Why don't more countries form Customs Unions instead of Free Trade Agreements? The role of flexibility.

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February 6, 2016

Abstract

In practice, Free Trade Agreements (FTAs) outnumber Customs Unions (CUs) by a ratio of 9:1. Nevertheless, the literature traditionally views CUs as optimal for members because CU members coordinate external tariffs. I show that a dynamic FTA flexibility benefit can help explain the prevalence of FTAs: individual FTA members have the flexibility to form their own future FTAs whereas CU members must jointly engage in future CU formation. Under asymmetry, even arbitrarily small degrees thereof, FTAs emerge in equilibrium if and only if the FTA flexibility benefit outweighs the CU coordination benefit.

JEL codes: C73, F12, F13

Keywords: Preferential Trade Agreement, Free Trade Agreement, Customs Union, coordination, flexibility, networks, dynamic, farsighted

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1 Introduction

Since the early 1990s, the world has seen unprecedented growth in the formation of Preferential Trade Agreements (PTAs). According to the WTO (2011, Figure B.1), the number of PTAs increased from around 50 in the late 1980s to nearly 300 by 2010. This trend has spawned numerous strands of literature spanning empirical contributions, e.g. what characteristics determine PTA partners (e.g. Baier and Bergstrand (2004) and Chen and Joshi (2010)), and theoretical contributions, e.g. whether PTAs are "building blocs" or "stumbling blocs" en route to global free trade (Bhagwati (1991)). However, strikingly, Free Trade Agreements (FTAs) outnumber Customs Unions (CUs) by a ratio of 9:1 with the WTO (2011, p.6) listing this phenomenon as one their five stylized facts regarding PTA formation.[1,2] However, as recently argued by Melatos and Woodland (2007, p.904) and Facchini et al. (2012, p.136), the lack of literature explaining this fact is surprising because the existing literature largely suggests CUs are the optimal type of PTA for members.

Unsurprisingly, the standard reason for the attractiveness of a CU relative to an FTA rests on a coordination benefit whereby CU members coordinate their external tariffs. However, the requirement that CU members set a common external tariff implies that *individual* CU members do not have the flexibility to form their own subsequent PTAs.[3] Using a three country dynamic farsighted model where trade agreements form over time, I highlight a dynamic benefit of FTAs which helps explain the prevalence of FTAs relative to CUs: FTAs allow *individual* FTA members to form future agreements. Indeed, this notion of an FTA flexibility benefit has permeated the mainstream media. Some have argued that the common external tariff of the MERCOSUR CU has prevented Uruguay from forming an FTA with the US. Similar arguments have been made in that the UK and Turkey should have FTAs rather than CUs with the EU to exploit the FTA flexibility benefit.[4]

[1] FTAs differ from CUs because FTA members individually set their tariffs on non–members while CU members set common tariffs on non–members.

[2] http://rtais.wto.org/UI/PublicMaintainRTAHome.aspx.. Specifically, CUs comprise only 14 of the 180 PTAs that were in force and notified under GATT Article XXIV by 2001 (FTAs make up the remainder) and only 5 of the 169 PTAs formed since 2000.

[3] If an individual CU member forms a PTA with a non-member then these two countries eliminate tariffs between themselves. But then the other CU members still have nonzero tariffs with the non-member which violates the common external tariff.

[4] For the Uruguay case, see http://en.mercopress.com/2011/03/11/how-argentina-torpedoed-uruguay-s-fta-with-the-us-according-to-wikileaks. For the UK case, see http://blogs.telegraph.co.uk/news/danielhannan/100186074/the-eu-is-not-a-free-trade-area-but-a-customs-union-until-we-understand-the-difference-the-debate-about-our-membership-is-meaningless/. For the Turkish case, see, for example, http://english.alarabiya.net/en/business/economy/2013/05/26/Turkey-fears-being-left-out-in-the-cold-by-EU-free-trade-deals-.html. The Turkish case is somewhat different in that, as part of its CU with the EU, and perhaps in anticipation of EU membership, Turkey agreed to extend any external tariff concessions to future FTA partners of the EU.

My dynamic three country model endogenizes whether CU or FTA formation emerges in equilibrium. Rather than posit a particular underlying trade model, as is standard in the trade agreements literature, I posit some general properties on one period and continuation payoffs. Moreover, I show these properties hold in a variety of trade models both under symmetry and under various types of asymmetries that include demand side asymmetries, supply side asymmetries or both. Within each period, countries make sequential proposals regarding trade agreements and the period ends once a proposal is accepted. I assume "more attractive" countries make earlier proposals under asymmetry, but I also show the results are robust to variations on this protocol. Thus, the results are robust to (i) the type of trade model, (ii) various types of country asymmetries and (iii) variations on the protocol.

The tension between the FTA flexibility and CU coordination benefits shapes whether CUs or FTAs emerge in equilibrium. Because individual FTA members set their own external tariffs on non-members, individual FTA members have the flexibility to form *future* FTAs with non-members. Thus, FTA formation permits a country to become the "hub" whereby it has FTAs with each of the other two countries but these "spoke" countries do not have an FTA between themselves. Forward looking countries value this FTA flexibility benefit because it affords sole reciprocal preferential access in the future with each spoke country.

Conversely, CUs possess a coordination benefit which, in general, consists of myopic and forward looking components. The "myopic CU coordination benefit" is merely the difference between one period CU and FTA payoffs. In models featuring the well known phenomena of tariff complementarity (i.e. PTA members voluntarily reduce tariffs on non-members), this difference reflects CU members' ability to coordinate external tariffs and thus internalize the intra-PTA negative externality posed by tariff complementarity. I label the forward looking component of the CU coordination benefit the "joint authority motive". It represents that, by implication of CU common external tariffs, joint member approval is required for CU expansion to include the non-member. CU members value this when they hold a "CU exclusion incentive" meaning that they want to exclude the non-member because CU expansion lowers member payoffs. The joint authority motive is valuable here because it allows members to block CU expansion to global free trade whereas an FTA member may precipitate global free trade by exploiting the myopic incentive to become the hub.

Under asymmetry, even arbitrarily small degrees of asymmetry, the tension between the FTA flexibility and CU coordination benefits influence the equilibrium type of PTAs in a very sharp manner: FTA formation emerges if and only if the FTA flexibility benefit dominates the CU coordination benefit and CU formation emerges if and only if the CU coordination benefit dominates the FTA flexibility benefit. In terms of global free trade, FTA formation eventually expands to global free trade while CU formation expands to global free trade if

and only if countries do not hold a CU exclusion incentive.

Under symmetry, the role played by the tension between the FTA flexibility and CU coordination benefits is somewhat weaker. Here, CU formation is always an equilibrium while FTA formation is only an equilibrium when the FTA flexibility benefit dominates the CU coordination benefit. The multiplicity of equilibria when the FTA flexibility benefit dominates the CU coordination benefit implies this condition is necessary but not sufficient for the equilibrium emergence of FTAs. Nevertheless, this weaker result rests entirely on the knife edge nature of symmetry given the stronger results under asymmetry hold for arbitrarily small degrees of asymmetry. Driving the weaker result under symmetry is that a country left out of an FTA is indifferent to the identity of its PTA partners. Hence, in the absence of any PTAs, a country can reject an FTA proposal from the eventual hub country in anticipation of forming a CU with the third country. However, once asymmetry destroys this indifference, a less attractive country will not reject an FTA proposal from a more attractive country because doing so results in a PTA between the more attractive country and the third country. Ultimately, this paper suggests the FTA flexibility benefit is an important component behind the prevalence of FTAs relative to CUs.

This paper is closely related to the three-country static model of Missios et al. (2014). Importantly, because they build on the Horn et al. (2010) competing importers model, countries hold an FTA exclusion incentive *and* a CU exclusion incentive: members of any bilateral PTA receive a higher payoff than under global free trade and, hence, want to exclude the PTA non-member from expansion to a three-country PTA. Missios et al. (2014) show that, unlike FTAs, CUs undermine global free trade. The joint authority motive allows CU members to block CU expansion but FTA formation yields global free emerges because, in equilibrium, the flexibility of FTAs prevents members exploiting their FTA exclusion incentive.

Conceptually, the most important difference between this paper and Missios et al. (2014) is that my model characterizes the situations where the flexibility of FTAs leads FTAs rather than CUs to endogenously emerge in equilibrium. Indeed, as described above, FTAs rather than CUs emerge in equilibrium when the FTA flexibility benefit dominates the CU coordination benefit. Two features of my model allow this conceptual difference. First, Missios et al. (2014) do not endogenize the choice between CUs and FTAs but rather compare a "CU formation game" and an "FTA formation game". Second, and more importantly, my model is dynamic. Even if Missios et al. (2014) endogenized the choice of CUs and FTAs, CUs would emerge because the flexibility of FTAs would still prevent exploitation of the FTA exclusion incentive. However, my dynamic model allows an FTA member to exploit the FTA flexibility benefit by becoming the hub on the *path* to global free trade. That is, my results rely on *forward looking* motivations which, by construction, are absent from the static model

of Missios et al. (2014).[5] Therefore, fundamentally different economic mechanisms drive my results relative to Missios et al. (2014).

This paper is also closely related to a small literature investigating how broad notions of flexibility and coordination affect the endogenous choice between CUs and FTAs. In a three country dynamic bargaining model with transfers, Seidmann (2009) shows PTAs can be valuable because of a "strategic positioning" motive. By affecting the outside option of the PTA outsider, PTA members can affect the share of the global free trade pie obtained by themselves. Because exploiting the strategic positioning motive requires direct expansion of the bilateral PTA to global free trade, CUs are more attractive than FTAs because CU expansion must immediately result in global free trade whereas FTA expansion can produce overlapping FTAs. Thus, the flexibility of FTAs drives FTA formation in this paper but undermines the strategic positioning motive for PTA formation in Seidmann (2009).[6,7] Moreover, given the strategic positioning motive favors CU formation relative to FTA formation, the strategic positioning motive cannot help explain the prevalence of FTAs.

Despite a static setting, Appelbaum and Melatos (2013) show uncertainty generates a coordination-flexibility trade-off underlying the choice between CUs and FTAs. When cost and demand uncertainties are realized after PTA formation but prior to tariff setting, the type of uncertainty matters greatly. Because larger differences in market size polarize each country's ideal external tariff, greater demand uncertainty makes FTAs more attractive relative to CUs. Conversely, greater cost uncertainty makes CUs more attractive relative to FTAs because larger cost differences increase the value of coordinating external tariffs to internalize the negative intra-PTA externalities posed by tariff complementarity. Note, this flexibility-coordination tension derives from *myopic* tariff setting motivations. In contrast, *forward looking* motivations drive the flexibility-coordination tension underlying my results.

Unlike the static but "uncertain trading environment" of Appelbaum and Melatos (2013), Melatos and Dunn (2013) analyze a dynamic and "changing trading environment" that also features notions of flexibility and coordination. The most important differences between

[5] Section 2 shows that the competing importers model used by Missios et al. (2014) is one model that nests within the general properties posited therein. Moreover, subsequent sections explicitly describe the equilibrium outcome for the competing importers model.

[6] Indeed, FTAs only emerge in equilibrium in Seidmann (2009) if tariffs are exogenous. But, in this paper, a key trade off between CUs and FTAs arises precisely because CU members endogenously determine a common external tariff.

[7] A key modeling difference between this paper and Seidmann (2009) that drives the different role of FTAs is the absence of transfers. Even if global free trade maximizes world welfare, global free trade may not result here because transfers are assumed away. Many papers in the literature assume transfers are available while many other papers assume transfers are not available. Bagwell and Staiger (2010, p.50) argue that reality is "... positioned somewhere in between the extremes of negotiations over tariffs only and negotiations over tariffs and [transfers]...".

Melatos and Dunn (2013) and the current paper are the fundamentally different economic environment and, in turn, the fundamentally different question of interest. Using a three-country two-period model, Melatos and Dunn (2013) analyze how the types of PTAs formed in period one depend on changes to the world trading system in period two via (i) entrance of a third country or (ii) departure of an existing country.[8] In practice, part of the prevalence that FTAs have over CUs may be driven by countries anticipating other countries may enter or leave the world trading system in the future. However, the overwhelming pervasiveness of FTAs relative to CUs also suggests a mechanism that does not rely on such anticipations.[9]

Finally, this paper relates to the small, but broader, literature analyzing the endogenous choice between CUs and FTAs. While Riezman (1999) finds CU formation emerges when there are two large countries and one small country (because, like here, such countries have a "CU exclusion incentive"), FTAs never emerge in equilibrium. Similarly, Melatos and Woodland (2007) find FTAs never emerge in a unique equilibrium despite greater preference or endowment asymmetries between countries increasing the attractiveness of FTAs relative to CUs. Conversely, Facchini et al. (2012) find FTAs rather than CUs emerge in equilibrium when income inequality is not too high but CUs can only emerge in equilibrium when members have low income inequality and share similar production structures. Because of their static nature, none of these papers address the flexibility versus coordination issue at the heart of this paper and only Facchini et al. (2012) addresses the prevalence of FTAs.

2 Payoffs, trade models and equilibrium concept

This section serves numerous purposes. First, Section 2.1 introduces basic network and payoff notation. Second, using this notation, Section 2.2 formally defines the FTA flexibility and CU coordination benefit and provides intuition for these concepts. Third, Section 2.3 introduces the general payoff properties used to derive later results and shows how different underlying trade models fit these general properties. Finally, Section 2.4 formally describes the strategies of countries and the equilibrium concept.

[8] Specifically, the former is modelled as an autarkic period one country becoming non-autarkic in period two while the latter is modelled as a non-autarkic period two country becoming (with respect to countries with whom it has not formed a PTA) autarkic in period two. The obvious motivation for the former is WTO accession by countries like China or Russia.

[9] This paper also differs in a number of other ways from Melatos and Dunn (2013). First, I consider a variety of different trade models and country asymmetries whereas Melatos and Dunn (2013) only consider an oligopolistic model with countries differing in the number of firms. Second, I do not assume a discount factor equal to one; indeed, I show that whether the FTA flexibility outweighs the CU coordination benefit depends on the discount factor and in ways that differ considerably across different trade models. Third, I do not rely on simulations to establish equilibria. Fourth, I adopt a non-cooperative solution concept rather than the cooperative core solution concept.

Network at beginning of current period	Network at end of current period
$\varnothing$	$\varnothing, g_{ij}, g_{ik}, g_{jk}, g_{ij}^{CU}, g_{ik}^{CU}, g_{jk}^{CU}$
g_{ij}	g_{ij}, 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

2.1 Preliminaries

Figure 1 depicts the possible networks and terminology between three countries i, j and k. Like the dynamic trade agreement model of Seidmann (2009), I assume at most one agreement can form in any given period and agreements formed in previous periods cannot be severed.[10,11] Table 1 illustrates the feasible transitions in any given period with $g_{t-1} \rightarrow g_t$ denoting the feasible transition when the network at the beginning of the current period is g_{t-1} and the network at the end of the current period is g_t. Given this setup, and the assumption below of Markov strategies, the network remains unchanged forever once either (i) no agreement forms in a given period or (ii) global free trade is attained. In turn, the network remains unchanged from no later than the third period onwards.

