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Free Trade Versus Free Riding Under GATT

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1. Introduction

The way in which a problem is described influences approaches to its solution. If the problem is large and complex, like agricultural trade policy, the act of description is non-trivial. A. K. Sen (1980) has argued that any analytical description involves choice. From a variety of aspects of a problem the analyst must choose those that most clearly reflect its nature. Description is of particular relevance when a synthesis is attempted of a problem traditionally approached from different disciplines.

Liberalizing agricultural trade is at once an economic, political, and legal problem. Economists emphasize efficiency gains and losses from trade; political scientists examine the interest group pressures and power structures affecting trade regimes; legal analysts focus on rules of obligation and liability in trade agreements. This paper attempts a partial synthesis of these perspectives by describing international agricultural trade as a "public good problem." Public goods are shared by a group without direct rivalry and without the exclusion of those whose benefits are not matched by proportionate contributions (Samuelson, 1954). Public goods form an intersection of economic, political, and legal scholarship, because they involve incentives leading to inefficiency, are directly related to interest group pressures, and are affected by rules of liability and obligation (see Olson, 1965).

Kindleberger (1986) and Silk (1987) have recently argued that the international trading system itself is such a good. While not a "pure" public good in the sense used by economists, free and open international agricultural markets generate an economic "surplus" which is shared by all

market participants (World Bank, 1987). These "gains from trade" are public benefits (ex ante) even if their distribution is ultimately a matter of rivalry. While the benefits of free trade are widely shared, its costs tend to fall more narrowly on those groups that are uncompetitive. When countries retain the general benefits of open trade while attempting to protect certain sectors from competition, they are "free riding," drawing down the global benefits which trade provides. Recent research on the provision of public goods, to be examined below, lends insight into the problem of opening agricultural trade in the face of protectionist pressures.

Beginning with Adam Smith, political economists have debated whether the public benefits of unrestricted trade are justified in light of the private costs it imposes on groups that are uncompetitive without protection. These groups have demanded protection from the shifting winds of creative destruction affecting foreign trade. The famous English Corn Law debates revolved around the same issues which today grip world agriculture. Can protection be lowered in the face of losses borne by protected sectors such as agriculture, or will the protected interests defeat such attempts? These demands for protection are often urgent and well-focused. Arguments for free trade often seem less urgent and unfocused, precisely because benefits are widely diffused.

In the face of these pressures, the post-war governments erected the General Agreement on Tariffs and Trade (GATT). Since 1947, when the GATT was signed by the United States and 22 other countries, it has grown to include 92 contracting parties and 31 de facto members, accounting for 90 percent of those engaged in trade. The legal principles on which it is

based are: (1) nondiscrimination and reciprocity in trade; (2) protection through "transparent" measures, such as tariffs, rather than quotas; (3) binding tariff levels fixed through negotiation; and (4) notification, consultation and arbitration in the face of disputes (see Catudal, 1961; Aho and Aronson, 1985). While these legal obligations are principally designed to reduce backsliding toward protectionism, they have succeeded in actually reducing levels of protection over time. In the manufacturing sector, they are credited with reducing tariffs from their original post-war level above 40 percent down to less than 5 percent today (Paarlberg, 1987).

Unfortunately, one of the most glaring exceptions to these principles is agriculture. In addition to general exceptions granted to agriculture under Articles XI and XVI, the United States has demanded and received special treatment under a 1955 waiver which allows quantitative import restrictions on agricultural products affected by price supports. These exceptions have encouraged agriculture to remain a highly protected sector, contrary to the basic GATT goal of trade liberalization (see Congressional Research Service, 1986; Paarlberg, 1987; Sanderson, 1986).

In September 1986, at Punta del Este, Uruguay, it was agreed to reopen trade negotiations under GATT, and to consider agricultural protection as a key priority in the "Uruguay Round". The purpose of this paper is to describe the uncoming round of negotiations over agricultural trade as a problem of public goods provision, utilizing a variety of recent innovations in economic and political theory to gain insight into the problem of trade policy reform. This description, we hope, can

contribute to better understanding of the difficulties confronting the next GATT round.

