Economic Integration, International Conflict and Political Unions

Enrico Spolaore*
Tufts University, Medford (MA - USA)

Questo articolo studia le interazioni tra integrazione economica, conflitto internazionale e la formazione e dissoluzione delle unioni politiche (stati e alleanze politico-militari centralizzate). Il processo di integrazione economica riduce i benefici di una maggiore dimensione politica, mentre il conflitto internazionale ha l'effetto opposto. Quando il conflitto internazionale riduce il livello di integrazione economica, possono emergere equilibri multipli. In un equilibrio, le unioni politiche sono di dimensioni inferiori, più aperte agli scambi internazionali e meno propense a entrare in conflitto con i propri vicini. In un altro equilibrio, il mondo è formato da unioni di maggiori dimensioni, con maggior conflitto e meno integrazione economica.

This article studies the interactions among economic integration, international conflict, and the formation and breakup of political unions. Economic integration reduces the importance of political size, while international conflict increases it. When international conflict reduces economic integration between politically separate units, multiple equilibria are possible. In one equilibrium, political units are small and more open and engage less in conflict, therefore making political size less important. In another equilibrium, the world is formed by larger units, with more conflict and less economic integration [JEL Code: D74, F15, H10, H56].

1. - Introduction

The spectacular breakup of countries and reshaping of political borders and alliances after the collapse of the Soviet Union has reminded us that political boundaries are not a permanent

* *<Enrico.Spolaore@tufts.edu>*

fixture of the geographic landscape, but can change suddenly and dramatically. Traditionally, the study of the formation and breakup of political units (sovereign states, empires, political alliances) has been the preserve of historians and political scientists. By contrast, economists have usually taken political borders as given. Only in recent years has a small but growing economic literature started to address the endogenous formation and breakup of political unions with the tools of economic analysis.[1] In fact, political unions — including sovereign states — are human-made institutions, affected by the decisions and interactions of individuals and groups who pursue their objectives under constraints, and the economic study of political unions can be viewed as a natural extension of the research program of modern political economics: the endogenization of collective decisions and institutions.

In particular, an area that remains largely unexplored is the interaction between economic forces and political and military forces in the formation of political boundaries. In one of the few contributions on this subject, Findlay (1996, p. 41) wrote: «Insofar as they are considered at all in economics, the boundaries of a given economic system or "country" are generally regarded as given [...]. The process by which these boundaries are determined and defined clearly depends on the interplay of economic and military forces, which have, however, generally been regarded as independent factors».[2]

This article extends the literature on this subject by explicitly modeling the interplay between international conflict and international economic integration as key factors in the determination of political borders. Our analysis is motivated by three relationships that emerge from the theoretical and empirical literature.

---

[1] For a general discussion of this literature, see BOLTON P. - ROLAND G. - SPOLAORE E. (1996), ALESINA A. - SPOLAORE E. (2003), and SPOLAORE E. (2005*a* and 2005*b*).

[2] Findlay also cites the eminent Sinologist ELVIN M. (1973, p. 17), who wrote: «The question of the size of political units never seems to attract among historians and sociologists the attention it deserves. What determines why states and empires have expanded to the limits which they have historically achieved? [...] As a general problem — distinct from the specific question of why particular units have disintegrated — this is still largely unexplored territory.»

1) The relationship between economic integration and the size of political units: When there are barriers to trade across different political units, the size of the market depends on the size of the political unit. If there are advantages to market size, high barriers to trade increase the benefits from forming larger units, while openness reduces the costs of forming smaller political units. By the same token, citizens of smaller units are likely to have a stronger interest in reducing trade barriers with the rest of the world.[3] Ades and Glaeser (1999) consider growth rates for nineteenth century US states and for twentieth century less developed countries, and find stronger correlation between growth and initial wealth among closed economies, which supports the extent-of-the-market hypothesis.[4] Alesina, Spolaore and Wacziarg (2000) consider cross-country growth and income regressions and find support for the hypothesis that the economic benefits to international openness are inversely related to country size, and the economic benefits to size are inversely related to openness.[5] Vamvakidis (1997) finds similar results using policy measures for openness, rather than trade volumes;

2) The relationship between international conflict and the size of political units: Defense is a public good, and, *coeteris paribus*, larger political units can provide better and cheaper security to their citizens. Therefore, low international conflict tends to decrease the incentives to form larger political units. The implications of conflict and defense spending on the number and size of countries has been studied by Alesina and Spolaore (2005*a*; 2005*b*)[6]. This analysis builds on a vast theoretical and empirical literature on conflict and defense.[7] This literature includes classic

---

[3] This point is related to the analysis of endogenous trade policy in trade blocs — in particular, to Bhagwati's J. (1993) influential idea that reduced barriers between members of a regional integration arrangement are likely to go together with increased protection against outside countries.

[4] Wacziarg R. (2001) extends the Ades and Glaeser result to a larger sample of countries.

[5] On the links between economic integration and political size see also Alesina A. - Spolaore E. (1997; 2003); Alesina A. - Wacziarg R. - Spolaore E. (2004).

[6] See also Wittman D. (2000).

[7] Surveys of the field are provided in Hartley K. - Sandler T. (1995). In particular, Hirshleifer (1995*a*) provides a review of the analytical theory on conflict;

contributions by Schelling (1960), Boulding (1962), Thomson (1974), and Tullock (1974). The public-good nature of defense and security in military alliances and its implications for burden sharing has been analyzed in numerous analytical and empirical studies, pioneered by Olson and Zeckhauser (1966)[8];

3) The relationship between international conflict and international trade: Conflict leads to a reduction of trade. Therefore, a cost of conflict comes from the lost gains from trade. This relationship is at the basis of important theoretical and empirical work, pioneered by Polachek (1980; 1992). In this literature conflict is usually measured using the Conflict and Peace Data bank, that includes not only wars, but also other events associated with hostility and aggression (Azar, 1980). The evidence points to «a strong and robust negative association between conflict and trade.» (Polachek, 1992, p. 113). Country pairs engaged in the most trade have the least conflict.[9] The causal direction can go both ways: more trade means bigger losses from hostility, and therefore less hostility. Conversely, less conflict means less barriers to trade, and therefore more trade.[10]

The main point of this article is that the three relationships above must be considered jointly. That is, conflict, economic integration and political borders are endogenously linked variables.

When conflict interacts with trade, multiple equilibria in conflict, openness and size of political units are possible. In one equilibrium, political units will be small and, consequently, more open and less engaged in conflict. In such a world of high openness and low conflict, political size will matter less, therefore justifying small units as the equilibrium outcome. In another equilibrium, the world

---

SMITH R. (1995) reviews the empirical evidence on demand for military expenditure; the large literature on arms races and proliferation is reviewed by BRITO D.L. - INTRILIGATOR M.D. (1995).

[8] For a survey of the theory and empirics of military alliances, see MURDOCH J.C. (1995).

[9] See POLACHEK S. (1992). See also POLACHEK S. - ROBST J. - CHANG Y. (1999), who test empirically models in which the gains from trade are endogenized, and depend, inter alia, on country size. For a contrarian view, see BARBIERI K. (2002).

[10] For Granger causality tests of the Trade-Conflcit and Conflict-Trade relationships see GASIOROWSKI M. - POLACHEK S. (1982).

will be formed by larger units, with less economic integration and more conflict. In such a world there will be larger benefits from the extent of the domestic market and the economies of scale in security, and, consequently, people will want to belong to larger political units in equilibrium. A multiple-equilibria framework can provide insights on the evolution of political and economic integration, and may help explain major shifts in the configuration of political borders. In recent years multiple-equilibria models have received renewed attention as useful tools to understand important economic issues, including oil shocks and financial crises. The study of conflict, trade and political borders as jointly endogenous variables, with the resulting possibility of multiple equilibria, can be viewed as a novel addition to this line of analysis.

The rest of this paper aims at developing the simplest and most tractable model that allows us to make our point. Section 2 presents a basic model of conflict and political borders. In Section 3 we derive conflict and political borders in equilibrium in the absence of trade (autarky). In Section 4 trade is introduced, and the interaction between trade and conflict is analyzed. First, we characterize trade patterns and equilibrium conflict for different possible configurations of borders. We then derive equilibrium conditions when borders are endogenous. In particular, the conditions for multiple equilibria in conflict, openness and borders are derived, and a welfare comparison is provided. Section 5 concludes. Section 1 of the *Appendix* contains formal derivations of the results. Section 2 of the *Appendix* provides an extension of the model to the case of decentralized alliances.

2. - A Model of Trade and Conflict

2.1 *Production*

Consider a world formed by a finite and discrete number of regions. In each region i, individuals are identical. Each obtains utility from consumption of a final good C_i and from government services G_i, according to the following utility function:

$$U_i = C_i + G_i \tag{1}$$

Each region produces its final good Y_i according to the following production function:

$$Y_i = \left(L_i^{\rho(1-\alpha)} \sum_{j \in A_i} X_{ji}^{\rho\alpha} + R_i^{\rho} \right)^{1/\rho} \tag{2}$$

where L_i is total (unskilled) labor in region i, and X_{ji} is the input of the intermediate good j used in region i. The set of intermediate goods used in region i is denoted by A_i. R_i is a natural resource ("land").

Intermediate goods are produced using region-specific human capital. Each region i has a stock of human capital H_i, which it uses to produce H_i units of intermediate good i. In the absence of trade, all units of intermediate good i are used for domestic production in region i (that is, $A_i = \{i\}$). When trade is allowed, intermediate input i can also be sold to other regions, while intermediate inputs produced elsewhere can be used for domestic production.

Factors of production are sold in perfectly competitive markets to profit-maximizing firms. Therefore, each factor is paid its marginal product. Since we assume constant-returns-to-scale technologies, an individual's income is given by the sum of the returns to the factors of production he or she owns.

2.2 *Conflict*

We assume that regions belong to political jurisdictions ("countries"). A political jurisdiction may consist of an independent region, or of a union of regions. To keep the model as simple as possible, we will focus on four regions, since four is the smallest number for which two different unions can be formed.

The inhabitants of each region have secure ownership over their labor and their human capital. By contrast, the ownership of natural resources is subject to dispute. Specifically, control over land depends on the resolution of conflict between different jurisdictions.

