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The New Political Economy of Trading and Its Institutional Consequences

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ABSTRACT. This article offers a theory that can explain a relatively open international trade system as corresponding to a non-cooperative (in the game-theoretical sense) outcome of bargaining interactions between states. Such a non-cooperative outcome, as will be shown, can be expressed as a subgame perfect Nash equilibrium between several states or trading blocs. This type of Nash equilibrium does not lead countries to complete "free" trade, but to an outcome that is closer to what is usually called "managed" trade. The theory also shows that under certain circumstances, this Nash equilibrium corresponds to a trade war similar to the one that broke out in the 1930s, and has the advantage of explaining the emergence of large trading blocs. Also introduced is the concept of a two-dimensional strategy when actors use two independent instruments as policy tools and establish the existence of a unique Nash equilibrium between three actors optimizing in two instruments.

Introduction

Despite significant changes in the economic theory of trade in the last two decades (Krugman and Obstfeld, 1988) a particular image of the organization of world trade is still prevalent in political theory. Organizing world trade is viewed first as a problem of cooperation in which countries are kept from realizing a common good (trade liberalization) through the pressure of domestic interests. This basic conception is reflected in the institutional arrangements that have characterized trade liberalization since the Second World War. Both GATT and WTO have been designed as instruments to counter domestic pressures against liberalization and to persuade governments of the benefits of "free" trade. As we will show, this domestic politics

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image is closely connected to the traditional theory of international trade which posits a comparative advantage in trading resulting from differences among countries in technology (Ricardo) or in factor endowments (the so-called Heckscher-Ohlin theory). This classical theory of international trade has had great difficulties in explaining some apparently contradictory empirical observations. For example, most trading seems to be heavily influenced by geographic proximity and concerns countries with relatively similar endowments in factors of production. Moreover, a great portion of international trade is intra-industry, that is, goods with similar factor proportions within closely related industrial sectors. Conversely, at the political level, a neat distinction between narrow domestic interests and the interests of exporters favorable to trade is difficult to make, since major exporters are often also major importers and since protectionist positions are sometimes adopted by large exporters. Furthermore, the preponderance of the executive in trade matters in important countries is hard to explain using a domestic interest paradigm, since it is normally taken for granted that the effects of lobbying are made discernible through a legislative body.

In opposition to this classical image, we offer a theory that is able to explain a relatively open international trade system as corresponding to a non-cooperative (in the game-theoretical sense) outcome of bargaining interactions between states. Such a non-cooperative outcome, as we will show, can be expressed as a subgame perfect Nash equilibrium between several states or trading blocks. This type of Nash equilibrium does not lead countries to complete "free" trade but to an outcome that is closer to what is usually called "managed" trade. We also show that under certain circumstances, this Nash equilibrium corresponds to a trade or tariff war similar to the one that broke out in the 1930s. Our theory has the advantage of explaining the emergence of large trading blocs, a relatively recent evolution in the political economy of trading.

Traditional Trade Theories

Traditional trade theories center on the notion of gains to be made from trade, resulting from a complementarity between two or more countries. These complementarities were originally thought to stem from different technological capabilities and also from different factor endowments in countries. This latter asumption is at the root of the Heckscher-Ohlin theory of international trade and the two main logical analyses associated with that conception, the Rybczynski and Stolper–Samuelson theorems. The Rybczynski theorem (Rybczynski, 1955) establishes that an increase of a production factor in a country will raise the output of the good that draws intensively upon that factor. The Stolper–Samuelson theorem (Stolper and Samuelson, 1941) asserts that a shift in the prices of goods that are produced will have a magnified effect on factor prices and, also that, under open trade, factor prices will tend to equalize across countries.[1] This result is usually cited as creating much opposition from domestic forces, in particular labor unions or farmers' associations, to open international trade. In general, the consequences of the classical theory point to the superiority of "free" trade, in terms of social welfare, over any form of protectionism. The only exception to this rule is the possibility for an important country to impose a so-called optimum tariff in order to improve its own terms of trade (prices of its exports over prices of its imports) at the expense of others. The tariff imposed must stay at a particular optimal level, otherwise welfare losses, even for important countries, will occur. According to

Krugman and Obstfeld, the use of an optimum tariff amounts to using national monopoly power to extract gains at other countries' expense (Krugman and Obstfeld, 1988: 209). Such behavior will in general lead to retaliation and possible trade wars with countries that resist predatory moves; the imposition of optimum tariffs leads to a generalized prisoner's dilemma type of situation, where the resulting equilibrium will be Pareto inferior to a common gain solution that coincides with an agreement to liberalize trade. In short, according to the classical theory, trade liberalization is considered a collective good that ultimately increases welfare at the world level. However, the supply of this good will be impeded or reduced through the influence of a variety of domestic special interests. Therefore, classical theories lead to the establishment of particular institutional frameworks at the international level.

Institutional Implications

The traditional institutional constructions to promote international trade, GATT (General Agreement on Tariffs and Trade) and its successor organization the WTO (World Trade Organization) have sought to promote international trade liberalization and fight domestic special interests through broad rules such as a generalized non-discrimination principle and recommendations to replace, wherever possible, quantitative trade restrictions, such as quotas, by the imposition of tariffs. These efforts to liberalize trade have been largely successful, since they were applied through successive trade negotiations and agreements to more and more areas. Thus, the latest negotiation, the Uruguay Round, ended by incorporating agriculture and services into the GATT framework, as well as with the creation of the WTO.

One objective of the transformation of the General Agreement on Tariffs and Trade into the World Trade Organization was to strengthen the institutions underpinning the "free" trade dimension of the international regime. Specific elements of the WTO established for that purpose are notably the reinforced mechanism for dispute settlement (DSB), the introduction of the new system for trade policy review (TPRM) and the intended upgrading of the ministerial meeting. There further exists an intention to substitute more continuous liberalization negotiations on a more limited range of issues for the GATT-round type of recurrent negotiations with an increasingly large agenda. This supposedly completes the grand plan to bolster the "free" trade elements incorporated in the WTO.

