{Flex}(\tau) \equiv 1$ 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 FTA formation would emerge in equilibrium if and only if $\beta \in \left(\underline{\beta}_{Flex}(\tau), \bar{\beta}^{Flex}(\tau)\right)$. However, the trade off underlying this logic 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. On one hand, 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. $\bar{\beta}^{Flex}(\tau) \leq \bar{\beta}_{IN}(\tau)$). On the other hand, the FTA outsider may hold a dynamic free riding incentive when an FTA insider prefers FTA over CU formation; indeed, $\underline{\beta}_{Flex}(\tau) < \bar{\beta}_{OUT}(\tau)$ obtains when $\tau > \bar{\tau}_{IN}^{CU}$. Thus, the equilibrium emergence of FTA formation requires not only that the FTA flexibility dominate the CU coordination benefits but also that the FTA outsider does not hold a dynamic free riding incentive. In this case, FTA expansion reaches global free trade.

When FTA formation does not emerge in equilibrium, either because PTA insiders see the CU coordination benefits as dominating the FTA flexibility benefit or because the FTA outsider has a 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 due to internalizing tariff complementarity. In this case, CU formation expands to global free trade. However, if the tariff binding falls below $\bar{\tau}_{IN}^{CU}$ then CU insiders

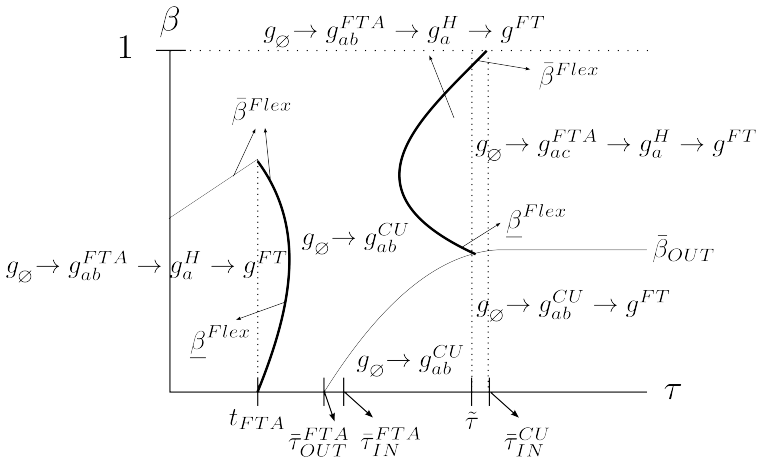

Figure 8: Equilibrium path of networks: PTA game

hold a CU exclusion incentive and exclude the CU outsider from CU expansion to global free trade. Thus, CU insiders remain permanent CU insiders.

Typically, the PTA literature has viewed the building bloc-stumbling bloc issue as a comparison between PTA formation and multilateral liberalization in terms of 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 either through various 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 a more informative view, would compare the different types of PTAs in terms of whether a given type of PTA improve the prospects of global free trade relative to the outcome if this type of PTA was banned.

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 FTAs (CUs) are a "PTA building bloc" if FTA (CU) formation emerges in equilibrium and leads to global free trade yet CU (FTA) formation would not lead to global free trade in the absence of FTAs (CUs). Comparing Proposition 3 with Propositions 1-2 reveals the following result.

Corollary 2 *When the tariff binding is not too tight $\tau < \bar{\tau}_{IN}^{CU}$:*

(i) CUs can be a PTA stumbling bloc but not a PTA building bloc

(ii) FTAs can be a PTA building bloc but not a PTA stumbling bloc.

Note that neither type of PTA is a PTA building bloc nor PTA stumbling bloc when the tariff binding is sufficiently lax, $\tau > \bar{\tau}_{IN}^{CU}$, because both types of PTA lead to global free trade whether they emerge in equilibrium or not.

