

Melatos, Mark; Dunn, Stephanie

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**Copenhagen
Business School**
HANDELSHØJSKOLEN

Department of Economics

Copenhagen Business School

Working paper 2-2010

FLEXIBILITY IN TRADE BLOC DESIGN

MARK MELATOS AND STEPHANIE DUNN

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ABSTRACT

A key characteristic of any trade bloc is its “flexibility” – the extent to which it can be modified or augmented by existing members. This paper investigates how prospective trade bloc members value the flexibility of proposed trade agreements in a changing trading environment. We demonstrate that country characteristics as well as the nature of the trade shock influence a nation’s desire for trade bloc flexibility. Our model of endogenous coalition formation yields predictions that are consistent with three stylized facts which characterize regionalism: (i) overlapping trade agreements, (ii) the popularity of free trade areas relative to customs unions and (iii) renegotiation or disbandment of existing trade agreements is rare. Finally, for the first time in the literature, we provide clear predictions about the identity of “hub” and “spoke” trade bloc members when overlapping free trade areas arise in equilibrium.

Keywords: Trade agreement flexibility, optimal trade bloc design, regional trade agreements, free trade areas, customs unions.

JEL classification: F12, F13, F15.

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I. INTRODUCTION

Regional trade agreements (RTAs) have proliferated at an unprecedented rate in recent years. A number of stylised facts characterise this trend. First, overlapping RTAs, in which countries simultaneously belong to multiple agreements, are now common.¹ Second, in practice, RTAs are rarely disbanded or undergo significant renegotiation.² This is despite the fact that they operate in a dynamic trading environment and, hence, are unlikely to remain optimal without modification. Finally, the vast majority of RTAs take the form of free trade areas (FTAs); few customs unions (CUs) are observed.³ This is inconsistent with theoretical arguments that, from the point of view of member countries, CUs welfare-dominate FTAs.

This paper investigates how, faced with a changing trading environment, countries make decisions about trade bloc formation and design. How does the nature of trade integration today reflect beliefs about the future trading environment? In light of the stylised facts described above, two questions are of particular interest. First, in a trading world subject to shocks, how do countries decide whether to stand alone, support global free trade or form an FTA or a CU? Second, how does the potential for trade blocs to overlap influence this decision? Underlying these questions is the issue of trade bloc *flexibility* – the ease with which members can modify or augment an existing agreement. This paper represents a first attempt at understanding how nations value the degree of flexibility inherent in a trade bloc when such coalitions are (to some extent at least) irreversible. This is a crucial issue because, in a trading world subject to change, a country's attitude to trade bloc flexibility is likely to help determine the type of coalition they wish to join.

This paper is based on the following conjecture: that the growth in overlapping trade blocs reflects the prohibitively high (reputation) cost of 'undoing' (i.e., reneging on) a trade agreement. Consequently, and consistent with the stylised facts described, countries adapt to changes in the trading environment by forming new trade blocs *in addition to* their existing agreements – overlapping RTAs result. Overlapping RTAs, however, can be more readily established the more flexible the design of any existing trade blocs.

There has been relatively little analysis of how countries choose between different types of trade agreements in a static world, let alone over time. Riezman (1985) pioneered the use of coalition formation techniques to analyse trade agreement formation. Recently, Abrego et al. (2006) and Melatos and Woodland (2007) among others have systematically analysed coalition formation between symmetric and asymmetric countries. All these analyses, however, are static; the decision to form a particular trade bloc is assumed to be a one-off event. As a result, changes to the trading environment and, hence, the inter-temporal suitability of trade bloc design are

¹ Almost 75% of countries belong to two or more trade blocs simultaneously (authors' calculations based on data obtained from the WTO's *Regional Trade Agreements Information System (RTA-IS)* available at <http://rtais.wto.org/UI/PublicMaintainRTAHome.aspx>).

² Most trade agreements include a clause stipulating withdrawal procedures; members are typically required to give advance notice of 6-12 months. Nevertheless, changes to RTA membership are rare. Of 272 RTAs currently in force, 260 are "new" while only 12 relate to the accession of new members; most of the latter relate to European Union accession (WTO *RTA-IS* database). Cases of countries withdrawing from trade blocs tend to be exceptional: Venezuela withdrew from the Andean Pact in 2006; Poland, Hungary, the Czech Republic, Romania and Bulgaria left the Central European Free Trade Area (CEFTA) to join the European Union.

³ Of 272 RTAs currently in force, 161 are FTAs and only 21 are CUs (WTO *RTA-IS* database).

not considered. Moreover, issues of trade agreement flexibility and overlap do not arise. In this paper, we explicitly model trade bloc formation over time.

While the ‘spaghetti bowl’ of overlapping trade agreements is widely acknowledged, there is little formal analysis of the phenomenon. Existing work, though illuminating, is largely descriptive and does not explain the formation of such agreements. Wonnacott (1996) and Krueger (1997) discuss the potential welfare implications of “hub-and-spoke” systems of RTAs. They argue that overlapping trade agreements dilute, for member countries, the value of concessions associated with an RTA. Overlap reduces welfare by increasing the administration and enforcement costs incurred to prove origin. Moreover, industry has greater opportunity to lobby for protection. The problems with trade bloc overlap, however, fail to explain its pervasiveness. This paper demonstrates that countries pursue overlapping trade blocs if the benefits of doing so outweigh the costs.

Existing work on trade bloc flexibility mainly focuses on the role of ‘contingency measures’ such as safeguards and antidumping procedures.⁴ Such measures can forestall more extreme protectionist tendencies (Bagwell and Staiger, 1990), help governments garner current domestic support for trade liberalization when future support is not guaranteed (Bagwell and Staiger, 2005), “shelter” firms in member countries from world price fluctuations (Freund and Ozden, 2008) and solidify cooperation between members who wish to avoid being targeted by such measures (Martin and Vergote, 2008). While the inclusion of contingency measures tends to reduce the (terms-of-trade) benefits arising from cooperation, they allow countries to respond to changes in the trading environment, credibly commit to time-consistent trade liberalization and address the contractual incompleteness of trade agreements (Guriev and Klimenko, 2009; Horn et al., 2010).

Since contingency measures appear in all types of trade agreements, this form of flexibility is unlikely to explain the stylised facts we identified at the outset. The literature on contingency measures does not (seek to) explain the popularity of FTAs relative to CUs nor the phenomenon of overlapping FTAs. Since these are our chief concerns, we focus on an alternative form of trade bloc flexibility.

Contingency measures enhance trade bloc flexibility by facilitating a *temporary*, WTO-compliant departure from existing policy commitments in response to a *temporary* change in the trading environment. In contrast, the stylised facts listed above reflect countries’ (irreversible) trade bloc membership decisions that are more likely to relate to *permanent* changes in the trading environment. As such, we define trade bloc flexibility as the ease with which countries can modify or augment an existing trade agreement; that is, the ability of a bloc member to *permanently alter their coalition membership status* in response to a shock to the trading environment.

In light of this definition, trade bloc flexibility is an issue if: (i) the trading world is subject to shocks which alter a country’s preferences over types of trade agreements and (ii) trade blocs are, to some extent, irreversible – due, for example, to non-trivial reputation costs.⁵ These two crucial assumptions underpin our analysis.

⁴ See WTO (2009) for a comprehensive and highly accessible survey of this literature.

⁵ Schwartz and Sykes (2002) argue that the costs of reneging on trade agreements are twofold; the reneging country suffers reputation and credibility costs when dealing with the injured country in the future and also incurs costs when dealing with all other nations aware of the breach. Maggi (1999) suggests that the dissemination of information is a primary role of the WTO, informing third parties of trade agreement breaches and thus strengthening the enforcement mechanism of reputation costs.