It cannot, however, be taken for granted that the institutional reform represented by the creation of the WTO will guarantee a continued movement toward further liberalization of world trade. Such a development is ultimately conditioned by the political will and economic realities of the countries belonging to the world trade regime. In particular, an international system governing trade relations can be expected to evolve at the same pace as the chosen trade policies of the pivotal actors on the trade scene, the United States, and the European Union. The introduction of the concept of fair trade, which is in contradiction to the non-discrimination principle of the "free" trade regime that was imbedded in GATT, by at least one of the dominant trading powers indicates that a march toward an increasingly liberalized global trading system is far from certain. In order to support these claims we will try to outline briefly how classical trade theories have been superseded and complemented by new conceptions that are more consistent with empirical realities.

New Trade Theories

Classical trade theories have become increasingly more difficult to apply because they do not account very well for some empirical observations. For instance, much trade takes place between countries with relatively similar endowments in factors of production. Moreover, a significant amount of international trade is predominantly regional, involving countries in the same geographic area, such as Europe, North America, or Asia.[2] In addition, trade is often conducted by relatively high-tech firms that sell similar types of goods in a variety of countries. Economists refer to such patterns as *intra-industry* trade, as opposed to *inter-industry* trade, which consists in the exchange of different types of goods such as food and manufactures. As noted by Krugman and Obstfeld (1988: 139), intra-industry trade does not reflect comparative advantages and thus falls outside the scope of traditional trade theories.

In order to deal with such issues, economists have come forward with other theoretical constructs that complement the classical approaches. These theories are based on the notion of increasing returns to (or economies of) scale. Increasing returns mean that a production process can more than proportionally enhance its capabilities through size increases. These size increases or economies of scale can, according to Krugman and Obstfeld (1988: 127), take the particular forms of *external economies* or *monopolistic competition*. These two forms are of special interest to trade theorists because they tend to squeeze out monopolistic profits.

External economies are characterized by decreasing costs in proportion to the size of the industry, but large firms are not favored over small firms. What usually happens in a case like this is a concentration of firms in a particular area such as the garment industry in New York, the electronic industry in Silicon Valley, or the watch industry in Switzerland. *Monopolistic competition* makes a market entry of a large number of firms, all profitable. Each firm produces a somewhat differentiated product and thus responds to a slightly different type of demand, a process that eventually eliminates monopolistic profits.

External economies will lead to gains from trade if the international market leads to higher returns to scale than the domestic market. This will make firms concentrated in a particular location gain more at the international level than they would have if confined to the domestic market. As a result, they will also offer higher wages and thus increase welfare at the domestic level. Monopolistic competition, on the other hand, will result as mentioned above, in firms producing differentiated products, such as slightly different kinds of cars. In this case, a single country is too small a market to take advantage of the full range of possible products that can be offered to consumers. Economies of scale make it possible to offer much more for a bigger market. Firms can take advantage of this and make greater profits and thus increase the welfare of the country in which they are located.

In our view, this new theory of international trade can also explain different types of political activity on the part of firms, governments, and domestic political decision-makers. If some firms can gain from economies of scale, they will lean on their respective governments to open up new markets for them while still preferring to keep domestic markets under their control. Sometimes they can achieve such a control better by other means than lobbying for tariffs and quantitative restrictions. Up to a point, they can use some of their monopolistic power to extract high prices from their domestic markets, which they use as a base for expanding

abroad.[3] These considerations lead us now to present a new theory of the political economy of trading and to look at its institutional implications on the international level.

A New Theory of the Political Economy of Trading

General Framework and Concepts

In order to address the problems associated with the traditional theories on trade policy-making we provide a theoretical framework for analyzing why actors need not necessarily favor a "free" trade regime in a multilateral setting. The results further apply when possibilities for coalition formation are considered.

To undertake this analysis, we assume here that a party's capacity to export and import constitute the decisive factor in delineating preferences for different types of institutional arrangements which rule international trade relations. In particular, we suggest that a country's foreign market shares and its buying power can explain the desire for a specific type of institutional arrangement such as a "free" trade or "managed" trade regime. We then address the following questions:

(1) What are the obstacles to the establishment of an institutional arrangement favoring "free" trade?
(2) What type of international institutional arrangement governing trade relations prevails given that actors' preferences are shaped by their relative foreign market shares and import capacity of the domestic market?
(3) What are some possible avenues for rendering incentives compatible with a "free" trade project?
(4) In particular, how can the formation of coalitions be expected to influence preferences for a particular international trade order?

Aims and Method

Our objective is to model the economic and political factors which influence preferences for a particular trade regime. A related aim is to determine the type of trade regime that a multilateral coalition can be expected to supply, given economic realities and political constraints. We do not subscribe to the mercantilist view that incentives are identical and constant across actors. In particular, mercantilists assume that all actors have an incentive to increase exports and restrict imports to achieve a balance of payments surplus. Consequently, the theory gives a unique prediction—a discernibly protectionist trading system. We are not suggesting that all actors have an interest to thwart further trade liberalization; in opposition to the mercantilist account, we will try to show that actors' strategies are formulated on the basis of the particular characteristics of their own economies.

By contrast, our central point is that most actors have an incentive to pursue policies that buttress the "free" trade regime, and some might even undertake unilateral liberalization.[4] In effect, it would only be rational for an actor with market power (an actor that combines export- and buying-power) to support a "managed" or protectionist trade order.

Our model gives precise predictions on the basis of relative differences between countries in their share of global exports and of world imports. The "managed" trade regime which emerges serves the marginal interest of an actor with market

power; no other actors have an interest in promoting such a trade regime. Any policy recommendation consistent with the results predicted by our model would thus be the pursuit of "free" trade policies, except under truly particular circumstances (such as having market power).

Our theoretical framework for analysis derives from the rational choice tradition. A game-theoretical model is presented in order to analyze interactions on the international trade scene under conditions where three actors optimize benefits by using two independent instruments: *exports* and *imports*. As a result, the concept of two-dimensional strategies (through the use of both exports and imports) in a three-dimensional space is introduced. The analysis is then extended to examine the effects of coalition formation, circumscribing the market power of the relatively stronger actor.

A country with market power has several advantages over other countries. On the one hand, relatively large *exports* (X) give a country revenue, thus improving the balance of payments position (obviously also in some sense its potential buying power). On the other hand, relatively large *imports* (Z) grant the country buying power which it can use as a leverage in opening up markets abroad. We refer to a country that has a relative advantage over other countries in terms of these two variables, or sources of power, as one having *market power*.

