CUSTOMS UNIONS AND ECONOMIC COMMUNITIES: SOME EXAMPLES

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Abstract

Kemp and Wan (1976) proved that nations forming customs unions can always implement a transfer system such that the formation of the unions is a pareto-improvement for the whole world. This seems to imply that customs unions would tend to grow until the world is free trade. This argument, however, does not take into consideration that a customs union may have an incentive to influence the world market equilibrium to its advantage. The present paper distinguishes between pure customs unions without transfers and economic communities with transfers. In a simple model examples are produces which show that under Nash-equilibrium behaviour of tariff-setters only a small set of customs unions may be able to form (which may fall short of free trade) and not even all economic communities may be able to form.

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1 Introduction

One of the most influential, and at the same time most puzzling, results in the normative theory of international trade is probably that pareto-improving customs unions do generally exist (Kemp and Wan (1976)). An implication of this result, often referred to as the Kemp and Wan proposition, is that there exists an incentive to form larger and larger unions until the world is one of free trade. The latter implication also poses the puzzle, because it sharply contrasts with real-world experience.

The logic of the Kemp and Wan proposition is analogous to the second theorem of welfare economics: Consider a world-trade equilibrium with an arbitrary initial structure of tariffs. Let any subset of countries form a coalition. Then there exists a common external vector of tariffs and a system of lump-sum transfers among the members of the coalition such that, at the new world-trade equilibrium, each country in the world is not worse off than before the formation of the coalition. To see the argument, hold imports and exports of the coalition constant and apply the second theorem of welfare economics to a pareto-optimal allocation among the participants in the coalition. Since imports and exports by the coalition are constant, no non-member can be made worse off and, if the initial allocation within the coalition was pareto-inferior, the participants in the coalition can be made better off.

Explicitely this argument assumes that transfers between the members of the coalition are feasible. Implicitely it suggests that the existence of a pareto-improvement provides an incentive to implement it. Both suggestions are not completely convincing. The requirement of transfers may pose serious political problems, because nothing excludes the possibility that rich countries within the coaliton may be net-gainers of transfers, while poor countries may be donors (see Section 5 for an example). The second obstacle is that to set a tariff-vector which is consistent with constant international trade by the coalition may not be a best-response for the coaltion as a whole. As Kennan and Riezman (1988) suggest, big trading units may win tariff-wars and may, therefore, have an incentive to considerably alter the world-market equilibrium.

While the first obstacle is obvious, the second needs some more qualification. The mere fact that a non-cooperative game is played between tariff-setting countries does not yet imply that the countries within some coalition are worse off under free trade than under a non-cooperative equilibrium, where the union plays against the rest of the world. The point to be made in the present paper is that the latter effect is possible (but by no means necessary), especially without transfers.

The abstract recognition of the possibility that the formation of a coalition in the setting of a non-cooperative game may not necessarily improve the positions of the members of the coalition is not new: in the context of the theory of horizontal mergers of firms playing on a Cournot-oligopoly market examples have been produced by Salant, Switzer and Reynolds (1983), who show that some firms may not have an incentive to merge, because they are jointly worse off at the new equilibrium, where they act as one player. In fact, the correspondence mapping the number of players of a given non-cooperative game (with symmetric strategy spaces) and their characteristics into equilibria does not display sufficient regularity to allow any conclusion on the likelihood of coalition formation. This abstract observation is the driving principle behind doubts to the validity of the main implication of the Kemp and Wan proposition.

The rest of the paper studies examples in this spirit. Section 2 briefly, but not exhaustively, lists related literature. Section 3 introduces a simple model of the tariff-game. Sections 4 and 5 study customs unions without international transfers and economic communities, defined as customs unions with access to international transfers, respectively. Section 6 summarizes the conclusions.

2 Related Literature

The problem of tariff games has influenced the literature on international trade for a long time. Special cases were already analysed by Johnson (1953) and Gorman (1958). This has led to models with more structure like Kuga (1973) and Otani (1980) (for an introduction to the issue see: McMillan (1986); Woodland (1982)). Hamilton and Whalley (1983) use simulation techniques to analyse the tariff retaliation problem, Riezman (1982) models the tariff game as a prisoner's dilemma. Kennan and Riezman (1988) study an example with two countries and suggest that big countries do win tariff-wars. The issue of customs unions dates back to Viner (1950). Schweinberger (1988), building on Neary and Schweinberger (1986) and Lloyd and Schweinberger (1988), raises the issue of incentive compatibility of customs unions. The related proposition by Kemp and Wan (1976) is generalized by Grinols (1981). The argument of the present paper, that coalitions of countries within a tariff-ridden world may be unable to improve their positions, is inspired by the related problem in the theory of horizontal mergers in oligopolies, where Salant, Switzer and Reynolds (1983) uncovered the analogous phenomenon (see also: Szidarovszky and Yakowitz (1982), and Perry and Porter (1985)).