2. Gains from Trade as a Public Good

In economic theory, the most powerful argument for free trade is its efficiency. Efficiency as used by economists means that trade satisfies the demands of more agents at higher levels than would occur in its absence. These are the "gains from trade." A fundamental theorem in welfare economics holds that in the absence of constraints on trade, the allocation of goods in a competitive equilibrium is "Pareto-efficient". Pareto-efficiency is a state in which no agent can be made better off without making at least one other agent worse off. In principle, once efficiency has been achieved, those disadvantaged by trade can be compensated out of the resulting gains. Unfortunately, the existence of public goods and other "externalities" upsets the fundamental theorems of welfare economics, making efficiency and compensation difficult to separate in practice (Stiglitz, 1985).

Critics of free trade and the relevance of Pareto-efficiency have also emphasized that neither is necessarily fair. "Fair trade", in addition to being an appealing (though ambiguous) argument for equity, is also a concern of some theorists, who note that even a Pareto-efficient allocation is entirely compatible with one person (or country) getting everything, and everyone else getting nothing (Sen, 1983). In reality, the economic debate over agricultural trade revolves around not only the efficiency, but also the fairness, of various alternatives (Rausser, 1982; Runge and von Witzke, 1987).

Public goods pose problems of both efficiency and fairness. They are

difficult to supply efficiently because of the "free rider" problem. Their supply is also related to fairness, since few are willing to contribute more than a "fair share", based on some prior understanding about what a fair contribution is (see Marwell and Ames, 1979; 1980; 1981). A free and open trading system is continually confronted by countries that enjoy its benefits while overtly or surreptitiously protecting certain sectors. This form of free riding offends other countries' sense of fairness, leading to retaliation. Both protection and retaliation reduce the gains from trade, leaving all countries worse off. Indeed, it is possible to show that the gains from trade can be completely eroded by retaliatory distortions in domestic agricultural policy (Schmitz et al., 1986).

Despite these incentive and equity problems, recent research points to the constructive role which obligations to institutional rules can play in the efficient provision of public goods. It is the relationship between rules and public goods that makes this research relevant to the impact of GATT on agricultural trade liberalization. The key feature of such rules is that they provide a structure of obligation and liability that is both well-defined and perceived to be fair, making claims of benefit and cost more secure. This security, or assurance, can result in successful collective agreements leading to public goods provision (Runge, 1984).

An important recent result consistent with this approach (Sugden, 1984) proves that public goods can be provided at Pareto-efficient levels. In Sugden's model, the propensity to free ride can be overcome by a set of reciprocal obligations in which each member of a group contributes to the

public good, conditional on the assurance that others will do the same. The result turns crucially on the resolution of this "assurance problem" (Sen, 1967). As Sugden emphasizes (1984, p. 781), a structure of reciprocal obligation, encoded in institutional rules of behavior, can provide public goods at a Pareto-efficient level only if the rules act to assure the group that its members are contributing their "fair shares". This approach does not predict that the free rider problem will be solved, only that it can, depending on the level of reciprocal obligation, and the assurance that these obligations will be kept. Without such assurance, any group can be trapped in an equilibrium in which everyone would contribute more if only others would too, but in which no one will make the first move.

The international trading system is in large part founded on a similar form of assurance. If countries fail to commit domestic resources to reduce protectionism, and instead seek to free ride by benefiting from the trading system while protecting themselves from its costs, the structure of reciprocity will unravel toward autarchy. In order to hold the line against demands for protection (especially domestic demands for "fair trade"), countries must be assured that other trading nations will not impose new barriers of their own. This structure of mutual obligation is encoded in the first and most basic principle of the GATT: nondiscrimination and reciprocity, expressed in the Most-Favored Nation (MFN) clause.