Once the tariff binding is not too tight, $\tau < \bar{\tau}_{IN}^{CU}$, CUs cannot be a PTA building bloc because the CU exclusion incentive implies CU formation does not expand to global free trade. In contrast, FTA formation expands to global free trade 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. $\beta > \bar{\beta}_{OUT}(\tau)$). As such, we now focus on $\beta \in \left(\bar{\beta}_{OUT}(\tau), \bar{\beta}_{IN}(\tau)\right)$ so that FTA formation expands to global free trade. In turn, CUs are a PTA stumbling bloc if they emerge in equilibrium but FTAs are a PTA building bloc if they emerge in equilibrium. On one hand, CUs emerge in equilibrium, and are a PTA stumbling bloc, when the CU coordination benefits dominate the FTA flexibility benefit (i.e. $\beta \in \left(\underline{\beta}_{Flex}(\tau), \bar{\beta}^{Flex}(\tau)\right)$). On the other hand, FTAs emerge in equilibrium, and are a PTA building bloc, when the FTA flexibility benefit dominates the CU coordination benefits (i.e. $\beta \notin \left(\underline{\beta}_{Flex}(\tau), \bar{\beta}^{Flex}(\tau)\right)$). Finally, FTAs cannot be a PTA stumbling bloc because they never emerge in equilibrium when they do not lead to global free trade.[15] Ultimately, CUs and FTAs play very different roles in terms of the possibility that PTA liberalization reaches global free trade.

To see the importance of the PTA stumbling blocs-building bloc concept, consider the recent empirical evidence of Felbermayr et al. (2018) who document little difference between the external tariffs of CU and FTA members. In our model, no difference between external tariffs of CU and FTA members implies $\tau < t_{FTA}$. In turn, the CU coordination benefit merely consists of the farsighted CU coordination benefit and the tension between this farsighted CU coordination benefit and the FTA flexibility benefit underlies the equilibrium type of PTA. Moreover, when FTA formation emerges in equilibrium, it is a PTA building bloc: while FTA expansion leads to global free trade, banning FTAs would lead to a CU that does not expand to global free trade. Thus, while costs associated with rules of origin cast a negative shadow over FTAs relative to CUs, as emphasized by Felbermayr et al. (2018), we would emphasize that the flexibility of FTAs can propel a greater degree of global liberalization than would be observed through CUs.

[15]Note, the equilibrium path of networks $g_{\varnothing} \to g_{ab}^{CU}$ is observationally equivalent to $g_{\varnothing} \to g_{ab}^{FTA}$ when $\tau \leq t_{FTA}$.

6 Conclusion

We investigate the impact of multilateral tariff binding liberalization on the equilibrium extent of Preferential Trade Agreement (PTA) formation. While the 1994 Uruguay Round represents 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 is likely to continue taking place moving forward, even in the absence of a successful turn in 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, tariff binding liberalization crucially impacts the nature of forces constraining FTA expansion. With relatively high tariff bindings, the FTA outsider's dynamic free riding incentive is the constraining force. Nevertheless, by impinging on the outsider's tariff setting ability, and thereby weakening the dynamic free riding incentive, tariff binding liberalization initially facilitates FTA expansion to global free trade. But, impinging on the outsider's tariff setting ability is a double-edged sword. Eventually, tariff binding liberalization eliminates the dynamic free riding incentive but creates a dynamic exclusion incentive for FTA insiders to permanently exclude the outsider. Now, the FTA insiders' dynamic exclusion incentive becomes the force constraining FTA expansion. Indeed, by strengthening this dynamic exclusion incentive, continual tariff binding liberalization further impedes FTA expansion.

