# Preferential Trading Arrangements as Strategic Positioning*

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**Abstract**

We analyze a three-country model of trade negotiations in which countries can form bilateral free trade areas, customs unions or a trilateral preferential trading arrangement, and can continue negotiating after reaching an agreement. In contrast to the literature on multilateral bargaining, the set of agreements can form a (non-partitional) network; while in contrast to the network literature, players can reach multilateral agreements. We show that patient enough countries reach bilateral arrangements if and only if insiders gain more than outsiders; and we characterize conditions under which a hub and spoke pattern emerges. We also use variants on the model to explain why a US commitment not to bargain bilaterally sustained progress at GATT negotiations; and the rarity of open access preferential trading arrangements.

## 1. INTRODUCTION

GATT/WTO rules allow countries to form two sorts of preferential trading arrangements ('PTAs'): either customs unions like the EU or free trade areas like NAFTA. They also allow members of such PTAs to continue negotiating with outsiders: so customs unions like the EU can expand, and members of free trade areas can each join other such areas, as the US has recently done (with Chile and Singapore).

Members of a customs union necessarily set the same set of tariffs; so any member of an existing customs union can only join another PTA if the customs union breaks up or if all current members join the other PTA. Thus, if all PTAs were customs unions, then the set of countries would always be partitioned (into mutually exclusive coalitions): the 'position' would be partitional. Members of a free trade area do not coordinate their tariffs, and can therefore each join another PTA. The position could therefore be nonpartitional if

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countries formed free trade areas: including the hub and spoke patterns which characterize contemporary agreements.[1]

We present a model of trade negotiations which allows countries to form either customs unions or free trade areas, and to continue negotiations with fellow PTA members and outsiders. Our main contribution is a theory of the transitions which occur on the equilibrium path: that is, the dynamics of PTA formation in an environment which is otherwise stationary. We can predict, for example, when hub and spoke patterns are reached.

The model is extremely simple. There are three symmetric countries which negotiate by making sequential offers, specifying a bilateral or trilateral PTA which can feasibly be reached from the current position and a lump sum transfer to other members of the prospective PTA. Each country's payoff is the net present value of the returns it earns in each period. These returns consist of the transfers agreed with fellow members of a PTA and the utility which that country earns at the current position. In contrast to the literature on trade negotiations, we treat these utilities as primitive.

Global free trade can be reached either by a trilateral PTA (of either sort) or by a complete network of free trade areas. We suppose that the aggregate utility from global free trade exceeds that at any other position: an assumption which implies that global free trade is always reached eventually in our model. The question is: how fast, and by which route?

Our most striking results arise when customs unions and free trade areas are utility-equivalent: each member of a bilateral customs union earns the same utility as each member of a free trade area; and an outsider earns the same utility whether excluded from a customs union or a free trade area.[2] If countries are patient enough then transitions depend on whether formation of a PTA relatively favors members or the outsider? If members are the relative beneficiaries then a bilateral PTA forms in equilibrium, and then expands to take in the outsider; and a trilateral PTA forms immediately if the outsider is the relative beneficiary.[3]

The intuition for this result turns on the motive for forming bilateral PTAs when global free trade is efficient. Formation of such a PTA shifts the status quo, and thereby affects the distribution of gains from global free trade via the transfers which are subsequently agreed. In particular, the status quo shifts favorably if PTA members are its relative beneficiaries. We dub this new motive for forming PTAs: 'strategic positioning'. By contrast, the status quo shifts unfavorably if the outsider is a PTA's relative beneficiary; so no country has an incentive to delay global free trade by proposing formation of a bilateral PTA.

If countries are patient enough then, irrespective of utility-equivalence, one free trade area would be followed by another if the hub earns greater utility than the spokes. In such cases, the advantages of strategic positioning are dissipated by competition to be the

[1] At the time of writing, Chile, Mexico and Singapore are local hubs. See Baldwin (2004) on hub and spoke patterns in East Asia.

[2] This assumption abstracts away from the issues addressed in the literature on commercial policy, which is surveyed in Panagariya (2000).

[3] Note that we refer to *relative* beneficiaries. Our result does not rely on whether members are better off forming the PTA: the theme addressed by the literature on trade creation and diversion.

hub. Utility-equivalence then implies that members earn less when they form the first bilateral free trade area than when they form a bilateral customs union; so any initial PTA must be followed by a trilateral PTA in equilibrium. On the other hand, hub and spoke patterns are reached on the equilibrium path if the hub is the relative beneficiary and utility-equivalence fails, with members of a bilateral free trade area earning sufficiently more utility than members of a customs union.

Our model treats the utilities at each position as primitive; so our model applies to more general settings than trade negotiations. In contrast to the literature on multilateral bargaining, we allow players to reach nonpartitional agreements.[4] This, of course, extends the scope of this literature to many contexts other than trade negotiations. In contrast to the literature on network formation, we allow players to reach multilateral as well as bilateral agreements, and can therefore ask when bilateral links predominate? In further contrast, we adopt a dynamic approach, whereas the literature following Jackson and Wolinsky (1996) studies the stability of terminal states.[5] However, we also use our approach to address a couple of issues of particular importance in trade negotiations:

According to a literature initiated by Olson and Zeckhauser (1966), international public goods have only been provided by a hegemon which is prepared to incur an undue burden. Kindleberger (1986) and Bhagwati (1993) argue that this theory can explain why progress in post-war trade negotiations was typically achieved via GATT/WTO rounds before the mid-'80s, and via bilateral agreements thereafter: the trigger for regime change being the US's willingness to negotiate bilaterally, as of 1982. However, neither author explains why a US commitment to multilateral negotiations deterred other countries from forming PTAs. We use a variant of our model to answer this question. If all countries are prepared to negotiate bilaterally and PTA members are the relative beneficiaries then it is unprofitable to make a multilateral proposal, as every country must then be compensated for not exercising its outside option of forming a PTA. By contrast, only two countries need be compensated if one country is committed to multilateral agreements; and it is then profitable to make multilateral proposals. While this argument addresses the critique of the Kindleberger/Bhagwati thesis, it is inconsistent with the tenor of the related literature: for we show that the hegemonic role can be undertaken by any of the *symmetric* countries.

GATT/WTO rules allow countries to form closed or open access PTAs: entrants must secure the assent of existing members to join a closed access PTA, but can choose unilaterally whether to join an open access PTA. Several papers have argued that mandating open access would promote global free trade (cf. Yi (1996) and Bergsten (1997)). By contrast, we use a variant on our model to explain why no countries have formed an open access PTA under existing rules: open access bilateral PTAs are dominated by closed access bilateral PTAs if strategic positioning is advantageous; and are otherwise dominated by a

[4]See, in particular, Seidmann and Winter (1998), Hyndman and Ray (2004) and Gomes and Jehiel (forthcoming). Yi (1996) analyzes negotiations to form customs unions on the supposition that a country leaves the bargaining table after joining a customs union. Aghion et al. (2004) analyze a bargaining model in which a specified country is the sole proposer, and must choose ex ante whether it will make bilateral or multilateral proposals.

[5]Jackson (2004) surveys this literature. See, in particular Section 4 on solution concepts. Goyal and Joshi (2004) study the pattern of free trade agreements from this perspective, while Bloch and Jackson (2004) analyze network formation with transferable utility.

trilateral PTA.

In Section 2, we present our model of negotiating closed access PTAs, analyzing the model in Section 3. Sections 4 and 5 respectively develop variants on this model to explain the effects of a commitment to negotiate multilaterally and the rarity of open access PTAs. We conclude in Section 6.

# 2. CLOSED ACCESS GAME: MODEL

We present our benchmark model in this section, studying a 'closed access' game in which countries can only join a PTA with the assent of existing members. We divide the section into two parts. We present our model in Section 2.1, treating the utilities which countries receive as primitive. In Section 2.2, we present a simple example which allows us to determine these utilities from primitives.

## 2.1. Model

Three symmetric countries, denoted $i \neq j \neq k$, negotiate the formation of preferential trading arrangements ('PTAs') over an infinite number of periods, indexed by $t$. We allow for two feasible sorts of PTAs: customs unions ('CUs') and free trade areas ('FTAs'). Members of such a PTA eliminate tariffs on all intra-PTA trade; and members set a common tariff on any outsider in a customs union, and choose tariffs independently in a free trade area.

### Positions and transitions

The three countries can be configured in six patterns of PTAs, which we call 'positions'. We define the various sorts of position in Table 2.1.1 below:

| *Positions* | *PTAs* |
|---|---|
| $\Pi_0$ | No PTAs |
| $\Pi_1^{ij}(FTA)$ | An FTA between $i$ and $j$ |
| $\Pi_1^{ij}(CU)$ | A CU between $i$ and $j$ |
| $\Pi_2^i$ | A hub and spoke pattern of FTAs, with $i$ as the hub |
| $\Pi_3$ | A trilateral PTA |
| $\Pi_4$ | The complete network of 3 bilateral FTAs |

Table 2.1.1 Positions

A trilateral FTA is equivalent to a trilateral CU; so we treat them as a single position. It is useful to distinguish between positions $\Pi_3$ and $\Pi_4$ even though global free trade prevails at both positions.

Each period $t \geq 1$ is characterized by a prevailing position. The prevailing position in period 1 is assumed to be $\Pi_0$, and otherwise depends on negotiations in previous periods. We assume that the position can be changed at most once in a period. We also assume that a PTA can only form or grow with the consent of all members: a property which we describe as 'closed access'.[6]

These assumptions differentiate our model from the multi-player bargaining literatures:

- Papers in the network literature usually assume that a bilateral link can be broken unilaterally, but can only formed by mutual consent;
- In contrast to the coalitional bargaining literature, we allow for a nonpartitional position ($\Pi_2^i$);
- In contrast to Gomes and Jehiel (forthcoming) and Hyndman and Ray (2004), we assume that a PTA can neither break up nor change from an FTA to a CU or conversely. This assumption is unrestrictive in our three-country model, and simplifies exposition.[7]

Table 2.1.2 below specifies the (different) positions which can be reached from each prevailing position, and the countries whose consent is required for such a change (in brackets).

| Prevailing position | Reachable positions (consenting countries) |
|---|---|
| $\Pi_0$ | $\Pi_1^{ij}(FTA)$ $(\{i,j\})$, $\Pi_1^{ij}(CU)$ $(\{i,j\})$, $\Pi_3$ $(\{i,j,k\})$ |
| $\Pi_1^{ij}(FTA)$ | $\Pi_2^i$ $(\{i,k\})$, $\Pi_3$ $(\{i,j,k\})$ |
| $\Pi_1^{ij}(CU)$ | $\Pi_3$ $(\{i,j,k\})$ |
| $\Pi_2^i$ | $\Pi_3$ $(\{i,j,k\})$, $\Pi_4$ $(\{j,k\})$ |
| $\Pi_3$ | None |
| $\Pi_4$ | None |

Table 2.1.2 Transition matrix

**Time line**

Period $t$ starts with Nature's history-dependent selection of a proposer. If some country rejected an offer in period $t-1$ then the last country to reject is selected to propose in period $t$; if no country rejected in period $t-1$ then Nature selects each country as the period $t$ proposer with equal probability.[8]

The selected country then makes a proposal to one or both of the countries, specifying both a position which can be reached in one step with the consent of the proposer and the respondents, and a lump sum transfer to be paid in every subsequent period to each of the chosen respondents. The latter respond in sequence by accepting or rejecting the proposal. The period ends as soon as either a respondent rejects the proposal or all respondents have

[6] We analyze an 'open access' game in Section 5, where we allow countries to form PTAs which can be joined without the assent of current members.