The role of irreversibility in trade bloc formation has received little formal attention in the regionalism literature. In a trading world subject to change, this is an important oversight because irreversibility implies that bloc formation is time dependent. The decision to establish a trade agreement, its design, and the identity of members all depend on coalition formation decisions taken by trading nations in the past. In other words, trade bloc formation and design depends, not just on the current trading environment, but also (implicitly) on the *past* trading environment.

Irreversibility also implies that prospective members face a trade-off between rigid and flexible trade agreement design. Rigid trade blocs not only have the potential to yield immediate terms-of-trade benefits for their members, they also serve to bind members to a free trade future with each other. Moreover, the ability of non-members to form (overlapping) trade agreements with member countries in the future is reduced the more rigid the design of the bloc. In other words, rigid trade blocs have an *insurance value* to prospective members.⁶ On the other hand, members of flexible blocs can respond more readily to changes in the trading environment – flexible trade agreements also have an *option value* to prospective members.

In a trading environment subject to change, therefore, irreversibility provides an incentive for countries to be forward-looking when committing to a trade bloc. A country's coalition formation decision reflects its desired degree of flexibility. In particular, a country's preferred mode of integration reflects a desire to insure itself against trade environment shocks while maintaining an option to respond to changes. In this paper we explicitly model these costs and benefits of trade bloc flexibility.

In a world of trade bloc irreversibility the degree of agreement flexibility varies by coalition type. At one extreme, standing alone affords a country maximum flexibility to respond to changes in the trading environment. At the other extreme, global free trade implies minimum coalitional flexibility. Regional agreements such as FTAs and CUs provide members with intermediate levels of flexibility. A CU, however, is more rigid than a FTA. Union members levy a 'common external tariff' (CET) on non-members and the CET revenue is shared according to an agreed formula. Partners in an FTA, on the other hand, choose their own external tariff rates, but must agree on a schedule of "rules-of-origin" (RoO) that determine the duty-free status of goods originating in non-member nations but traded within the FTA. While RoO are costly, they prevent non-members arbitraging away any external tariff differences between FTA members. In this respect, RoO enhance FTA flexibility.

While reneging on an existing trade agreement is costly, so too is establishing an overlapping agreement, especially when a rigid RTA is involved. The costs of overlap relate to any compensation a country must pay members of their existing agreement before establishing a new, concurrent RTA. Since a CU requires members to coordinate their choice of external tariffs, costs of overlap tend to be greater when a CU is involved.⁷ For example, the establishment of an FTA involving an existing CU member requires the cooperation of both members of the original CU. The establishment of a CU which shares a member with an existing FTA requires all the CU members to levy a zero tariff on all members of the original FTA. For simplicity, in this paper we abstract from compensation issues by assuming that countries can

⁶ Ethier (2002) refers to the insurance motive for contingency measures (i.e. unilateralism) within a multilateral framework. Observed behavior confirms that nations consider the impact of (expected) future shocks when deciding whether or not to join a trade agreement. Perroni and Whalley (2000) argue that small countries may seek to join RTAs as insurance against future protection.

⁷ Crawford and Fiorentino (2005) demonstrate that FTAs are concluded more rapidly than CUs.

only form overlapping FTAs. While this is a restrictive assumption, our primary aim is simply to demonstrate that, in a changing trading world, trade bloc irreversibility leads countries to pursue trade agreements of varying levels of flexibility.

So how do changes in the trading environment influence the value potential members place on trade agreement flexibility? This paper focuses on one particular type of change; namely, a shock to future trade costs. We demonstrate that if these costs are expected to decline in the future (“trade liberalization”), the preferred degree of trade bloc flexibility varies with country characteristics. On the other hand, if trade costs are expected to rise in the future (“trade protection”), trading nations opt for relatively rigid trade agreements regardless of their characteristics.

The intuition for these results is as follows. If trade liberalization is expected, the opportunity cost associated with membership of a rigid trade bloc can be significant; members are unable to exploit new trading opportunities that arise. This is particularly true for countries that have most to gain from the profit-shifting benefits of trade policy. If trade protection is expected, countries seek to “lock-in” trade partners to a free trade future via inflexible trade agreements. We characterise these preferences over flexibility in terms of, on the one hand, a country’s desire for the *option* to alter trade policy in light of changes to the trading environment, versus its desire for *insurance* against trade policy changes by trade partners on the other.

The paper proceeds as follows. Section II sets out the theoretical model, Section III discusses individual country preferences for trade agreement flexibility and Section IV analyses equilibrium coalition formation. Section V concludes.

II. THE MODEL

Following Krishna (1998), Freund (2000) and Ornelas (2007), we specify a 3-country partial equilibrium model of world trade in which N_X firms are domiciled in Country X , N_Y in Country Y and N_Z in Country Z . Markets are segmented.⁸ In each market firms compete on Cournot terms producing a homogeneous good at constant marginal cost $c > 0$. Demand for this good in Country i is given by $P_i = A_i - Q_i$ where P_i is its price, Q_i is the total quantity and $A_i (> c)$ is a demand parameter. Country i levies a specific trade tax t_i^j on imports from Country j .

Trade occurs over two periods. Between periods one and two, a trade shock occurs. In each period, countries play a three-stage game. First, trade agreements are formed. Second, given these coalitions, optimal trade taxes are chosen. Third, firms select their profit maximizing output and markets clear. In period 2, following the trade shock, this game is repeated subject to the coalitions formed in period 1. We solve backwards for a subgame perfect Nash equilibrium.

II.A. Stage Three: Firm Output Choice

Since markets are segmented, we focus our attention on country X . The analysis is analogous for countries Y and Z . Demand for the homogeneous good in country X is given by $Q_X^D = A_X - P_X$ and total supply by $Q_X^S = N_X q_X^X + N_Y q_X^Y + N_Z q_X^Z$ where q_X^j is

⁸ Price discrimination is observed even in highly integrated markets. See, for example, Goldberg and Verboven’s (2005) study of the European car industry. In integrated markets, market segmentation may be unrelated to member country trade policies arising, for example, due to differences in consumer tastes or income (Malueg and Schwartz, 1994) or government regulation (Grossman and Lai, 2008).

the amount that a firm domiciled in Country j sells in Country X . Since all firms regardless of origin have identical costs, we focus on the symmetric equilibrium in which all firms of common nationality sell the same output in a particular market.

The profit a Country- j firm makes from selling in Country X can be written as $\pi_X^j = (P_X - c - t_X^j)q_X^j$, $j = X, Y, Z$. The firm chooses q_X^j to maximize this profit subject to the output choices of its Cournot competitors and independent of its own output choices in other markets. The first order condition is

$$(1) \quad \frac{\partial \pi_X^j}{\partial q_X^j} = (P_X - c - t_X^j) - q_X^j = 0, \quad j = X, Y, Z.$$

Equation system (1) comprises three best-response functions, one for each country, in three unknowns. Solving this system yields Nash equilibrium outputs of the form:

$$(2) \quad \begin{aligned} q_X^X &= \frac{(A_X - c) + N_Y t_X^Y + N_Z t_X^Z}{1 + N_X + N_Y + N_Z} \\ q_X^Y &= \frac{(A_X - c) - (1 + N_X + N_Z)t_X^Y + N_Z t_X^Z}{1 + N_X + N_Y + N_Z} \\ q_X^Z &= \frac{(A_X - c) + N_Y t_X^Y - (1 + N_X + N_Y)t_X^Z}{1 + N_X + N_Y + N_Z} \end{aligned}$$

In equation (2), the impact of Country X 's trade taxes on the quantities sold in X is weighted by the number of firms domiciled in each country. That is, the trade tax impact depends on the extent to which there exist alternative sources of supply.