The purpose of GATT as an institution is to adjudicate and coordinate the system of reciprocal trading rules. Like many other international institutions, GATT is relatively weak, because countries are unwilling to

provide international public goods by surrendering sovereignty to an international government or single hegemonic power (Kindleberger, 1986). The role of the U.S. as a hegemonic power after World War II, which allowed it to demand and receive the 1955 waiver to agriculture, has eroded (Keohane, 1984). In the absence of hegemony, the system depends primarily on coordinating the collective actions of the trading nations as a whole (Snidal, 1985). Because it is a glaring exception to the rules of reciprocity embodied in the treaty, the U.S. waiver and other forms of agricultural protectionism are major contributors to the inefficiency and perceived lack of fairness in world trade.

This view of international agricultural trade has implications for both theory and policy. In theory, wherever public goods are present, efficiency will not be achieved through atomistic competition alone. Its achievement will be bound up not only with fairness but with the problem of acquiring information concerning the likely behavior of others.¹ The assurance problem arises because of insufficient information concerning the willingness of others to honor an agreement to contribute to a public good. Theory must thus account explicitly for problems of information acquisition and the strategic structure of reciprocal expectations.

At the level of policy, the approach is at variance with atomistic pursuit of national or group self-interest. The invisible hand guiding

¹Much of the work in this area has concerned "principal-agent problems". In these cases, the "principal" has less information than necessary to direct the behavior of the "agents", an asymmetry leading to problems of efficient allocation. In other problems, the informational asymmetry takes the form of "adverse selection", in which there is imperfect information concerning the characteristics of what is being bought or sold in the market, or "moral hazard", in which there is imperfect information concerning the action which the individual undertakes (see Stiglitz, 1985; Runge and Myers, 1985).

decisions toward collectively rational outcomes is a palsied one without explicit efforts at coordination provided by nonmarket institutions (Stiglitz, 1985). Where international governance is weak, and hegemonic power by single countries is insufficient to provide order, efforts at coordination and the assurance it brings will rise in importance (Snidal, 1985). This approach leads to calls for strengthening international institutions such as the GATT. It predicts that policies favoring protectionist free riding or unrealizable hegemony -- notably the GATT exceptions for agriculture -- will reduce the level of obligation felt to the international trading system as a whole. The remainder of this paper elaborates this argument in the more formal language of economic and political theory.

3. Agricultural Trade as a Coordination Problem

Any country's policies have some effects on other countries.² Macroeconomic policies of economic expansion or contraction in one country, for example, may lead to costs for other countries. Stimulative monetary policy under flexible exchange rates may cause a country to increase inflation in the hope of weakening its currency, leading to reductions in domestic unemployment at the expense of increases in domestic inflation. But if all (or a sufficiently large) number of countries pursue such a policy, none can succeed, because exchange rates cannot fall for everyone. Overall, expansionary monetary policies then

²The fundamental insight of modern economics is that market trading leads to positive effects that are greater than in the absence of such trade. This gain from trade is a "pecuniary externality" (Scitovsky, 1954) which, if widely shared, is a form of public good. When large numbers of agents share a positive externality, it is a public good (Mishan, 1971, pp. 9-13).

result in much higher inflation than expected, due to a failure to anticipate that other countries will follow suit. Instead of increasing export trade through a lower exchange rate, such policies may only "export inflation" (Hamada, 1976).

In agriculture, U.S. attempts to raise price supports, expand exported output and increase farm income in the 1970's have led to similar problems due to a failure to account for the strategic interdependence of U.S. policies and those of other trading nations. Many other agricultural exporters also pursued policies of price supports and expanded output, contributing to ever-increasing world production and decreasing world prices. The consequence is that governments' agricultural policies have led to higher and higher budget expenditures to protect agricultural incomes, substantially increasing farm program costs.