[7] More precisely, the game would not exhibit any cycles if we allowed coalitions to break up.

[8] Our results do not rely, qualitatively, on this particular protocol: for example, we obtain analogous results if the proposer is randomly chosen each period, as in Okada (2000).

accepted the proposal. In the former case, the same position prevails in periods $t$ and $t+1$; in the latter case, the proposed new position prevails in period $t+1$.

Our assumption that countries can make transfers is crucial to our results, as PTAs can only be motivated by strategic positioning if there are several possible ways of dividing the gains from global free trade; but our results would still hold if transfers were not lump sum. While trade agreements rarely incorporate direct money transfers, both bilateral and multilateral agreements typically include nontrade issues. Furthermore, trade agreements rarely eliminate all intra-PTA tariffs immediately; and the transfers in our model could be interpreted as a choice of a path to free trade.[9]

We will use the phrase 'a subgame at new position $\Pi$' to describe any subgame which starts at the beginning of period $t$ immediately after the prevailing position has changed to $\Pi$, and before Nature has selected the period $t$ proposer.

**Payoffs**

In any period $t$, each country receives a return which is the sum of the net transfers to which it has agreed in periods up to and including $t$, and a utility which depends on the position at the end of period $t$. We normalize utilities such that each country earns a utility of 0 absent any PTAs, and earns a utility of 1 under global free trade. We define notation for utilities at each position in Table 2.1.3 below.

| Position | Country $i$ | Country $j$ | Country $k$ |
|---|---|---|---|
| $\Pi_0$ | 0 | 0 | 0 |
| $\Pi_1^{ij}(FTA)$ | $v^{FTA}$ | $v^{FTA}$ | $w^{FTA}$ |
| $\Pi_1^{ij}(CU)$ | $v^{CU}$ | $v^{CU}$ | $w^{CU}$ |
| $\Pi_2^{i}$ | $h$ | $s$ | $s$ |
| $\Pi_3$ and $\Pi_4$ | 1 | 1 | 1 |

Table 2.1.3 Utilities

Our assumption that countries receive the same utility under a complete network and a trilateral PTA suppresses the spaghetti bowl costs of a complete network. This assumption simplifies exposition without losing important generality.

In contrast to Bagwell and Staiger (1997), we de-emphasize the role of enforcement in determining transitions. However, our approach is complementary in the sense that the utilities associated with each position can be interpreted as equilibrium payoffs in unmodelled tariff-setting subgames.

We will focus on games in which aggregate utility under global free trade exceeds aggregate utility at any other position. Accordingly, we adopt the following assumption:

**Efficient Free Trade** $\max\{2v+w, h+2s\} < 3$

Efficient Free Trade implies that every efficient position is negative-externality-free in Gomes and Jehiel's (forthcoming) terms. While their bargaining model has a slightly

[9]See Bond and Park (2002) for an explanation of gradual adjustment of tariffs.

different protocol (random proposers), a simple variant on their argument establishes that every stable position is efficient (their Proposition 6).

Efficient Free Trade places upper bounds on the sum of utilities, but not on the utilities themselves. In particular, PTAs can be disadvantageous to their members (as in models of trade diversion), and can be advantageous to the outsider (as in Bond et al's (2004) model of free trade areas).

We sketch the new transitions which can occur if Efficient Free Trade fails in Remark 3, at the end of the next section.

Our results will turn on some simple conditions on the four parameters $\{h, s, v, w\}$. Accordingly, we will treat these parameters as primitive. However, it will prove convenient to track some conditions using a simple example, which we present in the next subsection.

We refer to games which satisfy the conditions above as 'closed access games'. Such multilateral bargaining games have a multiplicity of pure strategy subgame-perfect equilibria.[10] Accordingly, we follow the literature by using a version of stationary subgame perfection (aka Markov perfection) to characterize play. Specifically, we characterize those subgame perfect equilibria in which a country's proposal only depends on history via the prevailing position; and in which a country's response to any given proposal only depends on history via the proposer, the countries which have already accepted the proposal, and the prevailing position.[11] We refer to such strategy combinations as 'equilibria'.

Our results clearly generalize to games with asymmetric countries. Symmetry not only simplifies exposition, but also allows us to focus on a hegemon's strategic role in the Section 4 variant on this model.

### 2.2. Example

In this subsection, we use an example of a three good exchange economy to calculate values of the parameters $\{h, s, v, w\}$:

We suppose that each country is composed of a single consumer, who is endowed with the entire endowment of one good (normalized to one unit). We index the three goods, like countries, by $i$, $j$ and $k$. Consumption of good $j$ by consumer $i$ denoted by $x^i_j$.

In each period, consumer $i$ trades competitively, paying $p^i_j$ for good $j$. If countries $i$ and $j$ are members of the same PTA then consumer $i$ pays the international price of $P^j$ for the good; otherwise, trade between countries $i$ and $j$ is subject to an ad valorem tariff of $\tau > -1$: where $\tau$ is fixed, and independent of $i$ and $j$.[12] This assumption will imply that customs union and free trade areas are utility-equivalent, in the sense that they entail the same pattern of utilities. Accordingly, we identify positions $\Pi^{ij}_1(FTA)$ and $\Pi^{ij}_1(CU)$ in this subsection, writing both as $\Pi^{ij}_1$.

In any period, a consumer's return depends on consumption of the three goods and on money (lump sum) transfers - where net transfers to $i$ denoted by $m^i$. We assume that

[10] See, for example, Chatterjee et al. (1993).

[11] Stationarity excludes (inter alia) strategies which punish countries for rejecting previous offers.

[12] The assumption of a fixed tariff can be interpreted as equilibrium strategies in a tariff war game where countries are subject to the WTO rule that PTAs don't raise tariffs and equilibrium tariffs at $\Pi_0$ are high enough.

consumer i's preferences are represented by

$$\begin{aligned} u^i(x_1^i, x_2^i, x_3^i) &= A[\sum_{j=1}^{j=3} \log x_j^i - \log(1+\tau) + 3\log(3+\tau)] + m^i \\ \text{where } A &\equiv \frac{1}{3\log(3+\tau) - \log(1+\tau) - 3\log 3} > 0. \end{aligned}$$

We write consumer $i$'s income as $Y^i$, which is equal to $P^i$, the international price of good $i$, plus the tariffs country $i$ collects on consumer $i$'s purchases of goods $j$ and $k$. Consumer $i$'s demand for good $j$ then given by $x_j^i = Y^i/3p_j^i$. We now use this demand function to calculate each consumer's utility at every position.

At position $\Pi_0$, each country sets $\tau$ on all trade, so symmetry implies that world price of each good is 1. Solving for incomes yields $Y^i = \frac{3(1+\tau)}{3+\tau}$; so

$$x_j^i = \begin{cases} \frac{1+\tau}{3+\tau} : j = i \\ \frac{1}{3+\tau} : j \neq i \end{cases}$$

It is easy to confirm that country $i$'s utility is 0 at this position.

Now consider position $\Pi_1^{ij}$. In equilibrium, we must have $P^i = P^j \equiv P$, $Y^i = Y^j \equiv Y$ and $x_l^i = x_l^j \equiv x_l$ for every good $l$. Hence,

$$x_l = \begin{cases} \frac{Y}{3P} : l \neq k \\ \frac{Y}{3(1+\tau)P^k} : l = k \end{cases} \quad \text{and} \quad x_l^k = \begin{cases} \frac{Y^k}{3(1+\tau)P} : l \neq k \\ \frac{Y^k}{3P^k} : l = k \end{cases}$$

Substituting for incomes: $Y = \frac{3(1+\tau)}{3+2\tau}P$ and $Y^k = \frac{3(1+\tau)}{3+\tau}P^k$; and substituting back into the demand functions, we have:

$$x_l = \begin{cases} \frac{1+\tau}{3+2\tau} : l \neq k \\ \frac{1}{3+2\tau}\frac{P}{P^k} : l = k \end{cases} \quad \text{and} \quad x_l^k = \begin{cases} \frac{1}{3+\tau}\frac{P^k}{P} : l \neq k \\ \frac{1+\tau}{3+\tau} : l = k \end{cases}$$

Relative prices are determined by the market-clearing conditions. In particular, net aggregate demand for good $i$ equals 0:

$$\frac{2(1+\tau)}{3+2\tau} + \frac{1}{3+\tau}\frac{P^k}{P} = 1,$$

which implies that $\frac{P^k}{P} = \frac{3+\tau}{3+2\tau}$. Substituting into the demand functions and then into returns yields the following expressions for $v$ and $w$:

$$\begin{aligned} v &= A[\log(1+\tau) + 2\log(3+\tau) - 2\log(3+2\tau)] \text{ and} \\ w &= A[2\log(3+\tau) - 2\log(3+2\tau)] \end{aligned}$$

It is easy to confirm that $w < 0 < v < 1$ if $\tau > 0$; and that $v < 0 < 1 < w$ if $\tau < 0$. In other words, PTA members are the sole beneficiaries of a PTA which removes a positive tariff, while the outsider is the sole beneficiary of a PTA which removes a subsidy.