In equilibrium the goods market clears such that $Q_X^D = Q_X^S$. Substituting the output expressions from (2) into the demand function yields the following solution for the equilibrium price of the homogeneous good in country X :

$$(3) \quad P_X = \frac{A_X + c(N_X + N_Y + N_Z) + N_Y t_X^Y + N_Z t_X^Z}{1 + N_X + N_Y + N_Z}.$$

Equation (3) implies that the impact of local trade taxes on the domestic price is greater the larger the number of foreign firms.

II.B. Stage Two: Optimal Trade Tax Choice

Country X 's welfare is the sum of consumer surplus, trade tax revenue and total firm

profit and can be written as $W_X = \frac{Q_X^2}{2} + (t_X^Y N_Y q_X^Y + t_X^Z N_Z q_X^Z) + \sum_{i=X,Y,Z} N_X (P_i - c - t_i^X) q_i^X$.

Policymakers choose optimal trade taxes to maximize welfare. Note that from equations (2) and (3) a country's trade taxes only influence domestic prices and output. The implications of this are two-fold. First, there is no terms-of-trade welfare benefit associated with trade taxes. Second, the domestic policymaker cannot influence her firms' foreign profits.

In choosing optimal trade tax rates, countries adhere to the WTO's most favored nation (MFN) principle; equal tax rates are levied on all trade partners. RTA members are exempted from this rule and can discriminate in favor of each other.

In the case in which all countries stand alone, referred to here as “unilateral tariff setting” (*UTS*), MFN implies that $t_X^Y = t_X^Z = t_{X,UTS}$, $t_Y^X = t_Y^Z = t_{Y,UTS}$ and $t_Z^X = t_Z^Y = t_{Z,UTS}$. For the *UTS* case, Country *X*'s optimal MFN trade tax is:

$$(4) \quad t_{X,UTS} = \frac{(A-c)(1+2N_X)}{2+2N_X(2+N_X)+N_Y+N_Z}.$$

In the case where Country *Z* stands alone while countries *X* and *Y* form a free trade area, *FTA*(*X*,*Y*), bilateral trade between countries *X* and *Y* is duty free, i.e. $t_X^Y = t_Y^X = 0$. Country *X*'s optimal trade tax on the excluded Country *Z* takes the form:

$$(5) \quad t_{X,FTAxy}^Z = \frac{(A-c)(1+2N_X)}{2(1+N_X+N_Y)^2+N_Z+2N_YN_Z}.$$

In the case where Country *Z* stands alone while countries *X* and *Y* form a customs union, *CU*(*X*,*Y*), countries *X* and *Y* levy zero trade taxes on each other as well as a common external tariff (CET) on imports from *Z*, i.e. $t_X^Y = t_Y^X = 0$ and $t_X^Z = t_Y^Z = t_{CET,CU(X,Y)}^Z$. In choosing the optimal CET, countries *X* and *Y* maximize a weighted sum of their national welfare, $W_{CU(X,Y)} = \gamma W_X + (1-\gamma)W_Y$. In this paper, the weights are set to $\gamma = 1/2$ exogenously.⁹ The optimal CET can be written as:

$$(6) \quad t_{CET,CUxy}^Z = \frac{(A-c)(1+2N_X+2N_Y)}{2(1+N_X+N_Y)^2+N_Z}.$$

In our framework, other coalition structures are also possible. In particular, we consider the case of global free trade (*GFT*) in which all trade regardless of origin or destination is duty free. Furthermore, we consider the possibility of overlapping FTAs. To illustrate the trade tax equilibrium in this latter case, consider the situation in which *FTA*(*X*,*Y*) and *FTA*(*X*,*Z*) coexist. In this case, $t_X^Y = t_Y^X = 0$ and $t_X^Z = t_Z^X = 0$. Hence only two trade tax rates require to be solved for, t_Y^Z and t_Z^Y . In this framework, these are identical to $t_{Y,UTS}$ and $t_{Z,UTS}$ respectively. In fact, for all the coalition structures analyzed in this paper, the equilibrium trade tax rates are either analogous or identical to the rates defined in equations (4), (5) and (6).

LEMMA 1. *Optimal trade taxes are positive provided $A > c > 0$ and $N_X, N_Y, N_Z \geq 1$.*

PROOF. By inspection of equations (4), (5) and (6).

⁹ In fact, the choice of weights can influence coalition formation (Melatos and Woodland, 2007).

Lemma 1 says that, provided that there is at least one firm domiciled in each country, import tariffs are always optimal; import subsidies never arise. In the presence of import tariffs, prices and quantities are always positive (see equations (2) and (3)).

II.C. Trade Shocks

We have argued that countries' coalition formation decisions are likely to change in response to changes in the trading environment. To demonstrate how, we examine two cases of very simple, stylized (and exogenous) trade shocks.¹⁰

The first case represents expected future “trade liberalization” in which an initially autarkic Country Z opens to world trade in period 2.¹¹ In solving this case, the above model is augmented with the following additional restrictions in period 1: $q_Z^X = q_Z^Y = q_X^Z = q_Y^Z = 0$. The second case represents an episode of expected future “trade protection” in which Country Z, a trading nation in period 1, becomes autarkic in period 2. In solving this case, the following additional restrictions are imposed in period 2: $q_Z^X = q_Z^Y = q_X^Z = q_Y^Z = 0$. Note that in the “trade protection” case, although Country Z is isolated in period 2, we assume that it continues to trade freely with any country with which it concluded a trade agreement in period 1. This captures the insurance motive for trade bloc formation.

II.D. Stage One: Coalition Formation

Having determined the welfare implications of each potential coalition structure, countries can select their preferred option from the menu of possible outcomes. Following Riezman (1985), the solution concept employed here is the core. A coalition structure resides in the core if it is not blocked by any coalition. A coalition, S , blocks a coalition structure, T , if for all countries i in S , $U^i(S) \geq U^i(T)$, with strict inequality for at least one member of S .

Trade blocs can form in each period. Indeed, countries may also agree to form multiple RTAs simultaneously in any given period. However, for simplicity we assume that once established, trade agreements cannot be reversed; the (reputation) costs of reneging on an existing trade agreement are prohibitive. This implies that the feasible set of coalitions in period 2 is constrained by the coalitions formed in the period 1. Effectively, therefore, countries choose a sequence of coalitions to maximize their two-period welfare.¹² Tables I and II list the feasible two-period sequences of coalition structures that can occur in the “trade liberalization” and “trade protection” cases respectively.

[Insert Tables I and II about here]

While overlapping FTAs are allowed, CUs are not permitted to overlap with an FTA.¹³ If a CU overlaps with an existing FTA, or an FTA overlaps with an existing CU, the CET is necessarily zero and one union member will be obliged to

¹⁰ Endogenizing the trade shock is an important issue, but lies beyond the scope of this paper.

¹¹ This approach, although highly stylized, provides a simple way to demonstrate how trade blocs may overlap as a result of changes to the trading environment. In fact, such extreme changes to the trading environment are not unknown in the real world – the incorporation of China and the former Eastern Bloc countries into the world trading system are cases in point. In any case, the trade shock could be modeled more generally as a continuous trade costs variable.

¹² For simplicity we abstract from time discounting.

¹³ In this model, if CUs overlap with each other global free trade (considered separately) results.

levy this duty free rate in the face of a positive tariff from its trade partner outside the union. By forbidding CU-FTA overlap the analysis is simplified by removing the need to consider compensatory transfers between trade bloc members.¹⁴ However, members of an existing RTA can agree to deepen their bloc or expand its membership; for example, an FTA in period 1 can mature into a CU or global free trade in period 2.