Furthermore, because of the relative superiority in these two variables, a country with market power is also relatively immune to retaliatory moves by other parties. One could imagine two immediate types of retaliation. The retaliating country can either cut the flow of essential products to the punished country (or significantly increase the price, through punitive actions sanctioned by the WTO), or restrict the punished country's market access. Either way, countries will be reluctant to pursue these forms of retaliation, given their relative dependency on the punished country's discretion to grant others market access.

Methodologically, we try here to contribute to the existing body of game-theoretic literature by introducing the concept of a two-dimensional strategy. This result is of significance, since parties often attempt to maximize several variables when interacting. The topic is related to but ultimately different from the concept of a mixed strategy. Rather than considering a probability distribution over two strategies, we consider optimal strategies in two instruments. These lead to the existence of two different equilibria in the three-dimensional space defined by the interactions among the three actors. As we will show, each of these two subgame perfect Nash equilibria constitutes a unique subgame perfect Nash equilibrium among the three actors, viewed in a two-dimensional policy space.

Relations to Pre-existing Literature

Two major strands of thought prevail in the literature on trade-policy making, describing obstacles to trade liberalization. First, it has been widely acknowledged that the domestic policy process constitutes a major impediment to international trade liberalization. Second, it is often argued that small states act as "free-riders" and thus renege on trade agreements. Generally, these two views should be incompatible. Governments can only provide export interests with market access abroad if they have significant bargaining power vis-à-vis other governments. Inter-governmental bargaining power will in turn be determined by the country's buying power. Therefore it only makes sense for countries with sufficiently important economies to grant (some) industries import protection, since, they are, internationally, still

able to offer market access within other sectors of the economy. However, small economies are able to pursue such a strategy to a much lesser extent, since they either risk being denied market access, or else do away with their already limited means for opening up foreign markets. Thus, clearly, interest-group pressure is less effective in small countries, because they tend to lack market power. Of course, one could imagine a small country which combines a high capacity to export and import (market power), but this would tend to be the exception rather than the rule (further discussed below in the section "Market Power and the Actors"). It would thus appear that small states have an incentive to contribute to stable regimes' promoting unconditional "free" trade. In addition, empirical findings seem to lend support to the view that large states defect from the rules laid down in the GATT articles (Ahnlid, 1992).

We would like to emphasize that representatives for the export-oriented sector frequently lobby their governments for market access abroad. There is a catch here, since one country's market access translates into rivalry in the import-competing sector for another country. Still further complexity is added by considering that a producer is frequently an importer as well as an exporter: an importer for inputs and an exporter with respect to the end product. In this respect, the effects of lobbying, in relation to the chosen policy of a government, are unclear.

Moreover, the domestic policy approach cannot explain why some countries are relatively more successful in skewing trade agreements in their favor when countries bargain internationally. We suggest that the relative export and import capacity determines actors' ability to negotiate international trade agreements to their benefit (for example, agreements that enable them to increase exports and imports). We use the term market power to describe a country with the advantage of being a large exporter and which is also a large importer. We use the same gauge for both variables. Exports and imports are taken as shares out of their global counterpart.

Nollen and Quinn (1994) lend some support to the notion that there is more to government trade policy than interest-group pressure. In an analysis of the United States' trade policy machinery, they suggest that Congress has had a relatively marginal role in trade policy affairs, arguing that trade policy is influenced rather by the preferences of trade committees independent of interest-group pressure. It should be added that this provides quite powerful evidence of what one can expect trade policy-making to resemble generally, although the study only considers the United States. This conclusion is important, since Congress is often taken to constitute the prime example of how logrolling influences political outcomes. In this connection, Lohmann and O'Halloran (1994) confirm the influence of the Executive, as opposed to Congress, in trade policy affairs, asserting that this line emerged with the explicit objective of lessening the influence of specific interest groups. They model the trade policy apparatus as a distributive policy process in which efficiency is maximized. In particular, they argue that Congress delegates authority to the Executive in trade policy affairs because members of Congress realize that considerable efficiency gains can be achieved when the President designs trade policy to the demands of the entire national constituency. This stands in contrast to the inefficiency which results when members of Congress consider the marginal benefits and costs in relation only to their respective districts.

In essence, however, we agree with the view that interest groups lobby governments for export expansion and import protection.[5] We differ, nevertheless, with the conclusions that stem from the domestic policy approach, and which lead some

authors to propose to insulate government from interest-group pressure through various means. For instance, it has been suggested that effective trade liberalization is only possible under conditions of constitutional safeguards offering governments protection against the temptation to cater to interest-group pressure (Petersmann, 1995). However, from our perspective, governments that have acquired market power have no incentive to renounce their trade policy powers. On the contrary, it is in their interest to promote a trade order in which the rules are such that defection is possible through quantitative restrictions and different types of market arrangements. Gray-zone measures serve as an instance in which increased buying power can be used to further expansion abroad. The increasing returns to scale experienced for exports and imports tend to preserve the relative advantage over other actors. Greater exports imply further possibilities to export, and the capacity to import reinforces the capacity to continue to absorb imports. In short, it is rational for some governments to promote a "managed" trade regime and not a "free" trade regime.

In terms of methodology, we are not here trying to apply what has been called two-level game theory because, in our view, attempts to apply this theory have relied excessively on the domestic politics conception of international trade agreements. This approach has thus mostly tried to explain why domestic opposition might be successful in blocking the adoption or the ratification of "free" trade agreements and the influence of domestic factors on international trade negotiations (see, for instance, on this Milner and Rosendorff, 1997). As stated above, our concern is different in the sense that we are trying to explain the expansionist behavior of certain states in trade matters and their propensity to push for "managed" trade solutions.

As indicated previously, we are introducing the new concept of optimal strategies in two instruments representing two objectives, leading to the existence of two different equilibria in the three-dimensional space defined by the interactions among the three actors. In this connection, studies undertaken in the economics field, focusing on monetary policy in particular, have given some attention to optimal interactions in several variables. For instance, Rogoff (1985) allows for two objectives, but these are realized in one instrument. Similarly, for Canzoneri (1985), and Persson and Tabellini (1996), the two variables are not independent.