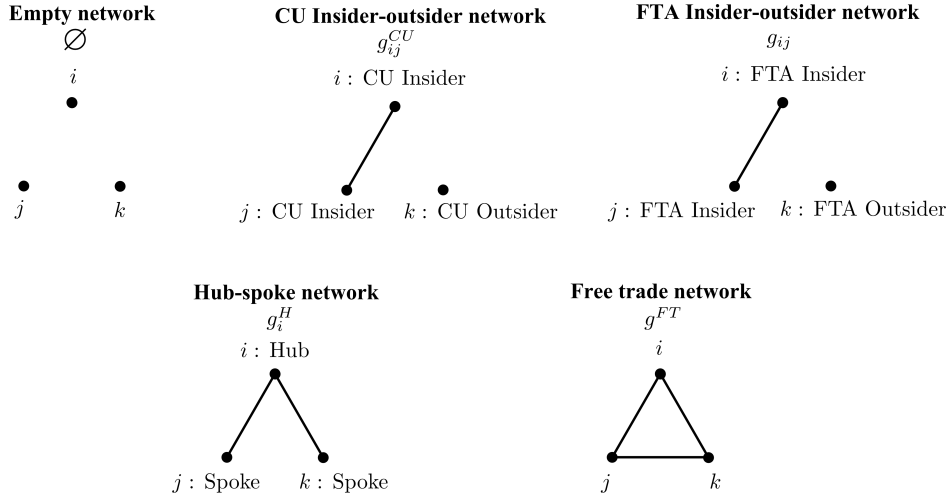


Figure 1: Networks and network positions

[10] Many authors (e.g. Ornelas (2008) and Ornelas and Liu (2012)) argue the binding nature of trade agreements is both realistic, in terms of real world observation, and pervasive in the literature. They also argue realism as a reduced form shorthand for more structural justifications such as sunk costs (see McLaren (2002) and, for empirical support, Freund and McLaren (1999)).

[11] Essentially, I interpret a period as the required time to negotiate an agreement. Indeed, negotiations often take many years to complete; for example, despite not being signed until 1992, NAFTA negotiations date back to 1986 (Odell (2006, p.193)).

Given a network g, country i's one period payoff is denoted $v_i(g)$ with Section 2.3 describing how $v_i(g)$ depends on the network structure. Given the dynamic nature of the model, countries also have continuation payoffs resulting from the transition in the current period. $V_i(g_t)$ denotes the continuation payoff for country i resulting from the transition $g_{t-1} \to g_t$. For example, letting $\delta \in (0,1)$ denote the common discount factor, country i's continuation payoff in period 1 from the transitions $\varnothing \to g_{ij} \to g_i^H \to g^{FT}$ is $V_i(g_{ij}) = v_i(g_{ij}) + \delta v_i\left(g_i^H\right) + \frac{\delta^2}{1-\delta} v_i\left(g^{FT}\right)$ while country i's continuation payoff in period 1 from the transitions $\varnothing \to g_{ij}^{CU}$ is $V_i\left(g_{ij}^{CU}\right) = \frac{1}{1-\delta} v_i\left(g_{ij}^{CU}\right)$.[12]

2.2 FTA flexibility and CU coordination benefits

The central idea of this paper is that a trade-off between the FTA flexibility benefit and the CU coordination benefit shapes whether PTAs take the form of FTAs or CUs.

This trade-off could materialize in two distinct ways, illustrated as follows:

$$V_i(g_{ij}) = v_i(g_{ij}) + \delta v_i\left(g_i^H\right) + \frac{\delta^2}{1-\delta} v_i\left(g^{FT}\right) \gtrless V_i\left(g_{ij}^{CU}\right) = v_i\left(g_{ij}^{CU}\right) + \frac{\delta}{1-\delta} v_i\left(g^{FT}\right) \quad (1)$$

$$V_i(g_{ij}) = v_i(g_{ij}) + \delta v_i\left(g_i^H\right) + \frac{\delta^2}{1-\delta} v_i\left(g^{FT}\right) \gtrless V_i\left(g_{ij}^{CU}\right) = \frac{1}{1-\delta} v_i\left(g_{ij}^{CU}\right) \quad (2)$$

The left hand side of (1)-(2) represent country i's continuation payoff from being an FTA insider and then the hub on the path to global free trade and takes the same form in (1) and (2). The right hand side of (1)-(2) represent the continuation payoff country i obtains from being a CU insider, but takes a different form in (1) and (2). In (2), the CU between i and j does not expand to include the CU outsider k. As will be seen later, this occurs if $v_h\left(g_{ij}^{CU}\right) > v_h\left(g^{FT}\right)$ for $h = i, j$ meaning that CU insiders hold a "CU exclusion incentive" by wanting to exclude the CU outsider from expansion to a three country CU. However, in (1), the CU between i and j expands to the three country CU which is equivalent to global free trade. Naturally, this requires $v_h\left(g^{FT}\right) > v_h\left(g_{ij}^{CU}\right)$ for $h = i, j$ meaning that CU insiders do not hold a "CU exclusion incentive".

Manipulating these equations formalizes the FTA flexibility and CU coordination benefits. If CU insiders do not hold a CU exclusion incentive, manipulating (1) yields

$$\delta \underbrace{\left[v_i\left(g_i^H\right) - v_i\left(g^{FT}\right)\right]}_{\text{FTA flexibility benefit}} \gtrless \underbrace{\left[v_i\left(g_{ij}^{CU}\right) - v_i\left(g_{ij}\right)\right]}_{\text{CU coordination benefit = Myopic CU coordination benefit}}. \quad (3)$$

In (3), the CU between i and j expands to include country k, thus yielding global free

[12] To be clear, the last network in a sequence of transitions indicates the network that remains in place thereafter.

trade. Since FTA formation also yields global free trade via the hub-spoke network, the CU coordination and FTA flexibility benefits derive from what happens along the path to global free trade. The CU coordination benefit is merely the excess one period payoff deriving from the ability to coordinate external trade policy: $v_i\left(g_{ij}^{CU}\right) - v_i\left(g_{ij}\right) \geq 0$. I refer to this as the *myopic* CU coordination benefit because it arises in the initial period where insiders choose whether to form an FTA or a CU. The FTA flexibility benefit arises from the flexibility of the FTA insider country i to become the hub by forming an additional future FTA with the FTA outsider. This future flexibility is foregone when forming a CU because the only possible expansion of the CU is to a three country CU or, equivalently, global free trade. Moreover, this flexibility is valuable, $v_i\left(g_i^H\right) - v_i\left(g^{FT}\right) > 0$, because the hub enjoys reciprocal preferential market access with both spoke countries yet these other spoke countries do not have preferential market access with each other.

As discussed above, CU insiders want to permanently exclude the CU outsider by blocking CU expansion when they hold a CU exclusion incentive. In this case, manipulating (2) yields

$$\delta \underbrace{\left[v_i\left(g_i^H\right) - v_i\left(g^{FT}\right)\right]}_{\text{FTA flexibility benefit}} \gtrless \underbrace{\underbrace{\left[v_i\left(g_{ij}^{CU}\right) - v_i\left(g_{ij}\right)\right]}_{\text{Myopic CU coordination benefit}} + \frac{\delta}{1-\delta}\underbrace{\left[v_i\left(g_{ij}^{CU}\right) - v_i\left(g^{FT}\right)\right]}_{\text{Joint authority motive}}}_{\text{CU coordination benefit}}. \tag{4}$$

Like (3), the FTA flexibility benefit and myopic CU coordination benefit still arise in (4). However, a forward looking component to the CU coordination benefit now emerges. Unlike FTA formation which allows *individual* members to form subsequent FTAs and precipitate the eventual onset of global free trade, CU expansion to global free trade requires the *joint* approval of CU members. This "joint authority" motive is valuable when countries have a CU exclusion incentive: $v_i\left(g_{ij}^{CU}\right) - v_i\left(g^{FT}\right) > 0$. Thus, when countries hold a CU exclusion incentive, the CU coordination benefit consists of both the myopic CU coordination benefit and the joint authority motive.

Naturally, the trade-off between the FTA flexibility and CU coordination benefits shapes whether FTAs or CUs emerge in equilibrium. In particular, the equilibrium emergence of FTAs will require the FTA flexibility benefit outweigh the CU coordination benefit. Whether this happens or not depends on the valuation countries place on future events. On one hand, assuming the myopic CU coordination benefit is strictly positive ($v_i\left(g_{ij}^{CU}\right) - v_i\left(g_{ij}\right) > 0$), letting $\delta \to 0$ in (3)-(4) shows the FTA flexibility benefit cannot outweigh the CU coordination benefit as countries become exceedingly myopic. That is, countries must be somewhat patient for the FTA flexibility benefit to outweigh the CU coordination benefit given the FTA flexibility benefit stems from the flexibility to form future FTAs.

What about when countries become exceedingly patient, i.e. $\delta \to 1$? First, suppose CU insiders have a CU exclusion incentive. Then, (4) shows the joint authority motive implies the FTA flexibility benefit cannot exceed the CU coordination benefit. While FTA formation leads to global free trade, CU formation allows CU insiders to block expansion to global free trade. Thus, when considering a PTA with country j, country i views the FTA flexibility benefit as outweighing the CU coordination benefit if and only if $\delta \in \left(\underline{\delta}_{i,j}(\alpha), \bar{\delta}_{i,j}(\alpha)\right)$ where $\alpha = (\alpha_i, \alpha_j, \alpha_k)$. In this case, country i places sufficient weight on the flexibility associated with the ability to become the hub on the path to global free trade.

Second, suppose CU insiders do not hold a CU exclusion incentive. Then, (3) shows the FTA flexibility benefit outweighs the CU coordination benefit under sufficient patience or, alternatively, $\delta \in \left(\underline{\delta}_{i,j}(\alpha), \bar{\delta}_{i,j}(\alpha)\right)$ where $\bar{\delta}_{i,j}(\alpha) \equiv 1$. On one hand, the absence of a CU exclusion incentive means global free trade emerges regardless of FTA or CU formation. But, sufficient patience places enough weight on the flexibility associated with becoming the hub on the path to global free trade relative to the myopic CU coordination benefit.

2.3 Payoff rankings and underlying trade models

2.3.1 General payoff properties

Rather than impose a particular underlying trade model, I impose general properties on one period and continuation payoffs. This should allay concerns that the results are driven by a particular feature of a particular underlying trade model. Nevertheless, I will show these general properties are satisfied in four commonly used underlying trade models: the competing exporters, competing importers, oligopoly and political economy oligopoly models.

Condition 1 presents the properties imposed on one period payoffs where α_i is a scalar that denotes the characteristics of country i. Note, $g + ij$ indicates that a PTA between countries i and j is added to the network g (for a feasible transition $g \to g + ij$).

Condition 1 *(i)* $v_i(g + ij) > v_i(g)$ *for any* $g \neq g_{jk}$
(ii) $v_i\left(g_{ij}^{CU}\right) \geq v_i(g_{ij})$
(iii) $v_i\left(g_{ij}^{CU}\right) > v_i\left(g_{jk}^{CU}\right)$
(iv) $v_h\left(g_{hh'}^{CU}\right) > v_h\left(g^{FT}\right)$ *for all* h, h' *or* $v_h\left(g_{hh'}^{CU}\right) < v_h\left(g^{FT}\right)$ *for all* h, h'
(v) $v_i(g + ij) > v_i(g + ik)$ *if* $\alpha_j > \alpha_k$

Part (i) of Condition 1 essentially says the reciprocal exchange of preferential access embodied in bilateral PTA formation, whether it be FTA or CU formation, is mutually beneficial for PTA members. However, to fit a variety of standard trade models under symmetry (including the competing exporters and oligopoly models), part (i) permits the

following possibility: $v_i(g_{jk}) > v_i\left(g_j^H\right)$, implying an FTA outsider suffers myopically from becoming a spoke. Intuitively, the attractiveness of such an FTA to the FTA outsider may be substantially diluted by either (i) the preferential access already exchanged between FTA insiders or (ii) the well known phenomenon of tariff complementarity whereby PTA formation induces PTA members to lower tariffs on non-members.

Part (ii) represents the myopic CU coordination benefit described in Section 2.2 by imposing that $v_i\left(g_{ij}^{CU}\right) \geq v_i(g_{ij})$. In models where PTA members engage in tariff complementarity, the myopic CU coordination benefit will generally be strictly positive absent significant country asymmetries. In such cases, practicing tariff complementarity is individually optimal for each PTA member but imposes a negative externality on the other PTA member. Thus, the common external tariff policy of a CU allows PTA members to internalize this intra-PTA negative externality. However, such tariff complementarity does not hold in all standard trade models (e.g. the competing importers model). Indeed, in such cases, FTA formation may leave the desired tariffs of members unaffected but, due to the ability to pool their market power on world markets, CU formation may raise the desired tariffs of CU members. Nevertheless, GATT Article XXIV would then constrain the tariffs of CU members to equal those of FTA members and leave a zero myopic CU coordination benefit.[13]

Effectively, part (iii) says that, despite any tariff complementarity, the discrimination faced by a CU outsider when CU members coordinate their external tariffs is sufficiently large that a country prefers being a CU insider, and benefit from this coordination, rather than a CU outsider.

Part (iv) says either all countries hold a CU exclusion incentive or all countries do not hold a CU exclusion incentive. Under sufficient asymmetry, it is possible only some countries hold a CU exclusion incentive. Thus, part (iv) restricts the possible extent of asymmetry to focus on the trade-off between the FTA flexibility and CU coordination benefits.

Finally, part (v) describes the simple way asymmetry is modeled. Specifically, I view the payoff-relevant characteristics of country i as a scalar α_i which represents the "attractiveness" of country i.[14] Moreover, part (v) imposes a common view regarding what constitutes a more attractive partner. As shown below, this independence of country perspective is a common property of standard underlying trade models.

Having described the properties imposed on one period payoffs, Condition 2 now describes the properties imposed on continuation payoffs.

Condition 2 *(i)* $v_i(g_{ij}) + \delta v_i\left(g_i^H\right) + \frac{\delta^2}{1-\delta} v_i\left(g^{FT}\right) > V_i\left(g_{ij}^{CU}\right)$ *if and only if* $\delta \in \left(\underline{\delta}_{i,j}(\alpha), \overline{\delta}_{i,j}(\alpha)\right)$

[13] GATT Article XXIV forbids PTA members from raising tariffs on non-members.

[14] This setup is equivalent to an alternative setup where country i has a vector of characteristics $\boldsymbol{\alpha}_i$ that map into a scalar summary statistic α_i.

(ii) $v_i\left(g_j^H\right) + \frac{\delta}{1-\delta} v_i\left(g^{FT}\right) > \frac{1}{1-\delta} v_i\left(g_{jk}\right)$ *if* $\delta \in \left(\underline{\delta}_{j,k}(\alpha), \bar{\delta}_{j,k}(\alpha)\right)$
(iii) $v_i\left(g_{ij}\right) + \delta v_i\left(g_j^H\right) + \frac{\delta^2}{1-\delta} v_i\left(g^{FT}\right) > V_i\left(g_{jk}^{CU}\right)$
(iv) $v_i\left(g_{ik}\right) + \delta v_i\left(g_i^H\right) + \frac{\delta^2}{1-\delta} v_i\left(g^{FT}\right) > V_i\left(g_{ik}^{CU}\right)$ *if* $\delta \in \left(\underline{\delta}_{i,j}(\alpha), \bar{\delta}_{i,j}(\alpha)\right)$

Part (i) of Condition 2 merely records what was already described in Section 2.2 whereby the FTA flexibility benefit dominates the CU coordination benefit if and only if the discount factor lies in an intermediate range.