Tables I and II clarify the concept of trade bloc flexibility which underpins this paper. The *UTS* coalition structure in which all countries stand alone guarantees the greatest flexibility (i.e. the greatest number of feasible period 2 coalition structures). Note that for case 1, when Country *Z* is autarkic in period 1, $FTA(X,Y)$ and $CU(X,Y)$ are welfare equivalent in period 1. However, they do *not* imply the same two-period welfare because $FTA(X,Y)$ provides access to a larger set of feasible period 2 coalition structures. That is, $FTA(X,Y)$ is more flexible than $CU(X,Y)$.

II.E. Some Important Relationships

We now derive three results that underpin the propositions presented in later sections. Consistent with the simulation results reported later, we assume that all countries have identical demands; that is, $A_i = A, \forall i$.

LEMMA 2. *In equilibrium, Country i 's welfare is inversely related to foreign tariffs.*

PROOF. See the Appendix.

Lemma 2 implies that foreign tariffs impact negatively on a country's welfare regardless of the international distribution of firms. The intuition is as follows. Foreign tariffs only influence a country's welfare through their impact on the foreign profits of its domestically domiciled firms. At the same time, tariffs shift profit from domestic to foreign firms.

Lemma 3 relates a country's optimal tariff choice to the parameters of the model, in particular, the international distribution of firms.

LEMMA 3.

Provided that N_i, N_j and N_k are such that under $FTA(i,j)$

$$2N_i(1 + N_i) - 2N_j(1 + N_j + N_k) - N_k > 0; (i, j, k = X, Y, Z):$$

- (i). *Country i 's optimal equilibrium tariffs are inversely related to the number of firms domiciled in Country i .*
- (ii). *The optimal equilibrium CET for $CU(i,j)$ is inversely related to the number of firms domiciled in Country i and Country j .*

PROOF. See the Appendix.

Lemma 3 says that a country's (or customs union's) optimal tariffs are inversely related to the number of its domestic firms provided that this number of firms is "sufficiently large" relative to the number of firms domiciled overseas.

The intuition behind Lemma 3 is as follows. To begin, note that a country's consumer surplus, tariff revenue and the domestic profitability of its local firms depend only on its own (not foreign) tariffs. In choosing its optimal tariff, therefore, a

¹⁴ The role of compensation in trade bloc overlap is an important issue deserving of separate study. Note that the EU, a CU, has a number of FTAs with non-member countries, agreements to which all EU members are signatories.

country (or CU members jointly) must balance three effects of raising its tariffs. First, equations (2) and (3) show that domestic prices and domestic sales rise by more, the greater the number of foreign-domiciled firms. Second, foreign firm sales fall by more the greater the number of local firms (equation (2)). Third, an increase in domestic tariffs raises tariff revenue further the more firms are domiciled abroad. Overall, therefore, while higher domestic tariffs help shift profits to local firms (and tariff revenue to the local government), the reduction in consumer surplus may be even greater if there are too many local firms. In short, countries with many local firms relative to their trading partners will tend to levy lower tariffs.¹⁵

Lemmas 2 and 3 together provide an insight into the driving force behind RTA formation and design in our modeling framework. Lemma 2 suggests that countries seek to ‘avoid’ high tariffs levied by their trading partners. In this model, countries ‘avoid’ foreign tariffs by creating trade blocs. Lemma 3 implies that there is a greater incentive to pursue duty free trade with nations characterized by a small number of domestic firms because such nations will tend to levy higher tariffs.

One implication of Lemmas 2 and 3 is that if both a country’s trading partners are characterized by few domestic firms, it will prefer free trade with both of them. The country may achieve this either by pursuing global free trade or by establishing overlapping FTAs with itself as the hub. Lemma 4 shows that in our modeling framework, overlapping FTAs will always be preferred in this case.

LEMMA 4. *A prospective hub country prefers overlapping FTAs to GFT*

PROOF. Without loss of generality, compare the coalition structure $\{FTA(X,Y), FTA(X,Z)\}$ to *GFT*. Lemma 4 implies that Country *X* prefers the former coalition structure to the latter. This is because under overlap, Country *X* firms benefit in two ways from the tariffs countries *Y* and *Z* levy on each other. First, as can be seen from equation (2), a tariff war between *Y* and *Z* translates into higher sales in those countries for Country *X* firms. Second, as equation (3) demonstrates, a tariff war between *Y* and *Z* raises domestic prices in both countries. Thus, compared to the case in which there is free trade between countries *Y* and *Z*, Country *X* firms export more units to *Y* and *Z* and, once there, sell them at higher prices. At the same time, *X*’s exports have duty free access to *Y* and *Z* just as they would under global free trade.

III. COUNTRY PREFERENCE FOR TRADE BLOC FLEXIBILITY

In this section we demonstrate that in a trading world such as that described in Section II, the desire for trade bloc flexibility varies with country characteristics and the nature of any trade shock. This section is only concerned with an individual country’s preferences among different trade bloc designs. Equilibrium coalition formation – that is, the contents of the core – is calculated in Section IV.

Unfortunately, our model does not yield easily interpretable closed form solutions with regards to country preference rankings of coalition structures. Since these preference orderings are our ultimate concern, we simulate the model. In the simulations that follow, all countries have identical demands but the distribution of

¹⁵ In this model, it is important not to confuse the number of domestic firms with country size. Here, countries with few firms levy higher tariffs; they act like the “large” countries of traditional analysis. Remember, however, that in this model, there are no terms-of-trade effects.

firms is unequal across countries. In particular, $A_i = 10 \forall i$, $c = 1$ and $N_Z = 5$. The number of firms in X and Y vary in the range $N_X, N_Y \in [1, 40]$.¹⁶

For the trade liberalization case, Figure I shows how Country X 's trade bloc preferences vary with the international distribution of firms. For each cell, the shading reveals Country X 's preferred two-period sequence of coalition structures. That is, the sequence that maximizes Country X 's total two-period (undiscounted) welfare.

[Insert Figure I about here]

The contents of each cell in Figure I indicate whether Country X 's preferred two-period coalition sequence is consistent with welfare maximization in periods 1 and 2 separately. Empty cells, indicate that it is. Cells populated with a "&", however, indicate that while, in a static world, X would prefer to establish $FTA(X, Y)$ or $CU(X, Y)$ in period 1, concern for its second period welfare combined with trade bloc irreversibility induces it to choose a less preferred coalition structure in the first period in order to maximize its total two-period welfare. Cells labeled "\$" meanwhile, indicate that X prefers a two-period coalition sequence which is inconsistent with welfare maximization in the *second* period.

In order to interpret Figure I, note first that the bolded border cell at $(N_X, N_Y) = (5, 5)$ represents the symmetric equilibrium in which all three countries are identical. At this point, Country X 's welfare (both the two-period total and in each period individually) is maximized if in period 1 it forms $FTA(X, Y)$ and in period 2 it forms an overlapping FTA with Country Z .

Inspection of Figure I suggests the following proposition:

PROPOSITION 1. *If trade agreements are irreversible and a trade liberalizing shock is expected in the future, then a country's desire for trade bloc flexibility varies inversely with the number of domestic firms it has relative to its trading partners.*

The lemmas derived in Section II.E. underpin Proposition 1. In the yellow-shaded region in Figure I (N_X large relative to N_Y and N_Z) Country X wants free trade with both Y and Z so as to avoid the high tariff rates that these countries would otherwise impose on its exports. Since from Lemma 4 we know that a "hub" country prefers overlapping FTAs to GFT , then Country X prefers $FTA(X, Y) \& FTA(X, Z)$ in period 2. But trade bloc irreversibility implies that in period 1 X must either stand alone or form $FTA(X, Y)$. That X prefers $FTA(X, Y)$ to standing alone in period 1 is indicative of a desire for trade bloc rigidity.¹⁷

This 'rigidity bias' is even more stark in the case of the yellow-shaded cells populated by a "\$". Here, X 's period 2 welfare is maximized by forming $CU(X, Z)$.