In the cases of both exchange rates and agricultural price supports, there are generally coordinated solutions that would leave all countries better off. However, such coordination generally means that existing institutions must be modified or a new institutional framework invented, so that countries are assured that their actions will be coordinated to mutual advantage.³ In the GATT case, the primary change in the institutional arrangement contemplated in the upcoming round of negotiations is greater inclusion of agriculture under GATT rules. However, a wide variety of other forms of agricultural policy coordination

³Kehoe (1986a, b) demonstrates in a dynamic optimal taxation model that fiscal policy coordination may be inoptimal due to a lack of binding commitments by government not to tax capital too highly. Interestingly, the problem is a lack of assurance by consumers that taxes on capital will not be raised once an agreement between countries has been struck. This assurance problem is what prevents coordination from being a superior solution. What is lacking is an institution to maintain this assurance.

are possible, both inside and outside the GATT (see Paarlberg, 1987; Schmitz, et al., 1981). In this paper, we shall focus on the GATT, and the prospect for bringing agriculture into line with other sectors under the GATT Treaty. We regard GATT as a necessary, though not a sufficient, basis for agricultural policy reform (see Paarlberg, 1987).

This problem of international institutional innovation may be approached from the perspective of game theory. Artis and Ostry (1986), following Hamada (1976), compare three game-theoretic solutions to the problem of policy coordination. These solutions are Nash, Stackelberg, and cooperative equilibria. Nash equilibrium results when each country optimizes by acting individually, accepting other countries' policy as given. Stackelberg equilibrium results when one country, such as Canada, emerges as a leader, and other countries follow in a Nash fashion, with the leader alone optimizing individually (e.g., McCalla, 1966). Cooperation, the third solution concept, yields a range of equilibria.

A simple coordination problem for two countries, each with trade strategies 0 and 1, is shown below in normal form.

| | | Country B | |
|-----------|---|-----------|--------|
| | | 0 | 1 |
| Country A | 0 | (4, 3) | (2, 2) |
| | 1 | (1, 1) | (3, 4) |

Trade strategies coordinated along the diagonal lead to outcomes that are Pareto-Optimal (Sen, 1969). Despite the optimality of the solutions in which trade policy coordination occurs, one cooperative solution (0, 0) is better for Country A, and one (1, 1) is better for country B, illustrating the distinction between Pareto-Optimality and distribution.⁴ However, both equilibria are better than the off-diagonal, uncoordinated strategies. Note that policy coordination does not necessarily imply that countries A and B pursue the same policy, only that their trade strategies are coordinated with each other.

As Snidal notes in discussing this game (1985, pp. 931-934), the problem is that neither country can choose its best policy without some assurance concerning what the other intends to do. Easy resolution is hindered by the inherently opposed country interests over where coordination should occur. Unlike the more familiar prisoners' dilemma (PD) game, the problem in this case is one of a choice over multiple stable equilibria. In the PD the problem is to avoid a single stable but Pareto-inferior equilibrium.⁵ It is also important to emphasize that

⁴Schelling (1960) describes such a problem in terms of Holmes and Moriarty, each aboard separate trains, neither in touch with one another, attempting to coordinate the point at which they might detrain. Both benefit from getting off at the same station, with Holmes benefitting most if they detrain together at (0, 0) and Moriarty benefitting most if they detrain together at (1, 1).

⁵If C^A represents the strategy of country A and C^B that of country B, for two strategies 0 and 1, the prisoners' dilemma ordering is:

$$C^A(0, 1) > C^A(1, 1) > C^A(0, 0) > C^A(1, 0)$$

$$C^B(1, 0) > C^B(1, 1) > C^B(0, 0) > C^B(0, 1)$$

The equilibrium (0, 0) is a single, stable, and Pareto-inferior equilibrium. In contrast, the assurance problem takes the general form:

$$C^A(0, 0) > C^A(1, 1) > C^A(0, 1) = C^A(1, 0)$$

$$C^B(1, 1) > C^B(0, 0) > C^B(1, 0) = C^B(0, 1)$$

Here there are multiple equilibria: (0, 0) and (1, 1). In the special form of this game in which there is an agreed best outcome, the ordering

trade negotiations involve non-discrete choices that are not "all or nothing", and which are affected by considerations of both bargaining power and fairness. These and other complexities are taken up below in the discussion of the GATT.