Remember, Condition 1(i) allows the possibility that a country suffers myopically from FTA formation as an FTA outsider. Nevertheless, Condition 2(ii) says the prospect of eventually attaining global free trade, and thereby eliminating any discrimination faced as an FTA outsider or a spoke, induces the FTA outsider to form an FTA with a willing FTA insider. Note, the qualification $\delta \in \left(\underline{\delta}_{j,k}(\alpha), \bar{\delta}_{j,k}(\alpha)\right)$ says that j is a willing FTA insider.

Part (iii) address whether a country prefers to be an FTA insider-turned spoke on the path to global free trade or a CU outsider. Specifically, part (iii) says the discrimination faced as a CU outsider when CU members coordinate external tariffs is sufficiently large that a country prefers FTA formation even though it will then face temporary discrimination as a spoke on the path to global free trade.

Part (iv) deals with an implication of asymmetry. Asymmetry implies that, say, country i may view the FTA flexibility benefit as outweighing the CU coordination benefit when forming a PTA with country j but not when forming a PTA with country k. Part (iv) rules out this possibility. Since this property will generally fail above some asymmetry threshold, part (iv) again restricts the degree of asymmetry under consideration.

2.3.2 Underlying trade models

I now present a variety of different trade models, and numerous types of country asymmetries, to illustrate that Conditions 1-2 are quite reasonable. Except for the political economy oligopoly model, $v_i(g) \equiv W_i(g) = CS_i(g) + PS_i(g) + TR_i(g)$ where country i's national welfare W_i consists of consumer surplus CS_i, producer surplus PS_i and tariff revenue TR_i. In the political economy oligopoly model, $v_i(g) \equiv (1-b) W_i(g) + bPS_i(g)$ where $b > 0$ is the additional value governments place on producer surplus relative to national welfare. In all models, countries set tariffs optimally by maximizing their individual payoff or, in the case of CUs, maximizing their joint payoff. Appendix A presents closed form solutions for the welfare components and optimal tariffs.[15]

Competing exporters endowments model. The competing exporters model was introduced by Bagwell and Staiger (1999). Three countries $i = s, m, l$ have endowments of

[15] All of these models feature a numeraire sector that absorbs all general equilibrium effects and balances trade when needed.

three (non-numeraire) goods $Z = S, M, L$. Country i's demand for good Z is $d_i\left(p_i^Z\right) = \bar{d}_i - p_i^Z$ where p_i^Z is the price of good Z in country i. Country i has endowments $e_i^Z = 0$ of good $Z = I$ and $e_i^Z > 0$ of goods $Z \neq I$. Hence, country i has a "comparative disadvantage" in good I. Conversely, countries j and k have a "comparative advantage" in good I and, in equilibrium, compete when exporting good I to country i.

No arbitrage conditions link cross-country equilibrium goods prices. Ruling out prohibitive tariffs and letting τ_{ij} denote the tariff imposed by country i on country j, $p_i^I = p_j^I + \tau_{ij} = p_k^I + \tau_{ik}$ for each good I.[16] In turn, closed form solutions for equilibrium prices emerge from international market clearing conditions. Denoting country i's net exports of good Z by $x_i^Z = e_i^Z - d_i\left(p_i^Z\right)$, market clearing in good Z requires $\sum_i x_i^Z = 0$ which yields:

$$p_i^I = \frac{1}{3}\left[\sum\nolimits_i \bar{d}_i - (e_j + e_k) + \tau_{ij} + \tau_{ik}\right] \text{ and } p_j^I = \frac{1}{3}\left[\sum\nolimits_i \bar{d}_i - 2(e_j + e_k) + \tau_{ik} - 2\tau_{ij}\right].$$

In this paper, I consider three forms of country asymmetries in the competing exporters model. First, endowment asymmetry: $\bar{d}_i$ is independent of i but $e_i \neq e_j \neq e_k$. Second, market size asymmetry: e_i is independent of i but $\bar{d}_i \neq \bar{d}_j \neq \bar{d}_k$. Third, economic size asymmetry.[17] While the first two models of asymmetry are special cases of the general setup presented above, the third model has a slightly different interpretation. Here, each country i has a mass of θ_i consumers who each own one unit of goods $Z \neq I$ and have demand $\bar{d}_i - p_i^Z$ for each good Z where $\bar{d}_i = \bar{d}$ for all i. Thus, country i's endowment of goods $Z \neq I$ is $e_i^Z = \theta_i$. Moreover, country i's demand for good Z is $d_i\left(p_i^Z\right) = \theta_i\left(\bar{d} - p_i^Z\right)$ which produces the inverse demand curve $p_i^Z\left(d_i^Z\right) = \bar{d} - \frac{1}{\theta_i} d_i^Z$ that rotates outward as θ_i grows. Therefore, economic size asymmetry captures the fact that large countries tend to be large from both demand and supply perspectives.

Competing importers model with flexible supply. The competing importers model dates back to Horn et al. (2010) and was subsequently extended to a three country setting by Missios et al. (2014). Again, the model has three countries $i = s, m, l$ and three (non-numeraire) goods $Z = S, M, L$ with demand for any good Z given by $d_i\left(p_i^Z\right) = \bar{d}_i - p_i^Z$. Unlike the endowment nature of the competing exporters model, supply is now flexible with $x_{ii}^Z\left(p_i^Z\right) = \lambda_i^Z p_i^Z$ denoting the domestic supply of good Z by country i. Thus, $\frac{1}{\lambda_i^Z}$ represents the slope of this inverse supply curve with $\lambda_i^Z = 1$ for $Z \neq I$ but $\lambda_i^I = 1 + \lambda_i > 1$. Unlike the competing exporters model, countries j and k have a "comparative disadvantage" in good I and hence, in equilibrium, compete for imports from country i who is the sole exporter of good I given its "comparative advantage" in good I.

[16] Throughout the models presented, $\tau_{ii} = 0$ and, if countries i and j have a PTA, $\tau_{ij} = 0$.

[17] This is an endowment based version of the size asymmetry in Bond and Park (2002).

No arbitrage conditions link cross-country equilibrium goods prices. Ruling out prohibitive tariffs, $p_j^I = p_i^I + \tau_{ji}$ and $p_k^I = p_i^I + \tau_{ki}$ for each good I. In turn, closed form solutions for equilibrium prices emerge from international market clearing conditions. Denoting country j's imports of good I from country i by $m_{ji}^I\left(p_j^I\right) = d_j\left(p_j^I\right) - x_{jj}^I\left(p_j^I\right)$ and country i's exports of good I to country j by $x_{ij}^I = x_{ii}^I\left(p_i^I\right) - d_i\left(p_i^I\right) - m_{ki}^I$, market clearing in good I requires $x_{ij}^I = m_{ji}^I$ and $x_{ik}^I = m_{ki}^I$ which yields:

$$p_i^I = \frac{1}{6+\lambda_i}\left(\sum\nolimits_i \bar{d}_i - 2\tau_{ji} - 2\tau_{ki}\right) \text{ and } p_j^I = \frac{1}{6+\lambda_i}\left(\sum\nolimits_i \bar{d}_i - 2\tau_{ki} + (4+\lambda_i)\,\tau_{ji}\right).$$

In this paper, I consider two forms of country asymmetries in the competing importers model. First, technology asymmetry: $\bar{d}_i$ is independent of i but $\lambda_i \neq \lambda_j \neq \lambda_k$. Second, market size asymmetry: λ_i is independent of i but $\bar{d}_i \neq \bar{d}_j \neq \bar{d}_k$.

Oligopoly model. Three countries $i = s, m, l$ each have a single firm that produces a homogenous good in segmented international markets. x_{ij} denotes the quantity sold by country i in country j's market (this allows $j = i$). Country i's demand is $d_i(p_i) = \bar{d}_i - p_i$ where p_i denotes the price in country i. Assuming a common and constant marginal cost (normalized to zero), country i's maximization problem in country j has the standard form: $\max_{x_{ij}}\left[\left(\bar{d}_j - \sum_i x_{ij}\right) - \tau_{ji}\right] x_{ij}$. Given a network g, the equilibrium quantity $x_{ij}^*(g)$ is

$$x_{ij}^*(g) = \frac{1}{4}\left[\bar{d}_j + \left(3 - \eta_j(g)\right)\bar{\tau}_j(g) - 4\tau_{ji}(g)\right]$$

where (i) $\eta_j(g)$ is the number of countries facing a zero tariff in country j (including country j itself) and, per WTO rules, (ii) $\bar{\tau}_j(g)$ is the non-discriminatory tariff faced by countries who do not have an FTA with country j. Ruling out prohibitive tariffs, country i's equilibrium profits in country j are $\pi_{ij}(g) = \left(x_{ij}^*(g)\right)^2$ and country i's total profits are $\pi_i(g) = \sum_j \pi_{ij}(g)$.

In this paper, I only consider market size asymmetry in the oligopoly model: $\bar{d}_i \neq \bar{d}_j \neq \bar{d}_k$.

Political economy oligopoly model. The underlying trade model is identical to the oligopoly model just described. But, as described above, countries now place an additional weight b on firm profits relative to national welfare.

With these four models in place, Lemma 1 describes how they fit Conditions 1 and 2 under symmetry.

Lemma 1 *Suppose countries are symmetric. Then, Conditions 1 and 2 are satisfied for (i) the competing exporters when* $\delta \notin \left(\underline{\delta}^{CX}, \bar{\delta}^{CX}\right)$*, (ii) the oligopoly model, (iii) the political economy oligopoly model when* $b \in \left(\underline{b}^{PEO}, \bar{b}^{PEO}\right)$ *and* $\delta \notin \left(\underline{\delta}^{PEO}(b), \bar{\delta}^{PEO}(b)\right)$ *and (iv) the competing importers model.*

Model	Myopic CU coordination benefit	Joint authority motive
Competing exporters	Yes	No
Oligopoly	Yes	No
Competing importers	No	Yes
Political economy oligopoly	Yes	Yes

Table 2: Components of CU coordination benefit across different trade models

Lemma 1 says, under symmetry, Conditions 1-2 always hold in the oligopoly and competing importers model but only hold under certain restrictions in the competing exporters and political economy oligopoly model. Nevertheless, $\left(\underline{\delta}^{CX}, \bar{\delta}^{CX}\right) = (.313, .328)$ and, for example, $\left(\underline{\delta}^{PEO}(b), \bar{\delta}^{PEO}(b)\right) = (.290, .457)$ when $b = .356$. Thus, Lemma 1 clearly illustrates Conditions 1-2 embody properties that pervade numerous underlying trade models.

Moreover, Table 2 highlights that these models differ substantially in the nature of the CU coordination benefit along the lines discussed in Section 2.2. The competing exporters and oligopoly models have a myopic CU coordination benefit (i.e. $v_i\left(g_{ij}^{CU}\right) - v_i\left(g_{ij}\right) > 0$) because CU coordination of external tariffs internalizes the negative externality associated with tariff complementarity. But, there is no joint authority motive because there is no CU exclusion incentive (i.e. $v_i\left(g_{ij}^{CU}\right) - v_i\left(g^{FT}\right) < 0$). Conversely, the CU exclusion incentive creates a a joint authority motive in the competing importers model but there is no myopic CU coordination benefit. While FTA formation leaves the optimal tariffs of FTA members unchanged, the pooling of market power under CU formation increases the optimal tariffs of CU members. However, GATT Article XXIV binds the tariffs of CU insiders at the same level as FTA insiders and eliminates any myopic CU coordination benefit (i.e. $v_i\left(g_{ij}^{CU}\right) - v_i\left(g_{ij}\right) = 0$). The political economy oligopoly model rounds out the possibilities by featuring a myopic CU coordination benefit (via internalizing the negative externality of tariff complementarity) and a joint authority motive (via the CU exclusion incentive).

Given Conditions 1-2 are satisfied under symmetry, it is unsurprising they hold under small degrees of asymmetry as shown in Lemma 2 where $\alpha \equiv (\alpha_s, \alpha_m, \alpha_l)$.

Lemma 2 *Suppose countries are asymmetric. Then, given $\delta \in (0,1)$, there is a range of asymmetry such that Conditions 1 and 2 are satisfied for (i) the competing exporters model with either market size, economic size or endowment asymmetry when $\delta \notin \left(\underline{\delta}^{CX}(\alpha), \bar{\delta}^{CX}(\alpha)\right)$, (ii) the oligopoly model with market size asymmetry, (iii) the political economy oligopoly model with market size asymmetry when $b \in \left(\underline{b}^{PEO}(\alpha), \bar{b}^{PEO}(\alpha)\right)$ and $\delta \notin \left(\underline{\delta}^{PEO}(\alpha, b), \bar{\delta}^{PEO}(\alpha, b)\right)$, and (iv) the competing importers model with market size asymmetry or, when $\lambda_i \notin (5,6)$ for all i, technology asymmetry.*

What may not be obvious from Lemma 2 is what characteristics make attractive partners.

Under market size asymmetry, larger partners make more attractive partners (i.e. $\alpha_i \equiv \bar{d}_i$) because (i) larger markets provide greater market access and (ii) countries with larger markets set higher tariffs, enhancing any preferential market access. Conversely, countries with smaller endowments make more attractive partners in the competing exporters model (i.e. $\alpha_i \equiv \frac{1}{e_i}$) because, in such markets, a member competes against a non-member exporting country with a relatively large endowment and tariff barriers increase with exporting country size. When technology asymmetry is not very high in the competing importers model (i.e. $\lambda_i < 5$ or the slope of the supply curve $\alpha_i \equiv \frac{1}{1+\lambda_i} > \frac{1}{6}$), less technologically advanced countries make more attractive partners because of a desire to protect the domestic import competing sector. However, by diverting imports to the non-member, *non-member* tariff complementarity also protects the import competing sector of member countries.[18] Moreover, the degree of tariff complementarity initially rises with the level of technology in exporting countries. Thus, given the lost consumer surplus from protecting the domestic import competing sector, more technologically advanced countries make more attractive partners once technology asymmetry is very high (i.e. $\alpha_i \equiv \lambda_i > 6$).

2.4 Strategies and equilibrium concept

My dynamic model closely resembles Seidmann (2009). As described in Section 2.1, at most one agreement can form in any given period and agreements formed in previous periods are binding. Moreover, given a network at the end of the previous period g_{t-1}, I follow Seidmann (2009) and refer to the current period t as the subgame at g_{t-1}.

Seidmann (2009) assumes a stochastic protocol where a single "proposer" country can propose an agreement in a given period. However, I assume a deterministic protocol. In each period, country l is the first proposer (stage 1), followed by country m (stage 2) and country s (stage 3). A proposer country proposes a trade agreement and the proposed members, i.e. recipients, respond by accepting or not accepting. The proposed agreement forms and the period ends if each recipient country accepts the proposal in a given stage. But, the protocol moves to the subsequent stage if at least one of the recipient countries rejects the proposal or the proposer makes no proposal. Hence, the period ends after (i) an agreement forms or (ii) no agreement forms even though each country has been the proposer.

A proposer country can propose an agreement that has not yet formed and to which it will be a member. Table 3 illustrates the proposals available to each country i in each possible subgame at network g; $P_i(g)$ represents this set of proposals and $\rho_i(g) \in P_i(g)$ represents a proposal. In Table 3, ij denotes the FTA between i and j while ij^{CU} denotes the CU

[18] Non-member tariff complementarity refers to the phenomena where PTA formation induces non-members to lower their tariff on members (see Missios et al. (2014)).

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

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

between i and j and ijk^{CU} denotes a three-country CU. ϕ denotes the proposer country's choice to make no proposal. Having received a proposal $\rho_i(g)$, each recipient country j (i.e. a country of the proposed agreement) responds by announcing $r_j(g, \rho_i(g)) \in \{Y, N\}$ where Y (N) denotes j accepts (does not accept) the proposal.

