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“Strategic Formation of Customs Unions”

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Abstract

In this paper, we analyze the static effects of customs unions formation on national welfare under oligopolistic competition, accounting for market sizes, the number of firms and marginal costs. We build a basic four-country model, analyzing the members and non-members’ welfare situation moving from tariff-ridden trade to a single customs union and then to a double customs union situation, before analyzing a free trade option. Our analysis confirms that customs union formation generates positive effects on consumers and, under certain conditions, on producers within the union, while it has a negative impact on the rest of the world. We also identify conditions under which all countries may improve with several customs union formation. This exercise provides a simple yet direct explanation to the proliferation of trade agreements when these occur in waves. To this end, we solve a game with at least four countries and show that -under tariff-ridden trade- the Nash equilibrium entails two customs unions formation between similar countries and under specific market conditions. However, whenever possible free trade remains the preferred option.

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1 Introduction

Under the GATT’s code of non-discrimination (art. I), signatories have agreed to pursue global trade liberalization which was commonly accepted as a good way to improve welfare and economic development. Several authors demonstrated that high costs of protection incurred losses in welfare and that even low tariffs caused large deadweight losses under imperfect competition (for eg. Panagariya (2002)). Bhagwati and Srinivasan (2002) say that freer trade benefit the poor even. They point out that from a dynamic analysis, trade promotes growth, which in turn reduces poverty\(^1\).

However the best way toward global free trade and welfare improvement is unclear. Indeed, besides its Art.I, the GATT also allowed trade integration through free trade agreements -under art. XXIV- provided they fulfill certain conditions regarding partners’ mutual trade and external tariffs. Since then, we have witnessed a real proliferation (and expansion) of preferential trade agreements of all kinds and nowadays there are over 190 (Whalley 1998, World Bank 2000), with growing concerns over the impact of such preferential agreements on the world trading system and welfare, as well as governments’ real incentives to reach such agreements instead of just reducing trade barriers unilaterally!\(^2\)

An empirical econometric study by Rose (2004), using a ”gravity” model of bilateral trade for 175 countries over a period of 50 years, actually shows that there is ”no evidence that GATT/WTO has actually encouraged trade” but trade might have grown faster than income for many other reasons as for example: higher productivity, falling transport costs or regional trade agreements...

So what part do PTAs play in encouraging or undermining free trade liberalization and in improving or reducing welfare?

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\(^1\)That is, if they use their comparative advantage and/or maintain export-promoting policies while monitoring inflation.

\(^2\)See Whalley (1998) for a review of ”regional” trade agreements and the motives behind their formation.
1.1 Some theoretical background

As early as 1950, Viner defined preferential trade agreements as *second best* "partially free trade" and demonstrated that they are not always to be considered as a good step towards *best option* free trade: specifically customs unions can be trade diverting instead of trade creating, the former incurring social loss.\(^3\)

Many years after, that question still gives rise to much literature (see Panagariya 2000 review). And yet, it has not appeared to be a clear-cut separation between the authors who are somehow confident in that "FTAs offer a quicker and surer way"\(^4\) of getting to multilateral free trade whilst accompanying global welfare improvement and those who are more skeptical in that respect. Indeed, both the former (eg. Krishna 1998, Moner and Sempere 2004, Ornelas 2005b) and the latter (eg. Copeland 1990, Kennan and Riezman 1990, Bagwell and Staiger 1994, Andriamananjara 1999, Ornelas 2005a!) have long integrated Viner’s trade-either-diverting-or-creating (and hence welfare-improving-or-deteriorating) aspect of FTAs and have now engaged in more detailed theoretical considerations regarding their effects on welfare and trade multilateralization.

More refined theoretical settings allow thus for different possible outcomes that may serve in one sense or the other, depending on specific contexts and given parameters: See for example Spilimbergo and Stein’s (1998) variations on Krugman’s (1991) tariff-optimizing model with market segmentation and differentiated products; and subsequent ripostes by Haveman (1992) and Deardoff et al. (1994).

Along those lines of work, stands the work of Krishna (1998) advocating for the *positive effect* of trade diversion. Through an oligopolistic-competition setting of three countries, with segmented markets, in which *only producer interests* matter to trade policy makers, Krishna pledges that the more "trade diverting" the FTA the better (in terms of its impact on multilateralism). Under a more advanced form of integration (customs union), Moner and Sempere (2004) find that, under diseconomies of scope at home, both members and non-members can benefit from customs union formation.

Ornelas gives a good example of how relative things can be depending on the settings chosen. He first adopts Krishna’s framework (Ornelas, 2005a) allowing for

\(^3\)Winters (1994).

\(^4\)See Krishna 1998
endogenous tariffs - to focus on the trade creating aspect of FTAs - and finds that, even then, FTAs can be harmful to the world trading system. Later, in Ornelas (2005b) he constructs a model where both FTA formation and external tariffs settings are endogenous and concludes that FTAs can only reduce obstacles to further multilateral -and hence global- liberalization.

While most of these models offered a limited setting with only three countries, Das and Gosh (2006) study the endogenous formation of trading blocs among four or more countries, under imperfect competition (oligopolistic firms and market segmentation), introducing countries asymmetries in size and accomodating inter-industry and intra-industry trade for both industrialized and developing countries. In this paper, we adopt the novel use of four countries for it allows different trading blocs at once, while introducing substantial variations on markets structures. Whether regional trade agreements are stumbling or building blocs towards global free trade is definitely still open to discussion, but it seems that through negotiations and cooperative attitude governments can reach welfare-improving trade policies after all.

1.2 Our proceedings

Our basic model is similar to Das and Gosh (2006) in that it studies the endogenous formation of trading blocs through a novel four-country model in an imperfectly competitive model (oligopolistic and market segmented), introducing countries asymmetries in size (accomodating trade between industrialized and developing countries), but it differs in that besides market size asymmetries, we introduced asymmetric marginal costs and account for industrial size with more than 1 firm in each country.

In this chapter we build a basic four-country model, analyzing the static effects of customs unions formation on welfare under oligopolistic competition, accounting both for market sizes and the number of firms. We hence studied members and non-members’ welfare moving from tariff-ridden trade to a single customs union and then to a double customs union situation. Governments intend to set external tariffs that maximize national welfare, which we define as the sum of firms profits, consumer surplus and government tariff revenues to disregard special interests politics. Note that once a customs union is formed, union governments tariffs are set to maximise union welfare as a whole with no political consideration regarding how union welfare
is distributed among union member countries and their respective economic agents\textsuperscript{5}.

In the following sections, we modify our model and consider different situations: free trade; customs union expansion and asymmetric marginal costs.

Our analysis confirms that customs union formation generally occurs among similar countries and generates positive effects on consumers and, under certain conditions, on producers within the union, while it has a negative impact on the rest of the world. However, we also find that industrial concentration, market size and relative marginal costs determine whether members’ welfare exceed non-members’ or not and also whether countries are better off in the double-union situation or when no union existed.