3 A Simple Model

The model used for the analysis is a slightly generalized version of the model by Kennan and Riezman (1988). It assumes that all countries have identical preferences and portrays a world of pure exchange with two commodities. Kennan and Riezman assume equal weights in a Cobb-Douglas utility function and only two countries. For the present analysis two generalizations are adopted. The first, and rather inessential variation, is that the goods need not be equally weighted, but identical Cobb-Douglas preferences are retained. The second generalization is the essential one and is necessary to allow for an analysis of customs unions: Instead of assuming only two countries the number of countries here is arbitrary, but finite. The essential simplification which these special assumptions provide is that the indirect utility functions of countries are of the Gorman-form and, therefore, allow for aggregation across countries without the need to invoke a social welfare function applied to (a subset of) countries. Since the aim is to provide an example and not general conclusions, the restrictive assumptions do not really matter. By allowing for more than just two countries the solutions to the tariff-game become more complicated. In particular it is not possible any longer to solve explicitely for the equilibrium, despite the highly restrictive assumptions on preferences and endowments.

Consider a world with n countries, $n \geq 2$, indexed by $j \in \mathcal{N} = \{1, ..., n\}$, and two commodities. Let $e^j = (e_1^j, e_2^j) \in \mathcal{R}_+^2$ denote country j's endowment vector and denote by $p = (p_1, p_2) \in \mathcal{R}_+^2$ the vector of world-market prices (the commodity index will throughout be written as a subscript, while countries are indexed with superscripts). Each country $j \in \mathcal{N}$ may charge a tariff on its imports: If country j imports commodity i, then it may charge a tariff-rate of $t_i^j \geq 0$ on its imports, such that domestic prices in country j are given by $p_i^j = (1 + t_i^j)p_i, i = 1, 2$. All countries have identical preferences given by the utility function

$$u(c_1, c_2) = c_1^{\alpha} c_2^{1-\alpha},\ \alpha \in (0,1).$$

The (identical) consumers in each country maximize their utility subject to the budget constraint

$$p_1^j c_1^j + p_2^j c_2^j \leq y^j,\ \forall j \in \mathcal{N}$$

where $c_i^j \geq 0$ denotes consumption of commodity i in country j. Income y^j consists of the value of endowments plus tariff-revenue. Let $\mathcal{N}_1 \subset \mathcal{N}$ be the subset of countries importing commodity 1 and $\mathcal{N}_2 \subset \mathcal{N}$ the subset of countries importing commodity 2. Then, if $j \in \mathcal{N}_1$ one has

$$\begin{aligned} y^j &= p_1^j e_1^j + p_2 e_2^j + (p_1^j - p_1)[c_1^j - e_1^j] \\ &= p_1 e_1^j + p_2 e_2^j + (p_1^j - p_1) c_1^j, \qquad p_2^j = p_2, \end{aligned}$$

and if $j \in \mathcal{N}_2$, then

$$\begin{aligned} y^j &= p_1 e_1^j + p_2^j e_2^j + (p_2^j - p_2)[c_2^j - e_2^j] \\ &= p_1 e_1^j + p_2 e_2^j + (p_2^j - p_2) c_2^j, \qquad p_1^j = p_1. \end{aligned}$$

The assumption on preferences implies that expenditure shares are constant and equal to α for commodity 1 and $(1-\alpha)$ for commodity 2. This implies for $j \in \mathcal{N}_1$

$$\begin{aligned} y^j &= p_1 e_1^j + p_2 e_2^j + (1 - \tfrac{p_1}{p_1^j}) \alpha y^j \\ &= [\alpha \tfrac{p_1}{p_1^j} + 1 - \alpha]^{-1} [p_1 e_1^j + p_2 e_2^j] \end{aligned}$$

and for $j \in \mathcal{N}_2$

$$\begin{aligned} y^j &= p_1 e_1^j + p_2 e_2^j + (1 - \tfrac{p_2}{p_2^j})(1-\alpha) y^j \\ &= [\alpha + (1-\alpha) \tfrac{p_2}{p_2^j}]^{-1} [p_1 e_1^j + p_2 e_2^j] \end{aligned}$$

such that $j \in \mathcal{N}_1$, if and only if

$$\alpha e_2^j > (1-\alpha) \frac{p_1}{p_2} e_1^j,$$

and $j \in \mathcal{N}_2$, if and only if

$$(1-\alpha) \frac{p_1}{p_2} e_1^j > \alpha e_2^j.$$

Clearly no country can import both commodities, $\mathcal{N}_1 \cup \mathcal{N}_2 = 0$, because of the budget constraints.

The consumption levels of the two commodities in the countries $j \in \mathcal{N}$ are given by

$$c_1^j = \frac{\alpha[p_1 e_1^j + p_2 e_2^j]}{\alpha p_1 + (1-\alpha)(1+t_1^j)p_1} > e_1^j, \ \forall j \in \mathcal{N}_1,$$

$$c_2^j = \frac{(1-\alpha)[p_1 e_1^j + p_2 e_2^j]}{\alpha \frac{p_2}{1+t_1^j} + (1-\alpha)p_2} \leq e_2^j, \ \forall j \in \mathcal{N}_1,$$

$$c_1^j = \frac{\alpha[p_1 e_1^j + p_2 e_2^j]}{\alpha p_1 + (1-\alpha)\frac{p_1}{1+t_2^j}} \leq e_1^j, \ \forall j \in \mathcal{N}_2,$$

$$c_2^j = \frac{(1-\alpha)[p_1 e_1^j + p_2 e_2^j]}{\alpha(1+t_2^j)p_2 + (1-\alpha)p_2} > e_2^j, \ \forall j \in \mathcal{N}_2.$$