Given the protocol, country i's Markov strategy must do two things for every subgame at network g: (i) assign a proposal $\rho_i(g) \in P_i(g)$ for the stage where country i is the proposer and (ii) assign a response $r_i\left(g, \rho_j(g)\right) \in \{Y, N\}$ to any proposal country i may receive from another country j. I follow Seidmann (2009) and solve for a type of pure strategy Markov perfect equilibrium. Specifically, I use backward induction to solve for a pure strategy subgame perfect equilibrium where the proposal by the proposer and the response(s) by the respondent(s) in period t only depend on history via the network in place at the end of the previous period g. [19]

3 Equilibrium path of networks

3.1 Symmetry

To begin the backward induction, consider the subgame at a hub-spoke network. Condition 1(i) says spokes always benefit from exchanging reciprocal preferential access and forming the final FTA that leads to global free trade. Lemma 3 records this result.

Lemma 3 *Consider the subgame at a hub-spoke network g_i^H. The equilibrium outcome of the subgame is the FTA between the spoke countries j and k (i.e. $g_i^H \to g^{FT}$).*

[19] For convenience, I make two assumptions that restrict attention to certain Markov Perfect Equilibria. First, given the simultaneity of responses to a proposal for expansion of a CU to include the CU outsider, I assume countries respond to such proposals affirmatively if they prefer global free trade over the status quo. That is, $r_h\left(g_{ij}^{CU}, ijk^{CU}\right) = Y$ if and only if $v_h\left(g^{FT}\right) > v_h\left(g_{ij}^{CU}\right)$. I also assume a recipient country responds with $r_i\left(g, \rho_j(g)\right) = Y$ when responding with $r_i\left(g, \rho_j(g)\right) = N$ would merely delay formation of the proposed agreement to a later stage of the current period. This can be motivated by the presence of an arbitrarily small cost involved in making a response.

Now roll back to the subgame at an FTA insider-outsider network g_{ij}. In terms of the FTA outsider's myopic incentives, FTA formation may be unattractive. Indeed, Section 2.3 discussed reasons why this occurs in some common trade models. Nevertheless, Condition 2(ii) says the eventual attainment of global free trade, and the associated elimination of discrimination faced as an FTA outsider, is sufficiently attractive that an FTA outsider wants to become a spoke by forming an FTA with an FTA insider.

What about the incentives held by FTA insiders? For the eventual equilibrium path of networks, it is sufficient to focus on the case where countries view the FTA flexibility benefit as outweighing the CU coordination benefit. Thus, dropping subscripts due to symmetry, attention can be restricted to $\delta \in \left(\underline{\delta}, \bar{\delta}\right)$ (see Condition 2(i)). In this case, an FTA insider must benefit from forming a subsequent FTA and becoming the hub because becoming the hub is precisely what makes FTA formation attractive given the myopic CU coordination benefit and the joint authority motive. Thus, each FTA insider and the FTA outsider mutually benefit from FTA formation.

Which FTA actually emerges depends on the FTA outsider's position in the protocol. If the FTA outsider is not the first proposer in the protocol, the first proposer (country l) proposes an FTA with the FTA outsider and the FTA outsider accepts. But, if the FTA outsider is the first proposer then, due to symmetry, it is indifferent between proposing to either FTA insider and either FTA insider will accept. Lemma 4 records these results.

Lemma 4 *Suppose Conditions 1-2 hold with $\alpha_l = \alpha_m = \alpha_s$ and consider the subgame at an FTA insider-outsider network g_{ij} with $\delta \in \left(\underline{\delta}, \bar{\delta}\right)$. If the FTA outsider is not the first proposer in the protocol, the equilibrium outcome of the subgame is the FTA between the first proposer, say country i, and the FTA outsider (i.e. $g_{ij} \to g_i^H$). If the FTA outsider is the first proposer in the protocol, the equilibrium outcomes of the subgame are the FTAs between i and k and between j and k (i.e. $g_{ij} \to g_i^H$ and $g_{ij} \to g_j^H$).*

Before rolling back to the subgame at the empty network, and thus solving the equilibrium path of networks, consider the subgame at a CU insider-outsider network g_{ij}^{CU}. Given the only possible agreement is to expand the bilateral CU to a three country CU, such expansion requires the consent of all three countries. Naturally, this happens if and only if all countries benefit from the expansion. Condition 1(ii) says a country prefers to be a CU insider, and thereby enjoy the CU coordination benefit, rather than be discriminated against as a CU outsider. Thus, whether the bilateral CU expands to global free trade ultimately depends on whether CU insiders hold a CU exclusion incentive: the bilateral CU expands to global free trade if and only if countries do not hold a CU exclusion incentive. Lemma 5 records this result.

Lemma 5 *Suppose Conditions 1-2 hold and consider the subgame at a CU insider-outsider network g_{ij}^{CU}. If countries do not hold a CU exclusion incentive (i.e. $v_h\left(g^{FT}\right) > v_h\left(g_{ij}^{CU}\right)$ for $h = i, j$), the equilibrium outcome of the subgame is expansion to the three country CU (i.e. $g_{ij}^{CU} \rightarrow g^{FT}$). If countries hold a CU exclusion incentive (i.e. $v_h\left(g_{ij}^{CU}\right) > v_h\left(g^{FT}\right)$ for $h = i, j$), the equilibrium outcome of the subgame is no agreement (i.e. $g_{ij}^{CU} \rightarrow g_{ij}^{CU}$).*

Finally, rolling back to the subgame at the empty network and solving for the equilibrium outcome of this subgame reveals the equilibrium path of networks. As alluded to in Section 2.2, the trade off between the FTA flexibility benefit and CU coordination benefit shape whether FTA or CU formation emerges along the equilibrium path of networks.

When $\delta \in \left(\underline{\delta}, \bar{\delta}\right)$, each country prefers being an FTA insider-turned hub on the path to global free trade over being (i) a CU insider on the path to global free trade when countries do not hold a CU exclusion incentive or (ii) a permanent CU insider when countries hold a CU exclusion incentive. Equations (3) and (4) show this is equivalent to saying that the FTA flexibility benefit dominates the CU coordination benefit. In the case of (i), the flexibility associated with being the hub and having temporary but exclusive reciprocal and preferential market access with each spoke country outweighs the myopic CU coordination benefit stemming from coordination of external tariffs by CU members. In the case of (ii), the FTA flexibility benefit outweighs the CU coordination benefit which now consists of the myopic CU coordination benefit as well as the joint authority motive whereby CU formation allows CU members to block expansion to global free trade.

Indeed, a necessary condition for the emergence of FTA formation in equilibrium is that the FTA flexibility benefit dominate the CU coordination benefit, i.e. $\delta \in \left(\underline{\delta}, \bar{\delta}\right)$. If the CU coordination benefit outweighs the FTA flexibility benefit, i.e. $\delta \notin \left(\underline{\delta}, \bar{\delta}\right)$, then the first proposer in the protocol (country l) proposes CU formation with either of the other two countries who accept given that exchanging reciprocal and preferential market access and becoming a CU insider is more attractive than being discriminated against as a CU outsider (see Condition 1(iii)). Because symmetry creates indifference on the part of the first proposer (country l) regarding its initial CU partner, this CU could be between countries l and s or countries l and m. If the CU insiders hold a CU exclusion incentive, this CU remains permanently. If, in contrast, the CU insiders do not hold a CU exclusion incentive then this CU expands to include the CU outsider and thus reaches global free trade.

While a necessary condition for the equilibrium emergence of FTA formation is the FTA flexibility benefit outweigh the CU coordination benefit, this is not a sufficient condition. Specifically, although FTA formation is *an* equilibrium outcome, there are multiple equilibria with CU formation also being an equilibrium outcome. The source of multiplicity is the possibility that country s (the third proposer) could credibly threaten to refuse an FTA

proposal from country l (the first proposer) which forces country l to propose a CU rather than an FTA.

Whether country s can credibly threaten to refuse an FTA proposal from country l in stage 1 depends on the proposal by country m in stage 2. If m proposes a CU with l in stage 2, then FTAs emerge in equilibrium.[20] In this case, s accepts an FTA proposal from l in stage 1 to avoid being discriminated against as a CU outsider in stage 2 (see Condition 2(iii)). Indeed, l would accept this stage 2 CU proposal anticipating that s would propose a CU rather an FTA in stage 3 given that s can never be the hub (see Lemma 4). Thus, there is an equilibrium with FTAs when the FTA flexibility benefit outweighs the CU coordination benefit and the equilibrium path of networks is $\varnothing \to g_{sl} \to g_l^H \to g^{FT}$.

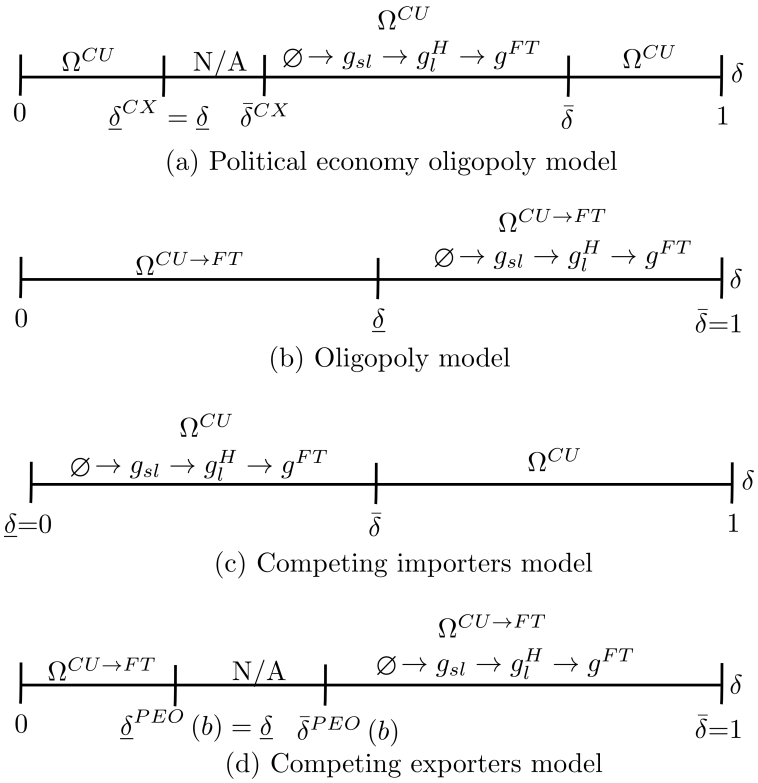
However, if m proposes a CU with s in stage 2 then CUs emerge in equilibrium even though the FTA flexibility dominates the CU coordination benefit. Indeed, given symmetry, m is indifferent between s and l as its CU partner. Crucially, given s will accept the CU proposal, s can now credibly reject an FTA proposal from l in stage 1. This contrasts with the previous paragraph where s accepted the FTA proposal to avoid being discriminated against as a CU outsider. In turn, this credible threat forces l to propose a CU and symmetry implies l is indifferent between proposing to s or m with either country accepting l's proposal. Thus, CUs emerge in equilibrium with the equilibrium paths of networks being $\varnothing \to g_{sl}^{CU}$ and $\varnothing \to g_{ml}^{CU}$ when countries hold a CU exclusion incentive but $\varnothing \to g_{sl}^{CU} \to g^{FT}$ and $\varnothing \to g_{ml}^{CU} \to g^{FT}$ when countries do not hold a CU exclusion incentive. Proposition 1 summarizes this discussion.

Proposition 1 *Suppose Conditions 1-2 hold and $\alpha_l = \alpha_m = \alpha_s$. Then, FTAs emerge in equilibrium only if the FTA flexibility dominates the CU coordination benefit. If $\delta \in \left(\underline{\delta}, \bar{\delta}\right)$, the equilibrium paths of networks are (i) $\varnothing \to g_{sl} \to g_l^H \to g^{FT}$ and either (ii) $\varnothing \to g_{hl}^{CU}$ for $h = s, m$ if countries hold a CU exclusion incentive or (iii) $\varnothing \to g_{hl}^{CU} \to g^{FT}$ for $h = s, m$ if countries do not hold a CU exclusion incentive. If $\delta \notin \left(\underline{\delta}, \bar{\delta}\right)$, the equilibrium paths of networks are $\varnothing \to g_{ml}^{CU}$ and $\varnothing \to g_{sl}^{CU}$ when countries hold a CU exclusion incentive but $\varnothing \to g_{ml}^{CU} \to g^{FT}$ and $\varnothing \to g_{sl}^{CU} \to g^{FT}$ when countries do not hold a CU exclusion incentive.*

Figure 2 depicts Proposition 1 for the four models described in Section 2.2 with $\Omega^{CU} \equiv \left\{\varnothing \to g_{sl}^{CU}, \varnothing \to g_{ml}^{CU}\right\}$ and $\Omega^{CU \to FT} \equiv \left\{\varnothing \to g_{sl}^{CU} \to g^{FT}, \varnothing \to g_{ml}^{CU} \to g^{FT}\right\}$. As described in Proposition 1, CU formation is always an equilibrium outcome with a bilateral CU ex-

[20] Noting that Lemma 4 says l is the hub after g_{ml}, m cannot exploit the FTA flexibility benefit as an FTA insider with l. Moreover, it cannot exploit the FTA flexibility benefit as an FTA insider with s because s would reject such a proposal in stage 2 so it can propose a CU in stage 3.

panding to global free trade if and only if countries do not hold a CU exclusion incentive which happens in the oligopoly and competing exporter models of Figure 2(b) and 2(d).



(a) Political economy oligopoly model

(b) Oligopoly model

(c) Competing importers model

(d) Competing exporters model

Figure 2: Equilibrium path of networks in various models under symmetry

In contrast to CUs, FTAs emerge in equilibrium only if the FTA flexibility benefit outweighs the CU coordination benefit. Panels (b) and (d) of Figure 2 depict the oligopoly and competing exporter models where countries do not hold CU exclusion incentives. Here, absent a joint authority motive, the CU coordination benefit consists entirely of the myopic CU coordination benefit. In turn, $\bar{\delta} \equiv 1$ and the FTA flexibility benefit outweighs the CU coordination benefit if and only if $\delta > \underline{\delta}$. Hence, putting aside the N/A region in the competing exporters model (see Lemma 1), FTAs emerge in equilibrium when $\delta > \underline{\delta}$.

In contrast, panels (a) and (c) of Figure 2 depict the political economy oligopoly and competing importer models where countries hold CU exclusion incentives. The resulting joint authority motive implies the CU coordination benefit outweighs the FTA flexibility benefit when countries are sufficiently patient and, hence, $\bar{\delta} < 1$. In the political economy oligopoly model, the competing exporter structure generates a myopic CU coordination benefit via tariff complementarity. However, there is no myopic CU coordination benefit in the competing importers model because GATT Article XXIV constrains the ability of CU members to exercise their pooled market power as the sole buyers on the world market and

eliminates any myopic CU coordination benefit. Thus, the FTA flexibility benefit outweighs the CU coordination benefit, and FTAs emerge in equilibrium, for $\delta < \overline{\delta}$ in the competing importers model but for $\delta \in \left(\underline{\delta}, \overline{\delta}\right)$ in the political economy oligopoly model.

3.2 Asymmetry

I now introduce a small amount of asymmetry to address whether the role played by the FTA flexibility and CU coordination benefits rest on the knife-edge case of symmetry. To this end, it is useful to think of countries l, m and s as the "large", "small" and "medium" countries, i.e. $\alpha_l > \alpha_m > \alpha_s$, remembering that Condition 1(v) says larger countries make more attractive PTA partners.