The results presented in this paper are thus fundamentally different from previous research efforts, since we show here that two objectives in two independent instruments yield one equilibrium.

Introducing the Model: The Utility Function

Our model is formulated in terms of preferences of countries or governments (we do not distinguish here between the two) for enlarging their foreign market shares as well as their buying power: the capacity of their home markets to absorb imports. The utility (preference) function of a given country (or group of countries as in the case of the European Union) is defined as revenues from export volume (x) and import volume (z) less costs associated with the relative values of (x) and (z). Revenues are computed as quantities times prices. Prices are endogenously determined, in the sense that either more exports or imports on the part of one actor reduces the level of utility for all if the other actors maintain their shares (of x or z). These utility functions take then the following form for three actors, labeled i, j and k:[6]

$$U_i = [(1 - \rho x_i - \kappa x_j - \iota x_k)\rho x_i + (1 - \varsigma z_i - \xi z_j - \varepsilon z_k)\varsigma z_i] - [\psi_i + \beta x_i^2 + \left(\frac{\alpha x_i + \varphi x_j + \theta x_k}{\alpha x_i}\right) x_i^2 + \nu z_i^2 + \left(\frac{\sigma z_i + \tau z_j + \eta z_k}{\sigma z_i}\right) z_i^2] \quad 1.1$$

$$U_j = [(1 - \rho x_i - \kappa x_j - \iota x_k)\kappa x_j + (1 - \varsigma z_i - \xi z_j - \varepsilon z_k)\xi z_j] - [\psi_j + \gamma x_j^2 + \left(\frac{\alpha x_i + \varphi x_j + \theta x_k}{\varphi x_j}\right) x_j^2 + \omega z_j^2 + \left(\frac{\sigma z_i + \tau z_j + \eta z_k}{\tau z_j}\right) z_j^2] \quad 1.2$$

$$U_k = [(1 - \rho x_i - \kappa x_j - \iota x_k)\iota x_k + (1 - \varsigma z_i - \xi z_j - \varepsilon z_k)\varepsilon z_k] - [\psi_k + \Omega x_k^2 + \left(\frac{\alpha x_i + \varphi x_j + \theta x_k}{\theta x_k}\right) x_k^2 + \mu z_k^2 + \left(\frac{\sigma z_i + \tau z_j + \eta z_k}{\eta z_k}\right) z_k^2] \quad 1.3$$

In the above expressions, the variables x and z (with the relevant subscripts i, j, and k) represent respectively exports and imports, and the Greek letters represent fixed parameters. In addition, the first bracket on the right hand side of the equations represents revenues (or some positive utility), the second costs. These utility functions are similar to the ones used by economists to model duopoly and oligopoly situations (see, for instance, Kreps, 1990: 326–328). The cost structures embedded in them allow the representation of increasing returns to scale for certain values of the parameters (see Appendix).

Market Power and the Actors

Actors are endowed with market power when they are able to combine superiority in terms of relative foreign market shares and buying power. Superiority in either a relatively higher share of exports or imports, as compared to other countries, is thus insufficient to establish an actor as having market power. Moreover, only a country such as the United States holds absolutely higher shares in both variables as compared to any other independent actor. In 1996 US exports amounted to $622 billion, and its imports to $817 billion. Hence, the buying power of the United States exceeds its exports by some $200 billion. One way to appreciate the importance of these figures is to consider them in light of other countries' trade statistics. For instance, the $200 billion of extra buying power roughly corresponds to either France's or Hong Kong's total imports or exports.[7]

Small European countries, such as Switzerland and Sweden, are export-driven economies. In terms of the GDP, their trade is important, but relative to the dominant position of a country like the United States, the trade data, in either variable, constitutes 1 percent of the US trade. Also, for a large trader, such as Japan, imports and exports amount to some 40 percent and 65 percent of the United States' respective trade indicators. Notwithstanding Japan's greater propensity to export rather than to enhance buying power, these figures also make clear that Japan is a pivotal actor on the trade scene. Moreover, the significant discrepancy between exports and imports can explain why, despite Japan's impressive trade position, it does not have the same bargaining leverage in trade negotiations as the United States.

In order to consider the implications of relative differences in market power, we establish a hierarchy of actors in each variable, both for exports (x) and imports (z). For exports, we will assume that i's utility from exports are higher than j's

which is greater than k's, e.g., $\rho > \kappa > \iota$. Similarly, the buying power obtained through imports for i is assumed to be larger than j's which in turn is larger than k's, e.g., $\varsigma > \xi > \varepsilon$. This hierarchy is also reflected in the cost element of the utility functions, such that for exports, $\alpha > \varphi > \theta$ and for imports, $\sigma > \tau > \eta$. It can also be noted that the cost element of the utility function exhibits increasing returns to scale. Economies of scale will be more important the lower the cost coefficients (see Appendix for further details).

The utility functions for i, j, and k are defined by the preference of the respective actors to exploit their market power, by which we understand their relative shares of exports and imports as a proportion of world trade. A better ability to influence prices or the possibility to achieve greater economies of scale will be important in this context.

We thus model the factors that determine what type of trading arrangement will emerge among three actors, and between coalitions, as well as the wider implications of such arrangements. Some considerations about the design of different trade arrangements will also be pursued.

Constraints

In this model, the actors are wary of the structurally determined conditions which they encounter when bargaining trade agreements internationally. The actors are also conscious of the fact that circumstances do not change rapidly, since a change of conditions in one's favor requires some effort, and efforts are costly. Actors are further aware that attempts to change conditions by increasing their own relative foreign market shares, inflict costs on other actors. Countries with small trade volumes will therefore tend to view extra imports as a cost, particularly since further imports cannot translate for them into significant buying power and thus will not help them attain superior market power status (through buying power). Hence, we will consider that each actor can only maximize market shares abroad, or imports to gain buying power, within the limits imposed by the constraints: the hierarchy imposed by them cannot be easily overturned (except, as we will see, through coalition-building). We will call these the *instruments* each actor has at its disposal.