Given that union formation affects negatively the other two countries’ welfare, it is interesting to examine non-members’ response and whether customs unions are socially desirable for all in a setting with strategic union formation. To this end, we solve a game where countries $A$ and $B$ on one side, and countries $C$ and $D$ on the other, decide simultaneously and independently whether to form a customs union. Then the formation of customs union is endogenously obtained as an equilibrium of this game, where the payoffs are given by the corresponding equilibrium welfare levels computed previously. It is shown that -under tariff-ridden trade- the Nash equilibrium entails two customs unions when market sizes do not differ much and under specific market conditions, although free trade remains the best possible strategy. That is consistent with Das and Gosh assertion that ’polarization’ is the best possible outcome, after free trade. However while they consider a setting with extremely concentrated industries (n=1 firm), we set $n$ firms in each country and introduce asymmetries in market sizes (or countries’ wealth) and production costs to show the role played by industrial concentration, along with market size and marginal costs.

\textsuperscript{5}We assume that union governments reached an agreement for an equitable share of union’s advantages beit compensation from one country to the other, and at all levels: governments revenues, consumer surplus, firms profits..
2 The Basic Model

We construct a model with four countries $\lambda$, $\lambda = A, B, C, D$. In each country there is a homogeneous good industry with $n$ firms behaving like Cournot type oligopolies, with $n_A = n_B = n_C = n_D = n$. All firms face the same constant marginal costs $c$ of producing the homogeneous good.

Demand in country $\lambda$ is given by

$$Q_\lambda = \gamma_\lambda (a - p_\lambda)$$  \hspace{1cm} (1)

where $a > c$, with parameter $\gamma_\lambda$ representing the market size\footnote{Note that market size here can be interpreted as the level of national demand or level of income, thus big $\gamma$ vs small $\gamma$ can also be interpreted as high-income (North) vs low-income (South) countries.} of country $\lambda$ and $Q_\lambda$ the demand in country $\lambda$ at price $p_\lambda$. All markets are open to trade. Each government sets a per unit nondiscriminatory tariff $t_\lambda$ on imports to their country. We are going to characterize the equilibrium of a two-stage game where first governments non-cooperatively set tariffs and then oligopolistic firms compete in quantities. The game is solved in the standard backwards way. We shall proceed to characterize three different situations, the \textit{pre-union situation}, the \textit{single customs union situation} and the "\textit{double" customs union situation}.

2.1 The pre-union situation

Thus, profits of a representative firm located in country $A$ consist of

$$\Pi_A = (p_A - c)q_{AA} + \sum_{\lambda = B,C,D} (p_\lambda - c - t_\lambda)q_{A\lambda}$$  \hspace{1cm} (2)

where the first term captures profits of sales in market $A$ and the latter three collect profits of output exported to the other markets. The notation $q_{A\lambda}$ indicates output of a firm from $A$ sold in market $\lambda$; the first subscript stands for the location of the producer firm whereas the second subscript denotes the target market.

Given the above assumptions, markets are segmented and we may therefore focus on firms’ maximisation problem in one of them, say market $A$. In market $A$ there clearly is an asymmetric oligopoly of size $4n$, with $n$ local firms having marginal costs $c$ on one side and on the other $3n$ foreign firms having marginal costs $c + t_A$. 
Multiplying the system of first order conditions by \( n \) (as there are \( n \) firms in each country), we yield the next subgame perfect equilibrium outputs in market \( A \):

\[
q_{AA}^* = \gamma_A \frac{a - c + 3nt_A}{4n + 1}
\]

\[
q_{BA}^* = q_{CA} = q_{DA} = \gamma_A \frac{a - c - (n + 1)t_A}{4n + 1}
\]

Clearly, the higher the tariff, the higher local firms’ output and the lower foreign firms’ output. In addition, there is a restriction on the size of \( t_A \) to ensure positive (equilibrium) imports, i.e. \( t_A < \frac{a-c}{n+1} \). It is also the case, from the Cournot assumption, that the above outputs are decreasing with oligopoly size \( n \).

Adding up firms’ outputs on market \( A \) we get total equilibrium output for market \( A \):

\[
Q_A^* = n \sum_{\lambda=A,B,C,D} q_{\lambda A}^* = \frac{n \gamma_A (4(a - c) - 3t_A)}{4n + 1}
\]

and subsequent equilibrium price:

\[
p_A^* = \frac{a + 4nc + 3nt_A}{4n + 1}
\]

Country \( A \) sets the per unit tariff that maximizes national welfare \( W_A \), which is defined as the sum of national firms’ profits \( n \Pi_A \), consumer surplus \( CS_A \) and tariff revenue \( TR_A \). In particular, consumer surplus in country \( A \) would be given by,

\[
CS_A = (a - p_A^*) \frac{Q_A^*}{2} = \frac{\gamma_A n^2 (4(a - c) - 3t_A)^2}{2 (4n + 1)^2}
\]

and tariff revenue:

\[
TR_A = t_A n \sum_{\lambda=B,C,D} q_{\lambda A}^* = 3nt_A \gamma_A \frac{a - c - (n + 1)t_A}{4n + 1}
\]

As for the equilibrium profits of a representative firm, and from the segmented markets assumption, it is easy to see that the tariff \( t_A \) just enters the profits expression in the term that corresponds with the local market, i.e. \( \Pi_{AA} \) so that we have that
\[ n \Pi_{AA} = n \gamma_A \left( \frac{a - c + 3nt_A}{4n + 1} \right)^2 \]  

(7)

Maximising \( W_A \) with respect to \( t_A \) yields the following equilibrium tariff:

\[ t^*_A = \frac{(a - c)(1 + 2n)}{2 + 7n + 2n^2} \]  

(8)

The equilibrium tariff decreases as oligopoly size \( n \) increases. Replacing \( t^*_A \) above allows us to write down country A’s equilibrium levels for (local and foreign) firm’s outputs, consumer surplus, tariff revenue, firm’s profits in the local market, and national welfare:

\[ q^*_{AA} = \frac{2(a - c)(1 + n)}{2 + 7n + 2n^2}, \quad \text{and} \quad q^*_A = \frac{(a - c)}{2 + 7n + 2n^2} \]  

(9)

\[ CS^*_A = \gamma_A \frac{(a - c)^2 n^2(5 + 2n)^2}{2(2 + 7n + 2n^2)^2} \]  

(10)

\[ TR^*_A = \gamma_A \frac{3(a - c)^2 n(1 + 2n)}{(2 + 7n + 2n^2)^2} \]  

(11)

Regarding equilibrium profits (say in country A) of a home firm and of a foreign firm, these are given by,

\[ \Pi^*_{AA} = \gamma_A \left( \frac{2(a - c)(1 + n)}{2 + 7n + 2n^2} \right)^2 \]  

\[ \Pi^*_A = \gamma_A \left( \frac{(a - c)}{2 + 7n + 2n^2} \right)^2 \]

The pre-union equilibrium in countries \( B, C \) and \( D \) is characterized straightforwardly by substituting for the corresponding market size. It then follows that equilibrium profits for one firm in country A can be written as,

\[ \Pi^*_A = \frac{(a - c)^2(4(1 + n)^2 \gamma_A + \gamma_B + \gamma_C + \gamma_D)}{(2 + 7n + 2n^2)^2} \]  