¹⁶ Many different parameter values were analyzed yielding similar results. In particular, we also investigate the case in which country demands differ. However, this analysis is hampered by the fact that for large parts of the parameter space equilibrium quantities, prices or import tariffs are negative for at least one of the equilibrium coalition structures considered. Nevertheless, where economically feasible equilibria are obtained for all coalition structures, the spirit of our results is maintained.

¹⁷ Similarly, in the purple shaded region, Countries X and Y have a small number of domestic firms relative to Z . Country X , therefore, seeks a CU with Country Y in period 2 in order to avoid the latter's relatively high tariff rates. Note that unlike Country Z , Y is available to join an RTA in period 1.

Nevertheless, it chooses to form the overlapping agreements $FTA(X,Y)$ and $FTA(X,Z)$ instead. Note from Table I that for $CU(X,Z)$ to be feasible in period 2, Country X would have to stand alone in period 1. That X does not choose to follow this route reflects the fact that the higher period 2 payoff from $CU(X,Z)$ does not compensate for the lower period 1 welfare associated with standing alone. The *option value* of trade bloc flexibility in these cases is clearly insufficient to tempt Country X.

In the red-shaded region in Figure I (N_Y and N_X large relative to N_Z) Country X wants free trade with Z in period 2 in order to avoid Z's high import tariff rates. In this region, Country X prefers $CU(X,Z)$ to $FTA(X,Z)$ because the CU internalizes the tariff externality by allowing X and Z to choose their external tariffs jointly.¹⁸ Remember, however, that $CU(X,Z)$ is only feasible in period 2 if X stands alone in period 1. Hence, X has a distinct preference for trade bloc flexibility.

This 'flexibility bias' is even more pronounced in the case of the red-shaded cells populated with a "&". While in this region X's period 1 welfare is maximized by forming $RTA(X,Y)$, this choice is inconsistent with the formation of $CU(X,Z)$ in period 2.¹⁹ Indeed, it turns out that in this region, the welfare Country X gains from $CU(X,Z)$ in period 2 more than compensates it for the welfare it sacrifices by standing alone in period 1. Country X clearly appreciates the *option value* of trade bloc flexibility (i.e. standing alone) in these cases.

When N_X becomes smaller relative to N_Y and N_Z (the blue-shaded region), Country X prefers to stand alone in both periods as the high tariffs it levies on imports from Y and Z shift sufficient profits from those countries to outweigh profits lost by Country X firms due to foreign tariffs. However, if N_X becomes too small (the green-shaded region), the profit shifting benefits to Country X from high local tariffs are diluted as suggested by Lemma 3. In this case, concern for the profit shifting effect of foreign tariffs once again dominates and Country X prefers overlapping FTAs with Y and Z.

Finally, it is worth noting a heartening feature of Figure I: overlapping FTAs are commonly, though not always, preferred. In fact, Figure I demonstrates that a country, at a given point of time, may prefer to stand alone (the red-shaded region), be a member of a single CU (the purple and red-shaded regions), be a member of a single FTA (the yellow and blue-shaded region) or be a member of multiple FTAs simultaneously (the green and yellow shaded regions). Figure I, therefore, reflects the observed diversity of trade agreement designs.

Turning now to the "trade protection" case, Figure II suggests the following proposition.

PROPOSITION 2. *If trade agreements are irreversible and a trade protection shock is expected in the future, then all countries will prefer greater trade bloc rigidity.*

[Insert Figure II about here]

Proposition 2 suggests that in a world in which future trade protection is expected there is no desire for trade bloc flexibility.

¹⁸ The externality arises because by raising its import tariffs, a country raises its domestic price (see equation (3)) thereby conferring a benefit on foreign firms selling into this market.

¹⁹ Remember that, by design, CUs and FTAs are not permitted to overlap.

In the red-shaded region in Figure II, Country X prefers $CU(X,Z)$ in period 1 so as to avoid Z 's high tariff rates. Due to irreversibility and the nature of the trade shock, this coalition structure will endure in period 2. In period 2, however, when Z only trades with its period one trade bloc partners or not at all, X would prefer to be the hub country in the overlapping agreements $FTA(X,Y)$ and $FTA(X,Z)$. In order to achieve this, X could choose to form the more flexible bloc $FTA(X,Z)$ in period 1 instead of $CU(X,Z)$. The fact that it does not do this implies that in these cases the option value associated with trade bloc flexibility is insufficient to compensate for the welfare forgone in period 1 by forming $FTA(X,Z)$. Effectively, Country X “locks-in” the welfare gains arising from first period coalition formation, *insuring* itself against the anticipated future constraints on trade (and bloc formation).

In the green-shaded region X prefers to be the hub linking two overlapping trade blocs, $FTA(X,Y)$ and $FTA(X,Z)$, in both periods 1 and 2.²⁰ This preference endures even when $CU(X,Z)$, $FTA(Y,Z)$ or $CU(X,Y)$ would yield a higher payoff in period 1 (respectively, the &-labeled, #-labeled and \$-labeled cells). Of course, none of these alternative first period coalition structures are consistent with X 's desire to be the hub of overlapping FTAs in period 2. The fact that X prefers to establish these overlapping agreements from the first period demonstrates its desire to “lock-in” the 2nd-period welfare benefits of overlap from period 1 even at the expense of some period 1 welfare. Country X effectively *insures* itself against future constraints to bloc formation resulting from trade bloc irreversibility and increased protection.

IV. EQUILIBRIUM TRADE BLOC FORMATION

While the preceding analysis has shed light on individual country attitudes to trade bloc flexibility, it provides little guidance on what type of coalition structure is observed in equilibrium. In particular, are the coalition structures predicted by our model consistent with the stylized facts on trade bloc formation identified at the outset? To answer questions such as this, we analyze the contents of the core.

The preceding section demonstrated that, consistent with observed behavior, countries commonly prefer FTAs (and overlapping FTAs) to other types of blocs. But do these preferences survive in the core? Figure III suggests that often they do.

[Insert Figure III about here]

For the “trade liberalization” case Figure III identifies those cells in which coalition structures in the core are characterized either by FTAs or a CU.²¹ In the green-shaded regions FTAs are observed. In the blue-shaded regions CUs are observed. In the red-shaded cells coalition structures characterized by overlapping FTAs or a CU coexist in the core. The labels in each region refer to the membership of equilibrium RTAs.

Figure III suggests the following two propositions.

PROPOSITION 3. *When the number of domestic firms in any two countries is “sufficiently similar” (and “sufficiently different” to the third country) then a CU involving the two similar countries is observed in the core.*

²⁰ This is for the same reasons that X preferred to form overlapping FTAs in the yellow and green-shaded regions in Figure I.

²¹ In some cases, the RTA coalition structures are not the unique elements of the core.

PROPOSITION 4. *If the distribution of firms among all countries is “sufficiently similar”, the core consists of either: (i) a FTA between the two countries with the smallest number of domestically domiciled firms, or (ii) overlapping FTAs in which the country with a relatively small number of domestic firms is the “hub” and the countries with the relatively large number of domestic firms are the “spokes”.*

Proposition 3 confirms a result obtained by Melatos and Woodland (2007) in a perfectly competitive general equilibrium model of world trade. The intuition is as follows. In the blue shaded regions in Figure III, two countries have a relatively large number of domestic firms. From Lemmas 2 and 3 we know that each of these countries wishes to engage in free trade with the third (dissimilar) country whose relatively small number of domestic firms induces it to levy high import tariffs. From the point of view of the core, however, symmetry ensures that the preferred coalition of each similar country – a CU with the dissimilar nation – block each other. Note that similar countries that are sufficiently different to the third country prefer a CU to a FTA for three reasons. First, the former internalizes the externality arising from the impact of tariffs on domestic prices. Second, this externality benefit is larger the more different is the excluded country. Third, if the CU members are sufficiently similar, the CET chosen does not diverge significantly from their individually optimal external tariff rates.