To fix ideas, assume that the four regions are located along a circle of diameter equal to R (where R measures the world stock of natural resources). The "capital city" of each region is equidistant from the "capital city" of the two contiguous regions. The "capital city" of each region is centered in a segment of length equal to $(1-\lambda)R/4$, where $0 < \lambda \leq 1$. This segment denotes the land each region can securely control independently of the outcome of international confrontations. Between each pair of regions lies a segment of land equal to $\lambda R/4$. This segment is a source of potential conflict between bordering regions.[11]

The allocation of the disputed land will depend on the amount of resources (units of the final good) invested in conflict by the government of each jurisdiction. Consider two bordering regions — i and i' — which belong to different political jurisdictions. Suppose that the government of region i invests c_i in conflict, while region i's government invests $c_{i'}$. Then, the disputed segment of land $\lambda R/4$ will be divided as follows. Region i will obtain:

$$\phi\left(c_i, c_{i'}\right)\frac{\lambda R}{4} \tag{3}$$

while region i' will obtain:

$$\left[1-\phi\left(c_i, c_{i'}\right)\right]\frac{\lambda R}{4} \tag{4}$$

where $\phi(c_i, c_{i'})$ is a function that takes values between zero and one, is increasing in c_i and is decreasing in $c_{i'}$. The function $\phi(c_i, c_{i'})$ specifies a "conflict resolution technology" and is consistent with the literature on conflict and appropriation.[12] The function $\phi(c_i, c_{i'})$ is

[11] In the rest of this paper, we will denote the four regions as 1, 2, 3, and 4, with 1 contiguous to 2 and 4, 2 contiguous to 1 and 3, *etc*.

[12] For example, see TULLOCK G. (1980); HIRSHLEIFER J. (1989; 1991; 1995*a*; 1995*b*); GROSSMAN H.J. (1991); SKAPERDAS S. (1992) and SKAPERDAS S. - SYROPOULOS C. (1996).

usually interpreted as region i's "probability of winning," and is referred to as a "Contest Success Function."[13]

In the rest of the paper we will assume the following specification:[14]

$$\phi\left(c_i, c_{i'}\right) = \frac{c_i}{c_i + c_{i'}} \tag{5}$$

To simplify the analysis, we will also assume that c can take only two values: either $\underline{c}$ or $\bar{c}$, where $0 < \underline{c} < \bar{c}$. That is, $\underline{c}$ will denote a government's choice of a low level of conflict activities, while $\bar{c}$ will denote a high-conflict choice.[15]

2.3 *Political Borders*

As we mentioned, we assume that regions can either be independent or form political unions. To simplify the analysis, we

[13] To simplify language and notation, we will interpret the amount of land that goes to each region as a deterministic quantity rather than as the expected value of a random variable.

[14] In our circular model each government faces two disputes (one at each border). The above specification is consistent with two different interpretations: 1) each dispute faced by a government is resolved by using all conflict activities at its disposal (conflict activities are nonrival) or 2) each of the two disputes faced by a government is resolved by using half of the conflict activities at its disposal (conflict activities are rival).

[15] In this paper, decisions over "conflict" are collapsed into a binary low conflict/high conflict decision. This assumption allows the maximum analytical simplicity without much loss of generality. The model could be extended to allow separate decisions over investment in means of conflict (weapons, *etc*.) and over their actual use in confrontations (wars, other hostile activities). This distinction is made, for example, in ALESINA A. - SPOLAORE E. (2005*b*), who study both peaceful "armed" bargaining and violent confrontations (wars). A related distinction between "security" and "hostility" has been stressed by Ronald Findlay in order to clarify different theoretical and empirical perspectives on the relationship between trade, military spending, and conflict (e.g., see SEIGLE C., 2001). In the present paper, we assume that conflict is resolved through the "hostile" use of conflict instruments (although not necessarily with open warfare), consistently with the way conflict is modeled and measured in the empirical literature on conflict and trade cited in the introduction (in particular, see POLACHEK S. (1980; 1992), and AZAR E.E. (1980).

will assume that there are only two feasible political unions: a union between regions 1 and 2, and a union between regions 3 and 4.

If two regions belong to the same political union, we have that:

1) The two regions share the same government. The central government chooses a common level of investment in conflict, which is then used to resolve the disputes of the union with its foreign neighbors. The costs of investing in conflict are shared equally across regions;[16]

2) Disputes over land within the union are resolved peacefully without recourse to conflict. Control rights within each political union are perfectly defined, with inhabitants in each region obtaining half of the contested land (that is, each region obtains $\lambda R/8$).[17]

By contrast, independent regions will choose their own level of investment in conflict activities and will bear the whole cost of it.

In this paper we will refer to political unions and independent regions as "countries." In other words, we will use the word "country" as a shorter way to indicate political units with perfectly centralized decisions over international conflict. In principle, those units do not need to be sovereign states in the legal meaning of the term. One can view them as tight political/military alliances in which decisions over defense, foreign policy, international conflict *etc.* have been completely and credibly centralized. However, military alliances among sovereign states are rarely able to provide such a degree of centralization over security and conflict decisions (including the enforcement of centralized burden-sharing mechanisms). As we mentioned in the introduction, the influential economic literature on military alliances has emphasized issues of free riding within alliances. As shown in Section 1 of the *Appendix*, our framework can be extended to allow for decentralized alliances and potential free riding. However, to keep matters simple, in the main

[16] We abstract from redistribution issues regarding taxes and transfers within political unions.

[17] A fifty-fifty split is a natural assumption given the symmetry of the model, and can be rationalized as a peaceful Nash bargaining solution.

text of this paper we will focus on the case of centralized political units, and will call them "countries" for short.

Consistently with the literature on the formation of political jurisdictions we assume that political unification does not come for free, but implies costs in terms of increased "heterogeneity."[18]

These costs may come from different sources. They may be related to coordination costs, monitoring costs, heterogeneous preferences over public policies and "types" of government, *etc*. They may even be related to expected losses from civil wars and other forms of internal conflict. In this paper we will assume that an independent region obtains utility from government services $G_i = G$, while a region that belongs to a political union obtains utility $G_i = G - Z$, where $Z > 0$ captures the "heterogeneity costs" associated with the formation of a larger and less homogeneous political jurisdiction.[19] Without any loss of generality, in the rest of the paper we will normalize $G = 0$.

In the rest of the paper we will also make the following simplifying assumptions:[20] 1) in each region, population is normalized to one, and $L_i = 1$; 2) each region has the same amount of human capital $H_i = H$; 3) the production function has parameters $\alpha=1/2$ and $\rho = 1$.

2.4 *Timing of the Game*

We will consider the following game.

In the first stage, each region decides whether to remain independent or form a union. In other words, each region chooses be-

[18] For a discussion of heterogeneity costs in models of country formation see ALESINA A - PEROTTI R. - SPOLAORE E. (1995); BOLTON P. - ROLAND G. - SPOLAORE E. (1996); ALESINA A - SPOLAORE E. (1997) and ALESINA A - SPOLAORE E. - WACZIARG R. (2001).

[19] A "spatial" ("geographical/ideological") interpretation, as in ALESINA A - SPOLAORE E. (1997), would relate Z to the "distance" between the "regional capital" and a "federal capital," located half-way between the two regional capitals. Such spatial interpretation is consistent with (but not necessary for) the results of this paper.

[20] Those assumptions simplify the algebra considerably, without much loss of generality.

tween a set of two actions: {"in favor of a union"; "against a union"}. A union is formed if and only if both regions are in favor.

In the second stage, each government chooses the level of conflict that maximizes average utility in its jurisdiction. Each government's action space is given by $\{\underline{c}, \bar{c},\}$.[21] Disputes are resolved, and consumption takes place.

We will consider the subgame perfect Nash equilibria of this game. Therefore, we will solve the game backwards. For each possible configuration of borders, each possible set of governments will choose conflict levels. Equilibrium borders will result as the Nash equilibrium of the game played by the four regions, when payoffs for each possible configuration of borders are calculated using the equilibrium solutions of the second-stage game.

Since a union between two regions can be formed if and only if both regions in the union agree, there always exist Nash equilibria in which unions are not formed. However, in some of those equilibria a region may be playing a (weakly) dominated strategy in the four-player reduced game among regions.[22] As it is standard practice, we will not consider those equilibria as part of our equilibrium concept. In other words, we will not consider equilibria in which a region decides against forming a union, although, for all possible strategies by the other regions, that region could obtain equal or higher utility by unilaterally changing its strategy (e.g., by choosing to be in favor of a union).

3. - The Autarkic Case

In this Section we will derive the equilibria under the assumption that no trade can take place across regions. That is, each region can only use the intermediate good produced domestical-

[21] As we will see, preferences over conflict decisions are identical across regions within a union. Therefore, maximization of average utility is equivalent to having the level of conflict investment decided through direct voting by all citizens of the union.

[22] By "four-player reduced game" we mean the game played in the first stage by the four regions, where the payoffs associated with each border configuration are calculated using the equilibrium solutions of the second-stage game among governments.

ly. Formally, for each i, $A_i = \{i\}$. In this case, output and consumption in each region i are given by

$$Y_i = C_i = H^{1/2} + R_i \tag{6}$$

Consequently, utility for each individual living in region i is[23]:

$$U_i = H^{1/2} + R_i - (1 - \delta_i)qc_i - \delta_i\left(\frac{qc_i}{2} + Z\right) \tag{7}$$

where δ_i is a binary index that takes value zero if the region is independent, and value 1 if it belongs to a union.[24]

3.1 *Equilibrium Conflict*

In the autarkic case the level of conflict chosen by each government is the same for all configurations of political borders. Specifically, by comparing payoffs under alternative scenarios one can derive the following:

PROPOSITION 1

For every possible configuration of political borders, low conflict $\underline{c}$ is the unique equilibrium choice by all governments if and only if:

$$q > \frac{\lambda R}{4(\underline{c} + \bar{c})} \tag{8}$$

[23] As all individuals in each region i have identical preferences, we will refer to their decisions as to decisions "by region i."

[24] We are making the simplifying assumption that taxes are raised only to finance conflict activities. Not much would be gained from introducing other taxes (e.g., to finance government services). If those other taxes, in per capita terms, were the same across jurisdictions of different size, they would not affect decisions over borders. If non-conflict related taxes were lower in larger jurisdictions (say, because of fixed costs in the the provision of non-conflict related public goods, as in ALESINA A - SPOLAORE E., 1997), one could take that difference into account by reinterpreting Z as a measure of net heterogeneity costs in larger jurisdictions (that is, gross heterogeneity costs minus the benefits from economies of scale in the provision of non-conflict related public goods).

while high conflict $\bar{c}$ is the unique equilibrium choice by all governments if and only if[25]:

$$q < \frac{\lambda R}{4(\underline{c} + \bar{c})} \tag{9}$$

Poof in Section 1 of the *Appendix*.

The above proposition means that for each given vector of parameters $(q, \lambda, R, \underline{c}, \bar{c})$ there exists a unique equilibrium in which governments choose low conflict when conflict is relatively costly (high q) relative to its benefits, which are related to the extent of the land in dispute between pairs of regions $(\lambda R/4)$. By contrast, governments choose high conflict when the costs of conflict are low and its benefits are high. Note that countries of different size will choose the same (absolute) level of conflict.[26]

3.2 *Equilibrium Borders*

We are now ready to consider the equilibrium configuration of political borders in the autarkic case.