Like the symmetric case, the backward induction begins at hub-spoke networks with Condition 1(i) saying spokes benefit from the reciprocal exchange of preferential market access. Thus, Lemma 3 applies again and the spoke-spoke FTA leads to global free trade.

However, rolling back to FTA insider-outsider networks g_{ij}, asymmetry eliminates the multiplicity of equilibria that arose under symmetry. As under symmetry, it is sufficient to focus on the case where the larger FTA insider, say country i, views the FTA flexibility benefit as dominating the CU coordination benefit. But, unlike under symmetry, the FTA outsider k prefers becoming a spoke by forming an FTA with the larger FTA insider. Thus, given $\delta \in \left(\underline{\delta}_{i,j}(\alpha), \overline{\delta}_{i,j}(\alpha)\right)$, the unique equilibrium outcome is an FTA between the FTA outsider k and the larger FTA insider i. Lemma 6 records this result.

Lemma 6 *Consider the subgame at an FTA insider-outsider network g_{ij} where $\alpha_i > \alpha_j$ and suppose $\delta \in \left(\underline{\delta}_{i,j}(\alpha), \overline{\delta}_{i,j}(\alpha)\right)$. The equilibrium outcome of the subgame is the FTA between i and k which produces the equilibrium transition $g_{ij} \to g_i^H$.*

Given Lemma 5 still describes the equilibrium outcome in subgames at CU insider-outsider networks, i.e. a bilateral CU expands to global free trade if and only if countries do not hold a CU exclusion incentive, now roll back to the subgame at the empty network. Solving the equilibrium outcome of this subgame reveals the equilibrium path of networks which is characterized in the following proposition and depicted in Figure 3.

Proposition 2 *Suppose Conditions 1-2 hold and let $\alpha_l > \alpha_m > \alpha_s$. Then, FTAs emerge in equilibrium if and only if the FTA flexibility dominates the CU coordination benefit for country l as an insider with country m. If $\delta \in \left(\underline{\delta}_{l,m}(\alpha), \overline{\delta}_{l,m}(\alpha)\right)$, the equilibrium path of networks is $\varnothing \to g_{sl} \to g_l^H \to g^{FT}$. If $\delta \notin \left(\underline{\delta}_{l,m}(\alpha), \overline{\delta}_{l,m}(\alpha)\right)$, the equilibrium path of networks is $\varnothing \to g_{ml}^{CU}$ when countries hold a CU exclusion incentive but $\varnothing \to g_{ml}^{CU} \to g^{FT}$ when countries do not hold a CU exclusion incentive.*

Two points stand out when comparing Proposition 2 under asymmetry with Proposition 1 under symmetry. First, the FTA flexibility benefit outweighing the CU coordination benefit is now a necessary and sufficient condition for FTA formation to emerge in equilibrium. Thus, the trade-off between the FTA flexibility benefit and CU coordination benefit shape the equilibrium type of PTA in a very sharp manner. Second, the multiplicity of equilibria present in Proposition 1 under symmetry was an artifact of the knife edge case of symmetry; even the slightest amount of asymmetry between the countries, i.e. $\alpha_l > \alpha_m > \alpha_s$, is enough to generate a unique equilibrium path of networks.

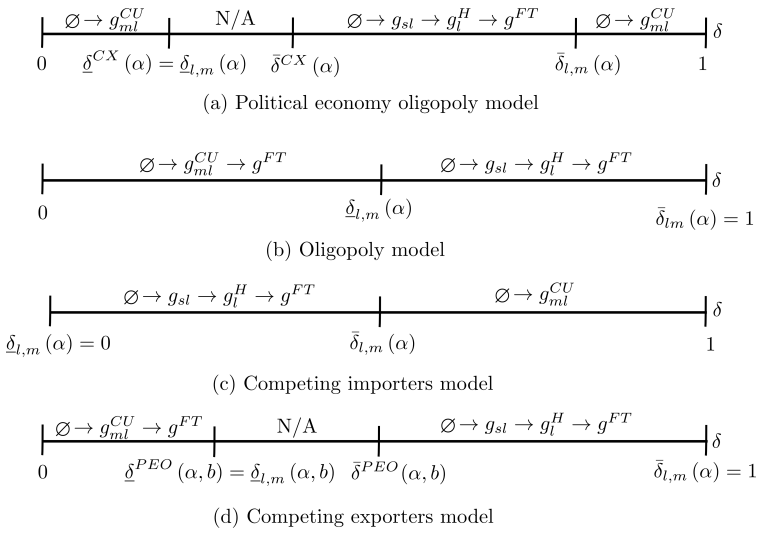


Figure 3: Equilibrium path of networks in various models under asymmetry

Using Condition 2(iv), $\delta \notin \left(\underline{\delta}_{l,m}(\alpha), \bar{\delta}_{l,m}(\alpha)\right)$ implies the CU coordination benefit outweighs the FTA flexibility benefit for country l regardless of its PTA partner. Thus, country l prefers CU over FTA formation and, given asymmetry, prefers a CU with country m over country s. Hence, l proposes a CU with m who accepts the proposal. Even if the FTA flexibility benefit outweighs the CU coordination benefit for m, m can only become the hub by forming an FTA with s but s would reject this FTA proposal and then propose its own CU with l. Thus, a CU between m and l forms when l views the CU coordination benefit as outweighing the FTA flexibility benefit. This CU expands to global free trade if and only if countries do not hold a CU exclusion incentive.

Multiple equilibria arose under symmetry because of the possibility that s could credibly threaten to reject an FTA proposal from l. This rested on s's anticipation of receiving a CU proposal from m in stage 2 given m's indifference regarding the identity of its CU partner. However, this is no longer a credible threat for s because asymmetry means m will propose

a CU with l rather than s in stage 2. Thus, s accepts an FTA proposal from l in stage 1.[21] Hence, s's inability to credibly refuse l's FTA proposal ensures a unique equilibrium with FTAs when l views the FTA flexibility benefit as outweighing the CU coordination benefit.

4 Discussion

4.1 Incorporating multilateral negotiations

To focus on the trade-off between the FTA flexibility and CU coordination benefits, the possibility of multilateral negotiations, including a direct move to global free trade via zero tariffs, was assumed away. Indeed, this matches the contrast between the extraordinary proliferation of PTAs since the mid 1990 and the complete failure of the current Doha round of multilateral negotiations. Nevertheless, with some minor modifications, my main results are quite robust to allowing multilateral negotiations. Moreover, doing so helps link the analysis to the recent literature on the role of PTAs as building blocs or stumbling blocs to global free trade (see, e.g., Saggi and Yildiz (2010), Saggi et al. (2013) and Lake (2016)).

To model multilateral negotiations, suppose each period has a stage 0 where countries sequentially announce whether they want to participate in multilateral negotiations. If all countries announce in favor, multilateral negotiations take place with the outcome being the tariff vector that maximizes the three-country joint government payoff subject to any zero tariffs associated with pre-existing PTAs.[22,23] That is, multilateral negotiations determine the *external* tariffs outside PTAs. Regardless of whether multilateral negotiations take place in stage 0, countries then have the opportunity to form PTAs in stage 1 as in earlier sections.

Nevertheless, in equilibrium, multilateral negotiations do not emerge after an initial PTA. In the perfect competition models, i.e. the competing exporter (CX) and competing importer (CM) models, multilateral negotiations yield global free trade because this maximizes world welfare. Thus, the FTA insider-turned-hub blocks multilateral negotiations either at the FTA insider-outsider network or the hub-spoke network to protect the sole preferential access it enjoys, albeit temporarily, as the hub. Moreover, CU insiders block multilateral negotiations at the CU insider-outsider network. In the imperfect competition models, i.e. the oligopoly and political economy oligopoly (PEO) models, multilateral negotiations can yield positive

[21] While asymmetry means l would ideally like to form an FTA with m, m can credibly reject such a proposal knowing l would accept a CU proposal in stage 2.

[22] When a country is indifferent between announcing in favor or against multilateral negotiations, I assume it announces against. This can be motivated by an arbitrarily small cost cost involved with participating in multilateral negotiations.

[23] The sequential nature here merely removes the multiple equilibria problem that would arise with simultaneous announcements. The sequence in which players make announcements is completely irrelevant.

tariffs because imperfect competition and political economy motivations imply global free trade need not maximize national welfare nor the three-country joint government payoff. Nevertheless, multilateral negotiations yield global free trade in the oligopoly model and either global free trade or the pre-existing external tariffs in the PEO model.[24] Thus, again, multilateral negotiations do not take place after an initial PTA.

Do multilateral negotiations take place prior to any PTAs having formed? In models with a CU exclusion incentive, i.e. the CM and PEO models, the answer is no. When the CU coordination benefit dominates the FTA flexibility benefit, CU insiders block multilateral negotiations, becoming permanent CU insiders. When the FTA flexibility benefit dominates the CU coordination benefit, the FTA insider-turned-hub blocks multilateral negotiations, becoming the hub on the path to global free trade.

In models without a CU exclusion incentive, i.e. the CX and oligopoly models, multilateral negotiations take place if and only if

$$v_l\left(g_{sl}\right)+\delta v_l\left(g_l^H\right)+\frac{\delta^2}{1-\delta}v_l\left(g^{FT}\right)>\frac{1}{1-\delta}v_l\left(g^{FT}\right)\Leftrightarrow\delta>\tilde{\delta}\left(\alpha\right)\equiv\frac{v_l\left(g^{FT}\right)-v_l\left(g_{sl}\right)}{v_l\left(g_l^H\right)-v_l\left(g^{FT}\right)}. \quad (5)$$

When $\delta>\tilde{\delta}\left(\alpha\right)$, there is sufficient weight on the FTA flexibility benefit, and the sole preferential access to each spoke country as the hub, that the FTA insider-turned-hub blocks multilateral negotiations and becomes the FTA insider-turned-hub on the path to global free trade. But, multilateral negotiations take place when $\delta<\tilde{\delta}\left(\alpha\right)$. Indeed, in this case, multilateral negotiations yield zero tariffs and, hence, global free trade.

Proposition 3 summarizes these findings.

Proposition 3 *Consider the four trade models from Section 2 under symmetry or sufficiently low asymmetry. In equilibrium, multilateral negotiations never take place after the formation of an initial PTA and multilateral negotiations take place prior to any PTAs only if (i) countries do not hold a CU exclusion incentive and (ii) δ exceeds a threshold $\tilde{\delta}\left(\alpha\right)$. When multilateral negotiations take place in equilibrium, the result is global free trade.*

Proposition 3 implies the possibility of multilateral negotiations only affects the equilibrium outcome in the CX or oligopoly model. Further, in these models, multilateral negotiations only affect the equilibrium when $\delta<\tilde{\delta}\left(\alpha\right)$ and, if they take place, lead directly to global

[24] To be clear, I only consider negotiation over tariffs which is consistent with real world multilateral negotiations. In the oligopoly model, unconstrained multilateral negotiations would actually yield an import subsidy. In the political economy oligopoly model, the first order conditions actually characterize a minimum rather than a maximum. Thus, the multilaterally negoitiated tariffs are either zero or the pre-existing external tariffs.

free trade. To compare this equilibrium structure to that in Section 3, note that $\delta < \tilde{\delta}(\alpha)$ can be written as a special case of $\delta \notin \left(\underline{\delta}_{l,m}(\alpha), \bar{\delta}_{l,m}(\alpha)\right)$ where $\bar{\delta}_{l,m}(\alpha) \equiv 1$ and $\underline{\delta}_{l,m}(\alpha) \equiv \tilde{\delta}(\alpha)$. Thus, like Section 3, a path of FTAs leading to global free trade emerges when $\delta \in \left(\underline{\delta}_{l,m}(\alpha), \bar{\delta}_{l,m}(\alpha)\right)$. However, unlike Section 3, a direct move to global free trade rather than CU expansion to global free trade emerges when $\delta \notin \left(\underline{\delta}_{l,m}(\alpha), \bar{\delta}_{l,m}(\alpha)\right)$.

Three results summarize the implications for the building bloc-stumbling bloc issue. First, PTAs are neither building blocs nor stumbling blocs in the CX and oligopoly models. In a hypothetical world without PTAs, multilateral negotiations would always be successful and would yield global free trade. But, in a world with multilateral negotiations and PTAs, PTAs eventually yield global free trade.

However, in the CM and PEO models with multilateral negotiations and PTAs, PTAs yield global free trade only if FTAs emerge in equilibrium. Alternatively, in these models, CUs undermine global free trade. Hence, the second result is that, if CUs were the only type of PTA, PTAs would be stumbling blocs in the CM and PEO models. This follows upon noting that, in the absence of PTAs, multilateral negotiations would be successful and yield global free trade in the CM and PEO models.[25]

Third, FTAs can mitigate the negative role of CUs. Specifically, FTAs emerge in equilibrium and lead to global free trade when $\delta \in \left(\underline{\delta}_{l,m}(\alpha), \bar{\delta}_{l,m}(\alpha)\right)$. Thus, when $\delta \in \left(\underline{\delta}_{l,m}(\alpha), \bar{\delta}_{l,m}(\alpha)\right)$, PTAs are neither building nor stumbling blocs in the CM and PEO models yet PTAs are stumbling blocs *if* CUs are the only type of PTA. Together, the second and third results highlight the importance of endogenizing the choice between FTAs and CUs. They also highlight the importance of the forward looking motivations underlying my dynamic model. Using the CM model in a static environment like Missios et al. (2014), one would conclude that PTAs were stumbling blocs even when endogenizing the choice between FTAs and CUs. However, in my dynamic environment, FTAs rather than CUs can endogenously emerge in the equilibrium of the CM model and thereby neutralize the stumbling bloc role of PTAs.

4.2 Alternative protocols

In an early paper explicitly modeling the sequential nature of FTA formation, Aghion et al. (2007) assume a leader country makes sequential take it or leave it offers to two follower countries but the two follower countries cannot make offers themselves. On one hand, my protocol is more general by giving each country the opportunity to make a proposal if

[25] As already noted, a corner solution (either zero tariffs or the pre-existing external tariffs) characterizes the multilaterally negotiated tariffs in the PEO model because the FOCs characterize a minimum rather than a maximum. For the range of b that satisfies Conditions 1-2, the multilaterally negotiated tariffs are zero in the subgame at $\varnothing$.

(larger) countries earlier in the protocol elect to make no proposal or other countries reject their proposals. On the other hand, given Aghion et al. (2007) motivate their leader as a large country like the US, their protocol is similar to mine in that larger countries have an earlier opportunity to make proposals relative to smaller countries.

Nevertheless, the following modified protocol would be closer to that of Aghion et al. (2007): in stage 1 of each period, country l makes a proposal; if a recipient country rejects country l's proposal in stage 1 then country l can make a proposal in stage 2 to the country that did not reject the proposal; if no agreement is reached in stage 2 then country m can make a proposal to country s in stage 3. It is easy to see the trade-off between the FTA flexibility benefit and CU coordination benefit still shape the equilibrium type of PTA. In particular, FTA formation arises if and only if countries view the FTA flexibility benefit as dominating the CU coordination benefit. The non-trivial part of this result is FTA formation when the FTA flexibility benefit dominates the CU coordination benefit. In the subgame at the empty network, l will propose an FTA with m in stage 1 and m will accept. m accepts because rejection merely leads to an FTA between l and s in stage 2. s would accept such an FTA proposal from l anticipating that it would be forced to accept an FTA proposal from m in stage 3. Thus, the equilibrium path of network formation would be $\varnothing \to g_{ml} \to g_l^H \to g^{FT}$. Therefore, the key insight from Proposition 2 remains under this alternative protocol.