Similarly, we assume that i's relative market shares abroad and import shares (market power) is greater than j's, which is greater than k's. For the instruments x and z, we assume the following relations as *constraints* to the game situation:

$$\frac{X_i}{X_j} > \frac{X_j}{X_i}, \frac{Z_i}{Z_j} > \frac{Z_j}{Z_i}, \frac{X_j}{X_k} > \frac{X_k}{X_j}, \frac{Z_j}{Z_k} > \frac{Z_k}{Z_j} \text{ everywhere.}$$

We can now define the following game: find the optimal strategies associated with the utility functions and the constraints enumerated above for each of the players i, j, and k, and answer the following questions:

(a) If each of the players plays the game by itself: Is the set of optimal strategies in each instrument unique? Do they define two unique (in each instrument) subgame perfect Nash equilibria?

(b) If coalitions obtain, do they lead to a set of unique optimal strategies in each instrument which define two unique (in each instrument) subgame perfect Nash equilibria?

As we will see, both questions can be answered affirmatively. When actors play by themselves as well as when they play in coalitions, two unique (in each instru-

ment) subgame perfect Nash equilibria obtain. A detailed presentation of the methodology used to prove these results is presented in the Appendix; we will present here some of the essential steps before we formulate conclusions.

Constrained Optimization and Game Solutions

Our constrained optimization problems and the game solutions associated with them can be considered in two steps. The first step consists in looking at actors playing in isolation, the second, in examining the influence of coalitions.

Solution to the Game where Actors Play in Isolation. A solution of this game consists in calculating optimal strategies under the following constraints:

$$2.1\ \frac{X_i}{X_j} > \frac{X_j}{X_i},\quad 2.2\ \frac{Z_i}{Z_j} > \frac{Z_j}{Z_i},\quad 2.3\ \frac{X_j}{X_k} > \frac{X_k}{X_j},\quad 2.4\ \frac{Z_j}{Z_k} > \frac{Z_k}{Z_j},\quad 2.5\ X_i, X_j, X_k, Z_i, Z_j, Z_k > 0$$

The constraints indicate that i, j, and k must accept the limitations imposed upon them by the order established in the respective parameters. Thus, the constraint is applied to i in the sense that it wishes to retain its market power: its capacity to export (markets abroad), and import (buying power) with regard to both j and k. The constraint is applied to k to suggest that it cannot change the politico-economic conditions that grant it less market power than j; at the same time j wishes to retain its advantage in market power over k.

Computing optimal strategies for each actor amounts now to take the Lagrangian of each utility function, i.e., 1.1, 1.2, 1.3, under the constraints 2.1 to 2.5. First and second order conditions for the Lagrangians can then be established in order to compute maxima. The Kuhn-Tucker theorem can be applied to the first order conditions in order to eliminate dominated strategies. The application of this theorem guarantees the existence of a subgame perfect Nash equilibrium, which, also in this case, is unique for each instrument. This is the case for our model, as shown in some detail in the Appendix, if we assume the constraints that we have indicated. Moreover, the respective unique subgame perfect Nash equilibria are also dynamically stable, a logical consequence of subgame perfection (cf. Moulin, 1984; 1986). We find here that this equilibrium gives a slight edge to the dominant actor in terms of market power.

The model accounts well for the current international trade order. Given that an actor has market power, it is able to impose its preferred trade regime.[8] Unfortunately, it will not be rational for such an actor to prefer a "free" trade regime. Thus, the model predicts a relatively open, and to some extent "managed" (or "fair") trade system where a dominant actor encourages efforts to further liberalize trade. In effect, an actor with market power has the possibility to introduce arrangements, which preserve the compatibility between the underlying institutions of the international trade system and their preferences. For instance, "gray-area" measures (VERs, VIEs, OMAs, etc.), or unilateral enforcement of trade "rights," are means to forward trade objectives while maintaining the institutional foundations of the trade regime.[9] In short, such trade policy practices can allow an actor with market power to expand access to markets abroad as well as reinforce its buying power. The model further suggests that actors are more sensitive to the adjustments of actors with relatively less market power. So, for instance, i reacts more strongly toward k then toward j, and j reacts more forcefully toward k than toward i. To some extent this can explain the large global discrepancies in trade among countries. In the next section we explore means to overcome this type of situation.

Solution for the Game where a Coalition Obtains. A well-formulated prediction by game theorists states that in situations where more than two actors intervene, coalitions will form. This possibility is likely to obtain in the kind of three-actor game that we are considering. Three-actor games are discussed by Caplow (1956), and again by Luterbacher (1994) who makes an attempt to generalize some of Caplow's results. Both perspectives suggest that a coalition of weaker actors against a stronger one is likely (though not the only possible coalition). Accordingly, we analyzed the strategic possibilities of a jk coalition against the stronger player, i. Once a given coalition has formed, the three-actor game is changed into a two-actor game which we can analyze the same way we investigated the previous three-actor situation. We assume that the utility function of coalition jk is simply the sum of the utilities of actor j and k taken separately. Hence

$$U_{jk} = U_j + U_k$$

We want to maximize U_{jk} and U_i subject to the following constraints:

$$5.1\ \frac{x_{jk}}{x_i} > \frac{x_i}{x_{jk}}, \quad 5.2\ \frac{z_{jk}}{z_i} > \frac{z_i}{z_{jk}}$$

As before, we can now compute the Lagrangians of U_{jk} and U_i and establish first and second order conditions in order to compute maxima under constraints. Here again we can apply the Kuhn-Tucker theorem to eliminate dominated strategies and then test also for stability conditions. The results are the same as previously: We can prove that this coalition game ends with unique subgame perfect Nash equilibria for each instrument and that these equilibria are dynamically stable (we refer again to the Appendix for the proofs). The difference from the previous outcome is that now the coalition takes the advantage over the actor who dominates the game when players are acting in isolation. Quite clearly an incentive exists here to build trade coalitions to counteract other powerful actors. Our model thus predicts the formation of trading blocs. Two different scenarios could obtain.