Let $\hat{c} = \hat{c}\ (q, R, \lambda, \underline{c}, \bar{c})$ denote the equilibrium level of conflict. That is, $\hat{c}$ is equal to $\underline{c}$ for $q > \lambda R/4(\underline{c}+\bar{c})$ and equal to $\bar{c}$ for $q < \lambda R/4(\underline{c} + \bar{c})$.[27]

By definition, utility for a region that stays independent is

$$U_{ind} = H^{1/2} + \frac{R}{4} - q\hat{c} \tag{10}$$

By contrast, if two regions decide to form a union, each of them obtains:

---

[25] In the knife-edge case $q=\lambda R/4(\underline{c}+\bar{c})$, both $\underline{c}$ and $\bar{c}$ are equilibria. Since this case has measure zero, the equilibrium is generically unique in the autarkic case. As we will see, this contrasts with the case of trade, in which multiple equilibria are generically possible.

[26] Consequently, spending in conflict per capita will be lower in larger countries.

[27] In the knife-edge measure-zero case $q=\lambda R/4(\underline{c}+\bar{c})$, either level is an equilibrium.

(11) $$U_{uni} = H^{1/2} + \frac{R}{4} - \frac{q\hat{c}}{2} - Z$$

Therefore, it is immediate to derive the following

PROPOSITION 2

In equilibrium two political unions will be formed if and only if:

(12) $$Z < \frac{q\hat{c}}{2}$$

while the four regions will choose to be independent if and only if[28]:

(13) $$Z > \frac{q\hat{c}}{2}$$

The intuition for the above result is straightforward. From the point of view of each country, investment in conflict is a public good, and its costs can be spread over a larger population in a union. Specifically, by joining a union, each region can reduce its costs for conflict by $q\hat{c}/2$. Henceforth, $q\hat{c}/2$ measures the benefits from joining a union, which are increasing in the equilibrium level of conflict $\hat{c}$ and in its cost per unit (q). If those benefits are high enough to offset the heterogeneity costs Z, unions result in equilibrium. Otherwise, regions will prefer to remain independent. Consequently, for given heterogeneity costs, higher and/or more costly levels of conflict are associated with a higher likelihood of larger political units in equilibrium.

In summary, in the case of autarky there exists a unique level of conflict (high or low), which depends on the costs and benefits of conflict — and is the same for all political units, independently of their size. The costs of equilibrium conflict are compared to the heterogeneity costs, and a unique equilibrium results,

[28] Both two unions and four independent regions are equilibria in the measure-zero case $Z = q\hat{c}/2$.

with small units when heterogeneity costs are relatively high, and large units when heterogeneity costs are relatively low.

As we will see in the next session, the picture changes when we allow trade between regions and assume that trade patterns are affected by conflict.

4. - Conflict and Trade

In this Section we will consider a world in which regions can use inputs purchased from their neighbors. That is, each region i can trade with its two neighbors i' and i'', with which it shares a border. Formally, we assume $A_i = \{i, i', i''\}$.[29]

If two regions belong to the same political jurisdiction, we assume that they can trade with each other without costs and restrictions.[30] However, if two regions belong to two different political jurisdictions, their economic exchanges take place at a cost.

The importance of political borders in affecting trade patterns, even in the absence of formal barriers (tariffs, *etc.*), has been documented in numerous empirical studies.[31] Many have stressed the existence of pervasive transactions costs associated with trade across different political jurisdictions, including costs that stem from imperfect enforcement of contracts and from insecurity of property rights.[32] In light of the above mentioned empirical evidence on the relationship between conflict and trade, it is realistic

[29] I.e., we consider trade between regions that are geographically contiguous. Empirically, distance is a major determinant of trade patterns (MCCALLUM J., 1995; FRANKEL J - STEIN E. - WEI S., 1997), and our specification could be viewed as a crude way of capturing this geographical dimension of trade. With some substantial complication in the algebra and no major change in the results, the model can be extended to allow for trade between noncontiguous regions.

[30] That is, we exclude "internal" barriers to trade. Within our framework, this is a natural implication of the assumption that there is no intraregional conflict within political units. In other words, we abstract from internal barriers due to "civil wars" etc. While the exogenous parameter Z may capture some of those costs, an extension of the model to deal explicitly with the possibility of domestic conflict and civil wars is left for further research.

[31] For example, see MCCALLUM J. (1995); ENGEL C. - ROGERS J. (1996); ANDERSON J. (1999).

[32] For example, an interesting model of trade and predation is provided in ANDERSON J. - MARCOUILLER D. (1997).

to assume that international conflict plays an important role as an underlying determinant of those costs and barriers. Hence we assume that, when two regions belong to different jurisdictions, the larger is the extent of the conflict between their governments, the higher are their costs to trade with each other. Those costs can have multiple sources. They may be due to the physical destruction of goods when force is actually used between countries. Equally or even more importantly, they may be due to higher transaction costs across jurisdictions when their governments are engaged in hostile activities against each other. For example, conflict may imply political and legal obstacles to economic exchanges, such as a reduced ability for an economic agent who belongs to a different jurisdiction to have his rights enforced within the jurisdiction of his counterpart. A state of conflict may also reduce the ability of an economic agent to acquire relevant information about potential economic partners who are located in different jurisdictions.

Specifically, we assume that if a region i sends X_i units of intermediate good i to region i', only $[1 - \Psi(c_i,c_{i'})]X_i$ units can be used for production in region i', while $\Psi(c_i,c_{i'})X_i$ are lost because of conflict. Henceforth, $\Psi(c_i,c_{i'})$ measures the barriers to international trade that two regions face because of the level of conflict between their governments.[33]

The function $\Psi(c_i,c_{i'})$ — like $\phi(c_i,c_{i'})$ — depends on the levels of conflict in the two countries. However, unlike $\phi(c_i,c_{i'})$, $\Psi(c_i,c_{i'})$ is increasing in both c_i and $c_{i'}$. In other words, an increase in hostile activities by either government increases the barriers to trade between the two political units. Without much loss of generality, in the rest of this paper we will assume the following linear specification:

$$\Psi(c_i,c_{i'}) = \psi(c_i + c_{i'}) \tag{14}$$

where $\psi \geq 0$.[34]

[33] The term $\Psi(c_i, c_{i'})$ plays a role formally analogous to the term β in Alesina A. - Spolaore E. - Wacziarg B. (2000). While in that paper β is an exogenous parameter, in this paper trade barriers depend on the endogenous level of conflict.

[34] Also, to insure that the nonnegativity constraint is always satisfied, we will assume that $2\psi\bar{c}<1$.

Intermediate inputs are sold in competitive markets both domestically and internationally. Let D_i denote the amount of intermediate input i used for domestic production (that is, either within region i or within another region that belongs to the same country), while $F_{ii'}$ denote the amount of intermediate input i used in a region i' that belongs to a different country.

Given our assumptions, each unit of intermediate good i will be sold at a price P_i equal to its marginal product both domestically and internationally.[35] Hence:

$$P_i = \frac{1}{2} D_i^{-1/2} = \frac{1}{2}\left[1 - \psi\left(c_i + c_{i'}\right)\right]^{1/2} F_{ii'}^{-1/2} \tag{15}$$

which implies:

$$\frac{F_{ii'}}{D_i} = 1 - \psi\left(c_i + c_{i'}\right) \tag{16}$$

Consequently, the equilibrium levels of exports and imports in each region will endogenously depend on the configuration of political borders and on the level of conflict chosen by each government.

For example, in a world with four independent countries, each engaging in conflict equal to $\hat{c}$, each region's production of intermediate input H will be used either domestically (D_{ind}) or for exports (F_{ind}):

$$H = D_{ind} + 2F_{ind} \tag{17}$$

which, together with[36]:

$$\frac{F_{ind}}{D_{ind}} = 1 - 2\psi\hat{c} \tag{18}$$

[35] The final good is used as numeraire.
[36] The assumption $\psi\hat{c}<1/2$ insures that no non-negativity constraint is violated.

implies:

(19) $$D_{ind} = \frac{H^{1/2}}{3 - 4\psi\hat{c}}$$

and:

(20) $$F_{ind} = \frac{(1 - 2\psi)H}{3 - 4\psi\hat{c}}$$

Consequently, each region's output will be given by:

(21) $$Y_{ind} = D_{ind}^{1/2} + 2[(1 - 2\psi\hat{c})F_{ind}]^{1/2} + R/4 = \\ = (3 - 4\psi\hat{c})^{1/2} H^{1/2} + R/4$$

By contrast, suppose that two political unions are formed, and engage in conflict $\hat{c}$ with each other. Then, each region will use a level D_{uni} of its own intermediate input for domestic production, and will sell an equal amount D_{uni} to the other region within the union, while it will export F_{uni} units of its intermediate input to its foreign neighbor:

(22) $$H = 2\ D_{uni} + F_{uni}$$

which, together with:

(23) $$\frac{F_{uni}}{D_{uni}} = 1 - 2\psi\hat{c}$$

implies:

(24) $$D_{uni} = \frac{H}{3 - 2\psi\hat{c}}$$

and:

(25) $$F_{uni} = \frac{(1 - 2\psi\hat{c})H}{3 - 2\psi\hat{c}}$$

Therefore, in each region, output will be equal to:

$$(26) \qquad Y_{uni} = 2D_{uni}^{1/2} + [(1 - 2\psi\hat{c})F_{uni}]^{1/2} + R/4 = \\ = (3 - 2\psi\hat{c})^{1/2} H^{1/2} + R/4$$

The above examples show that, for a given level of international conflict: 1) economies are more open internationally in a world of small countries than in a world of large countries ($F_{ind} > F_{uni}$); 2) output is higher in a world of large countries than in a world of small countries ($Y_{uni} > Y_{ind}$).

These implications stem from the fact that, in a world of large countries, regions can trade at no costs within domestic borders, and consequently increase the marginal product of their intermediate inputs.

The above results illustrate two general points: *a)* in a world of small countries international trade is more "important" than in a world of large countries; and, *b)* for a given level of conflict (and, consequently, for given barriers to trade), there is an economic benefit from being larger.

However, the above comparisons are made for a given level of conflict. But conflict is not exogenous. Exactly because trade is more important for smaller countries than for larger countries, in a world of small countries governments may be more reluctant to engage in conflict, if that means higher barriers to trade. But then, if a world of small countries is less conflictual than a world of large countries, in which case would output and/or utility be higher?

This and related questions will be addressed in the following analysis, in which both conflict and borders as endogenous variables.