Traders on the world market are a large number of individuals, who behave price parametrically, i.e. who form their excess demands given domestic prices in their home countries. World market prices clear the world markets given the tariff rates of individual countries. Since excess demands (imports and exports) must be homogeneous of degree zero, prices on the world market can be normalized. The normalization adopted here is to choose the second commodity as the numeraire and denoting $p = p_1/p_2$. Then equilibrium on the world markets requires

$$\sum_{j \in \mathcal{N}} c_i^j(p, t_i^j) = \sum_{j \in \mathcal{N}} e_i^j, i = 1, 2.$$

The simple functional form of excess demands allows to solve explicitely for the world market price

$$\begin{aligned} p &= \left[\sum_{j \in \mathcal{N}_1} \frac{(1-\alpha)(1+t_1^j)e_1^j}{1+(1-\alpha)t_1^j} + \sum_{j \in \mathcal{N}_2} \frac{(1-\alpha)e_1^j}{1+\alpha t_2^j} \right]^{-1} \times \\ &\times \left[\sum_{j \in \mathcal{N}_1} \frac{\alpha e_2^j}{1+(1-\alpha)t_1^j} + \sum_{j \in \mathcal{N}_2} \frac{\alpha(1+t_2^j)e_2^j}{1+\alpha t_2^j} \right]. \end{aligned}$$

The indirect utility functions V^j for countries $j \in \mathcal{N}$ can be written as

$$\begin{aligned} V^j(p, t_1^j) &= \alpha^\alpha (1-\alpha)^{(1-\alpha)} p^{-\alpha} (1+t_1^j)^{1-\alpha} \frac{pe_1^j + e_2^j}{1+(1-\alpha)t_1^j}, \ \forall j \in \mathcal{N}_1, \\ V^j(p, t_2^j) &= \alpha^\alpha (1-\alpha)^{(1-\alpha)} p^{-\alpha} (1+t_2^j)^{\alpha} \frac{pe_1^j + e_2^j}{1+\alpha t_2^j}, \ \forall j \in \mathcal{N}_2, \end{aligned}$$

where p is given above as the solution to the equilibrium conditions on the world markets. Since there are only finitely many countries, each country is aware of its influence on the world market price and seeks to maximize V^j by choosing an appropriate tariff-rate. Hence, while the assumption of non-atomic consumers is maintained, countries (or rather: the governments of the various countries) are not small, but are active players in a game among countries. The game is given by tariff-rates as pure strategies and the indirect utility functions V^j as payoff-functions.

The first order conditions for a maximum of V^j are given by

$$\begin{aligned}\frac{\partial V^j}{\partial t_1^j} &= -\alpha^{(\alpha+1)}(1-\alpha)^{(2-\alpha)}p^{(-\alpha-1)}(1+t_1^j)^{-\alpha}\frac{pe_1^j+e_2^j}{\left[1+(1-\alpha)t_1^j\right]^2}\times \\ &\times \left[pt_1^j+(1+(1-\alpha)t_1^j)^{-1}\left[\sum_{k\in\mathcal{N}_1}\frac{(1-\alpha)(1+t_1^k)e_1^k}{1+(1-\alpha)t_1^k}+\right.\right. \\ &+ \left.\left.\sum_{k\in\mathcal{N}_2}\frac{(1-\alpha)e_1^k}{1+\alpha t_2^k}\right]^{-1}(1+t_1^j)\left[(1-\alpha)pe_1^j-\alpha e_2^j\right]\right]=0,\end{aligned}$$

for all $j\in\mathcal{N}_1$, and

$$\begin{aligned}\frac{\partial V^j}{\partial t_2^j} &= \alpha^{\alpha+1}(1-\alpha)^{2-\alpha}p^{-\alpha-1}(1+t_2^j)^{\alpha}\frac{pe_1^j+e_2^j}{(1+\alpha t_2^j)^2}\times \\ &\times \left[(1+\alpha t_2^j)^{-1}\left[\sum_{k\in\mathcal{N}_1}\frac{(1-\alpha)(1+t_1^k)e_1^k}{1+(1-\alpha)t_1^k}+\sum_{k\in\mathcal{N}_2}\frac{(1-\alpha)e_1^k}{1+\alpha t_2^k}\right]^{-1}\times\right. \\ &\times \left.\left[(1-\alpha)pe_1^j-\alpha e_2^j\right]-\frac{pt_2^j}{1+t_2^j}\right]=0,\end{aligned}$$

for all $j\in\mathcal{N}_2$.