(12)

and consequently, equilibrium welfare reads as follows,

\[ W^*_A = \frac{n(a - c)^2[(7 + 2n)(2 + 7n + 2n^2) \gamma_A + 2(\gamma_B + \gamma_C + \gamma_D)]}{2(2 + 7n + 2n^2)^2} \]  

(13)

which is similar for all four countries (saving for market size variable).
2.2 The single customs union situation

Now suppose that two countries, say country $A$ and country $B$, form a customs union. We wish to characterize the equilibrium when a single customs union agreement has been signed. This has several implications. Firstly, firms located in $A$ and $B$ do not incur the tariff costs since trade is liberalized between these two countries. Secondly, the (common external) tariff on imports from countries $C$ and $D$ will be chosen to maximize the welfare of the two signatory countries. With this in mind, we next proceed to solve the two-stage game specified above. In particular, we have to compute the Cournot equilibrium in a market of size $\gamma_{AB}$, $\gamma_{AB} = \gamma_A + \gamma_B$. Adding up demands $Q_A + Q_B$, denoted by $Q_{AB}$, and inverting we have that $p_{AB} = a - \frac{Q_{AB}}{\gamma_{AB}}$. Now $t_{AB}$ stands for the tariff set by the customs union.

As in the pre-union situation, there is an upper bound on the size of the tariff to ensure positive equilibrium outputs, that is, $t_{AB} < \frac{a-c}{2n+1}$. In the first stage, the tariff $t_{AB}$ is set so as to maximize $W_{AB}$ defined as the sum of industry profits, $n(\Pi_A + \Pi_B)$, consumer surplus $\overline{CS}_{AB}$ and tariff revenue $\overline{T R}_{AB}$ (the upper bar is employed to denote the corresponding variable when a single customs union is formed $^7$).

Concerning firms’ profits, note that

$$\bar{\Pi}_\lambda = (\bar{p}_{AB} - c)\bar{q}_\lambda + (p_C - c - t_C)q_{\lambda C} + (p_D - c - t_D)q_{\lambda D}$$

$$= \Pi_{\lambda AB} + \Pi_{\lambda C} + \Pi_{\lambda D}$$

for $\lambda = A, B$, where due to market segmentation $t_{AB}$ only enters the first term, $\Pi_{\lambda AB}$ (profits of a representative firm belonging to the customs union in that market). Setting the derivative of $W_{AB}$ with respect to $t_{AB}$ equal to zero and solving for $t_{AB}$ yields the equilibrium tariff

$$\bar{t}_{AB}^* = \frac{(a - c)}{2(1 + n)}$$

Substituting for $\bar{t}_{AB}^*$ we obtain equilibrium outputs, profits, consumer surplus and tariff revenue. Note that profits of a firm in the customs union in markets $C$ and $D$ remain the same because of market segmentation. Following which, equilibrium

$^7$The properties of the demand function are such that the equilibrium output $\bar{q}_A = \bar{q}_B$ is indeed equal to the sum of the outputs had we considered separately each market demand, i.e. $\gamma_A \frac{a-c+2nt_{AB}}{4n+1} + \gamma_B \frac{a-c+2nt_{AB}}{4n+1}$. 

8
welfare for the countries in the customs union is given by,

\[ W_{AB}^* = \frac{n}{2}(a - c)^2 \left( \frac{\gamma_{AB}(5 + 4n)}{1 + 5n + 4n^2} + \frac{4(\gamma_C + \gamma_D)}{(2 + 7n + 2n^2)^2} \right) \]  

(15)

The formation of a customs union has produced an asymmetry and it is useful to obtain the equilibrium welfare level of a non-member country. In particular, consumer surplus and tariff revenue remain unchanged. However a representative foreign firm say from country C has profits given by,

\[ \Pi_C^* = \Pi_{CAB}^* + \Pi_{CC}^* + \Pi_{CD}^* \]

\[ = (a - c)^2 \left( \frac{\gamma_{AB}}{4(1 + 5n + 4n^2)^2} + \frac{4(1 + n)^2 \gamma_C + \gamma_D}{(2 + 7n + 2n^2)^2} \right) \]  

(16)

Consequently, the equilibrium welfare of a non-member, say country C, when a single customs union has been formed is

\[ W_C^* = \frac{n}{2}(a - c)^2 \left( \frac{\gamma_{AB}}{2(1 + 5n + 4n^2)^2} + \frac{2\gamma_D + \gamma_C(2 + n)(5 + 20n + 4n^2)}{(2 + 7n + 2n^2)^2} \right) \]  

(17)

We are now in a position to make some comparisons between the single customs union and the pre-union situations and state some results\(^8\).

**Result 1**  
i) The equilibrium output of a member firm, say from country A, in the union market is greater than before union formation, that is, \( \bar{q}_A > q_{AA}^* + q_{AB}^* \) iff \( \frac{\gamma_B}{\gamma_A} > \frac{n(1 + 2n + 4n^2)}{1 + 6n + 12n^2 + 4n^4} \).

ii) Imports from non-member countries decrease \( n(q_{\lambda A}^* + q_{AB}^*) > n\bar{q}_\lambda^* \), for \( \lambda = C, D \).

iii) The equilibrium tariff with single union formation is lower, \( \bar{t}_{AB} < t_A^* \).

Note that the ratio \( \frac{n(1 + 2n + 4n^2)}{1 + 6n + 12n^2 + 4n^4} \) is smaller than unity for any given oligopoly size. Let’s call \( \frac{\gamma_B}{\gamma_A} \) the relative market size ratio for member countries. Suppose that ratio is inferior to 1, i.e. that \( \gamma_A \) is greater than \( \gamma_B \). Then equalling \( \frac{\gamma_B}{\gamma_A} \) to \( \frac{n(1 + 2n + 4n^2)}{1 + 6n + 12n^2 + 4n^4} \) defines a threshold value for oligopoly size, say \( \bar{n} \), such that for \( n < \bar{n} \) member firms’ output increases. While for \( n > \bar{n} \) their output decreases. See Figure

\(^8\)All proofs available on request.
Remark also that a rather concentrated oligopoly (lower $n$) is compatible with some market size asymmetry; if competition is more intense, which is the case when $n$ is rather large, then market sizes must be quite similar for the above interval condition to be met. This reasoning highlights the relevance both of market size and of oligopoly size.

Part ii) leads us to elaborate on Viner’s concepts of trade creation and trade diversion: some imports shift from non-member countries to partner country, thus the union has a trade diverting effect; however we also witness a trade creating effect in that, with the suppression of tariffs between member countries, member firms lose home market shares to the benefit of their new partner (because consumers now have free access to the partner’s good). What makes the union appealing is the production and consumption re-allocation effect between member countries; this is well illustrated whenever part i) holds.