The second implication of tariff binding liberalization concerns the role played by FTAs and CUs in the attainment of global free trade when countries endogenously choose between FTAs and CUs. With relatively high tariff bindings, FTAs and CUs will deliver global free trade. However, outside these relatively high tariff bindings, CU insiders will exclude the CU outsider from CU expansion to global free trade because the associated tariff binding liberalization act as effective concessions from the CU outsider to the CU insiders. Indeed, when CUs emerge in equilibrium they can prevent (cannot facilitate) global free trade that would otherwise occur (not occur) via FTAs. In contrast, when FTAs emerge in equilibrium they can facilitate (cannot prevent) global free trade that would otherwise not occur (occur) via CUs. In our own terminology, CUs can be PTA stumbling blocs but not PTA building blocs whereas FTAs can be PTA building blocs but not PTA stumbling blocs. FTAs are PTA building blocs when the FTA flexibility benefit of FTAs, i.e. the benefit each FTA member derives from forming their own subsequent FTA, dominates the coordination benefits CU

members derive from coordinating their external tariffs. Ultimately, in terms of the prospects for global free trade, 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 recently. Conconi et al. (2018) document substantial impacts on 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, we would emphasize 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 while CUs are PTA stumbling blocs makes this exact point.

One may wonder about the robustness of our results in terms of their reliance on the competing exporters underlying trade model. Specifically, how would our results differ if we used the extension of the Horn et al. (2010) competing importers model to a three-country setting by Missios et al. (2016)? Crucially, regardless of the tariff binding, the FTA outsider never holds a myopic free riding incentive and the FTA insiders always hold an exclusion incentive in Missios et al. (2016). Thus, the competing importers model cannot capture how tariff binding liberalization shapes the existence of these incentives. In turn, the competing exporters model allows a more general analysis of the connection between tariff binding liberalization and substantive economic forces driving PTA formation.

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 Welfare expressions

Here, we present welfare as a function of prices and tariffs. For an arbitrary tariffs vector $\mathbf{t} = (t_{ij}, t_{ik}, t_{ji}, t_{jk}, t_{ki}, t_{kj})$, country i's welfare is

$$w_i = \sum_Z CS_i^Z + \sum_Z PS_i^Z + \sum_{z \neq i} t_{iz} x_z^I,$$

where

$$\begin{aligned}
\sum_Z CS_i^Z &= \frac{1}{2}\left[\left(\alpha - p_i^I\right)^2 + \left(\alpha - p_j^J + t_{ji}\right)^2 + \left(\alpha - p_k^J + t_{ki}\right)^2\right] \\
\sum_Z PS_i^Z &= \frac{1}{2}\left[\left(p_i^I\right)^2 + (1+\lambda_i)\left(p_j^J - t_{ji}\right)^2 + (1+\lambda_i)\left(p_k^K - t_{ki}\right)^2\right] \\
\sum_{z \neq i} t_{iz} x_z^I &= t_{ij}[(2+\lambda_j)\, p_j^I - \alpha] + t_{ik}[2+\lambda_k) p_k^I - \alpha].
\end{aligned}$$

Using the above formulae and the expressions for equilibrium prices and optimal tariffs reported in the text, one can easily calculate welfare under all possible PTA networks.

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 7 *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

Parts (ii) and (iii) follow from using the welfare expressions in Appendix A and, subject to the tariff binding, the equilibrium prices and optimal tariffs reported in the text. Similarly, part (i) follows because, for any τ, $\Delta w_i(g_{ij}^{FTA} - g_\varnothing) > 0$, $\Delta w_i(g_i^H - g_{ij}^{FTA}) > 0$ and $\Delta w_i(g_i^{FT} - g_j^H) > 0$.■

Proof of Lemma 2

The proof follows directly follow from using the welfare expressions in Appendix A 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(iii) 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 $V_z\left(g_{ij}^{FT}\right) - V_z(g_\varnothing) = \Delta w_z(g_{ij}^{FTA} - g_\varnothing) > 0$ 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, $V_i(g_\varnothing) = V_j(g_\varnothing)$ and it is easily verified that $V_j\left(g_{ij}^{FTA}\right) = w_j\left(g_{ij}^{FTA}\right) + \beta w_j\left(g_i^H\right) + \frac{\beta^2}{1-\beta} w_j\left(g^{FT}\right) > V_j(g_\varnothing)$ for all β. Hence, $V_z\left(g_{ij}^{FTA}\right) > V_z(g_\varnothing)$ 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 Appendix A 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, $g_{ij}^{FTA} \to g_i^H \to g^{FT}$ if and only if $\beta \in \left(\bar{\beta}_{OUT}(\tau), \bar{\beta}_{IN}(\tau)\right)$ but $g_{ij}^{FTA} \to g_{ij}^{FTA}$ otherwise.