It will be convenient for the representation of the equilibrium conditions to introduce the following new variables:

$$x^j=\frac{\alpha}{1+(1-\alpha)t_1^j},\ \forall j\in\mathcal{N}_1,$$

and

$$x^j=\frac{\alpha(1+t_2^j)}{1+\alpha t_2^j},\ \forall j\in\mathcal{N}_2.$$

Then for $j\in\mathcal{N}_1$ $x^j\to 0$ is implied by $t_1^j\to\infty$ and $x^j=\alpha$, if and only if $t_1^j=0$. Also for $j\in\mathcal{N}_2$ $x^j\to 1$ is implied by $t_2^j\to\infty$ and $x^j=\alpha$, if and only if $t_2^j=0$. Consequently

$$j\in\mathcal{N}_1\Leftrightarrow x^j\in(0,\alpha],$$

$$j \in \mathcal{N}_2 \Leftrightarrow x^j \in [\alpha, 1),$$

and the equilibrium conditions can be written as

$$\alpha(1-x^j)\left[1-\frac{x^j e_2^j}{\sum_{k\in\mathcal{N}} x^k e_2^k}\right] = (1-\alpha)x^j\left[1-\frac{(1-x^j)e_1^j}{\sum_{k\in\mathcal{N}}(1-x^k)e_1^k}\right]$$

for all $j \in \mathcal{N}$, with $x^j \in (0,1)$, $\forall j \in \mathcal{N}$, and

$$p = \frac{\sum_{k\in\mathcal{N}} x^k e_2^k}{\sum_{k\in\mathcal{N}}(1-x^k)e_1^k}.$$

Differentiating the equilibrium conditions yields

$$\begin{aligned} x^j(1-x^j)\sum_{k\in\mathcal{N}\setminus\{j\}}\left[\alpha\frac{e_2^j e_2^k}{\left(\sum_{k\in\mathcal{N}} x^k e_2^k\right)^2}+(1-\alpha)\frac{e_1^j e_1^k}{\left(\sum_{k\in\mathcal{N}}(1-x^k)e_1^k\right)^2}\right]dx^k \quad - \\ -\left[\alpha\frac{\sum_{k\in\mathcal{N}\setminus\{j\}} x^k e_2^k}{\left(\sum_{k\in\mathcal{N}} x^k e_2^k\right)^2}\left(e_2^j+\sum_{k\in\mathcal{N}\setminus\{j\}} x^k e_2^k\right) \quad + \right. \\ \left. +(1-\alpha)\frac{\sum_{k\in\mathcal{N}\setminus\{j\}}(1-x^k)e_1^k}{\left(\sum_{k\in\mathcal{N}}(1-x^k)e_1^k\right)^2}\left(e_1^j+\sum_{k\in\mathcal{N}\setminus\{j\}}(1-x^k)e_1^k\right)\right]dx^j \quad = \quad 0, \end{aligned}$$

which gives an explicit expression for the elements of the Jacobian matrix at the equilibrium. This Jacobian matrix obviously has positive off-diagonal elements and negative diagonal elements, if $x^j \in (0,1), \forall j \in \mathcal{N}$. Now consider the j-th column-sum of the Jacobian matrix which is given by

$$\begin{aligned} -\frac{\alpha e_2^j}{\left(\sum_{k\in\mathcal{N}} x^k e_2^k\right)^2}\sum_{k\in\mathcal{N}\setminus\{j\}}\left(x^k\right)^2 e_2^k - \frac{(1-\alpha)e_1^j}{\left(\sum_{k\in\mathcal{N}}(1-x^k)e_1^k\right)^2}\sum_{k\in\mathcal{N}\setminus\{j\}}\left(1-x^k\right)^2 e_1^k \quad - \\ -\alpha\left(\frac{\sum_{k\in\mathcal{N}\setminus\{j\}} x^k e_2^k}{\sum_{k\in\mathcal{N}} x^k e_2^k}\right)^2 - (1-\alpha)\left(\frac{\sum_{k\in\mathcal{N}\setminus\{j\}}(1-x^k)e_1^k}{\sum_{k\in\mathcal{N}}(1-x^k)e_1^k}\right)^2 \quad < \quad 0. \end{aligned}$$

Consequently, the absolute value of the (negative) diagonal element must exceed the sum of absolute values of the (positive) off-diagonal elements. By Gershgorin's theorem this is sufficient for the Jacobian matrix to be negative definite. Hence, the equilibrium conditions define a contraction mapping on $(0,1)^n$ and we have shown:

Theorem: *For every $e = (e^1, \ldots, e^n) \in \mathcal{R}^{2n}_{++}$ and $\alpha \in (0,1)$ there exists a unique equilibrium $x^* \in (0,1)^n$.*

The "minimum wealth" conditions that $e^j \gg 0, \forall j \in \mathcal{N}$, are necessary, for the usual reason, to avoid the boundary of $(0,1)^n$. Clearly, if all countries are identically endowed, the unique solution is $x^j = \alpha, \forall j \in \mathcal{N}$, i.e. free trade, because no country ever imports or exports anything. Hence an equilibrium with international trade will require that endowments differ across countries. The analysis by Kennan and Riezman suggests that the larger the variation of endowments across countries the more likely it is that larger trading units (countries on customs unions) can benefit at the expense of smaller units. This will be the driving intuition behind the examples presented below.