Figure 1 shows the comparative-static relationship between Nash, Stackelberg and cooperative equilibria (see Artis and Ostry, pp. 12-20). Countries A and B are assumed to have preferences defined over agricultural policy goals, notably the level of protection of the agricultural sector. Variables not dependent on agricultural policy are taken as given. Agricultural policy goals are direct functions of the agricultural policy instruments chosen by each country. Each axis, for example, could represent levels of domestic agricultural price support. Assume that the "bliss point" of Country A, in terms of agricultural income, is given by A^* and that of Country B by B^* . These points reflect the impact of price supports on income. Preferences are defined by elliptical indifference curves which fall for A the further they are from A^* , and which fall for B the further they are from B^* . R_A and R_B are reaction functions for each country. They plot the policies of Country A in response to those of Country B, and vice versa, under the myopic assumption that the other country's policy is taken as given.

Equilibria are labeled N (Nash), S (Stackelberg) and C (cooperative). Both the Nash and Stackelberg equilibria are single points; C is not a

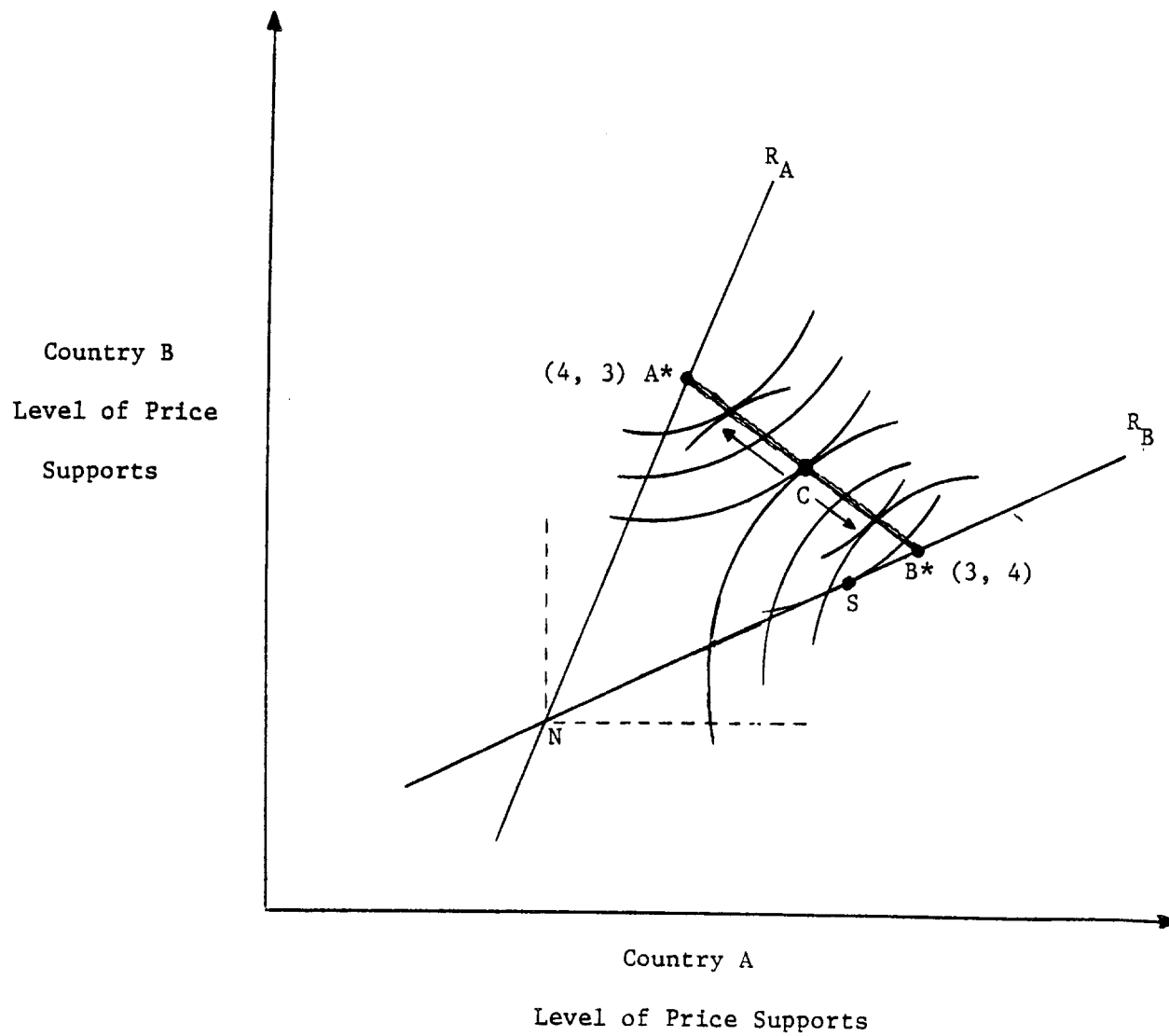
takes the form:

$$c^A(1, 1) > c^A(0, 0) > c^A(0, 1) > c^A(1, 0)$$

$$c^B(1, 1) > c^B(0, 0) > c^B(1, 0) > c^B(0, 1)$$

While retaining the set of multiple equilibria, the problem is now not one of conflict but of being assured of the other country's action (Sen, 1969, pp. 4-5).

Figure 1



single point, but the locus of tangencies between the preference curves of the two countries. The Nash equilibrium is at the intersection of R_A and R_B , since each reaction function describes the myopic optimization of the countries acting individually. The Stackelberg equilibrium shows Country A as the leader: A is not myopic, but determines its own policies so as to force B to adopt policies which, in combination with A's, leave A at its highest attainable indifference curve. Note as well that S lies to the Northeast of N, closer to both bliss points A^* and B^* , implying that leadership can make both countries better off than myopic adjustment.

Finally, the locus of cooperative equilibria stretches from A^* to B^* along the points of tangency between the indifference curves of the two countries. If the "bliss points" A^* and B^* are given a numerical value and the indifference curves surrounding them are thought of as declining contours, it is possible to imagine the points (4, 3) and (3, 4) as two ends of a continuum, linking the diagram to the coordination problem in normal form discussed above. Which point on the continuum will be chosen will depend on the relative bargaining strength of the countries, among other factors (see Snidal, 1985).

However, the achievement of points along the cooperative continuum, requires more than the myopia of Nash and Stackelberg behavior. Solving this problem of strategy requires a form of commitment, in which Country A commits to a cooperative solution conditional on its expectation that Country B will do likewise. As Johnson, Hemmi and Lardinois note in a recent study for the Trilateral Commission:

Although there are good economic arguments for greater market orientation even with other countries standing still, the chances of significantly reducing the degree of protection provided agriculture are far better with all trilateral areas

moving together. The fear that lowering protection unilaterally would result in a flood of imports with little or no prospect of offsetting advantages in international markets makes greater market orientation most unlikely unless carried out in concert with other major importers and exporters of farm products (Johnson and Hemmi, 1985, p. 45, quoted in Paarlberg, 1987).

This conditional commitment can be rationally self-interested where reinforced by strengthened rules of international trade. To provide a formal basis for this reciprocal obligation, the next section considers the role of GATT as a solution to the assurance problem.

4. Reciprocal Obligation and the Assurance Problem

The theory of reciprocity (Sugden, 1984) argues that agents can supply themselves with public goods through conditional commitments. Such commitments do not stipulate that a group member always contributes to a public good. They say only that if others in a well-defined group are contributing, then a group member is obliged to do the same. Well-defined obligations exist to a group to which one belongs and from which one derives benefits. These groups may be local, national, or international, including signatories of international trade agreements. Individual countries signing the GATT treaty, for example, have well defined obligations to maintain an open international trading system.