Now consider position $\Pi_2^i$ : In equilibrium, we must have $P^j = P^k \equiv P$, $Y^j = Y^k = \frac{3(1+\tau)}{3+2\tau}P$ and $Y^i = P^i$. The market-clearing conditions therefore imply that $\frac{P}{P^i} = \frac{3+2\tau}{3(1+\tau)}$. Substituting into the demand functions and then into returns yields the following expressions for $h$ and $s$:

$$h = A[3\log(3+\tau) + \log(1+\tau) - 2\log(3+2\tau) - \log 3]$$
$$s = A[3\log(3+\tau) - 2\log(3+2\tau) - \log 3]$$

It is easy to confirm that $h > 1 > v > s > w$ if $\tau > 0$; and that $w > s > v > h$ if $\tau < 0$.

Finally, each consumer buys $\frac{1}{3}$ of a unit of each good under global free trade, and therefore earns a utility of 1 at positions $\Pi_3$ and $\Pi_4$. It is easy to confirm that $h > 1$ if $\tau > 0$; and that $w > 1$ if $\tau < 0$.

The relative magnitudes of $v$ and $w$ will be crucial to our results below. Bond et al's (2004) model of an exchange economy with three tariff-setting governments illustrates how $v$ may exceed $w$ or conversely. The outsider always gains from formation of a free trade area (Proposition 5);[13] and the members lose if endowments of each good are distributed unequally enough (Table 1): so we have $w > 0 > v$. By contrast, members gain and the outsider loses from formation of a bilateral customs union.

## 3. CLOSED ACCESS GAME: RESULTS

In this section, we characterize equilibria of the game defined in Section 2. It will prove convenient to divide the analysis into three parts. In Section 3.1, we consider a special case of the game which satisfies the following restriction: if countries $i$ and $j$ form a bilateral PTA then the only feasible new PTA is trilateral. This condition is, of course, satisfied if every PTA must be a customs union. In Section 3.2, we characterize equilibria of a game in which every PTA must be a free trade area: so a member of a bilateral PTA cannot prevent its partner from forming another PTA with the outsider. Finally, in Section 3.3 we use our results to describe play in a game where countries can choose whether to form a customs union or a free trade area.

### 3.1. The customs union game

The distinguishing feature of this special case is the supposition that positions must be partitional: an assumption adopted throughout the literature on multilateral bargaining. Accordingly, we will refer to a bilateral PTA as a customs union. We simplify notation in this subsection by replacing $\Pi_1^{ij}(CU)$ with $\Pi_1^{ij}$, $v^{CU}$ with $v$, and $w^{CU}$ with $w$. The

[13] Kennan and Riezman (1990) Example B illustrates how this result could be reversed.

transition matrix in the CU game is

| Prevailing position | Reachable positions (consenting countries) |
|---|---|
| $\Pi_0$ | $\Pi_1^{ij}$ $(\{i,j\})$, $\Pi_3$ $(\{i,j,k\})$ |
| $\Pi_1^{ij}$ | $\Pi_3$ $(\{i,j,k\})$ |
| $\Pi_3$ | None |

Table 3.1.1 Transition matrix (CU game)

The model builds on the reversible action game presented in Seidmann and Winter (1998), extending their analysis by allowing for externalities.[14] The most closely related papers in the trade literature are Yi (1996) and Aghion et al. (2004). In Yi's unanimous regionalism model, transfers are unavailable, and PTA members cannot renegotiate their agreement. Aghion et al.assume that a prespecified country makes all of the offers, and that the game ends when an offer is rejected or when global free trade is reached.

Our first result characterizes equilibrium play after a CU has formed.

**Lemma 3.1** *The subgame which starts immediately after two countries have formed a customs union possesses a unique equilibrium in which both members receive an expected transfer of* $\frac{1}{3}(v-w)$.■

The proof of Lemma 3.1 uses arguments which are conventional in the bargaining literature, and is therefore omitted.

We now use Lemma 3.1 to characterize play when free trade is efficient:

**Theorem 3.1** *If*

$$(3-2d)v - dw > \frac{3(1-d)(3+4d)}{2(1+2d)}$$

*then, in every equilibrium of the closed access customs union game, a customs union forms in the first period and expands to global free trade in the second period. If*

$$(3-2d)v - dw < \frac{3(1-d)(3+4d)}{2(1+2d)}$$

*then the closed access game has a unique equilibrium in which the three countries agree to global free trade in the first period.*

**Proof**

In every equilibrium, the three countries choose pure, symmetric strategies such that an agreement is reached in the first period. Accordingly, we prove the result by providing necessary and sufficient conditions for existence of an equilibrium in which a customs union forms, and of an equilibrium in which all three countries agree to global free trade immediately. We start with the former case.

[14] Gomes and Jehiel (forthcoming) analyze a dynamic bargaining model with externalities, albeit with a slightly different protocol (= extensive form).

We claim that this game possesses an equilibrium in which each country proposes position $\Pi_1^{ij}$ and a transfer of $[\frac{d}{3(1+d)}w - \frac{3-2d}{3(1+d)}v - \frac{d}{1+d}]$ at prevailing position $\Pi_0$ if $(3-2d)v - dw > \frac{3(1-d)(3+4d)}{2(1+2d)}$. Lemma 3.1 implies that the proposer (say, country $i$) then earns $V^P \equiv \frac{2}{3(1-d^2)}[(3-2d)v - dw + 3d]$, while the respondent at position $\Pi_0$ earns $dV^P$. The transfer is calibrated such that the respondent at position $\Pi_0$ is indifferent between accepting and rejecting. If some country can profitably deviate then country $i$ can profitably deviate to proposing position $\Pi_3$ and a transfer which makes countries $j$ and $k$ indifferent between accepting and rejecting. It is easy to confirm that such a deviation is indeed profitable if and only if $(1+2d)V^P < \frac{3}{1-d}$. Substituting for $V^P$ and rearranging yields the first condition in the premise.

Now suppose that $(3-2d)v - dw < \frac{3(1-d)(3+4d)}{2(1+2d)}$. We claim that this game possesses an equilibrium in which each country proposes position $\Pi_3$ and a transfer of $-\frac{1-d}{1+2d}$ at prevailing position $\Pi_0$, which is calibrated such that both respondents are indifferent between accepting and rejecting. The proposer (say, country $i$) then earns $\frac{3}{(1-d)(1+2d)}$. If some country can profitably deviate then country $i$ can profitably deviate to proposing position $\Pi_1^{ij}$ and a transfer which makes country $j$ indifferent between accepting and rejecting. It is easy to confirm that such a deviation is indeed profitable if and only if the second condition in the premise is satisfied.

In sum, the equilibrium transition path is unique for generic closed access customs union games.■

In the special case of no externalities ($w = 0$), the set of countries and the pair $\{v, 3\}$ define a 0-normalized characteristic function game, whose core is empty if $v > 2$. The closed access customs union game then corresponds to Example 1 in Seidmann and Winter (1998), who show that patient enough countries form a customs union.[15]

If $d$ is close to 1 then Theorem 3.1 implies that a customs union forms in equilibrium if and only if $v > w$. We represent such transitions in Table 2.2. The notation $\Pi \mapsto \Pi$' means that position $\Pi$' is reached in one step from position $\Pi$:

| | |
|---|---|
| $v < w$ | $\Pi_0 \mapsto \Pi_3$ |
| $v > w$ | $\Pi_0 \mapsto \Pi_1^{ij} \mapsto \Pi_3$ |

Table 3.1.2 Equilibrium transitions (patient countries)

The intuition for Theorem 3.1 is that a customs union shifts the status quo point in a direction which is favorable for its members if and only if $v > w$. Such a shift allows members to gain a larger share of the gains from global free trade than they would earn if the trilateral PTA formed at the initial position. Accordingly, we refer to this motive for forming a PTA as 'strategic positioning'.

Strategic positioning requires that countries are patient enough: for if not, then the immediate opportunity cost of negotiating a customs union outweighs the gains in subsequent free trade negotiations. If $d$ is close to 0 then Theorem 3.1 implies that a customs union forms in equilibrium if and only if $v > \frac{3}{2}$. Lemma 3.1 implies that a trilateral PTA

[15] Seidmann and Winter (1998) Theorem 1 states that patient enough countries cannot agree to efficient free trade immediately if the core of the underlying characteristic function game is empty.

forms next period in our model. However, the motive for forming a PTA is independent of this property: a customs union would form in a model without any renegotiation if $v > \frac{3}{2}$.

Strategic positioning can only explain the formation of a customs union if trilateral negotiations cover other issues as well. (We highlight this condition in our model by assuming that countries can engage in lump sum transfers.). If transfers were impossible (as in Yi (1996)) then agreements would not be renegotiated in equilibrium, and a customs union would form if and only if $v > \frac{3}{2}$.

### 3.2. The free trade area game

In this subsection, we analyze a variant on the CU game in which a bilateral agreement does not prevent a PTA member from reaching a further agreement with the outsider. We dub this the 'FTA game'. We simplify notation in this subsection by replacing $\Pi_1^{ij}(FTA)$ with $\Pi_1^{ij}$, $v^{FTA}$ with $v$, and $w^{FTA}$ with $w$.

The transition matrix in the FTA game is

| Prevailing position | Reachable positions (consenting countries) |
|---|---|
| $\Pi_0$ | $\Pi_1^{ij}$ $(\{i,j\})$, $\Pi_3$ $(\{i,j,k\})$ |
| $\Pi_1^{ij}$ | $\Pi_2^{i}$ $(\{i,k\})$, $\Pi_3$ $(\{i,j,k\})$ |
| $\Pi_2^{i}$ | $\Pi_3$ $(\{i,j,k\})$, $\Pi_4$ $(\{j,k\})$ |
| $\Pi_3$ | None |
| $\Pi_4$ | None |

Table 3.2.1 Transition matrix (FTA game)

Our main result in this subsection characterizes transitions in the FTA game for generic discount factors.