First, if the jk coalition has much greater market power than the independent market power of i, one should expect that the coalition would simply impose a trade regime consistent with its trading capabilities and objectives. Alternatively, the relative balance in market power may be indecisive. Here it should be noted that if actors chose to execute their optimal strategies compatible with the non-cooperative equilibrium (the two equilibria), there exist possibilities for trade wars. At worst this could lead to a situation resembling the one in the 1930s when the introduction of the Smoot-Hawley Tariff by the United States caused a wave of protectionism. Today we have a situation in which both the United States and the European Union have mutual possibilities to retaliate against each other as their relative market power becomes increasingly balanced. In the interwar period, harsh economic lessons were drawn from the situation that emerged with these retailiatory moves. Eventually countries considered it better to promote a relatively liberal trading system. Fortunately, however, cooperative agreements can keep these market powers in check. For instance, the enforceability of agreements under the new Dispute Settlement Body (DSB) of the WTO may serve as a means to balance the market power of the United States and the European Union.

Conclusion and Inferences

Our work shows that, if an actor holds market power, it will be able to impose its preferred trade regime, which corresponds to a "managed," not a "free" trade regime. Generally, the United States' support of GATT in the post-war era can be explained in these terms since market access to previously closed economies was obtained, thus

contributing to greater market shares. With greater competition for international markets as a consequence of the integration of Europe and Southeast Asia, unconditional support of "free" trade principles started to decline. By virtue of their buying power, a market power such as the United States is able to use access to its own market as bargaining leverage. This desire of other countries to penetrate the American market also carries the advantage that it makes it possible to retaliate against other countries, while others will be reluctant to retaliate against the United States. On the other hand, the importance of its market shares creates opportunities to force others to restrict their exports or increase their imports. Notably, the United States' bilateral negotiation of quantitative restrictions such as VERs (voluntary export restrictions) and VIEs (voluntary import expansions) are consistent with these theoretical results. The United States' call for a "fair" trade regime as opposed to a "free" trade regime, in the wake of the Uruguay Round, also echoes such intentions. In this connection, the unilateral enforcement of US rights through Section 301 and associated legislation is one way to continue shaping the trade system in favor of the United States' trade position. Under such a scenario, friction can be expected in the trade system, where each actor attempts to exploits its counterparts' relative weak spot. This then illustrates the situation where actors do not necessarily have an unconditional interest in supporting "free" trade.

In addition, the coalition game raises three possibilities for the future: the coalition imposes its preferred trade regime (if it has greater market power); or the two market powers find a cooperative outcome consistent with their preferences; or the non-cooperative outcome could announce the onset of "trade wars."

The World Trade Organization should be wary of such possible developments, strengthen its dispute settlement mechanisms, and seek to foster conciliatory outcomes to trade conflicts whenever possible.

From a methodological point of view, our work has also shown that it is possible to conceive of a two-dimensional strategy. This extension of the concept of a strategy is important, since actors frequently optimize several variables and it is not always possible to express one variable in terms of another. The strategies are formulated in order to maintain and eventually expand exports and imports. Thus, actors are consistently more sensitive to adjustments of the relatively weaker party. This type of adjustment process further holds true across variables.

Viewed independently, there exists for each variable a unique subgame perfect Nash equilibrium, in a three-dimensional space, when the three parties execute their optimal strategy. Thus, we introduce the concept of a unique subgame perfect equilibrium for the three actors optimizing in two instruments. In this context, we have been able to show that the interaction among three actors, each executing a strategy in two instruments, yields a unique subgame perfect equilibrium viewed in a two-dimensional policy space. These results will be generalized at a later stage.

Obviously, more rigorous empirical applications of the model need to be undertaken to verify whether actors implement their strategies according to the logic presented here. In this respect, we will also review the institutional implications characterized by different configurations of equilibria.

Appendix

Scope and Purpose

The purpose of this appendix is to demonstrate how we model international trade relations. In particular, we wish to convey the methodology used to establish the

existence of subgame perfect equilibria in two instruments, viewed in three dimensions, for which we will introduce notation.At the same time, we have taken care to explain the elements behind the formal analysis.

A Multilateral Trade Model

In this section we outline our three-actor model. In the final section we will only briefly discuss the coalition model, since the procedures are the same as for the multilateral model. Hence, we focus on the discrepancies, in terms of resolving the game, between the two situations.

The model considers three actors ($n = 3$, $n = i,j,k$) whose utility functions all have the same form and structure. The utility functions are quadratic and represented as revenues less costs, expressed as: 1. $U_n = R_n - C_n$.

Our two variables, also referred to as the two instruments are:

(x_n) : the capacity to export, or alternatively to obtain market access

(z_n) : the capacity to import, or alternatively to offer market access.

Actors differ in their capacity to export and import goods, that is, their relative market power differs, which is why different parameters have to be assigned across actors. We establish a hierarchy between actors by attributing parameters, of the following order, to the variables with respect to the revenue and cost elements of the utility function:

$\rho,\kappa,\iota < 1$, such that $\rho > \kappa > \iota$: parameters for export revenue

$\varsigma,\xi,\varepsilon < 1$, such that $\varsigma > \xi > \varepsilon$: parameters for buying power

$\Psi_n,\Psi_i < \Psi_j < \Psi_k$: fixed costs

$0 < \beta,\gamma,\Omega < 1$, such that $\beta < \gamma < \Omega$: production costs for exports

$0 < \nu,\omega,\mu < 1$, such that $\nu < \omega < \mu$: costs for imported goods and services

$\alpha,\varphi,\theta > 0$, such that $\alpha > \varphi > \theta$: increasing returns to scale (w.r.t. x_n)

$\sigma,\tau,\eta > 0$, such that $\sigma > \tau > \eta$: increasing returns to scale (w.r.t z_n)

In our model, prices (or benefits) associated with exports and imports times quantity gives revenue. Prices are endogenously determined. In other terms, prices are determined by the model, such that increases in quantity reduce prices across actors, under conditions where all other actors maintain their (quantity) shares. Here, fixed costs refer to costs that do not vary with output levels. Increasing returns to scale, or economies of scale, refer to a phenomenon where an increase in efforts (or inputs) causes a more than proportionate increase in benefits (or output). Obviously, there is a limit to this process, so, for instance, economies of scale cannot be important enough to render costs negative. Hence, in our utility function, the higher an actor's share of exports to global exports (and for imports out of global imports) the more costs decrease. In other words, the greater the capacity to export, the lower the costs and the better the possibilities to continue acquiring foreign market shares. This is also true for imports and buying power.