4.1 *Equilibrium Conflict*

Consider the equilibrium decisions over conflict, for given configurations of political borders. Since small countries (independent regions) are more open than large countries (unions), an increase in conflict, by increasing the costs of trade, may hurt small countries comparatively more than large countries. Consequently, in a world of small countries governments may tend to choose lower levels of conflict than they would if their countries were large.

Clearly, if conflict is very costly (relatively to its benefits), countries will always choose low conflict, independently of their size. On the other hand, if conflict has very low costs (relative to its benefits), all governments will choose high conflict, independently of the configuration of political borders. However, we are not interested in those corner cases, but want to focus on the more interesting "non-corner" situations in which the choice over conflict depends on country size.

The following Propositions 3*a* and 3*b* characterize the conditions for which high conflict is chosen in a world of large countries and low conflict is chosen in a world of small countries.

PROPOSITION 3*a*

In a world with two large countries, each government will choose $\bar{c}$ in equilibrium if and only if:

$$q + \Delta_{\bar{c}} \leq \frac{\lambda R}{4\left(\underline{c} + \bar{c}\right)} \tag{27}$$

where:

$$\Delta_{\bar{c}} \equiv \frac{2H^{1/2}}{\bar{c} - \underline{c}}\left[\left[3 - \psi\left(\underline{c} + \bar{c}\right)\right]^{1/2} - \left[3 - \psi\left(\bar{c} + \bar{c}\right)\right]^{1/2}\right]$$

Proof in Section 1 of the *Appendix*.

The condition ensures that the costs of conflict are low enough for a large country when compared to the benefits. The costs include the direct costs (q) plus the losses due to the higher trade barriers associated with higher conflict ($\Delta_{\bar{c}}$).[37] The bene-

[37] Note that $[3 - \psi(\underline{c}+\bar{c})]^{1/2} H^{1/2}$ is non-land output when one of the two large countries unilaterally reduces conflict, while the other maintains a high level of conflict, while $[3 - \psi(\bar{c}+\bar{c})]^{1/2} H^{1/2}$ is non-land output in the high-conflict equilibrium. Therefore, that difference measures the potential gain that a large country would obtain from unilaterally reducing conflict. The higher that gain, the higher the opportunity cost of engaging in high conflict for that country.

fits, as in the case of autarky, are related to the size of the land in dispute ($\lambda R/4$).

An analogous proposition characterizes equilibrium conflict in a world of small countries:

PROPOSITION 3*b*

In a world with four small countries, each country will choose $\underline{c}$ in equilibrium if and only if:

$$q + \Delta_{\underline{c}} \geq \frac{\lambda R}{4\left(\underline{c} + \bar{c}\right)} \tag{28}$$

$$\Delta_{\underline{c}} \equiv \frac{H^{1/2}}{\bar{c} - \underline{c}}\left[\left[3 - 2\psi\left(\underline{c} + \underline{c}\right)\right]^{1/2} - \left[3 - 2\psi\left(\underline{c} + \bar{c}\right)\right]^{1/2} + Q\right]$$

where:

$$Q = [1 - \psi\ (\underline{c} + \bar{c})]\{[3 - 2\psi\ (\underline{c} + \bar{c})]^{-1/2} - [3 - \psi(3\underline{c} + \bar{c})]^{-1/2}\}$$

Proof in Section 1 of the *Appendix*.

The intuition for the above result is the same (in reverse) as for proposition 3*a*. That is, low conflict is an equilibrium in a world of small countries when the costs of conflict, both direct (q) and because of higher trade barriers ($\Delta_{\underline{c}}$), are larger than the potential benefit in terms of extra land. The term $\Delta_{\underline{c}}$ is analogous to the term $\Delta_{\bar{c}}$.[38]

In Section 1 of the *Appendix* we also provide an analogous set of conditions for the case of three countries (one large and two small).

The next step is to derive equilibrium borders. If the costs of conflict were so low or so high than all countries would choose

[38] Formally, the condition is slighty more complex (it includes the extra term Q, which is always positive). This slight increase in "complexity" stems from the intuitive fact that a world of four countries, in which one region chooses high conflict and the other three choose low conflict, is more complex than a world of only two countries, each choosing a different level of conflict. However, the basic intuition for the result remains the same: $\Delta_{\underline{c}}$ captures the loss in consumption due to higher trade barriers should a (small) country choose high conflict instead of low conflict.

one or the other irrespectively of their size, the analysis would basically mirror the one we provided for the autarkic case. Consequently, in the rest of this paper we will focus on the more interesting case in which propositions 3*a* and 3*b*[39] are simultaneously satisfied.[40]

That is, we will focus on the case in which small countries choose low conflict and large countries choose high conflict in equilibrium.

4.2 *Equilibrium Borders*

Now we can derive the equilibrium configuration of political borders when trade is affected by conflict.

The conditions for a world of large countries to be an equilibrium are given by the following:

PROPOSITION 4

A large-country world is an equilibrium if and only if:

$$Z \leq K + \Delta_{uni} \tag{29}$$

while a small-country world is an equilibrium if and only if:

$$Z \geq K + \min\{\Delta_{ind}, \Delta_{uni}\} \tag{30}$$

where:

$$K \equiv \frac{(\bar{c} - \underline{c})\lambda R}{8(\underline{c} + \bar{c})} + \frac{q}{2}(\bar{c} - 2\underline{c})$$

$$\Delta_{uni} \equiv \left\{\left\{\left[3 - \psi(\bar{c} + \bar{c})\right]^{1/2} - \left[3 - \psi(\bar{c} + 3\underline{c})\right]^{1/2}\right\} + M\right\} H^{1/2}$$

[39] Plus the analogous conditions in Proposition 3*c* (Section 1 of the *Appendix*), which ensure that high (low0 conflict is chsoen by large (small) countries in a world of three countries.

[40] Propositions 3*a* and 3*b* can hold simultaneously only if $\Delta_{\underline{c}} > \Delta_{\bar{c}}$. But that inequality is generically satisfied for a large range of parameters. For example, a sufficient (but not necessary) condition for $\Delta_{\underline{c}} > \Delta_{\bar{c}}$ is $\bar{c} < 3\underline{c}$.

$$\Delta_{ind} \equiv \left\{\left[3-\psi\left(\underline{c}-\overline{c}\right)\right]^{1/2} - \left[3-4\psi\underline{c}\right]^{1/2} + M\right\} H^{1/2}$$

$$M \equiv \frac{\left[1-\psi\left(\overline{c}+\underline{c}\right)\right]}{2}\left\{\frac{1}{\left[3-\psi\left(\overline{c}+3\underline{c}\right)\right]^{1/2}} - \frac{1}{\left[3-\psi\left(\overline{c}+\underline{c}\right)\right]^{1/2}}\right\}$$

Proof in Section 1 of the *Appendix*.

Propositions 4 immediately implies the following:

COROLLARY 1

Multiple equilibria exist for[41]

$$K + \Delta_{ind} \leq Z \leq K + \Delta_{uni} \tag{31}$$

The intuition for the above result goes as follows. If heterogeneity costs are very high ($Z > K + \Delta_{uni}$), only small countries will be formed in equilibrium. If the heterogeneity costs are small enough ($Z < K + \Delta_{ind}$), large unions will be the only equilibrium outcome. But for intermediate values of the heterogeneity costs, both a world of small countries and a world of large countries are possible in equilibrium. The key condition is that the costs of breaking up a union in a world of large countries must be larger than the benefits of forming a union in a world of smaller countries. The costs from breaking up an existing union ($K + \Delta_{uni}$) include the reduced access to the market of the former union member. Such access is relatively valuable (i.e., has a higher impact on output) when markets in the rest of the world are close (because the other regions belong to a high-conflict union). By contrast, forming a union in a world of small countries and low conflict brings about relatively lower gains ($K + \Delta_{ind}$), as most of the benefits from trade can be obtained by an independent region through international exchanges with its neighbors.

Therefore, the same level of heterogeneity costs may prevent the formation of a union in a world of small countries (where the

[41] Multiple equilibria are a generic outcome. That is, for any $\Delta_{uni} > \Delta_{ind}$, there exists a continuum of Z for which Corollary 1 is satisfied. A sufficient (but not necessary) condition for $\Delta_{uni} > \Delta_{ind}$ to be "always true" is $\overline{c} < 3\underline{c}$

benefits from forming a union are relatively small) but may be offset by the higher costs from breaking a union in a world of large countries.

4.3 *Welfare*

Is utility higher in a world of small countries and lower conflict or in a world of large countries and higher conflict?

Obviously, for given borders lower conflict is always better than higher conflict. That is, in a world of large countries everybody would be better off if each government could credibly commit to choose low conflict over high conflict. However, in principle that does not mean that a world of smaller countries and lower conflict would be preferable to a world of larger countries and higher conflict. Why? For two reasons: 1) in a world of small countries, a given level of conflict is more expensive on a "per capita" basis. As we already noticed, investment in conflict is a public good from a country's perspective. Whether the costs of conflict per capita is actually lower in a small-country world than in a large-country world depends on whether the reduction in the absolute level of conflict is high enough to compensate for the fact that, in each small country, those costs have to be spread over a smaller population; 2) in a world of small countries, barriers to international trade are lower than in a world of large countries. However, trade that would occur within political boundaries (and therefore freely) in a world of large countries becomes trade across costly political borders in a world of small countries. Whether output per capita is actually higher in a world of small countries than in a world of large countries depends on whether the benefits from having "lower" barriers between regions are high enough to compensate for the costs of having "more" barriers between regions.

Formally, in a world of large countries each individual's utility in equilibrium is given by[42]

[42] For a derivation of U_{uni} and U_{ind} see Section 1 of the *Appendix*.

$$U_{uni} = \left(3 - 2\psi\bar{c}\right)^{1/2} H^{1/2} + \frac{R}{4} - \frac{q\bar{c}}{2} - Z \tag{32}$$

while in a world of small countries utility is:

$$U_{ind} = \left(3 - 2\psi\underline{c}\right)^{1/2} H^{1/2} + \frac{R}{4} - q\underline{c} \tag{33}$$

Therefore, it is immediate to obtain the following:

PROPOSITION 5

Utility in a world of small countries U_{ind} is higher (equal/smaller) than utility in a world of large countries U_{uni} if and only if $\Delta_Y + q(\bar{c} - 2\underline{c})/2)+Z$ is higher (equal/smaller) than zero, where:

$$\Delta_Y \equiv \{[3 - 2\psi(\underline{c}+\underline{c})]^{1/2} - [3 - \psi(\bar{c}+\bar{c})]^{1/2}\}H^{1/2}$$

The above condition includes three terms, which measure the following differences when we compare the small-countries equilibrium to the large-countries equilibrium: *a)* Δ_Y measures the net difference in output; *b)* $q(\bar{c} - 2\underline{c})/2$ measures the difference in the direct costs of conflict, in per capita terms; *c)* Z measures heterogeneity costs.