It is well known that Nash-equilibria of tariff-games are generally inefficient (cf. McMillan, 1986, p. 30). This does not necessarily imply that all countries have an ex ante incentive to commit to free trade, if there are no transfers between countries. In the absence of transfers some countries could easily be better off at the Nash equilibrium than they would be under free trade. What the observation on the inefficiency of Nash equilibrium implies is that, if the world would consist of one customs union and only one other country, then there is a transfer-scheme between the union and the remaining country such that both would be better off under free trade then at the Nash equilibrium.

4 Customs unions

The difference between the case with transfers and the case without is crucial here. To stress the difference the following terminology will be adopted: A customs union $\mathcal{U}$ is a subset of countries, $\mathcal{U} \subset \mathcal{N}$, such that all countries $j \in \mathcal{U}$ set the same tariff-rate, $t_1^u \geq 0$, if $\mathcal{U} \subset \mathcal{N}_1$, or $t_2^u \geq 0$, if $\mathcal{U} \subset \mathcal{N}_2$, and the income of country $j \in \mathcal{U}$ is given by

$$\begin{aligned} y^i &= \frac{pe_1^j + e_2^j}{\frac{\alpha}{1+t_1^u} + (1-\alpha)}, \text{ if } \mathcal{U} \subset \mathcal{N}_1 \\ y^i &= \frac{pe_1^j + e_2^j}{\alpha + \frac{1-\alpha}{1+t_2^u}}, \text{ if } \mathcal{U} \subset \mathcal{N}_2. \end{aligned}$$

Hence in a customs union no transfers between member countries are allowed and income in a member country is just what this country earns by setting the same tariff rate as all the other member countries. An economic community is a subset $\mathcal{C}$ of countries, $\mathcal{C} \subset \mathcal{N}$, such that all countries $j \in \mathcal{C}$ set the same tariff rate, $t_1^c \geq 0$, if $\mathcal{C} \subset \mathcal{N}_1$, or $t_2^c \geq 0$, if $\mathcal{C} \subset \mathcal{N}_2$, but where income of an individual member country of the community is determined by an arbitrary transfer scheme between members of the community which satisfies

$$\sum_{j\in\mathcal{C}} y^j = \frac{p\sum_{j\in\mathcal{C}} e_1^j + \sum_{j\in\mathcal{C}} e_2^j}{\frac{\alpha}{1+t_1^c} + (1-\alpha)}, \text{ if } \mathcal{C} \subset \mathcal{N}_1$$

$$\sum_{j\in\mathcal{C}} y^j = \frac{p\sum_{j\in\mathcal{C}} e_1^j + \sum_{j\in\mathcal{C}} e_2^j}{\alpha + \frac{(1-\alpha)}{1+t_2^c}}, \text{ if } \mathcal{C} \subset \mathcal{N}_2,$$

and $y^i \geq 0, \forall j \in \mathcal{C}$.

Under the simplifying assumption of identical preferences the objective of a customs union or an economic community is to choose a tariff-rate such as to maximize

$$V^u(p, t_i^u) = \sum_{j\in\mathcal{U}} V^j(p, t_i^u),\ i \in \{1, 2\},$$

taking as given the tariff-rates set by non-members countries. Since identical Cobb-Douglas prefrences result in an indirect utility function of the Gorman-form a customs union (or an economic community) is just like an "aggregate" player with the same preferences as all member countries and endowed with the aggregate endowment vector of the union. Except for the number of players and the endowment parameters, therefore, the equilibrium conditions remain unchanged.

The present section will deal exclusively with customs unions, i.e. with the case where no transfers between countries are allowed. An example for this in the real world would be the final stage of GATT. Under this agreement all member countries would abolish all tariffs on trade between member countries, while possibly maintaining tariffs vis à vis the rest of the world.

Clearly, unless the customs union encompasses all countries in the world, free trade is generally not a Nash equilibrium (if the remaining players are not identically endowed). Since the Nash equilibrium will be inefficient, the question arises, whether certain countries will have an ex-ante incentive to join a customs union and commit to a common tariff-rate against the rest of the world.

This, of course, assumes that binding committments are feasible among countries, i.e. it is assumed that, if a country joins a customs union, it indeed sticks to the union's tariff-rate in the subgame, where tariff-rates are chosen. In fact, the formation of a customs union is not modelled non-cooperatively here. Rather it will be assumed that a customs union (or in the next section: an economic community) emerges from some initial situation, if the participants in the union are better off under the commitment than in the initial situation. This approach deliberately avoids any non-cooperative model of coalition- formation by, say, a multilateral bargaining process. Since a customs union acts like one player in the tariff-game, each pattern of customs unions is associated with a particular equilibrium and, therefore, with particular values of the payoff-functions (indirect utility functions) for the countries. Hence a particular country will have an ex-ante incentive to join an existing customs union (which may also be taken to be a single country), if the country and all members of the union are not worse off at the equilibrium under the enlarged customs union than at the initial equilibrium, where the country under consideration has not yet joined the union. Similarly, if some subset of countries within a customs union can make all of them better off by jointly leaving the union and either form their own, smaller union or unilaterally maximizing their payoffs, then these countries will have an ex-ante incentive to leave the union. In this spirit, say that a customs union $C' = C_1 \cup C_2$, $C_1 \cap C_2 = \emptyset$, $C' \subset \mathcal{N}$, can form from the customs unions C_1 and C_2, if for all $j \in C'$ the payoffs V^j are at least as large at the equilibrium under C' than at the equilibrium under C_1 and C_2. Also say that a customs union $C' \subset \mathcal{N}$ can break into the two separate customs unions C_1 and C_2, $C_1 \cup C_2 = C'$, if the payoffs V^j are larger at the equilibrium under C_1 and C_2 than at the equilibrium under C' for either all $j \in C_1$ or for all $j \in C_2$. Implicitely these definitions assume that at indifference countries prefer to join the customs union. Clearly, if a customs union $C' = C_1 \cup C_2 \subset \mathcal{N}$ can form from C_1 and C_2, it cannot break into C_1 and C_2 and if C' can break into C_1 and C_2, it cannot form from C_1 and C_2. Note that these definitions only apply to bilateral union-formation or -destruction. The definitions have an obvious generalization to multilateral union-formation or -destruction, but these more general definitions will not be needed for the present purpose.