Proposition 4 is an important result that links our paper to the literature on hub and spoke trade agreements and. Proposition 4, to the best of our knowledge, represents the first time that a theoretical result has been derived predicting the characteristics of hub and spoke countries in overlapping trade agreements. The intuition for Proposition 4 is as follows. FTAs (and, in particular, overlapping FTAs) survive in the core when all countries are similar because no two countries have sufficient incentive to form a CU (as per Proposition 3). Moreover, from Lemma 4 a “hub” country always prefers overlapping FTAs to *GFT*.

Note that Propositions 3 and 4 also hold in the case of an anticipated increase in trade protection in the future. This can be seen in Figure IV.

[Insert Figure IV about here]

Countries with a similar number of domestic firms tend to form CUs among themselves – witness the blue shaded regions in Figure IV. Moreover, in overlapping FTAs, the country with fewer domestic firms is the “hub”. There is, however, an important difference between the trade liberalization and trade protection cases. In the latter case, Countries X and Y *never* form a CU. As a result, overlapping FTAs are much more commonly observed in the trade protection case. This occurs because in this case Country Z withdraws from the trading system in period 2. Thus, X and Y wish to lock Z into a two-period trading relationship by concluding a FTA with it in period 1. Since CUs and FTAs are not permitted to overlap, this rules out *CU(X,Y)*.

Finally, two other issues merit some comment. The first concerns the observed lack of renegotiation of existing trade blocs even in the face of changes to the trade environment (our second stylized fact). Figure III shows that in this model, such ‘coalitional inertia’ is often reflected in the core; all countries often stand alone

in both periods (the black-shaded region) or, in the case of $CU(X,Y)$, form CUs in period 1 which endure into period 2.²²

The second issue worthy of comment relates to the occurrence of global free trade in equilibrium. In the trade liberalization case (Figure III), *GFT* only survives in the core in a handful of cells clustered around the symmetric case $N_x, N_y, N_z = 5$. On the other hand, in the trade protection case (Figure IV), *GFT* is much more commonly observed, invariably sharing the core with a coalition structure characterized by overlapping FTAs. In short, *GFT* is much more likely to be observed if trade protection is expected to increase in the future. This is because countries look to circumvent the expected trade protection in period 2 by locking-in free trade agreements from the first period. This is another manifestation of the insurance motive for rigidity in trade bloc design.

V. CONCLUSION

The main aim of this paper has been to model trade bloc formation and design over time when the trading environment is changing. In the process, we have sought to highlight the role trade agreement flexibility plays in coalition formation. Moreover, we set ourselves the goal of developing a model to endogenously explain three stylized facts characterizing regionalism: (i) overlapping RTAs, (ii) the popularity of FTAs relative to CUs and (iii) renegotiation or disbandment of existing RTAs is rare.

Implementing a partial equilibrium trade model that incorporates endogenous coalition formation, we find that when trade liberalization is expected in the future, a country's desire for trade bloc flexibility varies inversely with the number of domestic firms it has. On the other hand, when increased trade protection is expected in the future, there is no desire for trade bloc flexibility by any nation.

Our model also makes predictions regarding which coalition structures are likely to arise in equilibrium. Customs unions involving similar countries can be supported in equilibrium if the excluded country is sufficiently different. When individual free trade areas are observed in the core, the member countries are those with the fewest domestic firms. In the case where overlapping FTAs are observed the country with the smaller number of domestic firms is the "hub" while the countries with the relatively large number of domestic firms are the "spokes". A reticence to renegotiate existing trade agreements in the face of a trade shock is also observed.

All of these results are consistent with the stylized facts we set ourselves the task of explaining. Nevertheless, much remains to be done. In particular, further work should investigate the role of compensatory income transfers in the formation of overlapping RTAs. The relationship between trade shocks and trade bloc formation should be endogenized. Finally, modeling the trade shock more generally as a continuous trade cost variable for example should make it possible to relate the value a country places on trade bloc flexibility to the observed degree of volatility in the trading environment.

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²² In Figure IV, coalitional inertia is ubiquitous although this is mainly due to the nature of the trade protection shock that was exogenously imposed.

APPENDIX

Proof of Lemma 2

We prove Lemma 2 for Country X only; the proof is analogous for countries Y and Z . Consider the definition of Country X welfare in the text. Note that foreign tariffs only impact Country X welfare through the (foreign) profits Country X firms make in Y and Z , π_Y^X and π_Z^X respectively.

We wish to demonstrate that, in equilibrium, Country X welfare is inversely related to tariffs levied by a foreign Country j . That is, $\frac{dW_X}{dt_j^{MFN}} = \frac{d\pi_j^X}{dt_j^{MFN}} < 0$, $j = Y, Z$.

In the case in which the foreign country stands alone, differentiating Country X welfare with respect to j 's MFN tariffs yields

$$\frac{dW_X}{dt_j^{MFN}} = (P_j - c - t_j^{MFN}) \frac{dq_j^X}{dt_j^{MFN}} + q_j^X \left(\frac{dP_j}{dt_j^{MFN}} - 1 \right).$$

Using equations (2), (3) and (4) from the text and manipulating the algebra yields:

$$\frac{dW_X}{dt_j^{MFN}} = (A - c) \left[\frac{3 + 4N_Y + 2(N_X + N_Z)}{2 + 2N_Y(2 + N_Y) + N_X + N_Z} \right] > 0, \quad \forall N_X, N_Y, N_Z \geq 0.$$

By symmetry, this holds for each country j and, hence, Lemma 2 is confirmed. For the case in which the foreign country is a member of a discriminatory trade bloc, one of the foreign tariffs is zero and a similar expression is obtained.

Proof of Lemma 3

We prove Lemma 3 for Country X only; the proof is analogous for countries Y and Z . For each type of coalition structure CS , we wish to show under what conditions

$$\frac{\partial t_{X,CS}}{\partial N_X} < 0.$$

Differentiating equations (4), (5) in the text with respect to N_X and (6) with respect to both N_X and N_Y yields, respectively:

$$\begin{aligned} \frac{\partial t_{X,UTS}}{\partial N_X} &= - \frac{2(A - c) [2N_X(1 + N_X) - N_Y - N_Z]}{[2 + 2N_X(2 + N_X) + N_Y + N_Z]^2} \\ \frac{\partial t_{X,FTA(X,Y)}}{\partial N_X} &= - \frac{2(A - c) [2N_X(1 + N_X) - 2N_Y(1 + N_Y + N_Z) - N_Z]}{[2(1 + N_X + N_Y)^2 + N_Z + 2N_YN_Z]^2} \\ \frac{\partial t_{X,CU(X,Y)}}{\partial N_X} &= \frac{\partial t_{X,CU(X,Y)}}{\partial N_Y} = - \frac{2(A - c) [2(N_X + N_Y)(1 + N_X + N_Y) - N_Z]}{4(1 + N_X + N_Y)^4 + 4N_Z(1 + N_X + N_Y)^2 + N_Z^2} \end{aligned}$$

As pointed out in the text, all other coalition structures we consider either yield identical or symmetric outcomes to UTS , $FTA(X,Y)$ and $CU(X,Y)$. It is

straightforward to show that a sufficient condition for $\frac{\partial t_{X,CS}}{\partial N_X} < 0$, $\forall CS$ is given by

$$2N_X(1 + N_X) - 2N_Y(1 + N_Y + N_Z) - N_Z > 0.$$

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Table I
Feasible Two-Period Coalition Sequences: “Trade Liberalization” Case