**Theorem 3.2** *For generic FTA games:*

**a)** *The countries agree to a trilateral FTA in the first period if and only if one of the following sets of conditions is satisfied:*

- $h > \frac{1-d}{1+d} + \frac{2d}{1+d}s$, $(3-2d)v - dw < \frac{3(1-d)(3+4d)}{2(1+2d)}$ *and*

$$v - dw < \frac{1-d}{3(1+d)}\{(1+2d)[3(1+d)h - (3+2d)s] - 10d^2 - 20d - 9\};$$

- $h < \frac{1-d}{1+d} + \frac{2d}{1+d}s$, $(3-2d)v - dw < \frac{3(1-d)(3+4d)}{2(1+2d)}$ *and*

$$3(v - dw) < 3(1-d)(3+4d) + (1+2d)[(4d-3)s - (3-2d)h]$$

- $h > \frac{1-d}{1+d} + \frac{2d}{1+d}s$,

$$v - dw > \frac{1-d}{3(1+d)}\{(1+2d)[3(1+d)h - (3+2d)s] - 10d^2 - 20d - 9\},\ \textit{and}$$

$$
\begin{aligned}
(6+d-4d^2)v - d(2+d)w \quad < \quad & (1-d)[\frac{27+108d+169d^2+121d^3+34d^4}{3(1+d)(1+2d)} \\
& +d(2+d)h + \frac{d(15+28d+14d^2)}{3(1+d)}s];\ or
\end{aligned}
$$

- $h < \frac{1-d}{1+d} + \frac{2d}{1+d}s$, $3(v-dw) > 3(1-d)(3+4d) + (1+2d)[(4d-3)s-(3-2d)h]$

$$
\begin{aligned}
& and\ [(6+d-4d^2)v - d(2+d)w] + [\frac{d(6-4d-5d^2)}{3}h + \frac{d(15-2d-10d^2)}{3}s] \\
< \quad & \frac{(1-d)(9+27d+29d^2+10d^3)}{1+2d}.
\end{aligned}
$$

**b)** *Two countries agree to a bilateral FTA in the first period and a trilateral FTA is formed in the second period if and only if either*

- $h > \frac{1-d}{1+d} + \frac{2d}{1+d}s$, $(3-2d)v - dw > \frac{3(1-d)(3+4d)}{2(1+2d)}$ *and*

$$
v - dw < \frac{1-d}{3(1+d)}\{(1+2d)[3(1+d)h-(3+2d)s] - 10d^2 - 20d - 9\};\ or
$$

- $h < \frac{1-d}{1+d} + \frac{2d}{1+d}s$, $(3-2d)v - dw > \frac{3(1-d)(3+4d)}{2(1+2d)}$ *and*

$$
3(v-dw) < 3(1-d)(3+4d) + (1+2d)[(4d-3)s-(3-2d)h]
$$

**c)** *Two countries agree to a bilateral FTA in the first period, another FTA is formed in the second period and global free trade is reached in the third period if and only if either*

- $h > \frac{1-d}{1+d} + \frac{2d}{1+d}s$,

$$
v - dw > \frac{1-d}{3(1+d)}\{(1+2d)[3(1+d)h-(3+2d)s] - 10d^2 - 20d - 9\},\ and
$$

$$
\begin{aligned}
(6+d-4d^2)v - d(2+d)w \quad > \quad & (1-d)[\frac{27+108d+169d^2+121d^3+34d^4}{3(1+d)(1+2d)} \\
& +d(2+d)h + \frac{d(15+28d+14d^2)}{3(1+d)}s];\ or
\end{aligned}
$$

- $h < \frac{1-d}{1+d} + \frac{2d}{1+d}s$, $3(v-dw) > 3(1-d)(3+4d) + (1+2d)[(4d-3)s-(3-2d)h]$

$$
\begin{aligned}
& and\ [(6+d-4d^2)v - d(2+d)w] + [\frac{d(6-4d-5d^2)}{3}h + \frac{d(15-2d-10d^2)}{3}s] \\
> \quad & \frac{(1-d)(9+27d+29d^2+10d^3)}{1+2d}. \blacksquare
\end{aligned}
$$

We prove Theorem 3.2 in the Appendix via a couple of Lemmas:

Lemma 3.2.1 characterizes equilibrium play in a subgame starting at new position $\Pi_2^i$, distinguishing between two cases. If $(1+d)h > 1-d+2ds$ then the hub proposes to both spokes, and each spokes proposes to the other spoke alone; so the terminal position can either be a complete network of FTAs or a trilateral PTA, depending on the proposer's identity.[16] By contrast, a trilateral PTA always forms if $(1+d)h < 1-d+2ds$.

In either case, the hub successfully proposes a trilateral PTA.in equilibrium, even if it earns more utility as a hub ($h > 1$). It participates actively in negotiations in order to obtain some rent because the other two countries would reach an agreement next period, even if the hub's offer were rejected.[17] If $(1+d)h > 1-d+2ds$ then this rent disappears as the discount factor approaches 1 because the hub becomes essentially a dummy player.

Lemma 3.2.2 characterizes equilibrium play in a subgame starting at new position $\Pi_1^{ij}$, distinguishing between cases in which the trilateral PTA and the hub and spoke pattern are reached in the next period. In the former case, the FTA members obviously earn the same payoff at new position $\Pi_1^{ij}$ as they earn at that new position in the CU game (cf. Lemma 3.1). In the latter case, the FTA outsider is indifferent between proposing to country $i$ and to country $j$. Consequently, the subgame which starts at new position $\Pi_1^{ij}$ has a continuum of equilibrium outcomes, which are indexed by the probability with which the outsider proposes to a given FTA member. However, there is clearly an equilibrium in which the hub and spoke pattern is reached if and only if there is an equilibrium in which the outsider is equally likely to propose to each FTA member.

We then use the equilibrium payoffs at new positions $\Pi_1^{ij}$ and $\Pi_2$ to fully characterize equilibrium transitions. If the hub and spoke pattern is never reached then the game is strategically equivalent to the CU game; so Theorem 3.1 describes the conditions under which an FTA forms in equilibrium. Otherwise, an FTA is formed if and only if members of the intial FTA expect to earn more (after formation of a further FTA) than by agreeing to a trilateral FTA immediately.

The arguments which we use all involve comparisons between the joint surplus available to two countries when they form an FTA and when they agree with the other country. The free trade game therefore possesses unique equilibria, for generic discount factors.

The conditions in Theorem 3.2 are complicated functions of the discount factor; but they simplify drastically when $d$ is close to 1. Table 3.2.2 displays the equilibrium transitions when countries are very patient.

| | $h < s$ | $h > s$ |
|---|---|---|
| $v < w$ | $\Pi_0 \mapsto \Pi_3$ | $\Pi_0 \mapsto \Pi_3$ |
| $v > w$ | $\Pi_0 \mapsto \Pi_1^{ij} \mapsto \Pi_3$ if $s-h > v-w$<br>$\Pi_0 \mapsto \Pi_1^{ij} \mapsto \Pi_2^i \mapsto \Pi_3$ if $s-h < v-w$ | $\Pi_0 \mapsto \Pi_1^{ij} \mapsto \Pi_2^i \mapsto \Pi_3$ or $\Pi_4$ |

Table 3.2.2 Equilibrium transitions (patient countries)

[16] This is a consequence of our assumption that the hub may not propose formation of an FTA to which it does not belong.

[17] This rent always compensates for any initial loss of utility because $h+2s < 3$ by Efficient Free Trade.

Table 3.2.2 reveals that patient enough countries form an FTA if and only if its members earn a greater utility than the outsider: the necessary and sufficent condition for a customs union to form.

If this condition ($v > w$) is satisfied then a hub and spoke pattern may form even if the hub earns a lower utility than the spokes. If countries are patient then any relative loss that accrues when $h < s$ is transitory, and the hub expects to receive very small transfers when global free trade is achieved. The advantage to member $i$ of proposing an additional FTA necessarily accrues from the transfer demanded from the outsider (country $k$) to put it in a symmetric position to the other FTA member (country $j$). Hub and spoke patterns may therefore be reached because formation of an initial PTA does not commit its members not to compete against each other in this game. By contrast, formation of a customs union forces its members to extend the existing PTA rather than to replicate it. We will exploit this property in the next subsection.

A complete network ($\Pi_4$) is only reached if $v > w$ and $h > s$. Arguments used in the proof of Lemma 3.2.1 then imply that formation of a complete network relies on the identity of the proposer at position $\Pi_2^i$.

Suppose that the parameters are derived from the Example of the last section. If $\tau > 0$ then $h > s$ and $v > w$; whereas $h < s$ and $v < w$ if $\tau < 0$. Our model then implies that a hub and spoke pattern must form along the transition path if countries are patient enough and $\tau > 0$; whereas a trilateral FTA forms immediately if $\tau < 0$.

### 3.3. The closed access game

In this subsection, we analyze the closed access game introduced in Section 2.1, which allows countries to form either a customs union or a free trade area at the initial position. Our first result focuses on the case where CU members earn at least as much as FTA members:

**Theorem 3.3** *If $v^{CU} - w^{CU} \geq v^{FTA} - w^{FTA}$ and countries are patient enough then a hub and spoke pattern area is never reached in a closed access game.*

**Proof** Position $\Pi_2^i$ can be reached in an equilibrium of the closed access game if and only if it is reached in an equilibrium of the FTA game and if the aggregate payoff of the two FTA members exceeds their aggregate payoff after forming a customs union. If countries are patient enough then Lemma 3.1 implies that the latter condition is satisfied whenever an FTA insider's average payoff at new position $\Pi_1^{ij}(FTA)$ exceeds $\frac{1}{1-d}[1 + \frac{1}{3}(v^{CU} - w^{CU})]$. There are two cases to consider:

- If $(1 + d)h > 1 - d + 2ds$ then the average payoff at new position $\Pi_1^{ij}(FTA)$ is close to $\frac{1}{1-d}[1 + \frac{1}{4}(v^{FTA} - w^{FTA})]$. Theorem 3.2 implies that patient enough countries only form an FTA if $v^{FTA} > w^{FTA}$; so the country which proposes position $\Pi_1^{ij}(FTA)$ could profitably deviate to proposing $\Pi_1^{ij}(CU)$ instead, thereby precluding formation of a further FTA;
- If $(1 + d)h < 1 - d + 2ds$ then the average payoff at new position $\Pi_1^{ij}(FTA)$ is close to $\frac{1}{12(1-d)}[12 + 3(v^{FTA} - w^{FTA}) + s - h]$. Furthermore, Theorem 3.2 implies

that patient enough countries only form an FTA if $v^{FTA} - w^{FTA} > s - h$. Consequently, the country which proposes position $\Pi_1^{ij}(FTA)$ could profitably deviate to proposing $\Pi_1^{ij}(CU)$ instead, thereby precluding formation of a further FTA.■

The intuition for Theorem 3.3 is that an FTA member which is selected to propose at new position $\Pi_1^{ij}(FTA)$ can address its offer to the outsider, thereby reducing its fellow member's payoff. By contrast, global free trade must be reached if two countries form a customs union. The identity of the proposer at new position $\Pi_1^{ij}(FTA)$ is determined randomly, so the aggregate payoff of FTA members at this new position is less than the aggregate payoff of customs union members.