Let the welfare W_i of each GATT signatory i be an increasing function of the gains from international trade measured by z . This trade creation constitutes a public good. Country welfare is a decreasing function of the resources (political and economic) necessary to overcome domestic efforts at protection, q_i , equivalent to the domestic effort contributed to maintain an open trading system. One way of specifying q_i is the reduction in net effective protection for country i , in relation to a pre-determined base period. Hence:

$$W_i = W_i(q_i, z) \quad (i = 1, \dots, n) \quad (1)$$

If $h_i(q_i, z)$ is the marginal rate of substitution between z and q_i then by definition:

$$h_i(q_i, z) = - (\delta W_i / \delta q_i) / (\delta W_i / \delta z) \quad (i = 1, \dots, n) \quad (2)$$

Two additional restrictions, reasonable for one good (gains from trade) and one bad (efforts to reduce protection) are:

$$\delta h_i(q_i, z) / \delta q_i > 0 \quad (i = 1 \dots n) \quad (3)$$

and

$$\delta h_i(q_i, z) / \delta z > 0 \quad (i = 1 \dots n) \quad (4)$$

World gains from trade are a function of the resources devoted to keeping it free and open by individual countries. These are contributions to the public good. The "production function" for z is thus the weighted sum of individual country efforts to reduce domestic protection.

$$z = f\left(\sum_{i=1}^n \alpha_i q_i\right) \quad (5)$$

The function $f(\cdot)$ is assumed continuous, increasing and concave (or linear in the limit). The parameter α_i (a positive constant) is the "weight" or impact on world gains from trade of the policies of country i , on the assumption that equal effort need not be equally productive for all countries. This opens the possibility of disproportionate contributions by certain countries to an open international trading system. If the U.S. were prepared to concede its 1955 waiver to agriculture, for example, its impact on total gains from trade would be disproportionately felt by the world trading system. Now define a total contribution function $F(\cdot)$ for a given level of country efforts or contributions $\bar{q} = (q_1, \dots, q_n)$ by a group G (signatories of GATT) and a given level of total effort τ , such

that where $\tau \geq 0$,

$$F(G, \tau) = f\left(\sum_{j \in G} \alpha_j \tau + \sum_{k \notin G} \alpha_k q_k\right) \quad (6)$$

This says that for any group of countries G , and level of effort $\tau \geq 0$, $F(G, \tau)$ is the gain from trade that would result if every signatory of GATT had contributed to open trade by a lower level of protection τ and each non-member k had contributed q_k . (This function must be continuous, increasing and concave in τ .) For the GATT signatories, given the contributions of non-signatories q_k , let q_i^G be the value of τ that maximizes $W_i[\tau, F(G, \tau)]$.

Put more directly, if each country i could choose a lowered level of protection for all GATT signatories, this is the level it would choose. The principle of reciprocity says that GATT signatory i is obligated to contribute q_i^G , conditional on every other member of G doing the same.⁶ If countries pursue self-interest subject to these obligations, then country i will make the smallest contribution to reduced levels of protection that is compatible with its obligations to all groups of which it is a member, including the group $G = \{i\}$. Hence, purely domestic self-interest is allowed expression, since every country has an obligation to itself to contribute at least as much (or as little) protection as self-interest requires.

⁶The following formal definitions may be stated (Sugden, 1984, p. 777).

Obligations. For any vector of contributions \bar{q} , for any group G , and for any group member i , i is meeting its obligation to G if and only if either (a) $q_i \geq q_i^G$ or (b) for some other agent j in G , $q_i \geq q_j$.

Equilibrium. An equilibrium is a vector of contributions \bar{q} such that for each country i , given the contributions of other countries, q_i is the smallest contribution that is compatible with all of i 's obligations.

The essential features of this model are that (a) equilibrium exists; (b) it is not necessarily unique; (c) one equilibrium is Pareto-Optimal--the Samuelsonian one in which the marginal rate of substitution between q_i and z is equal to the marginal rate of transformation; (d) every other equilibrium involves undersupply of the public good (Sugden, 1984).⁷ Pareto-inefficient equilibria involving undersupply of the public good are due in the case of GATT to excessive levels of protection by the signatories.