The point to be made in the present section is that no general conclusions are available on the formation of customs unions. This is so, because the payoffs from the formation of a customs union depend on the Nash equilibrium of the tariff game in which the customs union appears as a new and larger player. Since the mapping from possible patterns of customs unions into the corresponding Nash equilibria does not exhibit any systematic properties, virtually anything can happen. In particular it is quite feasible that certain patterns of customs unions can form which do not encompass all countries. Hence neither the pattern with no customs unions at all nor free trade may be "stable" patterns.

Consider the following numerical example of a world consisting of three countries: Let the taste-parameter α be $\alpha = 0.2$ and the endowments be given by

$$\begin{aligned} e^1 &= (50, 30), \\ e^2 &= (10, 25), \\ e^3 &= (3, 0.01). \end{aligned}$$

The first country is very large (it may even be a customs union) the second one is medium sized, and the third country is a small one with a very uneven distribution of endowments. Table 1 summarizes the various equilibria: In the table p refers to the world market price, columns correspond to the three countries and each triplet of rows refers to a particular pattern of customs unions, listing the payoffs and the tariff-rates. Under perfect competition, of course, all tariff-rates are zero and are, therefore, not listed.

The notation "customs union = {i,j}" means that countries i and j form a customs union, while the remaining country does not join (a "customs union = {1,2,3}" is equivalent to perfect competition, and "no customs union" is equivalent to the Nash equilibrium, when each country plays unilaterally). As an illustration consider the triplet of rows preceeded by the header "customs union = {2,3}, p =0.269": this means that the game is one between a player consisting of countries 2 and 3 and one opponent, namely country 1. In the equilibrium of this game the world market price of commodity 1 will be p = 0.269, the customs union (consisting of 2 and 3) will charge a tariff of 18% on imports of commodity 1 and country 1 will charge a tariff of 52% on imports of commodity 2. The equilibrium payoffs (indirect utilities) are given in the first row of the triplet of rows.

By simply comparing the equilibrium payoffs it can be checked which customs union will form from which pattern and which customs union can break into which pattern. In Figure 1 the relation "can break into" is portrayed by downward pointing arrows, and the relation "can form from" is portrayed by upward pointing arrows.

The notation {i,j} again means a pattern, where countries i and j act as one player (i.e. form a customs union) against the remaining country. The symbol Ø refers to the case without any customs union and {1,2,3} represents

countries	1	2	3
(perfect competition)	customs union = {1,2,3}, p = 0.218		
ind. utilities	33.632	22.344	0.547
	customs union = {1,2}, p = 0.014		
ind. utilities	30.978	25.373	0.073
tariff-rate 1	14.979	14.979	0
tariff-rate 2	0	0	0.038
	customs union = {1,3}, p = 0,297		
ind. utilities	33.723	21.559	0.678
tariff-rate 1	0	0.202	0
tariff-rate 2	0.748	0	0.748
	customs union = {2,3}, p = 0.269		
ind. utilities	33.738	21.787	0.642
tariff-rate 1	0	0.181	0.181
tariff-rate 2	0.517	0	0
(non-coop.equ.)	no customs union, p = 0.262		
ind. utilities	33.685	21.811	0.630
tariff-rate 1	0	0.245	0
tariff-rate 2	0.493	0	0.053

Table 1: equilibria with customs unions

perfect competition. Hence the largest coalition, where the customs union encompasses the whole world (perfect competition) can break into a pattern, where 2 and 3 form a union against 1, because 1 has an incentive to leave the free-trade agreement. It may also break into a pattern, where 1 and 3 collude against 2, because both 1 and 3 are better off without 2 than with 2. The pattern, where 1 and 2 form a union against 3, can break into the non-cooperative equilibrium, because 1 is substantially better off without 2 than with 2. The customs union consisting of 2 and 3 can break into the non-cooperative equilibrium, because 2 is better off by not colluding with 3. On the other hand there is only one customs union which can form, namely the customs union consisting of the large country 1 and the small country 3 can form from the non-cooperative equilibrium. When 1 and 3 form a union country 2's payoff is the lowest among all possible equilibrium payoffs. It, therefore, seems to pay 1 and 3 to collude and exploit 2 by jointly playing