These arguments rely on the supposition that countries are patient enough. If countries were impatient ($d = 0$) then a hub and spoke pattern would be reached in the closed access game if either $h > 1$ and $v > \max\{h - s - 3, \frac{3}{2}\}$ or $h < 1$ and $v > \max\{3 - (h + s), \frac{3}{2}\}$. A hub and spoke can also, of course, form in equilibrium if $v^{CU} - w^{CU}$ sufficiently exceeds $v^{FTA} - w^{FTA}$.

Our last result in this section confirms a property which holds in both the CU and the FTA closed access games:

**Theorem 3.4** *If countries are patient enough then a PTA forms in a closed access game if and only if its members earn greater utility than the outsider.*■

Theorem 3.4 follows immediately from Theorems 3.1 and 3.2.

The condition for PTA formation ($v > w$) is satisfied in the Example of Section 2.2 if and only if $\tau > 0$. Our model then implies that patient countries form a PTA if and only $\tau > 0$.

If $\tau > 0$ in the Example then we also have $v > 0$. This condition is not, in general, necessary for a bilateral PTA to form. A PTA whose members earned less than 0 could form in equilibrium, provided that the outsider lost even more: a condition consistent with Vinerian arguments about trade diversion or with terms of trade effects. By contrast, a bilateral PTA can only form in Aghion et al. (2004) if $w < 0$ because the utility earned by the other PTA member ($v$) is irrelevant in equilibrium when one country has a monopoly on proposals.

In sum, our model predicts that inefficient PTAs form, ceteris paribus, when they inflict large collateral damage on outsiders.[18] This result may explain why Mexico might have agreed to join NAFTA, even though it suffered static losses (via loss of tariff revenue), as Panagariya (1999) argues: Mexican participation in NAFTA may have caused other Latin American countries to suffer sufficient collateral damage that Mexico was advantaged in its post-NAFTA negotiations with MERCOSUR, Chile, Caricom and the Andean Pact.

Our results in this section are related to Bhagwati's famous question: Are PTAs stumbling blocks or stepping stones to free trade?[19] Theorem 3.4 specifies conditions under which global free trade is delayed (but not prevented) by PTA formation. PTAs can

[18]See Winters and Chang (2000) for empirical estimates of the (adverse) terms of trade effects on outsiders.

[19]See, in particular, Bhagwati and Panagariya (1996).

therefore be interpreted as possible stumbling blocks in our model; though it does not admit an obvious interpretation of PTAs as stepping stones. In contrast to the related literature, our model allows countries to choose whether to propose at a bilateral or a trilateral level, as well as to renegotiate agreements.[20] Most of the literature also precludes any transfers, so PTAs are stumbling blocks if the associated utility vector is not Pareto-dominated by global free trade. The social desirability of a transition to global free trade is then moot. By contrast, we show that PTA formation can be unambiguously undesirable.

**Remark 3** The Efficient Free Trade assumption might fail if smaller PTAs can adopt deeper integration than their larger counterparts (cf. Baldwin (1995)) or if fewer multilateral agreements can be enforced. Suppose that the condition fails, and that PTAs could break up with the consent of all members. If $v$ were small and positive, $w$ large enough and countries patient enough then the trilateral PTA would form in the first period, with one member leaving (by mutual consent) in the second period.■

# 4. THE US COMMITMENT TO FREE TRADE

According to hegemonic stability theory, international cooperation requires a dominant country to exercise its power.[21] As Kindleberger (1986) notes, free trade has historically relied on the willingness of a hegemon to provide leadership. Britain's unilateral liberalization underpinned free trade in the later $19^{th}$ century, and the US commitment not to join any bilateral PTAs underwrote progress at GATT. This commitment was costly to the US, which gradually lost its dominant position in world trade. In 1982, the US announced that it would pursue a 'twin track' strategy, and then signed a free trade agreement with Canada. Multilateral negotiations have subsequently proceeded slowly (though the Uruguay Round was completed) while many bilateral PTAs have been agreed. As Bhagwati has frequently claimed (e.g. Bhagwati (1993)), the twin track strategy may have been responsible for these developments.

The Kindleberger/Bhagwati thesis is widely cited (but rarely discussed): primarily in the related literature on burden sharing in alliances, which was initiated by Olson and Zeckhauser (1966). This literature typically models alliances as voluntary contribution games;[22] whereas Kindleberger/Bhagwati address another mechanism by which a hegemon might sustain cooperation. However, on closer inspection, the claim that GATT negotiations were sustained by the American commitment seems problematic: for it is unclear why a commitment by one country not to join a PTA should preclude other countries from forming PTAs.

In this section, we use a variant of the closed access game to defend the argument against this critique. In brief, we will argue that formation of PTAs is a systemic property which depends on the value of all countries' outside options, rather than on a single country's commitment. On the other hand, we use a model with symmetric countries; so

[20] Panagariya (2000) surveys this literature.
[21] See Keohane (1984) for an exposition and elaboration.
[22] See, in particular, Hamada (1996).

our argument demonstrates that leadership need not be provided by a dominant power: contrary to the related literature, which (pessimistically) focuses on the declining US share of world trade.

We analyze two variants on the closed access CU game in which

1. Free trade negotiations (at least under GATT/WTO auspices) cannot be convened as regularly as PTA negotiations. We assume that free trade can only be proposed in odd-numbered periods, but that PTAs can be proposed in every period.[23] In light of this assumption, we also suppose that any proposer can also choose not to make an offer, in which case it retains the floor in the next period.

2. Either

    1. A single country (labelled 1) is exogenously committed neither to make nor to accept any bilateral proposal; or

    2. No country is so committed.

In all other respects, the games are identical to the closed access CU game.

Only one bilateral PTA can feasibly form if country 1 is committed; so the structure of PTAs is necessarily partitional. Accordingly, we simplify exposition by focusing on versions of the closed access CU games, in which the structure of PTAs is also necessarily partitional. We refer to the game satisfying 1 and 2a as the 'commitment game', and that satisfying 1 and 2b as the 'no-commitment game'.

We analyze these games by characterizing their stationary subgame-perfect equilibria; but, in light of Condition 1, we allow stationary offers to depend on the oddness of the period. Specifically, we define a state as a pair, consisting of a position and the oddness of the period, writing a state as $< \Pi, \delta >$: where $\delta \in \{odd, even\}$. We will say that a strategy combination is an 'equilibrium' if it is subgame-perfect, and is stationary at every state.

Condition 1 will turn out to be crucial to our results:

- If $\Pi_3$ could be proposed each period then stationarity would imply that every country proposes $\Pi_3$ in the initial round whenever some country proposes $\Pi_3$ in an equilibrium of the game. Hence, no countries have *valuable* outside options in an equilibrium of the game, and formation of a PTA depends on whether such an agreement strategically positions the first period proposer. These incentives are unaffected by a single country's commitment, as countries 2 and 3 can still each find a PTA partner: so they form a PTA if and only if $v > w$ in both games;

- If $\Pi_3$ could only be proposed in odd periods and proposers had to make an offer then country 1's return would be driven down to 0 in any equilibrium where $\Pi_3$ was proposed.

Our main result in this section focuses on outcomes when countries are patient. It states that the outcome of the no-commitment game is close to that of the closed access

[23] This assumption is, of course, empirically plausible.

CU game, and that a trilateral CU always forms in equilibrium: We will use this result to explain the effects of the US commitment on PTA formation.

**Theorem 4** *If countries are patient enough then generically:*

**a)** *No-commitment games possess a unique equilibrium in which a bilateral customs union forms in the first period if and only if* $v > w$ *and a trilateral customs union otherwise forms in the first period;*

**b)** *Commitment games possess a unique equilibrium in which a trilateral customs union forms in the first period;*

**c)** *If* $v > w$ *then country* 1 *earns less in the commitment game than in the no-commitment game, and if* $v < w$ *then country* 1 *earns the same in both games.*■

We prove Theorem 4 in the Appendix.

Suppose that $v > w$. Absent an agreement to form a trilateral customs union, any two countries which are not otherwise committed would immediately form a customs union in an even-numbered period. Consequently, these countries have an outside option in an odd-numbered period at the initial position. If country 1 is committed then it must offer each of the other countries a transfer sufficiently high that neither has an incentive to exercise its outside option of forming a customs union when proposing in an odd-numbered period at the initial position. This reduces the payoff which country 1 would demand at the initial position; so the other two countries would also propose that a trilateral customs union form in odd-numbered periods.

By contrast, if no country were committed, then each first round proposer would earn less than the value of its outside option if it offered the other countries sufficient to induce acceptance of a trilateral offer. Hence, a customs union must form in the first round, even though customs unions are inefficient and countries are impatient. In sum, formation of a customs union is a systemic property, which depends on whether the sum of the values of outside options exceeds the gains from free trade, rather than simply on individual countries' commitments.

Country 1's commitment hastens global free trade, but is never advantageous to that country: for if $v > w$ then country 1 must always compensate the other two countries for not forming a customs union; whereas it would be a customs union member whenever it proposed in the no-commitment game.

According to our model, the US commitment not to negotiate bilaterally may indeed have prevented other countries from forming bilateral PTAs, whereas a new regime was inaugurated when the US abandoned this commitment; so our argument supports Kindleberger's claim that the US commitment caused progress at multilateral talks. Our model also implies that the commitment was costly: a theme of the burden-sharing literature. On the other hand, we demonstrate that the 'hegemonic role' could be played effectively by a country which is not large. In this sense, our results run counter to the literature on hegemonic stability, which focuses on the US's relative decline.[24]

[24] See, for example, Keohane (1984).

Our model may also be of contemporary relevance because Japan has recently abandoned its own commitment not to negotiate bilaterally by agreeing to form a free trade area with Singapore after delays in effecting APEC's objectives.[25] Our analysis suggests that the change in Japanese policy may presage the formation of PTAs within East Asia, rather than the long mooted APEC free trade area.