Aghion et al. (2007) naturally motivate the leader country as a large country like the US. Indeed, recent evidence from Baier et al. (2014) gives strong empirical motivation to this modeling approach. Put simply, Baier et al. (2014) argue that countries with larger joint gains from PTA formation actually form PTAs earlier than countries with smaller joint gains from PTA formation. In common trade models, the joint member surplus from PTA formation is generally larger when PTA formation occurs between "more attractive" countries. That is, $[v_i(g+ij)+v_j(g+ij)]-[v_i(g+ik)+v_k(g+ik)]$ is proportional to $\alpha_j-\alpha_k$.[26] This suggests modeling larger countries as proposing earlier in the protocol.

Indeed, the main result of Proposition 2, i.e. FTA formation emerges if and only if the FTA flexibility benefit dominates the CU coordination benefit, holds as long as country l is not the last proposer and country s is not the first proposer. To see this, suppose countries view the FTA flexibility benefit as dominating the CU coordination benefit and consider the subgame at the empty network. First, suppose country l is the first proposer and, to avoid the case of prior sections, suppose s is the second proposer and m is the third proposer. Then, l proposes an FTA with m who accepts based on anticipation it will be left out of s's

[26] It is simple to show that, in the four models considered in this paper, there is only one exception to this statement. At the FTA insider-oustider network in the competing importers model with market size asymmetry, the FTA between the FTA outsider and the smaller FTA insider gives a larger joint member surplus than the FTA between the FTA outsider and the larger FTA insider.

proposal in stage 2. That is, the equilibrium path of networks is $\varnothing \rightarrow g_{ml} \rightarrow g_l^H \rightarrow g^{FT}$ if m and s switch places in the protocol of prior sections. Second, suppose l is the second proposer and m is the first proposer. Then, m proposes an FTA with s. Again, s accepts the proposal based on anticipation it will be left out of l's proposal in stage 2. That is, the equilibrium path of networks is $\varnothing \rightarrow g_{sm} \rightarrow g_m^H \rightarrow g^{FT}$ if m and l switch places in the protocol of prior sections. Thus, slight perturbations of the protocol ordering do not alter the key insight of the paper: when countries are asymmetric, FTA formation emerges in equilibrium if and only if the FTA flexibility benefit dominates the CU coordination benefit.

5 Conclusion

Since the early 1990s, the number of PTAs has expanded exponentially. However, while some influential PTAs are CUs, the vast majority of PTAs are FTAs. Indeed, as of February 2013, 164 out of the 169 PTAs notified to the WTO under GATT Article XXIV since 2000 were FTAs.[27] This is surprising given that CU members coordinate on common external tariffs. Indeed, dating back to Kennan and Riezman (1990), the literature has long recognized this coordination benefit of CUs. To this end, Melatos and Woodland (2007, p.904) state that "... the apparent inconsistency between the observed popularity of free trade areas [FTAs] and the theoretical primacy of customs unions..." remains an unresolved issue and Facchini et al. (2012, p.136) state "... the existing literature has indicated that CUs are... the optimal form of preferential agreements [for members].".

Recent papers have examined broad notions of flexibility and coordination. For those endogenizing the choice between FTAs and CUs, the coordination-flexibility trade-off tension relied on either (i) the impact of uncertainty on static tariff setting motivations, (ii) countries entering or leaving the world trading system or (iii) transfers. My dynamic model has none of these features. In my model, the FTA flexibility benefit emerges because individual FTA members have the flexibility to form their own subsequent agreements whereas, due to CU common external tariffs, CU members must jointly engage in future agreements. However, the joint approval required from CU members for CU expansion creates a valuable joint authority motive for CU formation when CU members benefit from excluding the non-member from CU expansion. Further, the coordination of external tariffs by CU members provides a myopic coordination benefit. The trade-off between the FTA and CU coordination benefit, which consists of a myopic CU coordination benefit and a forward looking joint authority motive, shape the equilibrium type of PTA.

The key insight of the paper is that an FTA flexibility benefit can help rationalize the

[27] http://rtais.wto.org/UI/PublicMaintainRTAHome.aspx

real-world prevalence of FTAs relative to CUs. When the FTA flexibility benefit outweighs the CU coordination benefit, FTAs can emerge in equilibrium. Under symmetry, this is a necessary but not sufficient condition for FTAs in equilibrium. However, under asymmetry, even arbitrarily small degrees thereof, this is a necessary and sufficient condition for FTAs in equilibrium. Therefore, the somewhat weaker result under symmetry rests entirely on the knife edge nature of symmetry and, ultimately, the model suggests the FTA flexibility benefit could be a central reason behind the real world prevalence of FTAs relative to CUs. The dynamic nature of the model is crucial to this result and explains why endogenizing the choice between CUs and FTAs in the static model of Missios et al. (2014) would always yield CUs in equilibrium. In other words, fundamentally different economic mechanisms drive my results relative to Missios et al. (2014).

By extending the model to include a stage of global free trade negotiations, the analysis relates to the long standing building bloc–stumbling bloc issue. The insight here is that FTAs may emerge in equilibrium and lead to global free trade even in settings where CUs would act as stumbling blocs and prevent global free trade if they were the only type of PTA. This possibility arises because of the FTA flexibility benefit and reflects a subtle but potentially important way in which FTAs mitigate the destructive role of CU members excluding non-members from future expansion. Moreover, this possibility also emphasizes the importance of endogenizing the choice between FTAs and CUs.

Appendix

A Welfare expressions and optimal tariffs

In what follows, I present the following for each model described in Section 2.2: consumer surplus, producer surplus and firm profits for arbitrary tariffs and the network dependent optimal tariffs.

Competing exporters model under symmetry.

$CS_i = \frac{1}{6}\left\{\left[2e-(t_{ih}+t_{ih'})\right]^2+\sum_{h\neq i,h\neq h'}\left[2e-(t_{hh'}-2t_{hi})\right]^2\right\}$,

$PS_i = \frac{1}{3}e\sum_{h\neq i,h\neq h'}\left[3\bar{d}-2e+t_{hh'}-2t_{hi}\right]$,

$TR_i = \frac{1}{3}\sum_{h\neq i,h\neq h'} t_{ih}\left(e-2t_{ih}+t_{ih'}\right)$,

$t_{ij}(\varnothing) = t_{ik}(\varnothing) = \frac{e}{8}$, $t_{ik}(g_{ij}) = \frac{e}{11}$, $t_{ki}(g_{ij}) = t_{kj}(g_{ij}) = t_k(\varnothing)$, $t_{jk}\left(g_i^H\right) = t_{jk}(g_{ij})$, $t_{ik}\left(g_{ij}^{CU}\right) = \frac{e}{5}$, $t_{ki}\left(g_{ij}^{CU}\right) = t_{ki}(\varnothing)$.

Competing exporters model with market size asymmetry.

$CS_i = \frac{1}{6}\left\{\left[2e+2\bar{d}_i-\bar{d}_h-\bar{d}_{h'}-(t_{ih}+t_{ih'})\right]^2+\sum_{h\neq i,h\neq h'}\left[2e+2\bar{d}_i-\bar{d}_h-\bar{d}_{h'}-(t_{hh'}-2t_{hi})\right]^2\right\}$,

$PS_i = \frac{1}{3}e\sum_{h\neq i,h\neq h'}\left[\bar{d}_i+\bar{d}_j+\bar{d}_k-2e+t_{hh'}-2t_{hi}\right]$,

$TR_i = \frac{1}{3}\sum_{h\neq i,h\neq h'} t_{ih}\left(e+\bar{d}_i+\bar{d}_{h'}-2\bar{d}_h-2t_{ih}+t_{ih'}\right)$,

$t_{ij}(\varnothing) = t_{ik}(\varnothing) = \frac{1}{8}\left[2e+2\bar{d}_i-\left(\bar{d}_j+\bar{d}_k\right)\right]$, $t_{ik}(g_{ij}) = \frac{1}{11}\left[e+\bar{d}_i+4\bar{d}_j-5\bar{d}_k\right]$, $t_{ki}(g_{ij}) = t_{kj}(g_{ij}) = t_k(\varnothing)$, $t_{jk}\left(g_i^H\right) = t_{jk}(g_{ij})$, $t_{ik}\left(g_{ij}^{CU}\right) = \frac{1}{5}\left[e+\bar{d}_i+\bar{d}_j-2\bar{d}_k\right]$, $t_{ki}\left(g_{ij}^{CU}\right) = t_{ki}(\varnothing)$.

Competing exporters model with endowment asymmetry.

$CS_i = \frac{1}{6}\left\{\left[e_j+e_k-(t_{ih}+t_{ih'})\right]^2+\sum_{h\neq i,h\neq h'}\left[e_i+e_h-(t_{hh'}-2t_{hi})\right]^2\right\}$,

$PS_i = \frac{1}{3}e_i\sum_{h\neq i,h\neq h'}\left[3\bar{d}-e_i-e_{h'}+t_{hh'}-2t_{hi}\right]$,

$TR_i = \frac{1}{3}\sum_{h\neq i,h\neq h'} t_{ih}\left(2e_h-e_{h'}-2t_{ih}+t_{ih'}\right)$,

$t_{ij}(\varnothing) = t_{ik}(\varnothing) = \frac{e_j+e_k}{8}$, $t_{ik}(g_{ij}) = \frac{5e_k-4e_j}{11}$, $t_{ki}(g_{ij}) = t_{kj}(g_{ij}) = t_k(\varnothing)$, $t_{jk}\left(g_i^H\right) = t_{jk}(g_{ij})$, $t_{ik}\left(g_{ij}^{CU}\right) = \frac{2e_k-e_j}{5}$, $t_{ki}\left(g_{ij}^{CU}\right) = t_{ki}(\varnothing)$.

Competing exporters model with economic size asymmetry.

$CS_i = \frac{1}{2}\theta_i\left\{\left[1-\frac{\theta_i+t_{ij}\theta_j+t_{ik}\theta_k}{\theta_i+\theta_j+\theta_k}\right]^2+\sum_{h\neq i,h\neq h'}\left[1-\frac{\theta_h+t_{hi}\theta_i+t_{hh'}\theta_{h'}}{\theta_i+\theta_j+\theta_k}+t_{hi}\right]^2\right\}$,

$PS_i = \theta_i\sum_{h\neq i,h\neq h'}\left(\frac{t_{hi}\theta_i+t_{hh'}\theta_{h'}+\theta_h}{\theta_i+\theta_j+\theta_k}-t_{hi}\right)$,

$TR_i = \sum_{h\neq i,h\neq h'} t_{ih}\theta_h\left(\frac{\theta_i+t_{ih}\theta_h+t_{ih'}\theta_{h'}}{\theta_i+\theta_j+\theta_k}-t_{ih}\right)$,

$t_{ij}(\varnothing) = t_{ik}(\varnothing) = \frac{\theta_i}{2\theta_i+\theta_j+\theta_k}$, $t_{ik}(g_{ij}) = \frac{\theta_i^2}{2(\theta_i+\theta_j)^2+\theta_k(\theta_i+2\theta_j)}$, $t_{ki}(g_{ij}) = t_{kj}(g_{ij}) = t_k(\varnothing)$, $t_{jk}\left(g_i^H\right) = t_{jk}(g_{ij})$, $t_{ik}\left(g_{ij}^{CU}\right) = t_{jk}\left(g_{ij}^{CU}\right) = \frac{\theta_i\theta_j}{2(\theta_i+\theta_j)+\theta_k}$, $t_{ki}\left(g_{ij}^{CU}\right) = t_{ki}(\varnothing)$

Competing importers model under symmetry.

$CS_i = \frac{1}{2}\left\{\left[\frac{(3+\lambda)\bar{d}+2(t_{hi}+t_{h'i})}{\lambda+6}\right]^2+\sum_{h\neq i,h\neq h'}\left[\frac{(3+\lambda)\bar{d}+2t_{h'h}-(4+\lambda)t_{ih}}{\lambda+6}\right]^2\right\}$,

$PS_i = \frac{1}{2}\left\{\frac{(1+\lambda)\left[3\bar{d}-2(t_{hi}+t_{h'i})\right]^2}{(\lambda+6)^2}+\sum_{h\neq i,h\neq h'}\frac{\left[3\bar{d}-2t_{h'h}+(4+\lambda)t_{ih}\right]^2}{(\lambda+6)^2}\right\}$,

$TR_i = \sum_{h\neq i,h\neq h'} t_{ih}\frac{\lambda\bar{d}-2(4+\lambda)t_{ih}+4t_{h'h}}{\lambda+6}$,

$t_{ij}(\varnothing) = \frac{\bar{d}\lambda}{\lambda^2+12\lambda+28}$, $t_{ik}(g_{ij}) = t_{ik}(\varnothing)$, $t_{ki}(g_{ij}) = \frac{\bar{d}\lambda}{(\lambda+8)(\lambda+4)}$, $t_{jk}\left(g_i^H\right) = t_{jk}(g_{ik})$, $t_{ik}\left(g_{ij}^{CU}\right) = t_{ik}(\varnothing)$, $t_{ki}\left(g_{ij}^{CU}\right) = t_{ki}(g_{ij})$.

Competing importers model with market size asymmetry.

$CS_i = \frac{1}{2}\left\{\left[\frac{(4+\lambda)\bar{d}_i+\bar{d}_j+\bar{d}_k+2(t_{hi}+t_{h'i})}{\lambda+6}\right]^2+\sum_{h\neq i,h\neq h'}\left[\frac{(4+\lambda)\bar{d}_i+\bar{d}_j+\bar{d}_k+2t_{h'h}-(4+\lambda)t_{ih}}{\lambda+6}\right]^2\right\}$,

$PS_i = \frac{1}{2}\left\{\frac{(1+\lambda_i)\left[\bar{d}_i+\bar{d}_j+\bar{d}_k-2(t_{hi}+t_{h'i})\right]^2}{(\lambda+6)^2}+\sum_{h\neq i,h\neq h'}\frac{\left[\bar{d}_i+\bar{d}_j+\bar{d}_k-2t_{h'h}+(4+\lambda)t_{ih}\right]^2}{(\lambda+6)^2}\right\}$,

$TR_i = \sum_{h\neq i,h\neq h'} t_{ih}\frac{(2+\lambda)\bar{d}_i-\bar{d}_j-\bar{d}_k-2(4+\lambda)t_{ih}+4t_{h'h}}{\lambda+6}$,

$t_{ij}(\varnothing) = \frac{\bar{d}_i\left(20+10\lambda+\lambda^2\right)-2(\lambda+6)\bar{d}_j-2(\lambda+4)\bar{d}_k}{\left(\lambda^2+12\lambda+28\right)(\lambda+6)}$, $t_{ik}(g_{ij}) = t_{ik}(\varnothing)$, $t_{ki}(g_{ij}) = \frac{(\lambda+4)\bar{d}_k-2\left(\bar{d}_i+\bar{d}_j\right)}{(\lambda+8)(\lambda+4)}$, $t_{jk}\left(g_i^H\right) = t_{jk}(g_{ik})$, $t_{ik}\left(g_{ij}^{CU}\right) = t_{ik}(\varnothing)$, $t_{ki}\left(g_{ij}^{CU}\right) = t_{ki}(g_{ij})$.

Competing importers model with technology asymmetry.