Stage 2. Note that Lemma 4 implies $g_{ij}^{FTA} \to g_{ij}^{FTA}$ if $\beta \notin \left(\bar{\beta}_{OUT}(\tau), \bar{\beta}_{IN}(\tau)\right)$ but Lemmas 3-4 imply $g_{ij}^{FTA} \to g_i^H \to g^{FT}$ 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 $g_{\varnothing} \rightarrow g_{ab}^{FTA}$ 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 Appendix A 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 7 describes the equilibrium transitions from CU insider-outsider networks with $g_{ij}^{CU} \rightarrow g^{FT}$ if $\tau > \bar{\tau}_{IN}^{CU}$ but $g_{ij}^{CU} \rightarrow g_{ij}^{CU}$ if $\tau \leq \bar{\tau}_{IN}^{CU}$.

Stage 2. Lemma 6(i) and, given the veto power of CU members, Lemma 7 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 7, the equilibrium path of networks is $g_{\varnothing} \rightarrow g_{ab}^{CU} \rightarrow g^{FT}$ if $\tau > \bar{\tau}_{IN}^{CU}$ but $g_{\varnothing} \rightarrow g_{ab}^{CU}$ 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 7 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 $g_{ij}^{FTA} \rightarrow g_{ij}^{FTA}$. 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.■

References

Aghion, P., Antrās, P., Helpman, E., 2007. Negotiating free trade. Journal of International Economics 73 (1), 1–30.

Amador, M., Bagwell, K., 2013. The theory of optimal delegation with an application to tariff caps. Econometrica 81 (4), 1541–1599.

Bagwell, K., Staiger, R., 1997a. Multilateral tariff cooperation during the formation of Customs Unions. Journal of International Economics 42 (1), 91–123.

Bagwell, K., Staiger, R., 1997b. Multilateral tariff cooperation during the formation of free trade areas. International Economic Review 38 (2), 291–320.

Bagwell, K., Staiger, R., 1999. Regionalism and multilateral tariff cooperation. In: Pigott, J., Woodland, A. (Eds.), International trade policy and the Pacific rim. Macmillan.

Bagwell, K., Staiger, R., 2005. Enforcement, private political pressure, and the General Agreement on Tariffs and Trade/World Trade Organization escape clause. The Journal of Legal Studies 34 (2), 471–513.

Beshkar, M., Bond, E., Rho, Y., 2015. Tariff binding and overhang: theory and evidence. Journal of International Economics 97 (1), 1–13.

Bond, E. W., Riezman, R. G., Syropoulos, C., 2004. A strategic and welfare theoretic analysis of Free Trade Areas. Journal of International Economics 64 (1), 1–27.

Conconi, P., García-Santana, M., Puccio, L., Venturini, R., 2018. From final goods to inputs: the protectionist effect of rules of origin. The American Economic Review (forthcoming).

Estevadeordal, A., Freund, C., Ornelas, E., 2008. Does regionalism affect trade liberalization toward nonmembers? The Quarterly Journal of Economics 123 (4), 1531–1575.

Ethier, W. J., 1998. Regionalism in a multilateral world. Journal of Political Economy 106 (6), 1214–1245.

Felbermayr, G., Teti, F., Yalcin, E., 2018. On the profitability of trade deflection and the need for rules of origin. CESifo Working Paper.

Freund, C., 2000. Multilateralism and the endogenous formation of preferential trade agreements. Journal of International Economics 52 (2), 359–376.

Freund, C., McDaniel, C., 2016. How long does it take to conclude a trade agreement with the US? Trade & Investment Policy Watch, Peterson Instituite for International Economics.

Freund, C., McLaren, J., 1999. On the dynamics of trade diversion: Evidence from four trade blocks. Board of Governors of the Federal Reserve System, International Finance Discussion Paper No. 637.