## 5. ACCESS GAMES

Despite the profusion and variety of PTAs, no countries have formed an open access PTA, which allows free entry by outsiders.[26] While APEC has announced an intention to allow free entry, it froze membership for ten years in 1997 (cf. Choi (2004)). If the PTA outsider gained more than its members from entry then members would be better off forming a closed rather than an open access PTA, which would explain why the latter type of PTA is so unusual. However, this argument relies on the assumed distribution of gains from entry, and there have surely been cases where this assumption failed. For example, prior to British entry into the EC (in 1973), it was widely believed that EC members would collectively gain more than Britain from British entry.

In this section, we present a model of PTA formation in which members can decide whether to form an open or a closed access PTA. Our main result (Theorem 5) explains why open access PTAs do not form, even if members would be the main beneficiaries of entry. We then use our argument to support Bergsten's (1997) suggestion that only open access PTAs be allowed under WTO rules, demonstrating that a trilateral PTA would form immediately in such a game. We end this section by relating our model to the literature.

We explain the rarity of open access PTAs by extending the closed access CU model by allowing members of a bilateral customs union to decide whether or not to allow free entry, showing that this game does not have an equilibrium in which a bilateral open access customs union is reached.

We denote the position at which countries $i$ and $j$ form a closed [resp. open] customs union as $\Pi_1^{ij}$ [resp. $P_1^{ij}$]. To simplify exposition, we suppose that a trilateral customs union (position $\Pi_3$) can alone be reached from either $\Pi_1^{ij}$ or $P_1^{ij}$.

Each period of the access game starts with a bargaining phase in which one country proposes either a trilateral, a closed bilateral or an open bilateral customs union (in each case with some transfers), and the respondent(s) accept or reject. The position changes if and only if all respondents accept an offer.

If the bargaining phase of some period ends with the game at any position other than $\Pi_1^{ij}$ then the game proceeds to the next period, as in the closed access CU game. If the bargaining phase of some period ends at position $P_1^{ij}$ then the period ends with country $k$ choosing whether to join the customs union. If country $k$ chooses to join then a trilateral customs union automatically forms in the next period, without any transfers to or from country $k$; whereas the next period starts at position $P_1^{ij}$ if the outsider chooses not to join.

[25] See Dent (2003) on the formation of bilateral and regional multilateral PTAs in East Asia.

[26] The phrase 'open access PTA' is sometimes used differently, e.g. to mean that a PTA offers unconditional MFN to outsiders. See Bergsten (1997).

Utilities at every position correspond to those introduced in Section 3.1. In particular, open and closed customs unions yield the same pattern of utilities. We call this the 'access game', which we analyze by characterizing those subgame perfect equilibria in which

- A country's proposal only depends on the position;
- A country's response to a proposal only depends on the proposal and the position; and
- A country's entry decision only depends on the identity of the proposer next period.

We again abuse terminology by denoting such a strategy combination an 'equilibrium'.

**Theorem 5** *If countries are patient enough then the access game has no equilibrium in which an open customs union forms.*

**Proof** There can be no equilibrium in which the outsider chooses to enter an open access customs union: for the rules of the game require that some offer must then have been rejected at position $P_1^{ij}$, delaying global free trade till the next period; so the country which proposes in that period could profitably deviate to an offer which the other two countries would accept. Consequently, position $\Pi_3$ must be reached immediately from position $P_1^{ij}$.

There are two cases to consider. If $v > w$ then country $k$ earns less than $\frac{1}{1-d}$ after some country proposes at position $P_1^{ij}$, and can therefore profitably deviate to rejecting the offer and entering the customs union if $d$ is close enough to 1. If $v < w$ then every equilibrium is symmetric; so each country earns about $v + \frac{d}{1-d}[1 + \frac{1}{3}(v - w)]$ if it proposes at position $\Pi_0$, and would therefore accept a transfer of less than $\frac{1}{1-d}$ to form a trilateral customs union. Consequently, the proposer at position $\Pi_0$ can profitably deviate.■

The proof of Theorem 5 implies that a generic access game possesses the same equilibrium outcomes as a closed access CU game with the same pattern of utilities.

The proof of Theorem 5 establishes that an open access PTA is never on the outer envelope of PTAs: if countries gain from strategic positioning ($v > w$) then the initial proposer is better off with a closed than an open access customs union, as the outsider would neutralize the strategic advantage by entering unilaterally; if countries lose from strategic positioning ($v < w$) then the outsider would not enter an open access PTA unilaterally, and it is better to propose a trilateral customs union at the initial proposition. Theorem 5 therefore explains why open access customs unions are so rare.

Bergsten (1997) has argued for a change in WTO rules which would require any PTA to be open access. We address this suggestion by analyzing a simplified version of access games in which countries are prohibited from proposing a closed access customs union at the initial position. We call this the 'open access game', and analyze it using the same solution concept as for access games. Our last result supports Bergsten's proposal in the context of our model:

**Corollary 5** *If countries are patient enough then a trilateral customs union forms immediately in every equilibrium of an open access game.*■

We omit the proof of Corollary 5 as it follows the same lines as the proof of Theorem 5.

This section has analyzed a game in which countries can choose whether to adopt open access provisions in PTA agreements. Accordingly, we can explain why so few PTAs have voluntarily adopted open access provisions. By contrast, the related literatures have compared equilibria in games with mandatory provisions to equilibria in games with no such provisions.

The closest relation is Yi's (1996) open regionalism model, where an open PTA consists of the set of countries which simultaneously announce the same address. Yi proves an analog of Corollary 5 above under conditions which translate into $v > 0$ and $w < 1$ in our model.[27]

## 6. CONCLUSIONS

We have presented a model of trade negotiations in which countries can form either customs unions or free trade areas, and can continue to negotiate after reaching an agreement. We have also used variants on this model to explain how one country's commitment to multilateral negotiations affects other countries' equilibrium proposals; and why open access PTAs are so unusual.

Both our benchmark model and its subsequent developments rely on the notion of strategic positioning: countries form PTAs in order to achieve a more favorable division of the gains from global free trade. This motive is novel in the literature because previous papers on trade negotiations have assumed that countries leave the bargaining table after forming a PTA. Strategic positioning seems to capture an important reason for the formation of the EU and of MERCOSUR: that these larger groups would be better positioned in subsequent negotiations with the US. It also seems to correspond to 'competitive liberalization': a motive that Trade Representative Zoellick has adduced for negotiating bilateral PTAs.[28]

The notion of strategic positioning seems to correspond to 'competitive liberalization': an explanations which Robert Zoellick, the current Trade Representative, has given for his conduct of US trade policy.

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[27] Baldwin (1995) and (1997) use similar assumptions in a domino model of the growth of open access PTAs.

[28] See, in particular, Zoellick (2004). Feinberg (2003) p.1020 interprets competitive liberalization as "establishing precedents, models or serving as catalysts for wider trade agreements".

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## APPENDIX: PROOFS

**Theorem 3.2** *For generic FTA games:*

**a)** *The countries agree to a trilateral FTA in the first period if and only if one of the following sets of conditions is satisfied:*

- $h > \frac{1-d}{1+d} + \frac{2d}{1+d}s$, $(3-2d)v - dw < \frac{3(1-d)(3+4d)}{2(1+2d)}$ *and*

$$v - dw < \frac{1-d}{3(1+d)}\{(1+2d)[3(1+d)h - (3+2d)s] - 10d^2 - 20d - 9\};$$

- $h < \frac{1-d}{1+d} + \frac{2d}{1+d}s$, $(3-2d)v - dw < \frac{3(1-d)(3+4d)}{2(1+2d)}$ *and*

$$3(v - dw) < 3(1-d)(3+4d) + (1+2d)[(4d-3)s - (3-2d)h]$$

- $h > \frac{1-d}{1+d} + \frac{2d}{1+d}s$,

$$v - dw > \frac{1-d}{3(1+d)}\{(1+2d)[3(1+d)h - (3+2d)s] - 10d^2 - 20d - 9\}, \text{ and}$$

$$\begin{aligned}(6 + d - 4d^2)v - d(2+d)w \quad &< \quad (1-d)[\frac{27 + 108d + 169d^2 + 121d^3 + 34d^4}{3(1+d)(1+2d)} \\ &+ d(2+d)h + \frac{d(15 + 28d + 14d^2)}{3(1+d)}s]; \text{ or}\end{aligned}$$

- $h < \frac{1-d}{1+d} + \frac{2d}{1+d}s$, $3(v-dw) > 3(1-d)(3+4d) + (1+2d)[(4d-3)s - (3-2d)h]$

$$\begin{aligned} &\textit{and } [(6+d-4d^2)v - d(2+d)w] + [\frac{d(6-4d-5d^2)}{3}h + \frac{d(15-2d-10d^2)}{3}s] \\ < &\quad \frac{(1-d)(9+27d+29d^2+10d^3)}{1+2d}. \end{aligned}$$

**b)** *Two countries agree to a bilateral FTA in the first period and a trilateral FTA is formed in the second period if and only if either*

- $h > \frac{1-d}{1+d} + \frac{2d}{1+d}s$, $(3-2d)v - dw > \frac{3(1-d)(3+4d)}{2(1+2d)}$ *and*

$$v - dw < \frac{1-d}{3(1+d)}\{(1+2d)[3(1+d)h - (3+2d)s] - 10d^2 - 20d - 9\}; \textit{ or}$$

- $h < \frac{1-d}{1+d} + \frac{2d}{1+d}s$, $(3-2d)v - dw > \frac{3(1-d)(3+4d)}{2(1+2d)}$ *and*

$$3(v-dw) < 3(1-d)(3+4d) + (1+2d)[(4d-3)s - (3-2d)h]$$

**c)** *Two countries agree to a bilateral FTA in the first period, another FTA is formed in the second period and global free trade is reached in the third period if and only if either*

- $h > \frac{1-d}{1+d} + \frac{2d}{1+d}s$,

$$v - dw > \frac{1-d}{3(1+d)}\{(1+2d)[3(1+d)h - (3+2d)s] - 10d^2 - 20d - 9\}, \textit{ and}$$

$$\begin{aligned} (6+d-4d^2)v - d(2+d)w \quad > \quad & (1-d)[\frac{27+108d+169d^2+121d^3+34d^4}{3(1+d)(1+2d)} \\ & + d(2+d)h + \frac{d(15+28d+14d^2)}{3(1+d)}s]; \textit{ or} \end{aligned}$$

- $h < \frac{1-d}{1+d} + \frac{2d}{1+d}s$, $3(v-dw) > 3(1-d)(3+4d) + (1+2d)[(4d-3)s - (3-2d)h]$

$$\begin{aligned} &\textit{and } [(6+d-4d^2)v - d(2+d)w] + [\frac{d(6-4d-5d^2)}{3}h + \frac{d(15-2d-10d^2)}{3}s] \\ > &\quad \frac{(1-d)(9+27d+29d^2+10d^3)}{1+2d}. \blacksquare \end{aligned}$$

## Proof

We start the analysis by characterizing equilibrium play in every subgame which starts at new position $\Pi_2^i$.