We also note a positive production effect in that lower tariffs induce total union outputs to increase

**Result 2** i) Profits of member firms increase as long as

$$\frac{M_1}{M_2} < \frac{\gamma_B}{\gamma_A} < \frac{M_2}{M_1}$$

where $M_1 \equiv n(1+2n+4n^2)(4+n(23+34n+12n^2))$ and $M_2 \equiv (3+4n(4+5n+n^2))(1+2n(3+6n+2n^2))$.

ii) Non-member firms’ profits always decrease as a result of AB union being formed.

iii) Even though non-member firms’ profits decrease as a result of AB union, those profits are not necessarily inferior to member firms profits. They are indeed superior under the sufficient condition $\gamma_C \geq \gamma_B + \gamma_A$, for $\lambda = C, D$.

A few comments on Part i). The function $\frac{M_1}{M_2}$ increases with oligopoly size $n$; the function $\frac{M_2}{M_1}$ decreases with $n$ (i.e. the interval gets smaller as $n$ increases). Altogether these restrict which oligopoly size is compatible with a certain degree of market size asymmetry. It is easily checked that the functions $\frac{M_1}{M_2}$ and $\frac{M_2}{M_1}$ intersect
at \( n = 2.46012 \). Thus, for \( \gamma_A = \gamma_B \) the oligopoly must be very concentrated \( (n \leq 2) \) such that firms in member countries earn higher profits after union formation.

Part ii) highlights that the advantage non-member firms gain with lower tariffs after AB union is offset by a substantial loss in AB market share thus the loss in profits; and part iii) unveils once again the relevance of market size and oligopoly size. Regarding market size for instance, if a non-member market size exceeds the combined sizes of member countries then, regardless of oligopoly size \( n \), equilibrium profits of firms not in the union are larger than member firms’.

**Result 3**  

i) *Consumer surplus in member countries always increases.*  

ii) *Welfare in member countries always increases.*  

iii) *In non-member countries, consumer surplus and tariff revenues remain unchanged thus welfare varies with firms profits only and decreases* (cf Result 2.ii)).

The fact that consumer surplus increases seems quite reasonable since it depends both on a price reduction (which is the case) and on a total output increment (which is also the case). As for members welfare, gains (be it in consumer surplus or firms profit) compensate for losses (eg. in tariff revenues), but it is oligopoly size which determinates whether the driving force behind the increase in welfare is consumer surplus or industry profits.\(^9\)

Finally, the formation of a customs unions results in welfare losses for non-member countries, regardless of market and oligopoly sizes. But this does not imply that welfare of non-member countries be lower than welfare of members (see part iii) in result 2 above).

### 2.3 The double customs union situation

Now suppose that the other two countries, C and D, form a customs union. We shall then consider a situation where a second customs union is formed (in addition to the existing one) and how both unions affect each other’s welfare.

\(^9\)In fact, total industry profits increase as long as \( n \leq 2.46 \) but one can check that the increase in consumer surplus offsets the decrease in tariff revenue for \( n > 1.325 \). That is, with duopoly, consumer gains suffice for a welfare improvement.
We solve a similar two-stage game for countries C and D forming a customs union; with demand in market CD being $Q_{CD} = \gamma_{CD} (a - p)$, where $\gamma_{CD} = \gamma_C + \gamma_D$, and thus $p_{CD} = a - \frac{Q_{CD}}{\gamma_{CD}}$. Now $t_{CD}$ stands for the tariff set by the new customs union. The computation of the equilibrium is straightforward. Thus, the output of a representative firm of members in the CD union will correspond with that computed for a representative firm of members when the AB union was formed, except for market size; accordingly for a non-member firm. Consumer surplus and tariff revenue expressions are similar to those given under the single union situation (switching CD for AB). However firms’ profits is now defined as

$$\hat{\Pi}_\lambda = \hat{\Pi}_{\lambda CD} + \hat{\Pi}_{\lambda AB}$$

$$= (\hat{p}_{CD} - c)\hat{q}_\lambda + (\hat{p}_{AB} - c - \hat{t}_{AB})\bar{q}_\lambda$$

for $\lambda = C, D$, where we use $\hat{\cdot}$ to denote the corresponding variable when a new customs union is formed. $\hat{\Pi}_{CD}$ - profits for a representative CD union firm in CD’s market- has the same expression as for AB union firms’ local profits, and $\hat{\Pi}_{\lambda AB}^*$ stands for the profits made from sales abroad (i.e. in AB union market), $\frac{\gamma_{AB}(a-c)^2}{4(1+5n+4n^2)^2}$; these remain the same due to market segmentation.

Once more we proceed to compute the union’s welfare $\hat{W}_{CD}$ as the sum of $\hat{C}S_{CD}$, $\hat{T}R_{CD}$ and $n(\hat{\Pi}_C + \hat{\Pi}_D)$. Deriving $\hat{W}_{CD}$ with respect to $t_{CD}$ and solving as before we get the equilibrium tariff $t_{CD}$, which is equal to $\hat{t}_{AB}^*$. From which we have similar expressions for equilibrium outputs, equilibrium consumer surplus, and equilibrium tariff revenue. Only equilibrium profits of a new member firm differ:

$$\hat{\Pi}_\lambda^* = \hat{\Pi}_{\lambda CD}^* + \hat{\Pi}_{\lambda AB}^*$$

$$= (a - c)^2 \left( \frac{\gamma_{CD}}{(1 + 5n + 4n^2)^2} + \frac{\gamma_{AB}}{4(1 + 5n + 4n^2)^2} \right)$$

for $\lambda = C, D$. Therefore, equilibrium total welfare for member countries is given by

$$\hat{W}_{CD}^* = \frac{n(a - c)^2}{2} \left( \frac{\gamma_{AB}}{(1 + 5n + 4n^2)^2} + \frac{\gamma_{CD}(5 + 4n)}{(1 + 5n + 4n^2)^2} \right)$$

As for AB countries, the outcome is now very similar so that equilibrium profits are:

$$\hat{\Pi}_\lambda^* = (a - c)^2 \left( \frac{\gamma_{AB}}{(1 + 5n + 4n^2)^2} + \frac{\gamma_{CD}}{4(1 + 5n + 4n^2)^2} \right)$$

for $\lambda = A, B$, and equilibrium total welfare is
\[ \overline{W}_{AB}^* = \frac{n(a-c)^2}{2} \left( \frac{\gamma_{CD}}{(1+5n+4n^2)^2} + \frac{\gamma_{AB}(5+4n)}{(1+5n+4n^2)} \right) \]  

(20)

Given the obvious symmetry in computations, saving for market sizes, we can establish similar statements to all Results above, except for Results 2iii), and 3iv). That is, the equilibrium output of a member firm in the union market is greater than before union formation as long as the relative market size ratio for the new member countries be sufficiently large; imports from non-member countries decrease; the equilibrium tariff with the new union formation is now lower; member firms profits increase under certain conditions while profits of firms outside the new union always decrease; and the new union’s welfare increases while countries outside the new union see their welfare decrease.