Freund, C., Ornelas, E., 2010. Regional trade agreements. Annual Review of Economics 2 (1), 139–166.

Furusawa, T., Konishi, H., 2007. Free trade networks. Journal of International Economics 72 (2), 310–335.

Goyal, S., Joshi, S., 2006. Bilateralism and free trade. International Economic Review 47 (3), 749–778.

Horn, H., Maggi, G., Staiger, R., 2010. Trade agreements as endogenously incomplete contracts. The American Economic Review 100 (1), 394–419.

Krishna, P., 1998. Regionalism and multilateralism: A political economy approach. Quarterly Journal of Economics 113 (1), 227–251.

Lake, J., 2017. Free Trade Agreements as dynamic farsighted networks. Economic Inquiry 55 (1), 31–50.

Lake, J., 2018. Dynamic formation of Preferential Trade Agreements: The role of flexibility. Canadian Journal of Economics (forthcoming).

Lake, J., Krishna, P., 2018. Preferential trade agreements: Recent theoretical and empirical developments. Mimeo.

Lake, J., Roy, S., 2017. Are global trade negotiations behind a fragmented world of "gated globalization"? Journal of International Economics 108, 117–136.

Lake, J., Yildiz, H. M., 2016. On the different geographic characteristics of Free Trade Agreements and Customs Unions. Journal of International Economics 103, 213–233.

Levy, P., 1997. A political-economic analysis of free-trade agreements. The American Economic Review 87 (4), 506–519.

Maggi, G., 2014. International trade agreements. In: Gopinath, G., Helpman, E., Rogoff, K. (Eds.), Handbook of International Economics. Vol. 4. Elsevier, pp. 317–390.

McLaren, J., 2002. A theory of insidious regionalism. Quarterly Journal of Economics 117 (2), 571–608.

Missios, P., Saggi, K., Yildiz, H. M., 2016. External trade diversion, exclusion incentives and the nature of preferential trade agreements. Journal of International Economics 99, 105–119.

Mölders, F., 2012. On the path to trade liberalization: Political regimes in international trade negotiations. Mimeo.

Mölders, F., 2015. On the path to trade liberalisation: Political regimes in trade negotiations. The World Economy 39 (7), 890–924.

Mrázová, M., Vines, D., Zissimos, B., 2012. Is the GATT/WTO's article XXIV bad? Journal of International Economics 89 (1), 216–232.

Nicita, A., Olarreaga, M., Silva, P., 2018. Cooperation in WTO's tariff waters. Journal of Political Economy (forthcoming).

Nken, M., Yildiz, H. M., 2018. Implications of multilateral tariff bindings on the extent of formation of preferential trade agreements. Mimeo.

Odell, J. S., 2006. Negotiating trade: Developing countries in the WTO and NAFTA. Cambridge University Press.

Ornelas, E., 2005. Trade creating free trade areas and the undermining of multilateralism. European Economic Review 49 (7), 1717–1735.

Ornelas, E., 2008. Feasible multilateralism and the effects of regionalism. Journal of International Economics 74 (1), 202–224.

Ornelas, E., Liu, X., 2012. Free Trade Agreements and the consolidation of democracy. Mimeo.

Saggi, K., Woodland, A., Yildiz, H. M., 2013. On the relationship between preferential and multilateral trade liberalization: the case of Customs Unions. American Economic Journal: Microeconomics 5 (1), 63–99.

Saggi, K., Yildiz, H., 2010. Bilateralism, multilateralism, and the quest for global free trade. Journal of International Economics 81 (1), 26–37.

Saggi, K., Yildiz, H. M., 2009. Optimal tariffs of preferential trade agreements and the tariff complementarity effect. Indian Growth and Development Review 2 (1), 5–17.

Seidmann, D., 2009. Preferential trading arrangements as strategic positioning. Journal of International Economics 79, 143–159.

Zhang, J., Xue, L., Zu, L., 2013. Farsighted free trade networks. International Journal of Game Theory 42 (2), 375–398.