**Lemma 3.2.1**

**a)** *If* $(1+d)h > 1-d+2ds$ *then, gross of any previously agreed transfers, each spoke earns* $\frac{2(1+2d)}{3(1-d^2)} + \frac{1}{3(1+d)}s$ *in every equilibrium of the subgame at new position* $\Pi_2^i$;

**b)** *If* $(1+d)h < 1-d+2ds$ *then, gross of any previously agreed transfers, each spoke earns* $\frac{1}{1-d} + \frac{1}{3(1-d)}(s-h)$ *in every equilibrium of the subgame at new position* $\Pi_2^i$.

It will prove useful to denote a spoke's equilibrium payoff at new position $\Pi_2^i$ by $\frac{1}{1-d}U$. Note that

$$\frac{2(1+2d)}{3(1-d^2)} + \frac{1}{3(1+d)}s > \frac{1}{1-d} + \frac{1}{3(1-d)}(s-h) \text{ if and only if } (1+d)h > 1-d+2ds.$$

**Proof**

It is easy to confirm that there is no equilibrium in which exactly one of the spokes proposes $\Pi_3$. Accordingly, we prove the result by characterizing conditions under which the subgame possesses an equilibrium in which the two spokes each propose position $\Pi_4$ and an equilibrium in which all countries propose position $\Pi_3$.

We start with the first case. In any such equilibrium, the hub must make a proposal (necessarily of position $\Pi_3$). It is easy to confirm that a proposing spoke must offer a transfer of $\frac{1-d}{1+d}s - \frac{1-d}{1+d} < 0$ to the other spoke; so the hub must (acceptably) propose position $\Pi_3$. Hence, $(1+d)h > 1-d+2ds$ implies that neither spoke can profitably deviate to proposing position $\Pi_3$.

We now turn to the second case. In any such equilibrium, the hub must make a proposal (necessarily of position $\Pi_3$). It is easy to confirm that a proposing spoke must offer a transfer of $\frac{1}{1+2d}s - \frac{1-d}{1+2d} - \frac{d}{1+2d}h$ to the other spoke, and of $\frac{1+d}{1+2d}h - \frac{1-d}{1+2d} - \frac{2d}{1+2d}s$ to the hub. Hence, $(1+d)h < 1-d+2ds$ implies that neither spoke can profitably deviate to proposing position $\Pi_4$.■

Our proof implies that an agreement to global free trade is reached immediately in every equilibrium; so the hub (country $i$) earns $\frac{1}{1-d}(3-2U)$ in every equilibrium.

We now characterize equilibrium play in subgames in which the prevailing position is $\Pi_1^{ij}$:

**Lemma 3.2.2**

**a)** *If either* $h > \frac{1-d}{1+d} + \frac{2d}{1+d}$ *and*

$$v - dw < \frac{1-d}{3(1+d)}\{(1+2d)[3(1+d)h - (3+2d)s] - 10d^2 - 20d - 9\}$$

*or* $h < \frac{1-d}{1+d} + \frac{2d}{1+d}$ *and*

$$3(v-dw) < 3(1-d)(3+4d) + (1+2d)[(4d-3)s - (3-2d)h]$$

*then the subgame which starts at new position* $\Pi_1^{ij}$ *possesses a unique equilibrium in which all countries propose position* $\Pi_3$ *and, gross of any previously agreed transfers, each FTA insider earns* $\frac{1}{1-d}[1+\frac{1}{3}(v-w)]$;

**b)** *If* $h > \frac{1-d}{1+d} + \frac{2d}{1+d}s$ *and*

$$v - dw > \frac{1-d}{3(1+d)}\{(1+2d)[3(1+d)h - (3+2d)s] - 10d^2 - 20d - 9\}$$

*then the subgame which starts at new position* $\Pi_1^{ij}$ *possesses a unique equilibrium in which all countries propose some position* $\Pi_2^l$ *and, gross of any previously agreed transfers, each FTA insider earns*

$$\frac{1}{1+d}[h + \frac{3+2d}{3(1+d)}s] + \frac{1}{1-d^2}(dv - w) + \frac{d(7-5d)}{3(1+d)(1-d^2)}$$

*if it proposes, and*

$$\frac{d}{3(1+d)^2}[3(1+d)h + (3+2d)s] + \frac{1}{1-d^2}(v - dw) + \frac{d^2(7-5d)}{3(1+d)(1-d^2)}$$

*if it responds.*

**c)** *If* $h < \frac{1-d}{1+d} + \frac{2d}{1+d}s$ *and*

$$3(v - dw) > 3(1-d)(3+4d) + (1+2d)[(4d-3)s - (3-2d)h]$$

*then the subgame which starts at new position* $\Pi_1^{ij}$ *possesses a unique equilibrium in which all countries propose some position* $\Pi_2^l$ *and, gross of any previously agreed transfers, each FTA member earns*

$$\frac{1}{1+d}(h+s) + \frac{1}{3(1-d^2)}[2dv - (3-d)w] + \frac{2d}{1-d^2}$$

*if it proposes, and*

$$\frac{d}{1+d}(h+s) + \frac{1}{3(1-d^2)}[(3-d^2)v - d(3-d)w] + \frac{2d^2}{1-d^2}$$

*if it responds.*

## Proof

At position $\Pi_1^{ij}$, each of the FTA members ($l$) can induce either position $\Pi_2^l$ or position $\Pi_3$; while the outsider (country $k$) can induce either position $\Pi_2^l$ (for some $l \neq k$) or position $\Pi_3$. It is easy to see that, for generic games, there are no equilibria in which any two countries propose different positions. We can therefore focus on the conditions under which all countries propose a position $\Pi_2^l$ or all countries propose position $\Pi_3$.

We start with putative equilibria in which all countries propose position $\Pi_3$. Conventional arguments imply that the two members accept a transfer of $\frac{v-dw-1+d}{1+2d}$, whereas the outsider accepts a transfer of $\frac{(1+d)w-2dv-1+d}{1+2d}$. If some country has a profitable deviation then it can profitably deviate to proposing position $\Pi_2^l$ and a transfer which, if accepted, would make its respondent as well off as in the putative equilibrium. This deviation is unprofitable if and only if the sum of the equilibrium payoffs of the outsider and an FTA member, with one as proposer and the other as respondent, exceeds $h+s+\frac{d}{1-d}(3-U)$.[29] Hence, generic games possess an equilibrium in which all countries propose position $\Pi_3$ if and only if

$$h < \frac{3(1-2d^2)}{(1-d)(1+2d)} - \frac{1}{(1-d)(1+2d)}(v-dw) - s + \frac{d}{1-d}U:$$

where $U$ is defined in the proof of Lemma 3.2.1.

There are two cases to consider. If $h > \frac{1-d}{1+d} + \frac{2d}{1+d}s$ then, using Lemma 3.2.1, the condition is satisfied if and only if

$$v - dw < \frac{1-d}{3(1+d)}\{(1+2d)[3(1+d)h-(3+2d)s] - 10d^2 - 20d - 9\};$$

and if $h < \frac{1-d}{1+d} + \frac{2d}{1+d}s$ then the condition is satisfied if and only if

$$3(v-dw) < 3(1-d)(3+4d) + (1+2d)[(4d-3)s-(3-2d)h]$$

Each FTA member then earns $\frac{1}{1-d}[1+\frac{1}{3}(v-w)]$ at new position $\Pi_1^{ij}$.

It is easy to confirm that, for generic games, no country can profitably deviate from a putative equilibrium in which all countries propose position $\Pi_2^l$ (some $l \neq k$) if and only if neither condition the premise of part **a)** holds. Parts **b)** and **c)** follow by substituting for $U$. An FTA insider's payoffs as proposer and respondent then follow from the equilibrium requirement that any respondent be indifferent between accepting and rejecting a proposal.■

If $\Pi_2^i$ is always reached from $\Pi_1^{ij}$ then country $k$ is indifferent between proposing to country $i$ and to country $j$. Consequently, the subgame which starts at new position $\Pi_1^{ij}$ has a continuum of equilibrium outcomes, which are indexed by the probability with which country $k$ proposes to country $i$. Clearly, there is an equilibrium in which $\Pi_2^i$ is reached if and only if there is an equilibrium in which country $k$ is equally likely to propose to each country in position $\Pi_1^{ij}$; in which case, each member earns

$$\frac{1}{6(1-d^2)}[(1-d)(2+d)h+(1-d)(5+4d)s+(1+2d)v-(2+d)w+3d(2+d)+d(1+2d)U)].$$

at the subgame starting at new position $\Pi_1^{ij}$.

The only positions which can be reached from $\Pi_0$ are $\Pi_1^{ij}$ and $\Pi_3$ (cf. the transition matrix: Table 3.2.1). If a trilateral PTA is reached in one step in equilibrium then the

[29] This sum is independent of the proposer's identity.

proposer and the other two countries must respectively earn $\frac{1}{1-d}\frac{3}{1+2d}$ and $\frac{1}{1-d}\frac{3d}{1+2d}$. This outcome can be supported in equilibrium unless the proposer can profitably deviate to proposing position $\Pi_1^{ij}$ and a transfer such that the respondent earns $\frac{1}{1-d}\frac{3d}{1+2d}$. There are three cases to consider:

- If the conditions in part **a)** of Lemma 3.2.2 are satisfied then the free trade game is then strategically equivalent to the customs union game in the sense that it possesses the same equilibrium paths. Equilibrium transitions then follow from the proof of Theorem 3.1.

- If the conditions in part **b)** of Lemma 3.2.2 are satisfied then a trilateral PTA is reached in one step if and only if

$$\begin{aligned}(6+d-4d^2)v - d(2+d)w \quad < \quad & (1-d)[\frac{27+108d+169d^2+121d^3+34d^4}{3(1+d)(1+2d)} \\ & +d(2+d)h + \frac{d(15+28d+14d^2)}{3(1+d)}s];\end{aligned}$$

  otherwise, an FTA is first formed, followed by a second FTA.