We have shown above (Result 3ii and 3iii) that customs union formation by a pair of countries is welfare improving for member countries whereas non-member countries see their welfare decrease. Then the question is whether it is possible that all countries gain with union formation. The answer is positive in the case that customs union formation occurs in waves. That can be checked easily when comparing the equilibrium welfare levels under the double customs union situation with those under pre-union situation.

**Result 4**  
*AB and CD unions members now have similar welfare gains - differing only with market sizes - and both unions’ welfare improve simultaneously, with respect to pre-union equilibrium levels, provided that*

\[ \frac{N_1}{N_2} < \frac{\gamma_{CD}}{\gamma_{AB}} < \frac{N_2}{N_1} \]

*where* \( N_1 \equiv 3n(1+2n)(4+17n+10n^2) \)  
and  \( N_2 \equiv (1+5n+4n^2)(4+n(23+40n+12n^2)). \)

Market size and concentration determine whether the countries actually benefit from joining in a union in comparison with how they did before none of the unions existed. That provides a simple yet direct explanation to the proliferation of trade agreements just because they can be socially advantageous to everyone in face of a customs union wave.
2.4 The basic simultaneous game of customs union formation

The foregoing analysis suggests that customs union formation is privately profitable only under some circumstances. It is interesting to examine whether they are socially desirable in a setting with strategic union formation. Thus, we solve a (non-zero sum) game where 2 sets of players\textsuperscript{10} -countries A and B, and countries C and D- decide simultaneously and independently between two strategies: to form a customs union with their co-player (U) or not to form a union (N). Then the formation of customs union is endogenously obtained as an equilibrium of this game. Payoffs are given by the corresponding equilibrium welfare levels computed in the previous section.

Let us proceed first to analyze the best response for countries A and B.

Provided that countries C and D do not form a union, countries A and B have an incentive to do so if

\[
\frac{\hat{W}_{AB}^\lambda}{2} - W_A^\lambda \geq 0 \quad (\lambda = A, B) \text{ i.e. if}
\]

\[
\frac{M1}{M2} \leq \frac{\gamma_B}{\gamma_A} \leq \frac{M2}{M1}
\]

where \(M1 = 4 + 31n + 38^2 + 8n^3\) and \(M2 = 16 + 136n + 381n^2 + 368n^3 + 132n^4 + 16n^5\), which means that for \(1 < n < \infty\), \(M1/M2\) ranges from 0.07722 to 1 and \(M2/M1\) ranges from 12.8272 to \(\infty\). The condition (29) is fulfilled for \(\frac{\gamma_B}{\gamma_A} = 1\).

Provided that C and D form a union, countries A and B have an incentive to do so if

\[
\frac{\hat{W}_{AB}^\lambda}{2} - W_A^\lambda \geq 0 \quad (\lambda = A, B) \text{ i.e. if}
\]

\[
\frac{M3}{M2} \leq \frac{\gamma_B}{\gamma_A} \leq \frac{M2}{M3}
\]

\textsuperscript{10}Here we simplify and present 2 sets of players, although to solve the game we allowed asymmetries between co-players which is equivalent to a setting where each player chooses endogenously their preferred partner.
where $M_3 = n(34 + 189n + 280n^2 + 132n^3 + 16n^4)$. The lower bound $M_3/M_2$ is increasing with $n$ and tends to 1 as $n$ tends to infinity. While the upper bound $M_2/M_3$ is decreasing with $n$ and tends to 1 as $n$ tends to infinity. Hence, condition (30) definitely holds for $\frac{\gamma_B}{\gamma_A} = 1$.

If we proceed in the same manner for countries $C$ and $D$, it is easy to verify that their best responses are the same, substituting $\frac{\gamma_B}{\gamma_A}$ for $\frac{\gamma_C}{\gamma_D}$.

**Result 5** Consider the game where countries $A$ and $B$ on one side, and countries $C$ and $D$ on the other, decide simultaneously whether to form a customs union. The Nash equilibrium is $(U, U)$ provided (29) and (30) hold. The double customs union is always the equilibrium outcome whenever members have symmetric market sizes.

Thus, we conclude that under conditions (29)-(30), no matter what strategy countries $C$ and $D$ choose, $A$ and $B$’s best response is always to form a customs union.

Recall that Result 3 ii) states that welfare always increases for member countries, provided that the other two do not form a customs union. Equation (29) also implies that there is a (small) possibility that forming a union may not be in the interest of both countries if their respective market sizes happened to be very dissimilar (assuming total welfare within the union be equally shared between both member countries). Thus, If $C$ and $D$ chose not to form a union, then $A$ and $B$ could form a union at almost any market size relatively to one another without suffering a loss in national welfare. The fulfilment of (29) means that there is a unilateral incentive to form a customs union which, as indicated earlier, is typically driven by consumer gains.

However, should $C$ and $D$ form a union, it is worth noting that the interval in condition (30) is smaller than the one specified in condition (29); i.e. condition (30) is most unlikely to hold if $A$ and $B$’s respective markets are characterized by low concentration combined with relative markets differing much in size, in which case $A$ and $B$’s best response is not to form a union.

Similarly, once AB union exists it is not worth for $C$ and $D$ to form a union if they are very dissimilar in size (even if condition under result 4
holds).

As mentioned above, what determines the outcome of the game is how customs union formation affects social welfare. From the previous section, we know that as countries join into a union, consumer surplus always increases, while government tariff revenues always diminishes (from the reduction both in tariffs and imports from non-members) and firms profits variation depends on market size and concentration.

It is remarkable that, due to market segmentation, conditions (29) and (30) that determine the game outcome depend on (co-players’) partners’ relative market size. What counts is not whether a union is ”doing better or worse” than the other (which depends on unions’ relative market size) but that a country’s national welfare should not be worse after forming a union with their partner. In sum, under this setting we claim that the Nash equilibrium entails two customs unions when market sizes do not differ significantly, regardless of oligopoly size.11

Following result 5 and the above considerations, we may proceed to formulate the game payoffs by comparing by comparing the pre-union and double-union situations, when conditions (29) and (30) hold -which is the case if we assume that market size of countries A and B is the same, say $\gamma_A = \gamma_B = \gamma$; similarly, market size of countries C and D is the same, say $\gamma_C = \gamma_D = \delta$. We now construct an ordinal payoff matrix indicating how each country ranks each possible customs union situation. Each set of countries ranks their welfare levels are ranked from 1 to 4 (from the least to the best payoff); the first entry in each cell is country A’s (and B’s) ranking whereas the second entry corresponds to country C’s (and D’s). We can then present the game and payoffs as follows:

<table>
<thead>
<tr>
<th>Countries A &amp; B / Countries C &amp; D</th>
<th>(N)</th>
<th>(U)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(N)</td>
<td>(2,2)</td>
<td>(1, 4)</td>
</tr>
<tr>
<td>(U)</td>
<td>(4,1)</td>
<td>(3, 3)</td>
</tr>
</tbody>
</table>

Note that if Result 4 does not hold -i.e. should the market size ratio $\frac{\delta}{\gamma}$ fall anywhere outside the interval defined above- then payoffs (N,N) and (U,U) will be

11If governments’ decisions were moved by producers interests only, then condition (29) holds harder: it does only for a highly concentrated market (less than 3 firms), beyond that number firms from either one country or the other experience profits losses.
different. Indeed, if \( \frac{\delta}{\gamma} < \frac{N_1}{N_2} \), then countries \( C \) and \( D \)s best response \( (U,U) \) will grant them lower payoffs than in a situation with no union being formed at all.\(^{12}\) Similarly, if \( \frac{\delta}{\gamma} > \frac{N_2}{N_1} \), then countries \( A \) and \( B \) would be those wishing no union (but theirs) were formed.\(^{13}\) This analysis unveils several points: i) that there is no prisoner’s dilemma situation, ii) that too large a union market size asymmetry would not render a setting with two customs unions equally desirable to all countries, and iii) countries are indeed better off when their customs union is the only one being formed.