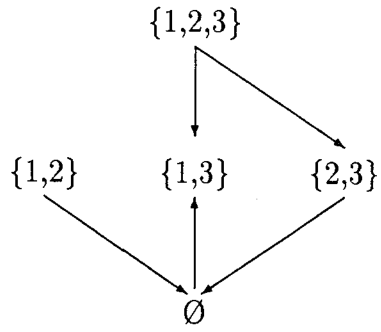

Figure 1: customs unions

against 2. The coalition between 1 and 3 is also the only "stable" customs union in the sense that it can form, but cannot break: wherever you start in Figure 1, by following the arrows you will eventually end up with the customs union consisting of 1 and 3.

It is worth pointing out in this example that, if transfers would be allowed, all possible economic communities except a single one can form: The exception is the economic community of the medium-sized country 2 and the small country 3. If these two countries would form an economic community, their payoff sum would be lower than it would be in the non-cooperative equilibrium, where everyone acts in his own best interest unilaterally, and would, therefore, break. The effect which operates here is reminiscent from Kennan and Riezman's analysis: Since 1 is larger, than even 2 and 3 together, it can win a tariff-war. Although all other economic communities can form, the preceeding analysis shows that the formation of all economic communities except {1,3} (which even forms as a customs union) and {2,3} (which breaks) require transfers between countries.

5 Economic communities

If transfers are allowed, the potential range for collusion will be increased: If a customs union can form from some initial situation, then this is also true for the corresponding economic community, but not the other way round. As the preceeding example has already shown, this does not mean that all economic communities can form. Rather, and this is the point in the present section, the pattern of which communities can form and which cannot may be quite complex.

Say that an economic community $C' = C_1 \cup C_2$ can form from the pattern of communities C_1 and C_2, if the payoff sum $V^{C'} = \sum_{j \in C'} V^j$ is at least as large at the equilibrium under C' than at the equilibrium under C_1 and C_2 seperately. Say that an economic community C' can break into C_1 and C_2, $C_1 \cup C_2 = C' \subset \mathcal{N}$, if the payoff sum $V^{C_i} = \sum_{j \in C_i} V^j$ is larger at the equilibrium under C_1 and C_2 than at the equilibrium under C' for either i = 1 or i = 2 (or both). These definitions are even a little too general for what will be needed in the sequel: In what follows only patterns with a single economic community will be considered, such that in the definitions above either C_1 or C_2 can always be taken as consisting of a single country.

Since perfect competition (free trade) is pareto-optimal and any Nash equilibrium in general is inefficient a first conclusion on economic communities is immediate: The economic community encompassing all countries (free trade) can always form from any pattern which consists of a single country playing against a single economic community. The logic of this final step towards a world of free trade does, however, not extend to intermediate steps of coalition-formation. This is the point of the final example to be presented here.

This example is considerably more complex, because it involves four countries. Let the taste parameter again be $\alpha = 0.2$ and assume the following endowments:

$$e^1 = (50, 30), \qquad e^2 = (10, 30),$$
$$e^3 = (3, 0.01), \qquad e^3 = (3, 0.1).$$

Table 2 summarizes the results for all possible equilibria with a single economic community in the same format as in Table 1. But now not the individual payoffs to members of an economic community are relevant, but only the sum of these payoffs across all members is relevant.

countries	1	2	3	4
(perfect compet.)	economic community = {1,2,3,4}, p = 0.228			
ind. utilities	33.732	26.309	0.565	0.638
	economic community = {2,3,4}, p = 0.266			
ind. utilities	33.774	25.741	0.636	0.707
tariff 1	0	0.205	0.205	0.205
tariff 2	0.469	0	0	0
	economic community = {1,3,4}, p = 0.317			
ind. utilities	33.717	25.208	0.707	0.774
tariff 1	0	0.245	0	0
tariff 2	0.897	0	0.897	0.897
	economic community = {1,2,4}, p = 0.014			
ind. utilities	30.745	30.181	0.074	0.142
tariff 1	15.328	15.328	0	15.328
tariff 2	0	0	0.036	0
	economic community = {1,2,3}, p = 0.045			
ind. utilities	31.240	29.513	0.139	0.264
tariff 1	4.180	4.180	4.180	0
tariff 2	0	0	0	0.032
	economic community = {1,2}, p = 0.033			
ind. utilities	30.993	29.693	0.131	0.239
tariff 1	6.030	6.030	0	0
tariff 2	0	0	0.038	0.029