We subject the utility function to a series of constraints. The ten constraints depict a hierarchy between the actors:

$$1.1\ \frac{x_i}{x_j} > \frac{x_j}{x_i},\ 1.2\ \frac{z_i}{z_j} > \frac{z_j}{z_i},\ 1.3\ \frac{x_j}{x_k} > \frac{x_k}{x_j},\ 1.4\ \frac{z_j}{z_k} > \frac{z_k}{z_j},\ 1.5\ x_i > 0,\ 1.6\ x_j > 0,$$

$$1.7\ z_i > 0,\ 1.8\ z_j > 0,\ 1.9\ x_k > 0,\ 1.10\ z_k > 0$$

The implication of these constraints is that i has greater market power than j, which has greater market power than k, for example, $i > j > k$ (w.r.t. x_n, z_n). If we constrain

our utility function by these relations, we can guarantee that this particular order is preserved. The formal term for such a constrained utility function is the Lagrangian function:

$$2.1\ L(x_i,z_i,\lambda_i) = ((1 - \rho x_i - \kappa x_j - \iota x_k)\rho x_i + (1 - \varsigma z_i - \xi z_j - \varepsilon z_k)\varsigma z_i) - (\Psi_i + \beta x_i^2 + \left(\frac{\alpha x_i + \varphi x_j + \theta x_k}{\alpha x_i}\right) x_i^2 + \nu z_i^2 + \left(\frac{\sigma z_i + \tau z_j + \eta z_k}{\sigma z_j}\right) z_i^2) + \lambda_1(x_i^2 - x_j^2) + \lambda_2(z_i^2 - z_j^2) + \lambda_3(x_j^2 - x_k^2) + \lambda_4(z_j^2 - z_k^2) + \lambda_5(x_i) + \lambda_6(x_j) + \lambda_7(z_i) + \lambda_8(z_j) + \lambda_9(x_k) + \lambda_{10}(z_k)$$

After having composed the Lagrangian functions, we can start the game. In order to play we are, however, obliged to rely on optimization techniques and nonlinear programming (such as the Kuhn-Tucker algorithm). Given such procedures and our initial assumptions, we can make predictions about the strategies actors will choose and how they will adjust to each other. However, we are also interested in knowing more about the nature of the interaction and ultimately the type of situation, or institution, that unfolds. This information can be obtained by inspecting the equilibria. What are the (institutional) implications of our equilibria? Are they self-enforcing, stable?

Our immediate interest is to generate equilibria that provide both unique and self-enforcing predictions. After all, we are trying to make definite claims about an international trade order. Equilibria that have the property of being subgame perfect fulfill these criteria. Subgame perfection is ensured when, and only when, dominant strategies are retained. One way to retain dominant strategies is to apply the Kuhn-Tucker theorem. The formal conditions under which the theorem is applicable are: if the utility function $f(x_n,z_n)$, $n = i,j,k$ and the constraints $g_{qn}(x_n,z_n)$, $q = 1,...,10$ are differentiable, and the partial derivatives are continuous in the neighborhood of a point A, that is, $g_{qn}(A) \geq 0$, such that the constraint $g_{qn}(x_n,z_n) \geq 0$ is regular in A. In other words, the rank of the Jacobian matrix of constraints, $g_{qn}(x_n,z_n) \geq 0$, $q = 1,...,10$ is equal to the number of constraints (Archinard and Guerrien, 1988 and Moulin, 1986). The Jacobian is the matrix of the first partial derivatives of the constraints. By looking at the rank of the Jacobian matrix we can find out whether there exists a functional dependence between the constraints. This is important, because functional (here, linear) independence is required in order for the Kuhn-Tucker theorem to apply. In our case, the rows of the Jacobian matrix are independent, and so its rank (the number of independent rows) is ten. Consequently, all the above conditions are satisfied and the Kuhn-Tucker theorem is applicable.

Subgame perfection can now be secured by presenting the following relations, that is, the constraints (from 1.1–1.10) with the Lagrange multipliers, $\phi = \lambda,\psi,F$:

$$1.1.1\ \phi(x_i^2 - x_j^2) = 0,\ 1.2.1\ \phi(z_i^2 - z_j^2) = 0,\ 1.3.1\ \phi(x_j^2 - x_k^2) = 0,\ 1.4.1\ \phi(z_j^2 - z_k^2) = 0,\ 1.5.1\ \phi(x_i) = 0,\ 1.6.1\ \phi(x_j) = 0,\ 1.7.1\ \phi(z_i) = 0,\ 1.8.1\ \phi(z_j) = 0,\ 1.9.1\ \phi(x_k) = 0,\ 1.10.1\ (z_k) = 0,$$

and solving for all ϕ'_ns gives $\phi_n = 0, q = 1,...,10$ ($\phi = \lambda,\psi,F$, and $n = i,j,k$). In essence, because we have established that the particular hierarchy given by the constraints is sustained, we can eliminate the constraints.

Having eliminated the constraints, and having determined the retention of subgame perfect equilibria (for the equilibria yet to be produced) we now turn to generating the strategies and their interrelation, the equilibria. We want to know more about the interaction between the players when each actor can choose its optimal strategy. Under these conditions, we can establish the content of each actor's strategy toward any, and all, other actor(s). In effect, such strategies are optimal reaction functions.

Technically, the strategies are derived by solving for each actor from the first-order conditions for each respective variable. The procedure guarantees Nash equilibria in both variables, because we are here looking at each actor's best response given the optimal strategy of another actor. Thus for i,

$$1.1.1\ \partial L/\partial x_i = -\rho^2 x_i + (1 - \rho x_i - \kappa x_j - \iota x_k)\rho - 2\beta x_i - x_i - \frac{\alpha x_i + \varphi x_j + \theta x_k}{\alpha} = 0$$

$$1.1.2\ \partial L/\partial z_i = -\varsigma^2 z_i + (1 - \varsigma z_i - \xi z_j - \varepsilon z_k)\varsigma - 2\nu z_i - z_i - \frac{\sigma z_i + \tau z_j + \eta z_k}{\sigma} = 0$$

Hence, the optimal reation of i for j and/or i for k with respect to x_n, is given by,

$$1.1.3\ x_i = -\frac{-\rho\alpha + (\rho\kappa\alpha + \varphi)x_j + (\rho\iota\alpha + \theta)x_k}{2\alpha(\rho^2 + \beta + 1)},$$

and similarly for imports (z_i), and for the optimal reaction function of j for k and so on.