### 3 A setting with Free Trade

The above analysis discloses then that there is an incentive to customs union formation, saving under some extreme market conditions. Despite its limitations it sheds some light on the proliferation of preferential trading arrangements. Nevertheless, as noted in the introduction, some authors think that they might indeed create an obstacle to multilateral trade liberalization. Hence one wonders whether the countries in our model could do better in a world with free trade.

### 3.1 Comparing free trade to a double-union situation

Under the assumptions made above about symmetric market sizes (\( \gamma_A = \gamma_B = \gamma \), and \( \gamma_C = \gamma_D = \delta \)) and setting tariffs equal to zero, it follows that the equilibrium output of a representative firm in country \( A \) (or \( B \)) is given by \( q_\lambda = \gamma(a - c)/(4n + 1) \), for \( \lambda = A, B, C, D \). In the same manner, the equilibrium output of a representative firm in country \( C \) (or \( D \)) is given by \( q_\lambda = \delta(a - c)/(4n + 1) \), for \( \lambda = A, B, C, D \).

Straightforward computations allow us to write down the equilibrium welfare under free trade as:

\[
W^*_{\lambda} = \frac{8\gamma n^2(a - c)^2 + 2n(\gamma + \delta)(a - c)^2}{(4n + 1)^2} + \frac{2n(a - c)^2(\gamma + 4n\gamma + \delta)}{(4n + 1)^2}
\]

\(^{12}\)Payoffs \((N,N)\) would be : \((2, 3')\); payoffs \((U,U)\): \((3, 2')\), but they would still definitely enjoy being the unique customs union under the sun since payoffs \((N,U)\): \((1, 4')\); and have no choice but unite if AB do so, as \((U,N)<(U,U)\)

\(^{13}\)Specifically, payoffs \((N,N)\): \((3', 2)\); payoffs \((U,U)\): \((2', 3)\) and Payoffs \((U,N)\): \((4',1)\).
for \( \lambda = A, B \), where the first term is consumer surplus and the second is total industry profits. The equilibrium welfare under free trade for country \( C \) (or \( D \)) is the following:

\[
W_k^{FT} = \frac{2n(a-c)^2(\gamma + 4n\delta + \delta)}{(4n + 1)^2}
\]

for \( k = C, D \). Since we have obtained the equilibrium welfare levels under the double customs union situation, which turns out to be the Nash equilibrium of the above game, we wish to establish whether welfare under free trade exceeds that under a setting with trade agreements. Specifically, country \( A \) (or \( B \)) will prefer free trade rather than a setting with customs unions if \( W_\lambda^{FT} > \hat{W}_{AB}^*/2 \), that is, if

\[
\frac{n(a-c)^2[(3 + 4n(2 + n))\delta - (1 + n)(1 + 4n)\gamma]}{2(1 + 5n + 4n^2)^2} > 0 \tag{23}
\]

Similarly, country \( C \) (or \( D \)) will prefer free trade rather than a setting with customs unions if \( W_k^{FT} > \hat{W}_{CD}^*/2 \), that is, if

\[
\frac{n(a-c)^2[(3 + 4n(2 + n))\gamma - (1 + n)(1 + 4n)\delta]}{2(1 + 5n + 4n^2)^2} > 0 \tag{24}
\]

Both the inequalities (23) and (24) will be positive as long as the terms in brackets in the numerators be positive. From (23) an upper bound on the relative market size ratio \( \gamma/\delta \) is obtained whereas a lower bound is found from (24). Therefore, all countries will be better off under multilateral free trade as long as,

\[
\frac{(1 + n)(1 + 4n)}{3 + 4n(2 + n)} < \frac{\gamma}{\delta} < \frac{3 + 4n(2 + n)}{(1 + n)(1 + 4n)} \tag{25}
\]

It is worth mentioning that such an interval exists. The lower bound is an increasing function in \( n \), which tends to one as \( n \) tends to infinity. The upper bound is a decreasing function in \( n \), which tends to one as \( n \) tends to infinity. For the particular case of symmetry in market sizes, \( \gamma = \delta \), free trade is always preferred by all. On the other hand, market sizes should not be too asymmetric as oligopoly size \( n \) gets larger, indeed for highly asymmetric partners market sizes (especially if associated with relatively large oligopoly size), governments will more likely defect from free-trade and prefer joining in a customs union which option is in turn less appealing than tariff-ridden trade.
4 A setting with asymmetric costs

We modify the above model to introduce firms constant marginal costs $c_\lambda$ varying across industries. Note that: - costs vary across industries but not across countries within the same industry, i.e. firms within the same industry face identical costs both on local and export goods, notwithstanding customs tariffs; - marginal costs must be such that $a > c_\lambda$

4.1 The pre-union situation

Here, profits of a representative firm located in country $A$ consist of

$$\Pi_A = (p_A - c_A)q_{AA} + \sum_{\lambda=B,C,D} (p_\lambda - c_A - t_\lambda)q_{A\lambda}$$

and firms’ profit maximization problem is given by

$$\max_{q_{AA}} \Pi_{AA} = (p_A - c_A)q_{AA} = (a - \frac{Q_A}{\gamma_A} - c_A)q_{AA}$$

$$\max_{q_{\lambda A}} \Pi_{\lambda A} = (p_A - c_\lambda - t_A)q_{\lambda A} = (a - \frac{Q_A}{\gamma_A} - c_\lambda - t_A)q_{\lambda A}$$

(where $\lambda = B, C, D$) so that in market $A$ there is an asymmetric oligopoly of size $4n$, with $n$ local firms having marginal costs $c_A$ on one side and on the other $3n$ foreign firms having marginal costs $c_\lambda + t_A$.

Obviously, the higher marginal costs $c_A$ the lesser local firms’ outputs $q_A$. Such effect is more visible when applying tariff $t_A$, as local firms’ output normally increase with $t_A$ while foreign firms’ output drop down. Put another way, an increase in local industry costs $c_A$ would partially offset foreign outputs reduction due to imports tariff on foreign goods.

It is also the case, under Cournot assumption, that the above outputs are decreasing with oligopoly size $n$.

At this stage, we may also introduce some restrictive considerations:

- regarding the size of $t_A$ to ensure positive (equilibrium) imports from all countries, i.e. $t_A < \frac{a - (3n+1)c_\lambda + n\sum_{i \neq \lambda} c_i}{n+1}$, where $i \neq \lambda$.