$CS_i = \frac{1}{2}\left\{\left[\frac{(3+\lambda_i)\bar{d}+2(t_{hi}+t_{h'i})}{\lambda_i+6}\right]^2+\sum_{h\neq i,h\neq h'}\left[\frac{(3+\lambda_h)\bar{d}+2t_{h'h}-(4+\lambda)t_{ih}}{\lambda_h+6}\right]^2\right\}$,

$PS_i = \frac{1}{2}\left\{\frac{(1+\lambda_i)\left[3\bar{d}-2(t_{hi}+t_{h'i})\right]^2}{(\lambda_i+6)^2}+\sum_{h\neq i,h\neq h'}\frac{\left[3\bar{d}-2t_{h'h}+(4+\lambda_h)t_{ih}\right]^2}{(\lambda_h+6)^2}\right\}$,

$TR_i = \sum_{h\neq i,h\neq h'} t_{ih}\frac{\lambda_h\bar{d}-2(4+\lambda_h)t_{ih}+4t_{h'h}}{\lambda_h+6}$,

$t_{ij}(\varnothing) = \frac{\bar{d}\lambda_j}{\lambda_j^2+12\lambda_j+28}$, $t_{ik}(g_{ij}) = t_{ik}(\varnothing)$, $t_{ki}(g_{ij}) = \frac{\bar{d}\lambda_i}{(\lambda_i+8)(\lambda_i+4)}$, $t_{jk}\left(g_i^H\right) = t_{jk}(g_{ik})$, $t_{ik}\left(g_{ij}^{CU}\right) = t_{ik}(\varnothing)$, $t_{ki}\left(g_{ij}^{CU}\right) = t_{ki}(g_{ij})$.

Oligopoly model under symmetry.

$CS_i = \frac{1}{32}\left(3\bar{d} - t_{ij} - t_{ik}\right)^2$,

$PS_i = \frac{1}{16}\left[\left(\bar{d}_i + t_{ij} + t_{ik}\right)^2 + \sum_{h\neq i, h\neq h'}\left(\bar{d}_h + t_{hh'} - 3t_{hi}\right)^2\right]$,

$TR_i = \frac{1}{4}\left[\bar{d}_i\left(t_{ij}+t_{ik}\right) + 2t_{ij}t_{ik} - 3\left(t_{ij}^2 + t_{ik}^2\right)\right]$,

$t_{ij}(\varnothing) = t_{ik}(\varnothing) = \frac{1}{2}\frac{(3-b)\bar{d}}{5-7b}$, $t_{ik}(g_{ij}) = \frac{(3-b)\bar{d}}{21-23b}$, $t_{ki}(g_{ij}) = t_{kj}(g_{ij}) = t_k(\varnothing)$, $t_{jk}\left(g_i^H\right) = t_{jk}(g_{ij})$, $t_{ik}\left(g_{ij}^{CU}\right) = t_{jk}\left(g_{ij}^{CU}\right) = \frac{(5-b)\bar{d}}{19-23b}$, $t_{ki}\left(g_{ij}^{CU}\right) = t_{ki}(\varnothing)$.

Oligopoly model with market size asymmetry.

$CS_i = \frac{1}{32}\left(3\bar{d}_i - t_{ij} - t_{ik}\right)^2$,

$PS_i = \frac{1}{16}\left[\left(\bar{d}_i + t_{ij} + t_{ik}\right)^2 + \sum_{h\neq i, h\neq h'}\left(\bar{d}_h + t_{hh'} - 3t_{hi}\right)^2\right]$,

$TR_i = \frac{1}{4}\left[\bar{d}_i\left(t_{ij}+t_{ik}\right) + 2t_{ij}t_{ik} - 3\left(t_{ij}^2 + t_{ik}^2\right)\right]$,

$t_{ij}(\varnothing) = t_{ik}(\varnothing) = \frac{1}{2}\frac{(3-b)\bar{d}_i}{5-7b}$, $t_{ik}(g_{ij}) = \frac{(3-b)\bar{d}_i}{21-23b}$, $t_{ki}(g_{ij}) = t_{kj}(g_{ij}) = t_k(\varnothing)$, $t_{jk}\left(g_i^H\right) = t_{jk}(g_{ij})$, $t_{ik}\left(g_{ij}^{CU}\right) = t_{jk}\left(g_{ij}^{CU}\right) = \frac{1}{2}\frac{(5-b)\left(\bar{d}_i+\bar{d}_j\right)}{19-23b}$, $t_{ki}\left(g_{ij}^{CU}\right) = t_{ki}(\varnothing)$.

B Proofs

Proof of Lemma 1

Competing exporters model. Consider Condition 1. For part (i), $v_i(g_{ij}) - v_i(\varnothing)$, $v_i\left(g_i^H\right) - v_i(g_{ij})$, $v_i\left(g^{FT}\right) - v_i\left(g_i^H\right)$ and $v_i\left(g_{ij}^{CU}\right) - v_i(\varnothing)$ are proportional to e^2 and hence strictly positive. For part (ii), $v_i\left(g_{ij}^{CU}\right) - v_i(g_{ij}) \propto e^2 > 0$. For part (iii), $v_i\left(g_{ij}^{CU}\right) - v_i\left(g_{jk}^{CU}\right) \propto e^2 > 0$. For part (iv), $v_i\left(g_{ij}^{CU}\right) - v_i\left(g^{FT}\right) \propto -e^2 < 0$.

Now consider Condition 2. For part (i), $\underline{\delta} \approx 0.313$ and $\bar{\delta} = 1$. For part (ii), $v_i\left(g_j^H\right) + \frac{\delta}{1-\delta}v_i\left(g^{FT}\right) > \frac{1}{1-\delta}v_i(g_{jk})$ for $\delta \gtrsim 0.3275$. Hence, part (ii) does not hold for $.313 \lesssim \delta \lesssim .328$. Given the absence of a CU exclusion incentive, part (iii) holds for all δ because $\left[v_i(g_{ij}) - v_i\left(g_{jk}^{CU}\right)\right] + \delta\left[v_i\left(g_i^H\right) - v_i\left(g^{FT}\right)\right] \propto e^2 > 0$. Part (iv) holds by part (i).

Oligopoly model. Consider Condition 1. For part (i), $v_i(g_{ij}) - v_i(\varnothing)$, $v_i\left(g_i^H\right) - v_i(g_{ij})$, $v_i\left(g^{FT}\right) - v_i\left(g_i^H\right)$ and $v_i\left(g_{ij}^{CU}\right) - v_i(\varnothing)$ are proportional to $\bar{d}^2$ and hence strictly positive. For part (ii), $v_i\left(g_{ij}^{CU}\right) - v_i(g_{ij}) \propto \bar{d}^2 > 0$. For part (iii), $v_i\left(g_{ij}^{CU}\right) - v_i\left(g_{jk}^{CU}\right) \propto \bar{d}^2 > 0$. For part (iv), $v_i\left(g_{ij}^{CU}\right) - v_i\left(g^{FT}\right) \propto -\bar{d}^2 < 0$.

Now consider Condition 2. For part (i), $\underline{\delta} \approx 0.225$ and $\bar{\delta} = 1$. For part (ii), $v_i\left(g_j^H\right) + \frac{\delta}{1-\delta}v_i\left(g^{FT}\right) > \frac{1}{1-\delta}v_i(g_{jk})$ for $\delta \gtrsim 0.02$. Hence, part (ii) holds without qualification. Given the absence of a CU exclusion incentive, part (iii) holds for all δ because $\left[v_i(g_{ij}) - v_i\left(g_{jk}^{CU}\right)\right] + \delta\left[v_i\left(g_i^H\right) - v_i\left(g^{FT}\right)\right] \propto \bar{d}^2 > 0$. Part (iv) holds by part (i).

Political economy oligopoly model. Let $b = 0.356$ and consider Condition 1. Parts

(i)-(iii) are identical to that for the oligopoly model. But, for part (iv), $v_i\left(g_{ij}^{CU}\right)-v_i\left(g^{FT}\right)\propto \bar{d}^2<0$.

Now consider Condition 2. For part (i), $\underline{\delta}\approx 0.2957$ and $\bar{\delta}\approx 0.99$. For part (ii), $v_i\left(g_j^H\right)+\frac{\delta}{1-\delta}v_i\left(g^{FT}\right)>\frac{1}{1-\delta}v_i\left(g_{jk}\right)$ for $\delta\gtrsim 0.4568$. Hence, part (ii) does not hold for $.29\lesssim\delta\lesssim .457$. For part (iii), $v_i\left(g_{ij}\right)-v_i\left(g_{jk}^{CU}\right)\propto\bar{d}^2>0$ and $v_i\left(g^{FT}\right)-v_i\left(g_{jk}^{CU}\right)\propto\bar{d}^2>0$ but $v_i\left(g_j^H\right)-v_i\left(g_{jk}^{CU}\right)\propto-\bar{d}^2<0$. Nevertheless, part (iii) holds because, given the CU exclusion incentive, $\left[v_i\left(g_{ij}\right)-v_i\left(g_{ij}^{CU}\right)\right]+\delta\left[v_i\left(g_j^H\right)-v_i\left(g_{ij}\right)\right]+\delta^2\left[v_i\left(g^{FT}\right)-v_i\left(g_j^H\right)\right]\propto 0.0107-0.0196\delta+0.0364\delta^2>0$ for all $\delta\in(0,1)$. Part (iv) holds by part (i).

Competing importers model. Consider Condition 1. For part (i), $v_i\left(g_{ij}\right)-v_i\left(\varnothing\right)$, $v_i\left(g_i^H\right)-v_i\left(g_{ij}\right)$, $v_i\left(g^{FT}\right)-v_i\left(g_i^H\right)$ and $v_i\left(g_{ij}^{CU}\right)-v_i\left(\varnothing\right)$ are proportional to $\left(\bar{d}\lambda\right)^2$ and hence strictly positive. For part (ii), $v_i\left(g_{ij}^{CU}\right)-v_i\left(g_{ij}\right)=0$. For part (iii), $v_i\left(g_{ij}^{CU}\right)-v_i\left(g_{jk}^{CU}\right)\propto\left(\bar{d}\lambda\right)^2>0$. For part (iv), $v_i\left(g_{ij}^{CU}\right)-v_i\left(g^{FT}\right)\propto\left(\bar{d}\lambda\right)^2>0$.

Now consider Condition 2. For part (i), $\underline{\delta}=0$ and $\bar{\delta}\in(0,1)$. Part (ii) holds without qualification because $v_i\left(g_j^H\right)-v_i\left(g_{jk}\right)\propto\left(\bar{d}\lambda\right)^2>0$ and $v_i\left(g^{FT}\right)-v_i\left(g_{jk}\right)\propto\left(\bar{d}\lambda\right)^2>0$. Given the CU exclusion incentive, part (iii) hold for all δ because $v_i\left(g_{ij}\right)-v_i\left(g_{jk}^{CU}\right)=0$ but $v_i\left(g_j^H\right)-v_i\left(g_{jk}^{CU}\right)\propto\left(\bar{d}\lambda\right)^2>0$ and $v_i\left(g^{FT}\right)-v_i\left(g_{jk}^{CU}\right)\propto\left(\bar{d}\lambda\right)^2>0$. Part (iv) holds by part (i).■

Proof of Lemma 2

Given continuity of the payoff functions $v_i\left(g\right)$ in the degree of asymmetry (captured by $\bar{d}_h$, e_h, θ_h or λ_h for $h=s,m,l$ across the different models) then, for a given δ, there exists a range of asymmetry such that Condition 1(i)-(iv) and Condition 2(i)-(iv) hold under the qualifications described in Lemma 1.

This leaves part (v) of Condition 1. Letting $\alpha_j>\alpha_k$, it needs to be shown that $v_i\left(g_{ij}\right)-v_i\left(g_{ik}\right)>0$, $v_i\left(g_j^H\right)-v_i\left(g_k^H\right)>0$ and $v_i\left(g_{ij}^{CU}\right)-v_i\left(g_{ik}^{CU}\right)>0$. For the definitions of α_i, let: $\alpha_i\equiv\bar{d}_i$ under market size asymmetry, $\alpha_i\equiv\theta_i$ under economic size asymmetry, $\alpha_i\equiv\frac{1}{e_i}$ under endowment asymmetry, $\alpha_i\equiv\frac{1}{\lambda_i}$ under technology asymmetry when $\lambda<5$, and $\alpha_i\equiv\lambda_i$ under technology asymmetry when $\lambda>6$. Then, in each of the models with country asymmetry, $v_i\left(g_{ij}\right)-v_i\left(g_{ik}\right)\propto\left(\alpha_j-\alpha_k\right)>0$, $v_i\left(g_j^H\right)-v_i\left(g_k^H\right)\propto\left(\alpha_j-\alpha_k\right)>0$ and $v_i\left(g_{ij}^{CU}\right)-v_i\left(g_{ik}^{CU}\right)\propto\left(\alpha_j-\alpha_k\right)>0$.■

Proof of Lemma 3

Condition 1(i) implies $r_h\left(g_i^H,jk\right)=Y$ for $h=j,k$ and, in turn, $\rho_h\left(g_i^H\right)=jk$ for $h=j,k$. Thus, the equilibrium transition is $g_i^H\rightarrow g^{FT}$.■

Proof of Lemma 4

To begin, note that $V_i\left(g_i^H\right)>\max\left\{V_i\left(g_j^H\right),\frac{1}{1-\delta}v_i\left(g_{ij}\right)\right\}$ given $\delta\in\left(\underline{\delta},\bar{\delta}\right)$. $\delta\in\left(\underline{\delta},\bar{\delta}\right)$ implies $V_i\left(g_{ij}\right)\equiv v_i\left(g_{ij}\right)+\delta v_i\left(g_i^H\right)+\frac{\delta^2}{1-\delta}v_i\left(g^{FT}\right)>V_i\left(g_{ij}^{CU}\right)$ with the proof of Lemma 5 establishing $g_{ij}^{CU}\rightarrow g^{FT}$ if and only if $v_i\left(g^{FT}\right)>v_i\left(g_{ij}^{CU}\right)$. Thus, using Condition 1(ii),

$V_i(g_{ij}) > V_i\left(g_{ij}^{CU}\right)$ only if $V_i\left(g_i^H\right) > \frac{1}{1-\delta}\max\left\{v_i\left(g_{ij}^{CU}\right), v_i\left(g^{FT}\right)\right\}$. In turn, Condition 1(ii) implies $V_i\left(g_i^H\right) > \frac{1}{1-\delta}v_i(g_{ij})$. Moreover, Condition 1(i) implies $v_i\left(g_i^H\right) > v_i\left(g^{FT}\right) > v_i\left(g_j^H\right)$ and, in turn, $V_i\left(g_i^H\right) > V_i\left(g_j^H\right)$.

Suppose country k, the FTA outsider, is not the proposer in stage 1. Then, Condition 2(ii) implies $r_k(g_{ij}, hk) = Y$ for $h = i, j$. Thus, $V_h\left(g_h^H\right) > \max\left\{V_h\left(g_{h'}^H\right), \frac{1}{1-\delta}v_h(g_{hh'})\right\}$ for $h, h' = i, j$ and $h, h' = j, i$ implies $\rho_h(g_{ij}) = hk$ for $h = i, j$. In turn, the equilibrium transition is $g_{ij} \to g_i^H$ where country i is the proposer in stage 1.