Two points are worth noting: the conditions for $\Delta_Y > 0$ is the same as the condition for $q(\bar{c} - 2\underline{c})/2>0$, that is, $\bar{c}>2\underline{c}$. This means that *a)* and *b)* go together: either both output and conflict costs are higher in a world of small country, or both are lower.

Secondly, there is an asymmetry between the large-countries equilibrium and the small-countries equilibrium. While it is true that either world may provide the higher level of utility in equilibrium, the conditions are less "stringent" for a world of small countries. A world of large countries will provide higher utility than a world of small countries if and only if not only *a)* and *b)* are negative, but also large enough — in absolute value — to offset the heterogeneity costs, which are always positive.[43] By con-

[43] If Z were negative (net "heterogeneity benefits"), there would be no multiple equilibria, but only large countries.

trast, as long as *a)* and *b)* are positive, a world of small countries Pareto dominates a world of large countries. In other words, because of the heterogeneity costs, the welfare comparison between equilibria tends to "favor" a world of small countries, all other things being equal. Formally, the above point can be summarized as a sufficient condition for the optimality of the small-countries equilibrium:

COROLLARY 2

If the condition in corollary 1 is satisfied, a sufficient condition to ensure that the small-country equilibrium Pareto dominates the large-country equilibrium is $\bar{c} > 2\underline{c}$.

In summary: 1) whether utility is higher in a world of small countries than in a world of large countries depends on whether the benefits from lower conflict compensate for the smaller base on which those costs must be spread, and on whether the benefits from lower barriers compensate for the losses due to more barriers between regions; 2) since heterogeneity costs are always lower in a world of small countries than in a world of large countries, the conditions for optimality are less stringent for the small-countries equilibrium than they are for the large-countries equilibrium.

5. - Concluding Remarks

In this paper we have proposed a model that links international conflict, trade and the determination of political borders. Our point is that high conflict, low openness and smaller political units tend to go together. By contrast, one can aspect high conflict to be associated with protectionism and larger political jurisdictions.

On the one hand, small political units have stronger incentives to be less conflictual and more open. In a world of high economic integration and low conflict, size matters less, and small units are viable in equilibrium. On the other hand, a world of larger units tends to be less open and more conflictual. In such a world the economies of scale in defense and in the extent of the domestic market are larger, and breaking up a large country is more costly. Hence, large countries result in equilibrium.

In fact, historical trends seem to suggest that both protectionism and the formation and expansion of large jurisdictions (nation-states, empires) are usually associated with more conflict between countries. By contrast, higher economic integration seems to be associated with less international conflict and the formation of new political units. Our framework presents a coherent story for those historical regularities. While this is not the place to expand on a historical survey, a few brief remarks are in order.[44]

During the "dark ages," after the collapse of the Roman Empire and the expansion of Islam, trade became relatively unimportant in large parts of a ruralized Western Europe.[45] In that semi-autarkic world, a high degree of political fragmentation (feudalization) could coexist with relatively high conflict. However, as trade became increasingly more important — and the link between trade and conflict started to play a key role again — two different equilibria emerged. At first, the world was economically dominated by Italian and Flemish city-states, i.e., small, open and highly independent political units. Conflict was kept at bay (consider the long period of relative peace in early Renaissance Italy during the fifteenth century). However, between the end of the Middle Ages and the beginning of the Modern Era, a transition to a very different equilibrium seems to have taken place. Larger and increasingly centralized political units developed.[46] Barriers to trade were raised dramatically, as mercantilist policies were pursued by these larger and more conflictual states during most of the sixteenth, seventeenth and eighteenth century. By contrast, the first half of the nineteenth century was a period of relatively free trade, early "decolonization" (breakup of the Spanish empire in

[44] ALESINA A. - SPOLAORE E. - WACZIARG R. (2000) present a brief historical discussion of the relationship between economic and political integration, which is consistent with our story, but does not link economic integration with international conflict.

[45] A classical reference is PIRENNE H. (1968).

[46] See JONES E.L. (1987).

Latin America) and relatively low conflict (the "long peace"). Those trends seemed to have stopped by the second half of the nineteenth century, when one could observe increasing protectionism, expansion of colonial empires and mounting international tensions up to the break of World War I.[47] Even more dramatically, protectionism, conflict and constant or increasing size of countries characterized the interwar period.

On the other hand, the cold-war era after World War II presents a two-sided picture. Within the Western alliance, high and increasing economic integration was associated with low conflict and the formation of numerous new countries (decolonization). By contrast, East/West relationships were characterized by high conflict and low trade between two large military blocs. The interaction between reduction in conflict, increasing integration with the West, and formation of new political units seems to have been at work during the process of independence in the Baltic States and elsewhere in the former Eastern bloc.

Certainly, complex historical phenomena, including the end of the cold war and the collapse of the Soviet Union, cannot be understood without the inclusion of numerous additional factors, which are not part of our analysis. In particular, in this paper we have astracted from the relationship between our variables of interest (trade, conflict and borders) and the process of democratization.[48] The relationship between democracy and conflict is at the heart of a vast literature in the field of international relations.[49] The hypothesis that democracies do not fight with each other (the "democratic peace") parallels the hypothesis that trading partners do not fight with each other, and the two phenomena are sometime jointly referred to as the "liberal peace." A more recent literature has emphasized the relationship between democratization

[47] See HOBSBAWN E.J. (1987).

[48] Another aspect that has been left out of our framework is the issue of domestic (i.e., "intrastate") conflict, such as civil wars. While our heterogeneity costs may capture some of the costs associated with domestic conflict, an extension of the analysis that fully endogenizes those aspects is beyond the scope of this article.

[49] For example, see LEVY J.S. (1989); BUENO DE MESQUITA B. - LALMAN D. (1992); MAOZ Z. - RUSSET B. (1993); BUENO DE MESQUITA B. - MORROW J.D. - SIVERSON R.M. - SMITH A. (1999).

and the size of political units.[50] A natural extension would include a formal study of the links between democratization, conflict, international trade and the size of political units.

Finally, our framework suggests that, for given fundamentals, alternative geopolitical outcomes are possible. The world may be moving towards higher political decentralization, relatively low conflict and high economic integration. But the world could as also take a different path, with fewer political and economic blocs, relatively less open and more hostile to each other. Our analysis suggests that either development may be self-fulfilling, and that international coordination of strategies and expectations may play a crucial role in determining the final outcome. The extensive debate on regionalism and trade blocs, usually formulated in purely economic terms, could then be reconsidered within this more general picture. In particular, the interaction between economic and political/military factors is particularly evident in the current discussions about the future of the European Union, and the role that should be played by a common foreign and defense policy.

[50] See ALESINA A. - SPOLAORE E. (1997; 2003). For a previous critical discussion of the political-science literature on size and democracy, see DAHL R.A. - TAFT E.R. (1973).

APPENDIX

1. - Derivations

1.1 - *Derivation of Proposition 1*

In a world of four countries, low conflict $\underline{c}$ is the equilibrium choice by all governments if and only if the utility each region obtains when its government chooses low conflict is higher than the utility it would obtain if its government were to choose high conflict, assuming that its neighbors choose low conflict. That is:

$$H^{1/2} + \frac{R}{4} - q\underline{c} \geq H^{1/2} + \frac{(1-\lambda)R}{4} + \frac{\lambda R}{2}\frac{\bar{c}}{\bar{c}+\underline{c}} - q\bar{c} \tag{34}$$

which is equivalent to:

$$q \geq \frac{\lambda R}{4(\underline{c}+\bar{c})} \tag{35}$$

By contrast, $\bar{c}$ is the equilibrium choice by all governments if and only if:

$$H^{1/2} + \frac{R}{4} - q\bar{c} \geq H^{1/2} + \frac{(1-\lambda)R}{4} + \frac{\lambda R}{2}\frac{\underline{c}}{\bar{c}+\underline{c}} - q\underline{c} \tag{36}$$

which is equivalent to:

$$q \leq \frac{\lambda R}{4(\underline{c}+\bar{c})}$$

By the same token, in a world of two countries $\underline{c}$ is the equilibrium choice by all governments if and only if:

$$(37) \qquad H^{1/2}+\frac{R}{4}-\frac{q\underline{c}}{2}\geq H^{1/2}+\frac{(1-\lambda)R}{4}+\frac{\lambda R}{8}+\frac{\lambda R}{8}\frac{\bar{c}}{\bar{c}+\underline{c}}-\frac{q\bar{c}}{2}$$

hich is equivalent to:

$$q\geq\frac{\lambda R}{4(\underline{c}+\bar{c})}$$

By contrast, $\bar{c}$ is the equilibrium choice by all governments if and only if the following holds:

$$(38) \qquad H^{1/2}+\frac{R}{4}-\frac{q\bar{c}}{2}\geq H^{1/2}+\frac{(1-\lambda)R}{4}+\frac{\lambda R}{8}+\frac{\lambda R}{8}\frac{\underline{c}}{\bar{c}+\underline{c}}-\frac{q\underline{c}}{2}$$

which is equivalent to:

$$q\leq\frac{\lambda R}{4(\underline{c}+\bar{c})}$$

Analogously, in a world of three countries (a two-region union plus two independent regions), all three governments will choose $\underline{c}$ in equilibrium if and only if the above equations *(34)* and *(37)* hold, which is equivalent to $q \geq \lambda R/4(\underline{c}+\bar{c})$. All three governments will choose $\underline{c}$ in equilibrium if and only if the above equations *(36)* and *(38)* hold, which is equivalent to: $q \leq \lambda R/4(\underline{c}+\bar{c})$.

QED

1.2 *Derivation of Proposition* 3a

Consider a world with two large countries. If both countries choose high conflict, their utility U_{uni} can be calculated as follows. Equation *(16)* will take the following form:

$$\frac{F}{D}=1-2\psi\bar{c}$$

where F denotes the units of intermediate input that each region exports to its foreign neighbor, while D denotes the amount of its intermediate input each region uses for its own production and also the (equal) amount it sells to the other region within its political jurisdiction. Consequently:

$$2D + F = H$$

The two equations above imply:

$$D = \frac{H}{3 - 2\psi\bar{c}}$$

and:

$$F = \frac{(1 - \psi\bar{c})H}{3 - 2\psi\bar{c}}$$

Let C denote a region's consumption in such a world. By definition, it will be equal to net income. Gross income is given by the sum of the payments to the region's factors of production, that is, by total wages plus total returns to human capital and land minus taxes (direct costs of conflict). Since labor is paid its marginal product, we have:

$$\frac{\partial Y}{\partial L} = \frac{1}{2}\left\{2D^{1/2} + (1 - 2\bar{c})^{1/2} F^{1/2}\right\}$$

while the total returns to human capital are equal to total human capital H times the price of intermediate inputs - which, from equation *(15)*, is equal to $1/2D^{-1/2}$. Land is $R/4$.