- regarding the level of costs asymmetries across industries. Indeed, whether foreign costs are superior or inferior to local costs determines if a restriction is to be considered on the costs difference margin allowing for positive outputs (for local
and/or foreign firms). We ought to identify three different cases -setting A firms marginal costs as benchmark so that $c_A = c_A + d$:

- **Case 1:** Foreign costs are superior to local costs, i.e. $d > 0$, then in order to ensure (positive) imports, $d$ must be such that $\frac{(a-c_A)}{|d|} > \frac{4 + 11n + 4n^2}{3}$

- **Case 2:** Foreign costs are inferior to local costs, i.e. $d < 0$, then in order to ensure (positive) local outputs, $d$ must be such that $\frac{(a-c_A)}{|d|} > n$

- **Case 3:** Foreign costs are equal to local costs, i.e. $d = 0$, (refer to Chapter 1 main section, in which no costs asymmetry is contemplated).

Proceeding as usual to obtain our subgame equilibrium, country A sets the per unit tariff that maximizes national welfare $W_A$,

$$t_A^* = \frac{a(3 + 6n) - 6c_A n^2 - (c_B + c_C + c_D)(1 + 2n - 2n^2)}{3(2 + 7n + 2n^2)} \quad (26)$$

which decreases as oligopoly size $n$ or/and $c_A$ increases.

Replacing $t_A^*$ above allows us to write down country A’s equilibrium levels for (local and foreign) firm’s outputs, firm’s profits in the local market, consumer surplus, tariff revenue\textsuperscript{14}, from which equilibrium national welfare reads as follows:

$$W_A^* = \gamma_A n \frac{(3a^2(7 + 2n) - 6a(\sum c_x + 2c_A(2 + n)) + (\sum c_x)^2 + (2 + n)[6c_A^2 + n(-3c_A + \sum c_x)^2]}{6(2 + 7n + 2n^2)^2} \quad (27)$$

where $c_x = C, D$

The pre-union equilibrium in countries $B, C$ and $D$ is characterized similarly by substituting for the corresponding market sizes and marginal costs.

### 4.2 The single-customs union situation

The outputs of firms located in $A$ and in $B$ will differ only with respect of the marginal costs specific to each country\textsuperscript{15}. As in the pre-union situation, there is an upper bound on the size of the tariff to ensure positive equilibrium outputs, that is, $t_{AB} < \frac{a-(3n+1)c_A+n\sum c_i}{2n+1}$, where $i \neq \lambda$. (Note that such restriction on $t_{AB}$ is more limitative than in the pre-union situation.)

\textsuperscript{14}Full written expressions and proofs available on request.

\textsuperscript{15}With all marginal costs equal, A and B outputs within AB union are equal.
Proceeding as before we yield the equilibrium tariff set so as to maximize $W_{AB}$,

$$\bar{t}_{AB}^* = \frac{2a - c_C - c_D}{4(1 + n)}$$

and subsequently obtain equilibrium levels for outputs, tariff revenues, consumer surplus, profits (See Appendix B for full written expressions and proofs) and welfare:

$$\bar{W}_{AB}^* = \frac{(Q_{AB})^2}{2\gamma_{AB}} + \bar{t}_{AB}^*(q_{CAB} + q_{DAB}) + \frac{n(\sum q_{AB}^2)}{\gamma_{AB}} + n \sum (p_C - c - t_C)q_{AC} + n \sum (p_D - c - t_D)q_{AD}$$

for $\lambda = A, B$

In order to compare between the single customs union and the pre-union situations and state some results, we proceed to simplify and assign specific levels of costs for member and non-member countries:

$$c_A = c_B = c \quad \text{and} \quad c_C = c_D = c + d$$

**Result 6** $\bar{t}_{AB}^* < t_A^*$. Equilibrium tariff with single union formation is lower than in the pre-union situation, except in case 2 $(d < 0)$, when $\frac{(a-c)}{|d|} \leq \frac{(1+4n)(2+n+2n^2)}{3n(-1+2n)}$

The above result confirms the theory that union formation has a positive production effect through a drop in external tariffs (and thus a higher demand which induces total union outputs to increase) unless marginal costs difference is such that

$$\frac{(a-c)}{|d|} \leq \frac{(1+4n)(2+n+2n^2)}{3n(-1+2n)}$$

**Result 7** i) Whether profits of member firms increase or not does depend both on industrial concentration and levels of marginal costs across countries. Indeed, for $n = 1,2$ i.e. for highly concentrated industries:

<table>
<thead>
<tr>
<th>Case 1 $(d &gt; 0)$, profits increase as long as</th>
</tr>
</thead>
<tbody>
<tr>
<td>$X_3 &lt; \frac{(a-c)}{</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Case 2 $(d &lt; 0)$, profits increase as long as:</th>
</tr>
</thead>
<tbody>
<tr>
<td>$X_2 &lt; \frac{(a-c)}{</td>
</tr>
</tbody>
</table>

16i.e. for $n = 1$ if $\frac{(a-c)}{|d|} \leq 8, 3$, for $n = 2$ if $\frac{(a-c)}{|d|} \leq 6$ or for $n = 3$ if $\frac{(a-c)}{|d|} \leq 6, 6$
where \( X_3 = (1+2n)^2 \), i.e. the restriction on \( \frac{(a-c)}{d} \); and \( X_2 = \) second polynomial root solving for profit difference\(^{17}\).

Whereas for \( n \geq 3 \), i.e. for lesser concentrated industries, member firms profits decrease with customs union creation in both cases 1 and 2.

ii) Non-member firms’ profits decrease in both cases 1 \((d > 0)\) and 2 \((d < 0)\), no matter the level of industrial concentration.

Member firms benefit from the union creation only if there are 1 or 2 firms in the industry and if \( \frac{(a-c)}{d} \) complies with certain restrictions. In the case where foreign costs exceed local firms’ costs \((d > 0)\), foreign firms suffer profits losses after AB union creation, which seems fairly logical, but it is remarkable that even with lower marginal costs (and even with the lowest), foreign firms still loose with AB union formation.

**Result 8** i) Consumer surplus in member countries increases if marginal costs difference margin complies with the output-related restrictions.

ii) Welfare in member countries increases under the same conditions as consumer surplus does.

iii) In non-member countries, consumer surplus and tariff revenues remain unchanged thus welfare varies with firms profits only and decreases (cf Result 3.ii)

Consumers obviously benefit from the market expansion effect and welfare improvement is clearly driven by the increase in consumer surplus.

Note that when foreign marginal costs are inferior to member firms’, home firms profitability margin need only be superior to \( d \) and \( 2d \), for \( n = 1 \) and \( n = 2 \) respectively, in order for member countries to benefit from customs union formation.