However, we need to ascertain that a maximum is indeed obtained when utility is maximized. The way to check this is to look at the second-order conditions, that is, if these are less than zero, we have maxima. If second-order conditions were greater than zero, we would obtain minima, and actors would be minimizing utility. Clearly, this would be nonsensical for this game. The second-order conditions, $L''\{x_n, z_n, \zeta\}$, are determined for i,j,k, giving second partials for i,

$$1.1.4\ \frac{\partial^2 L}{\partial x_i x_i} = -2\rho^2 - 2\beta - 2 < 0,\ 1.1.5\ \frac{\partial^2 L}{\partial x_i \partial z_i} = 0 < 0,\ \text{etc.}$$

In our case, we are maximizing in two variables, and we therefore need to investigate the matrix of the second-order partial derivatives (the Hessian matrix). If the Hessian determinant is negative definite, with respect to the utility functions, each actor maximizes its utility.

In addition, for our particular case, we also need to consider the constraints $g_{qn}(x_n, z_n)$. We therefore take what is called the bordered Hessian determinant ($|H|$). For i,

$$|\overline{H}| = \begin{vmatrix} 0 & 2x_i & 2z_i \\ 2x_i & -2\rho^2 - 2\beta - 2 & 0 \\ 2z_i & 0 & -2\varsigma^2 - 2\nu - 2 \end{vmatrix},$$

where it is clear that $\{x_i, z_i\}$ constitutes a maximum, since $f_{xixi}, f_{zizi} < 0$, $g_{xi}g_{zi} > 0$ and $f_{xixi}f_{zizi} > f_{xixi}f_{zizi}^2$. The Hessian determinant (i.e., d^2U) is negative definite subject to the constraints ($dg = 0$). Hence, at this point we have, through the combined results given above, established the existence of subgame perfect Nash equilibria.

Next we pursue stability analysis in order to confirm subgame perfection, even though subgame perfection implies stability (see Moulin, 1984). According to the stability theorem, the matrix of coefficients (w.r.t. x_n, z_n) of the second-order conditions must be negative definite (see Davis, 1962 on Liapunov's theorem). The characteristic equation can be found by the Laplace expansion, where,

$$|C_{lm}| \equiv (-1)^{l+m}\ |M_{lm}|,\ \text{and}\ |A| = \sum_{m=1}^{6} a_{lm}\ |C_{lm}|$$

It is now possible to find the characteristic roots. The eigenvalues are, $-2\varsigma^2 - 2\nu - 2$, $-2\iota^2 - 2\Omega - 2$, $-2\varepsilon^2 - 2\mu - 2$, $-2\xi^2 - 2\omega - 2$, $-2\kappa^2 - 2\gamma - 2$, $-2\rho^2 - 2\beta - 2$ where the condition for stability is satisfied since all (real) parts are negative and take on different values.

The Coalition Game

All of the discussion above and the related proofs pertain also to trading under conditions of coalition formation. We will therefore only introduce the utility

function and present the stability condition for the coalition game, since these two aspects differ from the multilateral setting.

We take the combined utility functions of j and k to denote the jk coalition. The parameters (to be checked against the parameters above) are as follows: $\zeta = \iota + \kappa$, $\zeta > \rho$; $\chi = \xi + \varepsilon$, $\chi > \varsigma$; $\delta = \gamma + \Omega$, $\delta < \beta$; $o = \varphi + \theta$, $o > \alpha$; $\Upsilon = \omega + \mu$, $\Upsilon < \nu$, $\Phi = \tau + \eta$, $\Phi > \sigma$

3.1. Lagrangian for jk coalition,

$$L(x_{jk},z_{jk},\aleph_{jk}) = ((1 - \rho x_i - \zeta x_{jk})\zeta x_{jk} + (1 - \varsigma z_i - \chi z_{jk})\chi z_{jk})$$
$$- (\Psi_{jk} + \delta x_{jk}^2 + \left(\frac{\alpha x_i + o x_{jk}}{o x_{jk}}\right) x_{jk}^2 + \Upsilon z_{jk}^2 + \left(\frac{\sigma z_i + \Phi z_{jk}}{\Phi z_{jk}}\right) z_{jk}^2) + \aleph_1 (x_{jk}^2 - x_i^2)$$
$$+ \aleph_2(z_{jk}^2 - z_i^2) + \aleph_3(x_{jk}) + \aleph_4(x_i) + \aleph_5(z_{jk}) + \aleph_6(z_i)$$

We leave it to the reader to verify that the coalition game can be resolved by the procedures delineated above. However, to perform stability analysis in a two-person game it suffices to check that the absolute value of the optimal reaction curve of the jk coalition is smaller than the slope of i's optimal reaction curve (Luterbacher, 1994). The condition is satisfied for exports since,

$$\left| - \frac{(2(\zeta^2 + \delta + 1) - \zeta)o}{\zeta\rho o + \alpha} \right| > \left| - \frac{(\zeta\rho o + \alpha) - \zeta o}{2o(\zeta^2 + \delta + 1)} \right|,$$

and so on for imports.

Notes

1. These results are discussed in Krugman and Obstfeld (1988: 73–83).
2. Only about 7% of European GDP is trade with regions outside Europe.
3. The Swiss pharmaceutical industry typifies this kind of behavior: very high prices are charged domestically to ensure expansion abroad.
4. On the merits of unilateral liberalization see Bhagwati (1988).
5. Notwithstanding the cost of the latter for export expansion unless one is a market power able to offer other important markets than the segments being protected.
6. This can be imagined as a game between the United States, the European Union, and the rest of the world.
7. These figures can be checked against the United Nations statistics (United Nations, 1997).
8. The imposition of a preferred trade regime by a dominant power is in line with the predictions of hegemonic stability theory (see Gilpin, 1987).
9. Voluntary export restraints (VERs), voluntary import expansions (VIEs), and orderly market arrangements (OMAs). Unilaterally enforced trade rights such as under US legislation, notably section 301 and super 301.

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