- If the conditions in part **c)** of Lemma 3.2.2 are satisfied then a trilateral PTA is reached in one step if and only if

$$\begin{aligned}& [(6+d-4d^2)v - d(2+d)w] + [\frac{d(6-4d-5d^2)}{3}h + \frac{d(15-2d-10d^2)}{3}s] \\ < \quad & \frac{(1-d)(9+27d+29d^2+10d^3)}{1+2d};\end{aligned}$$

  otherwise, an FTA is first formed, followed by a second FTA.■

**Theorem 4** *If countries are patient enough then generically:*

**a)** *No-commitment games possess a unique equilibrium in which a bilateral customs union forms in the first period if and only if $v > w$ and a trilateral customs union otherwise forms in the first period;*

**b)** *Commitment games possess a unique equilibrium in which a trilateral customs union forms in the first period;*

**c)** *If $v > w$ then country 1 earns less in the commitment game than in the no-commitment game, and if $v < w$ then country 1 earns the same in both games.*

**Proof**

**a)** The proof follows from arguments which are very similar to those exploited in the proof of Theorem 3.1.

**b)** We start by demonstrating that a commitment game possesses an equilibrium in which a bilateral and a trilateral customs union respectively form in states $<\Pi, even>$ and $<\Pi, odd>$ if and only if $v > w$.

We start in state $<\Pi_1^{23}, odd>$, where every country proposes a trilateral customs union, offering country 1 a transfer of $n_1$, and every other country a transfer of $m_1$. If a respondent rejects then it proposes in the next period, which is in state $<\Pi_1^{23}, even>$.

No trilateral customs union can be proposed in state $<\Pi_1^{23}, even>$, so the proposer delays its offer till the next period, which is in state $<\Pi_1^{23}, odd>$. Country 1 then earns $(1+d)w + \frac{d^2}{1-d}(1-2m_1)$ by rejecting in state $<\Pi_1^{23}, odd>$, whereas country $j \neq 1$ earns $(1+d)v + \frac{d}{1-d}(1-m_1-n_1)$ by rejecting in state $<\Pi_1^{23}, odd>$. Country 1's incentive condition requires that

$$\begin{aligned}
\frac{1}{1-d}(1+n_1) &= (1+d)w + \frac{d^2}{1-d}(1-2m_1) \text{ or} \\
\frac{1}{1-d}n_1 &= (1+d)w - (1+d) - \frac{2d^2}{1-d}m_1. \\
\text{Hence, } \frac{d^2}{1-d}(1-m_1-n_1) &= \frac{d^2(2-d^2)}{1-d} - \frac{d^2(1-2d^2)}{1-d}m_1 - d^2(1+d)w
\end{aligned}$$

The analogous condition for the other countries requires that

$$\begin{aligned}
\frac{1}{1-d}(1+m_1) &= (1+d)v + \frac{d^2}{1-d}(1-m_1-n_1) \\
&= (1+d)(v-d^2w) + \frac{d^2(2-d^2)}{1-d} - \frac{d^2(1-2d^2)}{1-d}m_1
\end{aligned}$$

Consequently,

$$\begin{aligned}
\frac{1}{1-d}m_1 &= \frac{1}{(1-d)(1+2d^2)}(v-d^2w) - \frac{1+d}{1+2d^2} \text{ and} \\
\frac{1}{1-d}n_1 &= -\frac{1}{(1-d)(1+2d^2)}[2d^2v - (1+d^2)w] - \frac{1+d}{1+2d^2}.\text{and} \\
\frac{1}{1-d}m_1 - \frac{1}{1-d}n_1 &= \frac{1}{1-d}(v-w).
\end{aligned}$$

In new state $<\Pi_1^{23}, odd>$, country 1 earns

$$\frac{1}{1-d} - \frac{2}{3(1-d)}(m_1-n_1) = \frac{1}{1-d} - \frac{2}{3(1-d)}(v-w);$$

whereas the other countries earn

$$\frac{1}{1-d} + \frac{1}{3(1-d)}(m_1-n_1) = \frac{1}{1-d} + \frac{1}{3(1-d)}(v-w).$$

We now turn to positions $\Pi_0$.

Every country proposes a trilateral customs union in state $< \Pi_0, odd >$, offering country 1 a transfer of $n_0$, and every other country a transfer of $m_0$. If a respondent (say, $l$) rejects then the next period is in state $< \Pi_0, even >$ with $l$ as proposer.

If country 1 rejects in state $< \Pi_0, odd >$ then it must delay its offer in state $< \Pi_0, even >$, proposing again next period, which is in state $< \Pi_0, odd >$. Hence, it earns $\frac{d^2}{1-d}(1-2m_0)$ by rejecting in state $< \Pi_0, odd >$: so

$$\begin{aligned} \frac{1}{1-d}(1+n_0) &= \frac{d^2}{1-d}(1-2m_0) \text{ or} \\ \frac{1}{1-d}n_0 &= -(1+d) - \frac{2d^2}{1-d}m_0 \end{aligned}$$

If some country $j \neq 1$ rejected in state $< \Pi_0, odd >$ then it proposes a bilateral customs union in state $< \Pi_0, even >$, with a transfer of $t$ to country $k$. If the latter rejects then it proposes next period in state $< \Pi_0, odd >$; if country $k$ accepts then the game reaches new state $< \Pi_1^{23}, odd >$. In the former case, country $k$'s payoff in state $< \Pi_0, even >$ is

$$\frac{d}{1-d}(1-m_0-n_0) = \frac{d(2-d^2)}{1-d} + \frac{d(2d^2-1)}{1-d}m_0.$$

In the latter case, country $k$ earns $v + \frac{1}{1-d}t + \frac{d}{1-d} + \frac{d}{3(1-d)}(v-w)$. Consequently, country $j \neq 1$ earns

$$2dv - \frac{d^4}{1-d} + \frac{d^2(1-2d^2)}{1-d}m_0 + \frac{2d^2}{3(1-d)}(v-w)$$

in state $< \Pi_0, odd >$ if it rejects a proposal. The transfer offered to country $j$ in that state must therefore satisfy

$$\frac{1}{1-d}m_0 = \frac{1}{1-d^2+2d^4}[2dv + \frac{d^4-1}{1-d} + \frac{2d^2}{3(1-d)}(v-w)].$$

If the proposer in state $< \Pi_0, even >$ deviated to delaying then it would earn $\frac{d}{1-d}(1-m_0-n_0)$. Cross-multiplying by $d(1-d)$, this deviation is unprofitable if and only if

$$2d(1-d)v + d^4 + \frac{2d^2}{3}(v-w) - d^2(2d^2-1)m_0 \geq d^2(2-d^2) + d^2(2d^2-1)m_0$$

Now the right-hand side of this inequality condition equals $1+m_0$; so the deviation is unprofitable if and only if

$$\begin{aligned} (1+d^2-2d^4)m_0 &= (1-d)(1+d+2d^2+2d^3)m_0 \geq -(1-d^2)^2, \text{ or} \\ (1+d+2d^2+2d^3)m_0 &\geq -(1+d)(1-d^2) \end{aligned}$$

Substituting for $m_0$ yields the condition

$$\frac{(1+d+2d^2+2d^3)}{1-d^2+2d^4}[2d(1-d)v + (d^4-1) + \frac{2d^2}{3}(v-w)] \geq -(1+d)(1-d^2).$$

Cross-multiplying by $1-d^2+2d^4 > 0$ and rearranging:

$$(1 + d + 2d^2 + 2d^3)[2d(1 - d) + \frac{2d^2}{3}(v - w)] \geq 4d^2(1 - d)(1 + d)^2,$$

which is satisfied for all $d$ close enough to 1 if $v > w$.

Suppose that some country $j \neq 1$ deviates in state $< \Pi_0, odd >$ by proposing a bilateral customs union. This deviation is unprofitable if and only if countries 2 and 3 jointly earn more in the putative equilibrium than their joint payoff after the deviation. Substituting for $n_0$, this condition is equivalent to

$$1 + d + \frac{2d^2}{1 - d^2 + 2d^4}[2dv + \frac{d^4 - 1}{1 - d} + \frac{2d^2}{3(1 - d)}(v - w)] \geq 2(1 + d)v + \frac{2d^2}{1 - d}[1 + \frac{1}{3}(v - w)].$$

Rearranging terms and cross-multiplying by $3(1 - d^2 + 2d^4) > 0$:

$$2d^2(2d^3 + 2d^2 - d - 1)(v - w) \geq 6(1 + d - d^2 - 3d^3 + 2d^4 + 2d^5)v - 9(1 + d - d^2 - d^3 + 2d^4 + 2d^5)$$

If $d$ is close to 1 then the left-hand and the right-hand sides are respectively close to $4(v - w)$ and $12v - 36$. Efficient Free Trade implies that this inequality holds.

Analogous arguments imply that there is an equilibrium in which all countries propose a trilateral customs union in state $< \Pi_0, odd >$, and delay their proposal in state $< \Pi_0, even >$ if and only if $v < w$. Specifically, every respondent receives a transfer of $-\frac{1+d}{1+2d^2}$ in state $< \Pi_0, odd >$ in such an equilibrium.

It is easy to confirm that if $d$ is close enough to 1, then no country can profitably deviate to proposing formation of a bilateral customs union in state $< \Pi_0, even >$ if and only if $v < w$.

If some country $j \neq 1$ deviated to proposing a bilateral customs union in state $< \Pi_0, odd >$ then it would have to pay a transfer whose net present value is at least $\frac{2d^2(1+d)}{1+2d^2} - (1 + d)v - \frac{d^2}{3(1-d)}(v - w)$. Hence, country $j$ cannot profitably deviate if and only if

$$\frac{2d^2}{3(1 - d)}(v - w) \leq \frac{(1 + d)(3 + 4d^2)}{1 + 2d^2} - 2(1 + d)v.$$

This condition is satisfied for $d$ close enough to 1 if and only $v < w$.

Part **b)** then follows because, for generic games, no other transitions are possible in equilibrium.

**c)** Each country clearly earns close to $\frac{1}{1-d}$ in the (unique) equilibrium of the no-commitment game. Parts **a)** and **b)** imply that the two games possess the same outcomes if $v < w$. By contrast, if $v > w$ then country 1 earns about $\frac{1}{1-d}[1 - \frac{2}{3}(v - w)]$ in the commitment game, whichever country is selected to make the game's first proposal.■