### 4.3 The double-customs union situation

Here the output-related restrictions on \( \frac{(a-c)}{d} \) ratio inherent to the double customs union situation are such that \( \frac{(a-c)}{d} > (1+2n)^2 \) for both cases 1 and 2. As calculus are the same as above, we may directly state a few results *(See Appendix B for full written expressions and proofs)*:

\(^{17} X_2 = \)
Result 9  i) Whether profits of CD member firms increase or not –with respect to the pre-union situation- depends both on industrial concentration and on the levels of marginal costs across unions. Indeed, member firms profits increase as long as $\frac{(a-c)}{|d|} > (1 + 2n)^2$ and $n < 3$; in both cases $(d > 0$ and $d < 0).^{18}$

<table>
<thead>
<tr>
<th>Case 1 $(d &gt; 0)$, profits increase as long as</th>
<th>Case 2 $(d &lt; 0)$, profits increase as long as:</th>
</tr>
</thead>
<tbody>
<tr>
<td>$(1 + 2n)^2 &lt; \frac{(a-c)}{d}$ and where $(1 + 2n)^2$ is the restriction on $\frac{(a-c)}{d}$</td>
<td>$-(1 + 2n)^2 &gt; \frac{(a-c)}{d}$ which is equivalent, thus ref. same restriction</td>
</tr>
</tbody>
</table>

Result 10 ii) For both cases 1 and 2, CD members’ welfare increases with respect to the pre-union situation as long as $\frac{(a-c)}{|d|} > (1 + 2n)^2$.

iv) Regarding AB union members’ welfare, we find that it decreases with respect to the pre-union situation if

$$(1 + 2n)^2 < \frac{(a-c)}{|d|} < X_2$$

where $X_2$ is the 2ry polynomial root for AB union welfare difference between pre- and double-union situations.

v) Comparing members’ and non-members’ welfare, we find that AB union welfare is superior to CD union welfare if $\frac{(a-c)}{|d|} > \frac{1}{2}$, which is smaller than $(1 + 2n)^2$ (output - related restrictions on $\frac{(a-c)}{d}$).

In fact, solving for the difference between members’ and non-members’ welfare gives us a necessary condition for that difference to be positive such that $\frac{(a-c)}{d} > \frac{1}{2}$, which is inferior to the restriction on $\frac{(a-c)}{d}$ ratio allowing for positive outputs $((1 + 2n)^2)$.

4.4 Solving the game with costs asymmetries

As in the basic version of the game, we proceed to analyze the best response for countries $A$ and $B$ and state that whenever countries $C$ and $D$ would not form a union, countries $A$ and $B$ have an incentive to do so if $W^*_{AB}/2 - W^*_\lambda \geq 0$ ($\lambda = A, B$) i.e.

Result 11 Considering the game where countries $A$ and $B$ on one side, and countries $C$ and $D$ on the other, decide simultaneously whether to form a customs union,

18We studied the part of CD profits that experienced changes after CD creation, as we know that -due to market segmentation- CD profits on AB union market remains unchanged.
the Nash equilibrium is (U,U) provided the respective output-related restrictions hold and that \( n < 3 \).

Both for \( d > 0 \) and \( d < 0 \), \( n < 3 \) and complying with output-related restrictions on

\[
\frac{(a-c)}{d} \text{ ratio*}
\]

<table>
<thead>
<tr>
<th>( A &amp; B )</th>
<th>( (N) )</th>
<th>( (U) )</th>
</tr>
</thead>
<tbody>
<tr>
<td>( (N) )</td>
<td>(2,2)</td>
<td>(1, 4)</td>
</tr>
<tr>
<td>( (U) )</td>
<td>(4,1)</td>
<td>(3, 3)</td>
</tr>
</tbody>
</table>

(*): For \( d > 0 \), \( \frac{(a-c)}{d} \) must be \( > X3 = (1 + 2n)^2 \), and for \( d < 0 \), \( \frac{(a-c)}{d} \) must be \( > n \)

Whether AB union welfare improves with respect to the pre-union situation depends on \( \frac{(a-c)}{d} \) (if \( X3<\frac{(a-c)}{d}<X2 \), welfare decreases)

5 To summarize

In the previous sections, we solved a game in several stages (in the usual backward way), obtaining first markets sub-game equilibrium for firms competing in quantities according to Cournot oligopoly theory, then establishing tariffs set by governments as to maximize national welfare and finally analyzing the optimal political strategy, as governments had to choose between: tariff-ridden trade, one customs-union, two-customs-unions situation.

In our basic model, we found that the Nash equilibrium is that all four countries choose to form a union with their partner (thus choosing the double customs-unions situation) unless partners’ relative market sizes are highly asymmetric (and worse even if associated with a very large number of firms on the market). It is worth recalling that, in this model, governments are concerned with maximizing ”total” national welfare (i.e. the sum of government tariff revenues, consumer surplus and firms profits) and that if they were to consider only producer interests then a double customs unions situation is more unlikely to exist: recall (from Results 2 and 3 above) that while consumer surplus always increased with the union, firms from both member countries gained only under restricted conditions (high market concentration combined with low market sizes asymmetry).\(^1\)

\(^1\)Incentives to form a customs union would probably be even larger if we considered the case in which governments can be motivated by other reasons that merely economical ones, as suggested
Our results are fairly consistent with Das and Gosh 2006, while underlying the importance of industrial concentration and *relative partners size* but among partners. In other words, *relative unions size* does not have much influence on governments’ decision to form a union or not.

*In a setting with free trade,* whenever partners have relative market size symmetry, free trade is preferred to forming a union, while, as we also said earlier on, forming a union is preferred to tariff-ridden trade. However, for highly asymmetric partners market sizes (especially if associated with relatively large oligopoly size), we can say all the contrary: governments will more likely defect from free-trade and prefer joining in a customs union -as we have just suggested- which option is in turn less appealing than tariff-ridden trade. That may be part of the answer to why so many tariff barriers still remain and preferential trade agreements proliferate.

*If we allow marginal costs to vary* from one country to another -whilst keeping symmetric partners market sizes- we also verify that producers interests hardly match other domestic agents’: in case of high industrial concentration (1 or 2 firms), producers having relatively high marginal costs (compared to their foreign counterparts) had rather belong to a customs union to face cheaper foreign goods; with 3 or more firms on the market, producers had rather deter from customs union formation. To be noted also that whenever foreign marginal costs are inferior, consumer surplus (and hence welfare) at home improve more (than if foreign marginal costs were superior).

As far as world welfare is concerned, its increase slows down with the number of customs unions formed. Constructing an *n*-country model under the same settings, we could follow Krugman’s and Andriamananjara’s intuitions, with a sequential formation of customs unions (up to *n/μ* customs unions) where *μ* varies according to the number of members we wish to define for each union (for bilateral agreements, *μ*=2).

Customs union formation definitely appears as the ’second best’ option, (that is after free-trade but before tariff-ridden trade) whenever partners have similar market sizes. Although we observe that customs unions benefit most to monopolies/dupolies and consumers, while large industries had rather their governments

by Whalley 1998, and solved the game to maximize the overall union’s welfare, allowing for side-payments within the union.
defect from customs union and apply customs tariffs. Therefore, be it market or industrial, size does matter!
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