Consequently, utility (U_{uni}) will be given by:

$$U_{uni} = (3 - 2\psi\bar{c})^{1/2} H^{1/2} + \frac{R}{4} - \frac{q\underline{c}}{2} - Z \qquad (39)$$

By contrast, if one country chooses high conflict and the other country chooses low conflict, in each region equation *(16)* will take the following form:

$$\frac{F'}{D'} = 1 - \psi(\underline{c} + \bar{c})$$

where F' denotes the units of intermediate input that each region exports to its foreign neighbor, while D' denotes both amount of its intermediate input each region uses for its own production and the amount it sells to the other region within its political jurisdiction. Consequently:

$$2D' + F' = H$$

which imply:

$$D' = \frac{H}{3 - \psi(\underline{c} + \bar{c})}$$

and:

$$F' = \frac{[1 - \psi(\underline{c} + \bar{c})]H}{3 - \psi(\underline{c} + \bar{c})}$$

Let C_L denote consumption in a region that belongs to the low-conflict country. Again, it will be given by the sum of the payments to the region's factors of production, that is, by total wages plus total returns to human capital and land minus taxes (direct costs of conflict). Since labor is paid its marginal product, we have:

$$\frac{\partial Y}{\partial L} = \frac{1}{2}\left\{2D^{1/2} + \left[1 - (\underline{c} + \bar{c})\right]^{1/2} F'^{1/2}\right\}$$

while the total returns to human capital are equal to total human capital H times the price of intermediate inputs - which, from equation *(15)*, is equal to $1/2D'^{-1/2}$. Land is:

$$\frac{(1-\lambda)R}{4} + \frac{\lambda R}{8} + \frac{\lambda R}{4}\frac{\underline{c}}{\bar{c} + \underline{c}} = \frac{R}{4} - \frac{\lambda R}{8}\frac{(\bar{c} - \underline{c})}{\bar{c} + \underline{c}}$$

Consequently, utility (U_L) will be given by:

$$U_L = \frac{1}{2}\left\{2D'^{1/2} + \left[1 - \psi(\underline{c} + \bar{c})\right]^{1/2} F'^{1/2}\right\} +$$

$$+ \frac{1}{2}D'^{-1/2}H + \frac{R}{4} - \frac{\lambda R}{8}\frac{(\bar{c} + \underline{c})}{\bar{c} + \underline{c}} - \frac{q\underline{c}}{2} - Z$$

By substituting D' and F' with their respective solutions in the above equation we have:

$$U_L = \left[3 - \lambda(\underline{c} + \bar{c})\right]^{1/2} H^{1/2} + \frac{R}{4} - \frac{\lambda R}{8}\frac{(\bar{c} + \underline{c})}{\bar{c} + \underline{c}} - \frac{q\underline{c}}{2} - Z$$

"Both countries choose $\bar{c}$" is a Nash equilibrium if and only if $U_{uni} \geq U_L$, which, by substituting from the equations above, implies:

$$q + \Delta_{\bar{c}} \leq \frac{\lambda R}{4(\underline{c} + \bar{c})}$$

where:

$$\Delta_{\bar{c}} \equiv \frac{2H^{1/2}}{\bar{c} - \underline{c}}\left[[3 - \psi(\underline{c} + \bar{c})]^{1/2} - [3 - \psi(\bar{c} + \bar{c})]^{1/2}\right]$$

QED

1.3 *Derivation of Proposition* 3*b*

Suppose that the world is formed by four independent regions. If each region chooses $\underline{c}$, by following the usual steps we can easily show that exports to each of the other region will be:

$$F = \frac{(1 - 2\psi\underline{c})H}{3 - 4\psi\underline{c}}$$

and domestic use of the region's intermediate input will be:

$$D = \frac{H}{3 - 4\psi\underline{c}}$$

Consequently, utility U_{ind} in each region will be:

(40) $$U_{ind} = C = (3 - 2\psi\underline{c})^{1/2} H^{1/2} + \frac{R}{4} - q\underline{c}$$

Now, consider the case in which one country chooses $\underline{c}$, while the other three countries chose $\underline{c}$. Let D_h denote the amount of the intermediate input of the high-conflict country that is used for domestic production, while each of the low-conflict countries uses D_l units of its own intermediate input domestically. Let F_{hl} denote the amount of intermediate inputs exported from the high-conflict country to each of the high-conflict countries, while F_{lh} denotes exports from low-conflict to high-conflict, and F_{ll} denotes exports from a low-conflict country to another low-conflict country. Equation *(16)* implies:

$$\frac{F_{hl}}{D_h} = 1 - \psi(\underline{c} + \bar{c})$$

$$\frac{F_{lh}}{D_l} = 1 - \psi(\underline{c} + \bar{c})$$

$$\frac{F_{ll}}{D_l} = 1 - 2\psi\underline{c}$$

while the resources constraints are:

$$D_h + 2F_{hl} = H$$

$$D_l + F_{lh} + F_{ll} = H$$

Therefore we have:

$$D_h = \frac{H}{3 - 2\psi(\underline{c} + \bar{c})}$$

$$F_{hl} = \frac{[1 - \psi(\underline{c} + \bar{c})]H}{3 - 2\psi(\underline{c} + \bar{c})}$$

$$D_l = \frac{H}{3 - \psi(3\underline{c} + \bar{c})}$$

$$F_{lh} = \frac{[1 - \psi(\underline{c} + \bar{c})]H}{3 - \psi(3\underline{c} + \bar{c})}$$

$$F_{ll} = \frac{[1 - 2\psi\underline{c}]H}{3 - \psi(3\underline{c} + \bar{c})}$$

Consumption in the high-conflict country is given by total income, that is, total wages (which are equal to the marginal product of labor) plus total returns to human capital (which are equal to the price of the country's intermediate input times H) plus the returns to land. By definition, the marginal product of labor is

$$\frac{\partial Y}{\partial L} = \frac{1}{2}\left\{D_h^{1/2} + 2\left[1 - \psi(\underline{c} + \bar{c})\right]^{1/2} F_{lh}^{1/2}\right\}$$

From equation *(15)* we have that the price of the country's intermediate input is $1/2D_h^{-1/2}$ which implies total returns to human capital equal to:

$$\frac{1}{2}D_h^{-1/2}H$$

After conflict is resolved, the total land in control of the country is:

$$\frac{(1-\lambda)R}{4} + \frac{\lambda R}{2}\frac{\bar{c}}{\bar{c} + \underline{c}}$$

Therefore, we have that total utility in the high-conflict country is:

$$U_h = C_h + G = \frac{1}{2}\left\{D_h^{1/2} + 2\left[1 - \psi(\underline{c} + \bar{c})\right]^{1/2} F_{lh}^{1/2}\right\} +$$

$$+\frac{1}{2}D_h^{-1/2}H + \frac{(1-\lambda)R}{4} + \frac{\lambda R}{2}\frac{\bar{c}}{\bar{c} + \underline{c}} - q\underline{c}$$

By substituting D_h and F_{lh} with the above solutions, and some algebraic manipulation, we obtain:

$$U_h = [3 - 2\psi(\underline{c} + \bar{c})]^{1/2} H^{1/2} +$$

$$-\ [1 - \psi(\underline{c} + \bar{c})]\{[3 - 2\psi(\underline{c} + \bar{c})]^{-1/2} - [3 - \psi(3\underline{c} + \bar{c})]^{-1/2}\}H^{1/2} +$$

$$\frac{(1-\lambda)R}{4} + \frac{\lambda R}{2}\frac{\bar{c}}{\bar{c} + \underline{c}} - q\underline{c}$$

"Each country chooses $\underline{c}$" is a Nash equilibrium if and only if U_{ind} is not smaller than the above utility U_h, which implies:

$$q + \Delta_{\underline{c}} \geq \frac{\lambda R}{4(\underline{c} + \bar{c})}$$

where:

$$\Delta_{\underline{c}} \equiv \frac{H^{1/2}}{\bar{c} - \underline{c}} \Big\{ [3 - 4\psi\underline{c}]^{1/2} - [3 - 2\psi(\underline{c} + \bar{c})]^{1/2} +$$

$$+ [1 - \psi(\underline{c} + \bar{c})][3 - 2\psi(\underline{c} + \bar{c})]^{-1/2} - [3 - \psi(3\underline{c} + \bar{c}]^{-1/2} \Big\}$$

QED

1.4 *Proposition 3c: Statement and Derivation*

In a world of three countries, the large country will choose $\bar{c}$ while the two small countries will choose $\underline{c}$ if and only if:

$$q + \Delta_{\bar{c}\underline{c}} \leq \frac{\lambda R}{4(\underline{c} + \bar{c})}$$

and:

$$q + \Delta_{\underline{c}\bar{c}} \geq \frac{\lambda R}{4(\underline{c} + \bar{c})}$$

where:

$$\Delta_{\bar{c}\underline{c}} \equiv \frac{2H^{1/2}}{\bar{c} - \underline{c}} \Big\{ (3 - 2\psi\underline{c})^{1/2} - [3 - \psi(\underline{c} + \bar{c})]^{1/2} + Q' \Big\}$$

$$\Delta_{\underline{c}\bar{c}} \equiv \frac{H^{1/2}}{\bar{c} - \underline{c}} \Big\{ [3 - \psi(3\underline{c} + \bar{c})]^{1/2} - [3 - \psi(\underline{c} + 3\bar{c})]^{1/2} + Q'' \Big\}$$

$$Q' = \frac{1 - 2\psi\underline{c}}{2} \Big[(3 - 4\psi\underline{c})^{-1/2} - (3 - 2\psi\underline{c})^{-1/2} \Big] +$$

$$+ \frac{1 - \psi(\underline{c} + \bar{c})}{2} \Big\{ [3 - \psi(3\underline{c} + \bar{c})]^{1/2} - [3 - \psi(\underline{c} + \bar{c})^{-1/2} \Big\}$$

$$Q'' = \frac{1 - \psi(\underline{c} + \bar{c})}{2}\Big\{[3 - \psi(\underline{c} + 3\bar{c})]^{-1/2} + [3 - \psi(\underline{c} + \bar{c})]^{-1/2} +$$

$$- [3 - 2\psi(\underline{c} + \bar{c})]^{-1/2} - [3 - \psi(3\underline{c} + \bar{c})]^{-1/2}\Big\} +$$

$$+ \frac{1 - 2\psi\bar{c}}{2}\Big\{[3 - \psi(\underline{c} + 3\bar{c})]^{-1/2} - (3 - 2\psi\bar{c})^{-1/2}\Big\}$$