Period-by-period coalition options		
Period 1 (2 countries)	Period 2 (3 countries)	2-period Coalition Sequence
UTS	UTS	{UTS, UTS}
	FTA(X,Y)	{UTS, FTA(X,Y)}
	FTA(X,Z)	{UTS, FTA(X,Z)}
	FTA(Y,Z)	{UTS, FTA(Y,Z)}
	CU(X,Y)	{UTS, CU(X,Y)}
	CU(X,Z)	{UTS, CU(X,Z)}
	CU(Y,Z)	{UTS, CU(Y,Z)}
	GFT	{UTS, GFT}
	FTA(X,Y) & FTA(X,Z)	{UTS, FTA(X,Y) & FTA(X,Z)}
	FTA(X,Y) & FTA(Y,Z)	{UTS, FTA(X,Y) & FTA(Y,Z)}
	FTA(X,Z) & FTA(Y,Z)	{UTS, FTA(X,Z) & FTA(Y,Z)}
FTA(X,Y)	FTA(X,Y)	{FTA(X,Y), FTA(X,Y)}
	CU(X,Y)	{FTA(X,Y), CU(X,Y)}
	FTA(X,Z)	{FTA(X,Y), FTA(X,Z)}
	FTA(Y,Z)	{FTA(X,Y), FTA(Y,Z)}
	GFT	{FTA(X,Y), GFT}
CU(X,Y)	CU(X,Y)	{CU(X,Y), CU(X,Y)}
	GFT	{CU(X,Y), GFT}

Table II
Feasible Two-Period Coalition Sequences: “Trade Protection” Case

Period-by-period coalition options		
Period 1 (3 countries)	Period 2 (2 countries)	2-period Coalition Sequence
UTS	UTS	{UTS, UTS}
	FTA(X,Y)	{UTS, FTA(X,Y)}
	CU(X,Y)	{UTS, CU(X,Y)}
FTA(X,Y)	FTA(X,Y)	{FTA(X,Y), FTA(X,Y)}
	CU(X,Y)	{FTA(X,Y), CU(X,Y)}
FTA(X,Z)	FTA(X,Z)	{FTA(X,Z), FTA(X,Z)}
	FTA(X,Z) & FTA(X,Y)	{FTA(X,Z), FTA(X,Z) & FTA(X,Y)}
FTA(Y,Z)	FTA(Y,Z)	{FTA(Y,Z), FTA(Y,Z)}
	FTA(Y,Z) & FTA(X,Y)	{FTA(Y,Z), FTA(Y,Z) & FTA(X,Y)}
FTA(X,Y) & FTA(X,Z)	FTA(X,Y) & FTA(X,Z)	{FTA(X,Y) & FTA(X,Z), FTA(X,Y) & FTA(X,Z)}
FTA(X,Y) & FTA(Y,Z)	FTA(X,Y) & FTA(Y,Z)	{FTA(X,Y) & FTA(Y,Z), FTA(X,Y) & FTA(Y,Z)}
FTA(X,Z) & FTA(Y,Z)	FTA(X,Z) & FTA(Y,Z)	{FTA(X,Z) & FTA(Y,Z), FTA(X,Z) & FTA(Y,Z)}
	GFT	{FTA(X,Z) & FTA(Y,Z), GFT}
GFT	GFT	{GFT, GFT}
CU(X,Y)	CU(X,Y)	{CU(X,Y), CU(X,Y)}
CU(X,Z)	CU(X,Z)	{CU(X,Z), CU(X,Z)}
CU(Y,Z)	CU(Y,Z)	{CU(Y,Z), CU(Y,Z)}

Figure I
Country X's Preferred Coalition Structures – Trade Liberalization Case ($N_z = 5$)

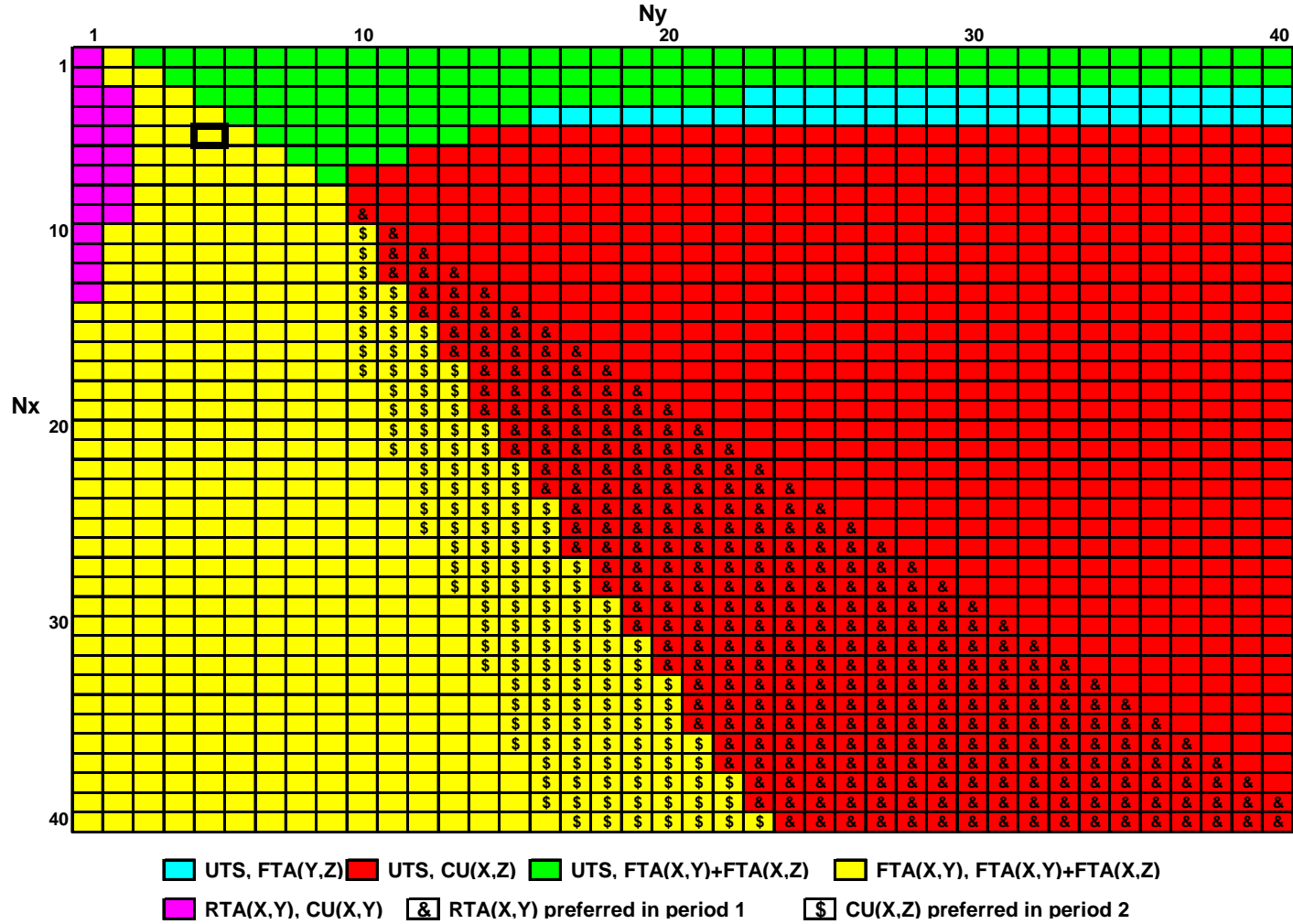


Figure II
Country X's Preferred Coalition Structures – Trade Protection Case ($N_Z = 5$)