Now suppose country k is the proposer in stage 1. $V_h\left(g_h^H\right) > \max\left\{V_h\left(g_{h'}^H\right), \frac{1}{1-\delta}v_h(g_{hh'})\right\}$ for $h, h' = i, j$ and $h, h' = j, i$ implies $r_h(g_{ij}, hk) = Y$ for $h = i, j$. But, symmetry implies $\rho_k(g_{ij}) = ik$ or $\rho_k(g_{ij}) = ij$. Thus, the equilibrium transitions are $g_{ij} \to g_i^H$ and $g_{ij} \to g_j^H$.■

Proof of Lemma 5

Let $v_i\left(g_{ij}^{CU}\right) > v_i\left(g^{FT}\right)$. Then, Condition 1(iv) implies $\rho_h\left(g_{ij}^{CU}\right) = \phi$ and $r_h\left(g_{ij}^{CU}, ijk^{CU}\right) = N$ for $h = i, j$ in any stage. In turn, the equilibrium transition is $g_{ij}^{CU} \to g_{ij}^{CU}$. Now let $v_i\left(g^{FT}\right) > v_i\left(g_{ij}^{CU}\right)$. Then, given Condition 1(iii), $v_i\left(g^{FT}\right) > v_i\left(g_{ij}^{CU}\right) > v_i\left(g_{jk}^{CU}\right)$. Hence, given symmetry, $r_h\left(g_{ij}^{CU}, ijk^{CU}\right) = Y$ for any h and, in turn, $\rho_{h'}\left(g_{ij}^{CU}\right) = ijk^{CU}$ for any h' in any stage. Thus, the equilibrium transition is $g_{ij}^{CU} \to g^{FT}$.■

Proof of Proposition 1

In subgames at hub-spoke networks g_i^H, Lemma 3 says the equilibrium transition is $g_i^H \to g^{FT}$. In subgames at insider-outsider networks g_{ij}, Lemma 4 says that the equilibrium transition is $g_{ij} \to g_i^H$ when country i is the proposer in stage 1 and $\delta \in \left(\underline{\delta}, \bar{\delta}\right)$ but that the equilibrium transitions are $g_{ij} \to g_i^H$ and $g_{ij} \to g_j^H$ when country k is the proposer in stage 1 and $\delta \in \left(\underline{\delta}, \bar{\delta}\right)$. In subgames at CU insider-outsider networks g_{ij}^{CU}, Lemma 5 says the equilibrium transition is $g_{ij}^{CU} \to g_{ij}^{CU}$ if $v_i\left(g_{ij}^{CU}\right) > v_i\left(g^{FT}\right)$ but $g_{ij}^{CU} \to g^{FT}$ if $v_i\left(g^{FT}\right) > v_i\left(g_{ij}^{CU}\right)$.

Now roll back to the subgame at the empty network $\varnothing$ and let $\delta \in \left(\underline{\delta}, \bar{\delta}\right)$. First, consider stage 3. Lemma 4 says country s cannot become the hub. Note, $g_{ij}^{CU} \to g^{FT}$ iff $v_h\left(g^{FT}\right) > v_h\left(g_{ij}^{CU}\right)$ for $h = i, j, k$. Thus, Condition 1(i) implies $V_h(g_{sh}) > V_h\left(g_{sh}^{CU}\right) > \frac{1}{1-\delta}v_h(\varnothing)$ and $\max\left\{V_s(g_{sh}), V_s\left(g_{sh}^{CU}\right)\right\} > \frac{1}{1-\delta}v_s(\varnothing)$ for $h = m, l$. Hence, $r_h(\varnothing, sh) = Y$ and $r_h\left(\varnothing, sh^{CU}\right) = Y$ for $h = m, l$. In turn, given Conditions 1(i)-(ii), $\rho_s(\varnothing) = sh^{CU}$ for some $h = m, l$ because (i) if countries hold a CU exclusion incentive then $v_s\left(g_{sh}^{CU}\right) \geq \max\left\{v_s\left(g^{FT}\right), v_s\left(g_h^H\right), v_s(g_{sl}\right.$ for $h = m, l$ and with strict inequality for $v_s\left(g^{FT}\right)$ and $v_s\left(g_h^H\right)$, and (ii) if countries do not hold a CU exclusion incentive then $v_s\left(g_{sh}^{CU}\right) \geq v_s(g_{sh})$ and $v_s\left(g^{FT}\right) > v_s\left(g_h^H\right)$ for $h = m, l$. Thus, the equilibrium transition is $\varnothing \to g_{sh}^{CU}$ for some $h = m, l$ if stage 3 is attained.

Second, consider stage 2. Given the equilibrium outcome and the logic in stage 3, $r_s(\varnothing, sm) = N$. Given Lemma 4 specifies the equilibrium transition from g_{ml} as $g_{ml} \to g_l^H$ then $\delta \in \left(\underline{\delta}, \bar{\delta}\right)$ implies $r_l(\varnothing, ml) = Y$. But, the logic from stage 3 implies $r_h\left(\varnothing, mh^{CU}\right) = Y$

for $h = s, l$ and, in turn, $\rho_m(\varnothing) = mh^{CU}$ for some $h = s, l$. Thus, the equilibrium transition is $\varnothing \to g_{mh}^{CU}$ for some $h = s, l$ if stage 2 is attained.

Finally, consider stage 1. Given the equilibrium outcome and the logic in stage 2, $r_m(\varnothing, ml) = N$. If the equilibrium outcome in stage 2 is g_{ml}^{CU} then Condition 2(iii) implies $r_s(\varnothing, sl) = Y$ and, given $\delta \in \left(\underline{\delta}, \bar{\delta}\right)$, $\rho_l(\varnothing) = sl$ with the equilibrium path of networks being $\varnothing \to g_{sl} \to g_l^H \to g^{FT}$. If the equilibrium outcome in stage 2 is g_{sm}^{CU} then, given the logic from stage 3, $r_s(\varnothing, sl) = N$. In turn, $\rho_l(\varnothing) = hl^{CU}$ for some $h = s, m$ with the equilibrium path of networks being $\varnothing \to g_{hl}^{CU}$ for some $h = s, m$ if countries hold a CU exclusion incentive but $\varnothing \to g_{hl}^{CU} \to g^{FT}$ for some $h = s, m$ if countries do not hold a CU exclusion incentive.

Now consider the subgame at the empty network $\varnothing$ but let $\delta \notin \left(\underline{\delta}, \bar{\delta}\right)$. For stage 3, the logic from the $\delta \in \left(\underline{\delta}, \bar{\delta}\right)$ case follows here with $\varnothing \to g_{sh}^{CU}$ for some $h = m, l$ being the equilibrium transition if stage 3 is attained. For stage 2, similar logic from the $\delta \in \left(\underline{\delta}, \bar{\delta}\right)$ case follows here with $\varnothing \to g_{mh}^{CU}$ for some $h = s, l$ being the equilibrium transition if stage 2 is attained. For stage 1, $\delta \notin \left(\underline{\delta}, \bar{\delta}\right)$ implies country l prefers CU formation over FTA formation with symmetry implying indifference between g_{sl}^{CU} and g_{ml}^{CU}. Moreover, given the equilibrium outcome in stage 2, $r_h\left(\varnothing, hl^{CU}\right) = Y$ for $h = s, m$. Thus, $\rho_l(\varnothing) = hl^{CU}$ for some $h = s, m$ with the equilibrium path of networks being $\varnothing \to g_{hl}^{CU}$ for some $h = s, m$ if countries hold a CU exclusion incentive but $\varnothing \to g_{hl}^{CU} \to g^{FT}$ for some $h = s, m$ if countries do not hold a CU exclusion incentive.■

Proof of Lemma 6

Asymmetry only affects the proof of Lemma 4 when country k is the proposer in stage 1. $V_h\left(g_h^H\right) > \max\left\{V_h\left(g_{h'}^H\right), \frac{1}{1-\delta} v_h\left(g_{hh'}\right)\right\}$ for $h, h' = i, j$ and $h, h' = j, i$ still implies $r_h(g_{ij}, hk) = Y$ for $h = i, j$. But Condition 1(v) now implies $\rho_k(g_{ij}) = ik$ with the equilibrium transition being $g_{ij} \to g_i^H$.■

Proof of Proposition 2

In subgames at hub-spoke networks g_i^H, Lemma 3 says the equilibrium transition is $g_i^H \to g^{FT}$. In subgames at insider-outsider networks g_{ij}, Lemma 6 says the equilibrium transition is $g_{ij} \to g_i^H$ when $\delta \in \left(\underline{\delta}, \bar{\delta}\right)$. In subgames at CU insider-outsider networks g_{ij}^{CU}, Lemma 5 says the equilibrium transition is $g_{ij}^{CU} \to g_{ij}^{CU}$ if $v_i\left(g_{ij}^{CU}\right) > v_i\left(g^{FT}\right)$ but $g_{ij}^{CU} \to g^{FT}$ if $v_i\left(g^{FT}\right) > v_i\left(g_{ij}^{CU}\right)$.

Now roll back to the subgame at the empty network $\varnothing$ and let $\delta \in \left(\underline{\delta}_{l,m}(\alpha), \bar{\delta}_{l,m}(\alpha)\right)$. For stage 3, the proof follows that of Proposition 1 except that, due to asymmetry and Condition 1(v), $\rho_s(\varnothing) = sl^{CU}$ with the equilibrium transition being $\varnothing \to g_{sl}^{CU}$ if stage 3 is attained. For stage 2, the proof follows that of Proposition 1 except that, due to asymmetry and Condition 1(v), $\rho_m(\varnothing) = ml^{CU}$ with the equilibrium transition being $\varnothing \to g_{ml}^{CU}$ if stage

2 is attained. For stage 1, the proof follows that of Proposition 1 except that, given the equilibrium outcome in stage 2 is g_{ml}^{CU}, $\rho_m(\varnothing) = sl$ with the equilibrium transition being $\varnothing \to g_{sl}$. Thus, the equilibrium path of networks is $\varnothing \to g_{sl} \to g_l^H \to g^{FT}$.

Finally, consider the subgame at the empty network $\varnothing$ and let $\delta \notin \left(\underline{\delta}_{l,m}(\alpha), \bar{\delta}_{l,m}(\alpha)\right)$. The proof follows that of Proposition 1 except that, in each stage, the proposer country h proposes $\rho_h(\varnothing) = h'h^{CU}$ where $\alpha_{h'} > \alpha_{h''}$ for $h \neq h''$ due to Condition 1(v) with the equilibrium transition being $\varnothing \to g_{h'h}^{CU}$ if stage 3 is attained. Thus, the equilibrium path of networks is $\varnothing \to g_{ml}^{CU}$ if countries hold a CU exclusion incentive but is $\varnothing \to g_{ml}^{CU} \to g^{FT}$ if countries do not hold a CU exclusion incentive.■

Proof of Proposition 3

To begin, suppose countries are symmetric. In the competing exporter and competing importer models, the tariff vector $\tilde{t}$ that maximizes $\sum_i v_i(g)$, subject to any zero tariffs associated with pre-existing PTAs, is the vector of zero tariffs. The same is true in the oligopoly model subject to the constraint of non-negative tariffs. In the political economy model, the FOCs characterizing $\tilde{t}$ do not satisfy the SOC. Thus, with the additional constraint that tariffs cannot exceed pre-existing external tariffs, $\tilde{t}$ is either the vector of zero tariffs or the vector of pre-existing external tariffs.

Consider the competing importer, competing exporter or oligopoly models. Multilateral negotiations in stage 0 of any subgame at g yield $g \to g^{FT}$. In stages 1-3 of the subgame at g_i^H, $g_i^H \to g^{FT}$. Thus, given l's indifference, it blocks multilateral negotiations in stage 0. In the subgame at g_{ij}, with a transition of $g_{ij} \to g_i^H$ if stages 1-3 are reached, $V_i\left(g_i^H\right) > V_i\left(g^{FT}\right)$ implies i blocks multilateral negotiations. In the subgame at g_{ij}^{CU}, $\max\left\{v_i\left(g_{ij}^{CU}\right), v_i\left(g^{FT}\right)\right\} > v_i\left(g^{FT}\right)$ implies i blocks multilateral negotiations with $g_{ij}^{CU} \to g_{ij}^{CU}$ in the competing importers model but $g_{ij}^{CU} \to g^{FT}$ in the competing exporter and oligopoly models. In the subgame at $\varnothing$, $v_i\left(g_{ij}^{CU}\right) > v_i\left(g^{FT}\right)$ in the competing importers model and hence i blocks multilateral negotiations because $V_i\left(g_{ij}^{CU}\right) > V_i\left(g^{FT}\right)$. But, $v_i\left(g^{FT}\right) > v_i\left(g_{ij}^{CU}\right)$ in the competing exporters and oligopoly models and hence, letting the path of FTAs be $\varnothing \to g_{ij} \to g_i^H \to g^{FT}$, i blocks negotiations multilateral negotiations if and only if $V_i(g_{ij}) > V_i\left(g^{FT}\right) = \frac{1}{1-\delta} v_i\left(g^{FT}\right)$. This reduces to $\delta > \tilde{\delta}(\alpha)$.

Consider the political economy oligopoly model. In the subgame at g_i^H, multilateral negotiations yield the pre-existing vector of external tariffs. Thus, multilateral negotiations do not take place in stage 0 and, subsequently, $g_i^H \to g^{FT}$. In other subgames, multilateral negotiations yield global free trade. Thus, the analysis mirrors that of the previous paragraph. Multilateral negotiations do not take place after an initial PTA. And, given countries have a CU exclusion incentive, $\delta \lessgtr \tilde{\delta}(\alpha)$ governs whether multilateral negotiations take place in the subgame at $\varnothing$.

Given continuity of the payoff functions $v_i(g)$ in the degree of asymmetry (captured by $\bar{d}_h$, e_h, θ_h or λ_h for $h = s, m, l$ across the different models) then, the results under symmetry extend to sufficiently small degrees of asymmetry.■

References

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

Appelbaum, E., Melatos, M., 2013. How does uncertainty affect the choice of trade agreements? Mimeo.

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. W., 2010. Backward stealing and forward manipulation in the WTO. Journal of International Economics 82 (1), 49–62.

Baier, S. L., Bergstrand, J. H., Clance, M. W., 2014. Preliminary examination of heterogeneous effects of Free Trade Agreements. Mimeo.

Baier, S. L., Bergstrand, J. H., 2004. Economic determinants of free trade agreements. Journal of International Economics 64 (1), 29–63.

Bhagwati, J., 1991. The world trading system at risk. Princeton University Press.

Bond, E. W., Park, J.-H., 2002. Gradualism in trade agreements with asymmetric countries. Review of Economic Studies, 379–406.

Chen, M., Joshi, S., 2010. Third-country effects on the formation of Free Trade Agreements. Journal of International Economics 82 (2), 238–248.

Facchini, G., Silva, P., Willmann, G., 2012. The Customs Union issue: Why do we observe so few of them? Journal of International Economics 90, 136–147.

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.

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

Kennan, J., Riezman, R., 1990. Optimal tariff equilibria with customs unions. Canadian Journal of Economics, 70–83.

Lake, J., 2016. Free Trade Agreements as dynamic farsighted networks. Mimeo.

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

Melatos, M., Dunn, S., 2013. Flexibility in trade bloc design. Mimeo.

Melatos, M., Woodland, A., 2007. Endogenous trade bloc formation in an asymmetric world. European Economic Review 51 (4), 901–924.

Missios, P., Saggi, K., Yildiz, H., 2014. External trade diversion, exclusion incentives and the nature of preferential trade agreements. Mimeo.

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

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.

Riezman, R., 1999. Can bilateral trade agreements help to induce free trade? Canadian Journal of Economics 32 (3), 751–766.

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.

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

WTO, 2011. World Trade Report 2011. The WTO and preferential trade agreements: From co-existence to coherence.