Derivation: suppose that all countries choose low conflict. Let F_l (F_L) denote exports of intermediate inputs from a region that belongs to a small (large) country to a foreign neighbor, while D_l (D_L) denotes the units used for domestic production in a region that belong to a small (large) country. Then. from equation *(16)* we have:

$$\frac{F_l}{D_l} = \frac{F_L}{D_L} = 1 - 2\psi\underline{c}$$

The resource constraints are:

$$D_l + 2F_l = H$$

$$2D_L + F_L = H$$

which imply:

$$D_l = \frac{H}{3 - 4\psi\underline{c}}$$

$$F_l = \frac{[1 - 2\psi\underline{c}]H}{3 - 4\psi\underline{c}}$$

$$D_L = \frac{H}{3 - 2\psi\underline{c}}$$

$$F_L = \frac{[1 - 2\psi\underline{c}]H}{3 - 2\psi\underline{c}}$$

Consequently, utility in a small country is:

(41)
$$U_l = C_l = \frac{1}{2}\left\{D_l^{1/2} + [1 - 2\psi \underline{c}]^{1/2}[F_l^{1/2} + F_L^{1/2}]\right\} +$$

$$+\frac{1}{2}D_l^{-1/2}H + \frac{R}{4} - q\underline{c} = (3 - 4\psi\underline{c})^{1/2}H^{1/2}$$

(42)
$$\frac{[1 - 2\psi\underline{c}]}{2}\left\{(3 - 4\psi\underline{c})^{-1/2} - (3 - 2\psi\underline{c})^{-1/2}\right\} +$$

(43)
$$+\frac{R}{4} - q\underline{c}$$

while utility in a region that belongs to the large country is:

$$U_L = C_L - Z = \frac{1}{2}\left\{2D_L^{1/2} + [1 - 2\psi\underline{c}]^{1/2}F_l^{1/2}\right\} +$$

$$+\frac{1}{2}D_L^{-1/2}H + \frac{R}{4} - \frac{q\underline{c}}{2} - Z = (3 - 2\psi\underline{c})^{1/2}H^{1/2} +$$

$$+\frac{(1 - 2\psi\underline{c})}{2}\left\{(3 - 4\psi\underline{c})^{-1/2} - (3 - 2\psi\underline{c})^{-1/2}\right\}$$

$$+\frac{R}{4} - q\underline{c} - Z$$

Now, suppose that the large country chooses high conflict while the two small countries choose low conflict. Let F_{ll} denote exports of its intermediate input from a small country to the other small country, while F_{lH} denotes exports from a small country to the large country, and F_{Hl} denotes exports from a region within the large country to a small country. Let D_{lH} (D_{Hl}) denote the units used for domestic production in a region that belong to a small (large) country. Then, from equation *(16)* we have

(44)
$$\frac{F_{ll}}{D_{lH}} = 1 - 2\psi\underline{c}$$

(45)
$$\frac{F_{lH}}{D_{lH}} = 1 - \psi(\underline{c} + \overline{c})$$

(46) $$\frac{F_{Hl}}{D_{Hl}} = 1 - \psi(\underline{c} + \overline{c})$$

The resource constraints are:

(47) $$D_{lH} + F_{lH} + F_{ll} = H$$

and:

(48) $$2D_{Hl} + F_{Hl} = H$$

which, together with the above, imply:

(49) $$D_{lH} = \frac{H}{3 - \psi(3\underline{c} + \overline{c})}$$

(50) $$F_{ll} = \frac{(1 - 2\psi\underline{c})H}{3 - \psi(3\underline{c} + \overline{c})}$$

(51) $$F_{lH} = \frac{[1 - \psi(\underline{c} + \overline{c})]H}{3 - \psi(3\underline{c} + \overline{c})}$$

(52) $$D_{Hl} = \frac{H}{3 - \psi(\underline{c} + \overline{c})}$$

(53) $$F_{Hl} = \frac{[1 - \psi(\underline{c} + \overline{c})]H}{3 - \psi(\underline{c} + \overline{c})}$$

Let U_{Hl} (U_{lH}) denote the corresponding utility in the large (small) country. Hence we have:

$$U_{lH} = \frac{1}{2}\left\{D_{lH}^{1/2} + [1 - 2\psi\underline{c}]^{1/2}[F_{ll}^{1/2} + F_{Hl}^{1/2}]\right\} +$$

$$+\frac{1}{2}D_{lH}^{-1/2}H + \frac{R}{4} - \frac{\lambda R}{8}\frac{(\bar{c} - \underline{c})}{\bar{c} + \underline{c}} - q\underline{c} =$$

$$= \left[3 - \psi(3\underline{c} + \bar{c})\right]^{1/2} H^{1/2} - \frac{1 - \psi(\underline{c} + \bar{c})}{2}\left\{[3 - \psi(3\underline{c} + \bar{c})]^{1/2}\right.$$

$$\left. -[3 - \psi(\underline{c} - \bar{c})]^{-1/2}\right\}H^{-1/2} + \frac{R}{4} - \frac{\lambda R}{8}\frac{(\bar{c} - \underline{c})}{\bar{c} + \underline{c}} - q\underline{c}$$

$$U_{Hl} = \frac{1}{2}\left\{2D_{Hl}^{1/2} + [1 - 2\psi\underline{c}]^{1/2}F_{lH}^{1/2}\right\} + \frac{1}{2}D_{Hl}^{-1/2}H +$$

$$\frac{R}{4} + \frac{\lambda R}{8}\frac{(\bar{c} - \underline{c})}{\bar{c} + \underline{c}} - \frac{q\bar{c}}{2} - Z =$$

$$= [3 - \psi(\underline{c} + \bar{c})]^{1/2} H^{1/2} + \frac{1 - \psi(\underline{c} + \bar{c})}{2}\left\{[3 - \psi(3\underline{c} + \bar{c})]^{1/2} +\right.$$

$$\left. -[3 - \psi(\underline{c} + \bar{c})]^{-1/2}\right\}H^{1/2} + \frac{R}{4} + \frac{\lambda R}{8}\frac{(\bar{c} - \underline{c})}{\bar{c} + \underline{c}} - \frac{q\bar{c}}{2} - Z$$

Finally, suppose that the large country and one small country choose high conflict, while the other small country chooses low conflict. Let $U_{h'}$ denotes utility in the small country that has chosen high conflict. Following analogous steps as above, we obtain:

$$U_{h'} = [3 - \psi(\underline{c} + 3\bar{c})]^{1/2} H^{1/2} +$$

$$+\frac{1 - \psi(\underline{c} + \bar{c})}{2}\left\{[3 - 2\psi(\underline{c} + \bar{c})]^{-1/2} - [3 - \psi(\underline{c} + 3\bar{c})]^{-1/2}\right\}H^{1/2} +$$

$$+\frac{1 - 2\psi\bar{c}}{2}\left\{(3 - 2\psi\bar{c})^{-1/2} - [3 - \psi(\underline{c} + 3\bar{c})]^{-1/2}\right\}H^{1/2} +$$

$$+\frac{R}{4} + \frac{\lambda R}{8}\frac{(\bar{c} - \underline{c})}{\bar{c} + \underline{c}} - q\bar{c}$$

"The large country chooses high conflict while the two small countries choose low conflict" is an equilibrium if and only if:

$$U_{Hl} \geq U_L$$

and:

$$U_{lH} \geq U_{h}$$

which are equivalent, respectively, to:

$$q + \Delta_{\bar{c}\underline{c}} \leq \frac{\lambda R}{4(\underline{c} + \bar{c})}$$

and:

$$q + \Delta_{\underline{c}\bar{c}} \geq \frac{\lambda R}{4(\underline{c} + \bar{c})}$$

QED

1.5 *Derivation of Proposition 4*

A world of two large countries is an equilibrium if and only if each region is better off in a union that it would be as an independent country. Since we assume that the conditions in propositions 3*a*, 3*b* and 3*c* hold, we have that in a world of two countries each government chooses high conflict, and utility in each region is given by U_{uni}, as obtained in the derivation of proposition 3*a*. By contrast, if a country were to break up, each of the two newly formed countries would choose low conflict, while the remaining large country would choose high conflict. Consequently, utility in the seceding region would be given by U_{lH}, as obtained in the derivation of proposition 3*c*. Therefore, a world of large countries is an equilibrium if and only if:

$$U_{uni} \geq U_{lH} \tag{54}$$

By substituting U_{uni} and U_{lH} with their respective solutions, and rearranging terms, we obtain equation *(29)*.

A world of four small countries is an equilibrium in non weakly dominated strategies if and only if choosing a union would not give a higher utility to a region for all possible configurations of borders. That is, if and only if the following holds:

(55) $$U_{Hl} \leq U_{ind}$$

and: $$U_{uni} \leq U_{lH}$$

where the condition $U_{Hl} \leq U_{ind}$ implies that a region would "not" be better off with a union if its potential partner agreed to form a union, and the two other regions remained independent, while $U_{uni} \leq U_{lH}$ implies that a region would not be better off with a union if its potential partner agreed to form a union, and the remaining two regions agreed to form a union between themselves.

The first condition implies:

(56) $$Z \geq K + \Delta_{uni}$$

while the second condition implies:

(57) $$Z \geq K + \Delta_{ind}$$

Both are satisfied if and only if:

(58) $$Z \geq K + \min\{\Delta_{ind}, \Delta_{uni}\}$$

QED

2. - Extension to Decentralized Alliances

In this paper we have focused on "countries," that is, on political units in which all decisions over conflict (including the way in which the burdens from conflict are shared across regions) are centralized. However, as we discussed in Section 2, perfectly centralized political unions can be viewed as one extreme case of more general classes of geopolitical organizations. For example, suppose that independent regions can join looser military alliances. In such alliances, each region is bound to use its conflict activities in favor of all the alliance's members, but investment in conflict activities is decided in a decentralized fashion by each region's independent government, and the direct costs of each region's decision are borne by the citizens of that region only. As pointed out by Olson and Zeckhauser (1966) in their classic contribution, military alliances of this kind are prone to free-riding problems.

Specifically, military alliances can be introduced in a relatively simple way within our framework. Assume that the return from conflict for each member of the alliance is a function of the sum of conflict activities by the alliance:

$$c_a = c_i + c_{i'} \tag{59}$$

where i and i' are the members of the alliances. The "conflict resolution technology" for each member will be:

$$\frac{c_a}{c_a + c_k} \tag{60}$$

where c_k is the conflict investment by a neighboring "enemy" (alliance or isolated country). Disputes between members of an alliance are solved peacefully and without use of conflict activities.[51]

To maintain symmetry, we will assume that the member of a two-region alliance can provide either a low share ($\underline{c}/2$) or a high share ($\bar{c}/2$). Consequently, two-region alliances may end up with a high level of conflict, a low level of conflict, or an intermediate level $(\underline{c}+\bar{c})/2$ in which the burden is unequally shared among its members.