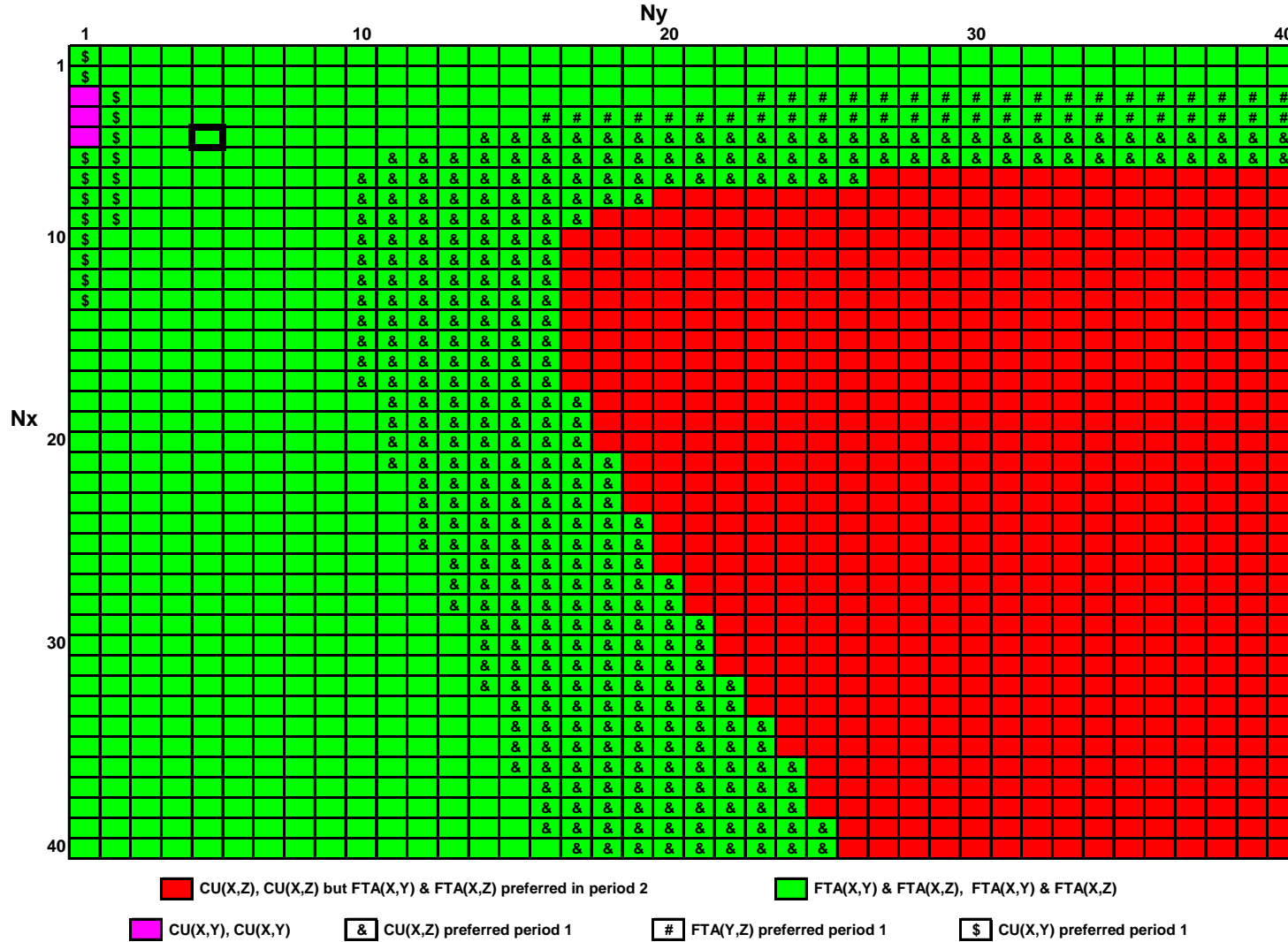


Figure III
Core Composition – FTAs and CUs in the Trade Liberalization Case ($N_z = 5$)

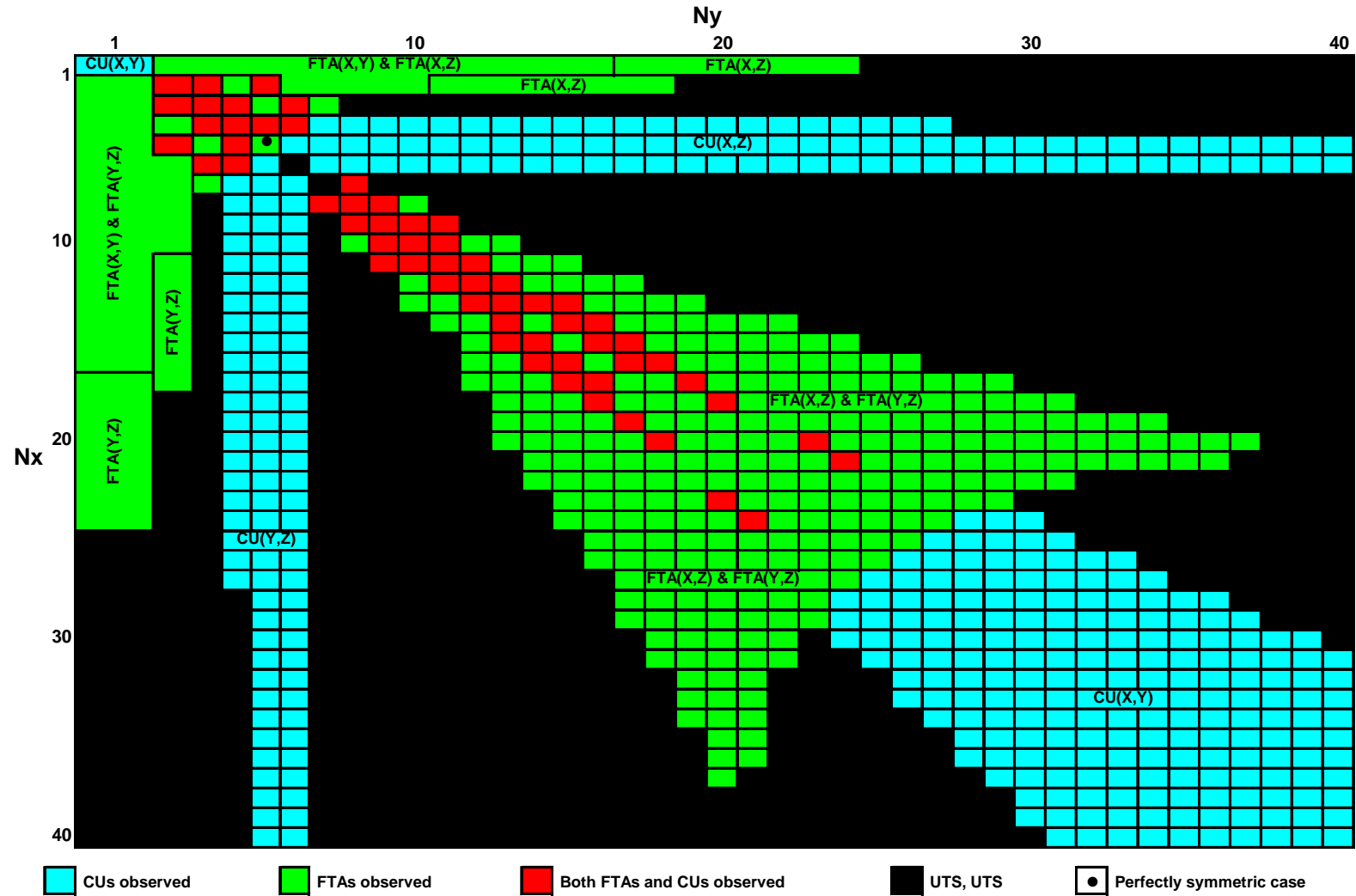


Figure IV
Core Composition – CUs, FTAs and Overlapping FTAs in the Trade Protection Case ($N_z = 5$)