Table 2: equlibria with a single economic community

countries	1	2	3	4
	economic community = {1,3}, p = 0.280			
ind. utilities	33.705	25.527	0.651	0.735
tariff 1	0	0.290	0	0
tariff 2	0.625	0	0.625	0.050
	economic community = {1,4}, p = 0.279			
ind. utilities	33.708	25.531	0.664	0.719
tariff 1	0	0.291	0	0
tariff 2	0.620	0	0.051	0.620
	economic community = {2,3}, p = 0.259			
ind. utilities	33.720	25.776	0.623	0.697
tariff 1	0	0.267	0.267	0
tariff 2	0.448	0	0	0.048
	economic community = {2,4}, p = 0.259			
ind. utilities	33.717	25.779	6.625	0.693
tariff 1	0	0.269	0	0.269
tariff 2	0.447	0	0.050	0
	economic community = {3,4}, p = 0.254			
ind. utilities	33.677	25.792	6.616	0.687
tariff 1	0	0.329	0	0
tariff 2	0.432	0	0.102	0.102
(non-coop.equ.)	no economic community = {2,3,4}, p = 0.253			
ind. utilities	33.672	25.799	0.614	0.686
tariff 1	0	0.330	0	0
tariff 2	0.429	0	0.050	0.048

Table 2: equlibria with a single economic community

Since the sum of payoffs of an economic community, V^C, can be written as

$$V^C(p, t_1^C) = \alpha^\alpha (1-\alpha)^{1-\alpha} p^{-\alpha} (1+t_1^C)^{1-\alpha} \frac{\sum_{j \in C} [p e_1^j + e_2^j]}{1 + (1-\alpha) t_1^C}, \text{ if } C \subset \mathcal{N}_1,$$

$$V^C(p, t_2^C) = \alpha^\alpha (1-\alpha)^{1-\alpha} p^{-\alpha} (1+t_2^C)^{\alpha} \frac{\sum_{j \in C} [p e_1^j + e_2^j]}{1 + \alpha t_2^C}, \text{ if } C \subset \mathcal{N}_2,$$

any transfer system of incomes between member countries which breaks even can be implemented in the economic community. As a consequence any payoff vector for the members of the community which sums to the sum of individual payoffs is feasible within the community.

Figure 2 portrays the relation "can break into" by downward pointing arrows. The relation "can form from" is not depicted in Figure 2, because, again, if an economic community can form from some pattern, it cannot break into this pattern, and if it can break into some pattern, it cannot form from it. Hence all the remaining possible relations in Figure 2 are of the "can form from"-variety. In other words: Wherever Figure 2 does not display a downward pointing arrow, an upward pointing arrow may be inserted.

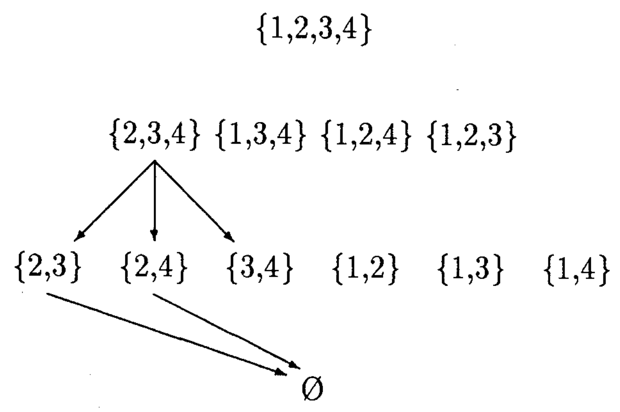

Figure 2: economic communities

What Figure 2 illustrates is that any bilateral collusion between the medium-sized country and any one of the two small countries will be bound to break into the non-cooperative equilibrium with no economic community at all. Also the community of the medium-sized country with both small countries is not yet sufficiently strong to win a traiff war against the large country. In fact the large country 1 would enjoy a coalition between the medium-sized country 2 and the two small countries 3 and 4, because country 1's payoff, when playing against an economic community of 2, 3 and 4 is the highest among all possible equilibria except for free trade with transfers in favour of country 1. This is also an example of a world, where, although free trade may be the ultimate stage of a process of coalition formation, and although all countries can be made better off at free trade than at any tariff-ridden equilibrium, the relative position of the large country will be improved under free trade by the necessary transfers to maintain the stability of the free trade arrangement. This effect casts doubt on the validity of the assumption on the feasibility of transfers: To achieve free trade "poor" countries may have to become donors in favour of "rich" countries.

6 Conclusions

The present paper has produced counter-examples to the spirit of the Kemp and Wan proposition under the presumption that countries are not price-takers but act as tariff-setters aware of their influence on the world market price. The logic of the argument is borrowed from analogous observations in the theory of horizontal mergers on oligopolistic markets. It rests on the fact that the mapping associating a Nash-equilibrium with each pattern of the number of players and their endowments is sufficiently irregular to violate the spirit of the Kemp and Wan proposition. This even holds, when the world is as simple as here, namely a two-commodity-world of pure exchange with countries having identical preferences.

Distinguishing between pure customs unions without access to an international transfer-technology and economic communities, who may use transfers, an example was produces which displays a stable pattern of customs unions which does not encompass the whole world. Another example shows that even with transfers not all possible economic communities may form. Although free trade is a feasible coalition in the latter example, it was argued that the necessary transfer structure may require the small countries to contribute to the welfare of the receiving large country. This casts doubt on the presumption that transfers are politically feasible. Hence, in general, the conclusions from this simple model are agnostic. A more thorough analysis of customs unions requires models with more structure and, possibly, an endogeneous process of coalition formation.

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