In the case of autarky, and assuming that four regions form two two-region alliances following holds.[52]

---

[51] This assumption could be relaxed to allow for "reduced" but nonzero conflict within alliances. For example, because of better enforcement mechanisms within alliances, the land in dispute between two regions that belong to the same alliance, but not to the same country, could be $\lambda_a R/4$, where $\lambda_a < \lambda$. In this example, for simplicity, we are assuming $\lambda_a = 0$.

[52] The derivation follows the same steps as the one of proposition 1, and is available upon request.

PROPOSITION 7

$c_a = \underline{c}$ is an equilibrium for both alliances if:

(61) $$q \geq \frac{\lambda R}{8(3\underline{c} + \bar{c})}$$

$c_a = \bar{c}$ is an equilibrium for both alliances:

(62) $$q \leq \frac{\lambda R}{8(\underline{c} + 3\bar{c})}$$

and $c_a = (\underline{c} + \bar{c})/2$ is an equilibrium for both alliances if:

(63) $$\frac{\lambda R}{8(\underline{c} + 3\bar{c})} \leq q \leq \frac{\lambda R}{8(3\underline{c} + \bar{c})}$$

It is immediate to notice that the conditions for high conflict are more stringent for "looser" alliances than for "tighter" political unions, that is, $\lambda R/8(\underline{c}+3\bar{c})$ <. $\lambda R/4(\underline{c}+\bar{c})$. the reason lies, of course, in the free riding incentives associated with alliances. Also, there exists a range of parameters for which one member actually free rides on the provision of the other member.

The analysis that we carried out in the paper can then be extended to include alliances. A natural assumption within our framework would be that belonging to an alliance carry some heterogeneity/coordination cost Z_a (with $Z_a \leq Z$).

By the same token, one can extend the analysis of the relationship between trade and conflict to the case of decentralized alliances, by assuming that the costs to trade between two countries that belong to different alliances would depend negatively on their respective levels of conflict. In the simpler case in which only decentralized alliances are possible, the analysis is formally very close to the case of centralized alliances The main difference with respect to the case of perfectly centralized unions, as we have seen in the above example, is the presence of the free riding problem, which reduces the incentives to engage in high conflict. When both political unions and decentralized alliances are possible, the analysis becomes formally more complex, but the main insights do not change.

BIBLIOGRAPHY

ADES A. - GLAESER E.L., «Evidence on Growth, Increasing Returns, and the Extent of the Market», *Quarterly Journal of Economics*, August, 1999.

ALESINA A. - PEROTTI R. - SPOLAORE E., «Together or Separately? Issues on the Costs and Benefits of Political and Fiscal Unions», *European Economic Review*, April, 1995.

ALESINA A. - SPOLAORE E., «On the Number and Size of Nations», *Quarterly Journal of Economics*, November, 1997.

— - —, «Conflict, Defense Spending, and the Number of Nations», *European Economic Review*, forthcoming, 2005*a*.

— - —, *The Size of Nations,* Cambridge (MA), MIT Press, 2003.

— - —, «War, Peace, and the Size of Countries», *Journal of Public Economics*, forthcoming, 2005*b*.

ALESINA A. - SPOLAORE E. - WACZIARG R., «Economic Integration and Political Disintegration,» *American Economic Review*, December, 2000.

— - —, «Trade, Growth, and the Size of Countries», in AGHION P. - DURLAUF S. (eds.), *Handbook of Economic Growth*, forthcoming, Amsterdam North-Holland, 2004.

ANDERSON J., «Why Do Nations Trade (So Little)?», *Pacific Economic Review*, vol. 5, 2000, pp. 115-34.

ANDERSON J. - MARCOUILLER D., «Trade and Security, I: Anarchy», *NBER, Working Paper*, no. 6223, 1997.

AZAR E.E., «The Conflict and Peace Data Bank (COPDAB) Project», *Journal of Conflict Resolution*, no. 24, 1980.

BARBIERI K., *The Liberal Illusion: Does Trade Promote Peace?*, University of Michigan Press, Ann Arbor, 2002.

BHAGWATI J., «Regionalism and Multilateralism: An Overview», in DE MELO J. - PANAGARIYA A. (eds.), *New Dimensions in Regional Integration*, Cambridge, Cambridge University Press, 1993.

BOLTON P. - ROLAND G. - SPOLAORE E., «Economic Theories of the Break-up and Integration of Nations», *European Economic Review*, April, 1996.

BOULDING K.E., *Conflict and Defense: A General Theory*, New York, Harper, 1962.

BRITO D.L. - INTRILIGATOR M.D., *Arms Races and Proliferation*, in HARTLEY K. - SANDLER T., 1995.

BUENO DE MESQUITA B. - LALMAN D., *War and Reason: Domestic and International Imperatives*, New Haven, Yale University Press, 1992.

BUENO DE MESQUITA B. - MORROW J.D. - SIVERSON R.M. - SMITH A., «An Institutional Explanation of the Democratic Peace», *American Political Science Review*, no. 93, 1999.

DAHL R.A. - TUFTE E.R., *Size and Democracy*, Stanford, Stanford University Press, 1973.

ELVIN M., *The Pattern of the Chinese Past*, Stanford, Stanford University Press, 1973.

ENGEL C. - ROGERS J., «How Wide is the Border?», *American Economic Review*, vol. 86, December 1996, pp. 1112-25.

FINDLAY R., «Towards a Model of Territorial Expansion and the Limits of Empire», in GARFINKEL M.R. - SKAPERDAS S. (eds.), *The Political Economy of Conflict and Appropriation*, Cambridge, Cambridge University Press, 1996.

FRANKEL J. - STEIN E. - WEI S., «Continental Trading Blocs: Are They Natural or Supernatural?», in FRANKEL J. (ed.), *The Regionalization of the World Economy*, Chicago, University of Chicago Press, 1997.

GASIOROWSKI M. - POLACHEK S., «Conflict and Interdependence: East-West Trade and Linkages in the Era of Detente», *Journal of Conflict Resolution*, vol. 26, no. 4, December 1982, pp. 709-29.

GROSSMAN H.I., «A General Equilibrium Model of Insurrections», *American Economic Review*, September, 1991.

HARTLEY K. - SANDLER T. (eds.), *Handbook of Defense Economics*, Amsterdam, North-Holland, 1995.

HIRSHLEIFER J., «Conflict and Rent-Seeking Success Functions: Ratio versus Difference Models of Relative Success», *Public Choice*, November, 1989.

— - —, «The Technology of Conflict as an Economic Activity», *American Economic Review*, May, 1991.

— - —, *Theorizing about Conflict*, in HARTLEY K. - SANDLER T., 1995*a*.

— - —, «Anarchy and Its Breakdown», *Journal of Political Economy*, vol. 103, February, 1995*b*.

HOBSBAWN E.J., *The Age of Empires*, New York, Vintage Books, 1987.

JONES E.L., *The European Miracle: Environments, Economies, and Geopolitics in the History of Europe and Asia*, Cambridge, Cambridge University Press, 1987.

LEVY J.S., «The Causes of War: A Review of Theories and Evidence», in TETLOCKET P.E. (ed.), *Behavior, Society, and National War*, Oxford, Oxford University Press, 1989.

MAOZ Z. - RUSSET B., «Normative and Structural Causes of the Democratic Peace, 1946-1986», *American Political Science Review*, no. 89, 1993.

MCCALLUM J., «National Borders Matter: Canada (US) Regional Trade Patterns», *American Economic Review*, 1995.

MURDOCH J.C., *Military Alliances: Theory and Empirics*, in HARTLEY K. - SANDLER T., 1995.

OLSON M. - ZECKHAUSER R., «An Economic Theory of Alliances», *Review of Economics and Statistics*, no. 48, 1966, pp. 266-79.

PIRENNE H., *Mohammed and Charlemagne*, New York, Barnes & Noble, 1968.

POLACHEK S., «Conflict and Trade», *Journal of Conflict Resolution*, no. 24, 1980, pp. 55-78.

— - —, «Conflict and Trade: An Economic Approach to Political International Interactions», Chapter 4 in. ISARD W - ANDERTON C.H. (eds.), *Economics of Arms Reduction and the Peace Process*, Amsterdam, North-Holland, 1992.

POLACHEK S. - ROBST J. - CHANG Y., «Liberalism and Interdependence: Extending the Trade-Conflict Model», *Journal of Peace Research*, July, 1999.

SCHELLING T.C., *The Strategy of Conflict*, Cambridge (MA), Harvard University Press, 1960.

SKAPERDAS S., «Cooperation, Conflict and Power in the Absence of Property Rights», *American Economic Review*, September, 1992.

SKAPERDAS S. - SYROPOULOS C., «Competitive Trade with Conflict», in GARFINKEL M.R. - SKAPERDAS S. (eds.), *The Political Economy of Conflict and Appropriation*, Cambridge, Cambridge University Press, 1996.

SMITH R., *The Demand for Military Expenditure*, in HARTLEY K. - SANDLER T., 1995.

SPOLAORE E., «The Political Economy of National Borders» in WITTMAN D. - WEINGAST B.R. (eds.), *Oxford Handbook of Political Economy*, fortcoming, Oxford, Oxford University Press, 2005*a*.

— - —, «The Economics Approach to the Size of Nations», in DURLAUF S. - BLUME L. (eds.), *New Palgrave Dictionary of Economics*, 2nd ed., London, Palgrave-Macmillan, forthcoming 2005*b*.

THOMPSON E.A., «Taxation and National Defense», *Journal of Political Economy*, 1974.

TULLOCK G., *The Social Dilemma: The Economics of War and Revolution*, Blacksburg (VA), University Publications, 1974.

— - —, «Efficient Rent Seeking», in BUCHANAN J.M. - TOLLISON R.D. - TULLOCK G. (eds.), *Toward a Theory of the Rent-Seeking Society*, Texas, A&M University Press, 1980.

VAMVAKIDIS A., *How Important Is a Large Market for Economic Growth?*, mimeo, Washington, IMF - Cambridge (MA), Harvard University, 1997.

WACZIARG R., «Measuring the Dynamic Gains from Trade», World Bank, *Economic Review*, vol. 15, no. 3, October 2001, pp. 393-429.

WITTMAN D., «The Wealth and Size of Nations», *Journal of Conflict Resolution*, no. 6, 2000, pp. 885-95.