If insufficient effort is expended to reduce these levels, the theory outlined here suggests the assurance problem as an important explanation. Inefficient equilibria are ones in which every country would reduce its level of protection if only they were assured that others would do so too (Sen, 1967; Runge, 1984).⁸ This does not suggest that the problem of protectionism will be solved--only that it can be solved. In theory, even in a world of identical countries, reciprocal obligations can break down in the face of the assurance problem. This breakdown is even more likely where the countries have widely varying objectives (Sugden, 1984, p. 783).

Despite these obstacles, we maintain that the reciprocal obligations defined by GATT can be an important basis for more open international trade. One of the important predictions generated by the theory is that if country j 's level of protection is the same as country i 's, an increase in j 's will be likely to bring about an increase in i 's, and vice versa.

⁷Sugden proves these results for the case of homogeneous agents. Where agents are heterogeneous, the results are qualitatively the same, but the assurance problem is exacerbated.

⁸If the problem were a prisoners' dilemma, then no country would reduce its level of protection, even if every other country did. Protectionism would be a dominant strategy.

If the United States, with a comparatively large influence (α_i) over GATT, reduces its level of protection by conceding its exceptional treatment and reducing its level of domestic subsidies, then the incentive of others to take similar actions will increase (Paarlberg, 1987). However, the overall success of policy coordination will depend on the assurance that the effort is general, and that some countries will not simply free ride by continuing to maintain high levels of protection. An important aspect of this assurance will be the "transparency" of domestic agricultural subsidies, allowing efforts at reducing protectionism to be clearly determined as "subsidy equivalents".

More generally, we conjecture that a critical mass of countries may be necessary to overcome the assurance problem. Schelling (1973) has proposed a framework in which the willingness of country i to contribute is described as a function of the number of others that are expected to do so. Figure 2 shows payoff curves to country i from contributing to the reduction of trade barriers (C) versus a protectionist trade strategy (P). The payoff W_i to country i is a function of the number of other countries that are expected to contribute. Where the P function lies above the C function, protection is a dominant strategy. This is the case until y , at which point a "critical mass" makes the reduction of trade barriers a dominant strategy. It is precisely the function of multilateral trade negotiations (MTN's) such as the upcoming GATT round to generate such a critical mass by negotiating agreements in which each country is assured that a sufficiently large number of others will engage in coordinated trade reforms.

An important feature of MTN's is the degree to which they prompt

optimism that other countries will in fact cooperate to reduce trade barriers. While beyond the scope of this paper, "pessimism" over whether other countries will reduce protectionism is one measure of assurance. Hurwicz (1951) has proposed an index of pessimism, such that the likelihood of a given country choosing a protectionist strategy is a direct function of a "pessimism-optimism index".⁹

⁹If each country follows the pessimism-optimism index of Hurwicz (1951), there exists a critical pair of values (a, b) representing the indices of Country A and B respectively, and contained in the open interval (0, 1), such that if either country actually has an index above this value (is "too pessimistic") then the outcome will be Pareto-inferior. If both countries have greater than critical pessimism, then the outcome will be a Pareto-inferior equilibrium point, equivalent to Sugden's underprovision equilibrium.

Let the index of pessimism of A and B be P_A and P_B respectively, and the strategies be 0 and 1 for C^A and C^B , as in the modified assurance problem (Footnote 5) in which (1, 1) is the agreed best outcome, such as multilateral reductions in agricultural protection. Then Country A will choose protectionist strategy 0 if:

$$P_A C^A(0, 1) + (1 - P_A) C^A(0, 0) > P_A C^A(1, 0) + (1 - P_A) C^A(1, 1)$$

i.e., if

$$P_A > [C^A(1, 1) - C^A(0, 0)] / [C^A(0, 1) + C^A(1, 1) - C^A(0, 0) - C^A(1, 0)]$$

$$= a$$

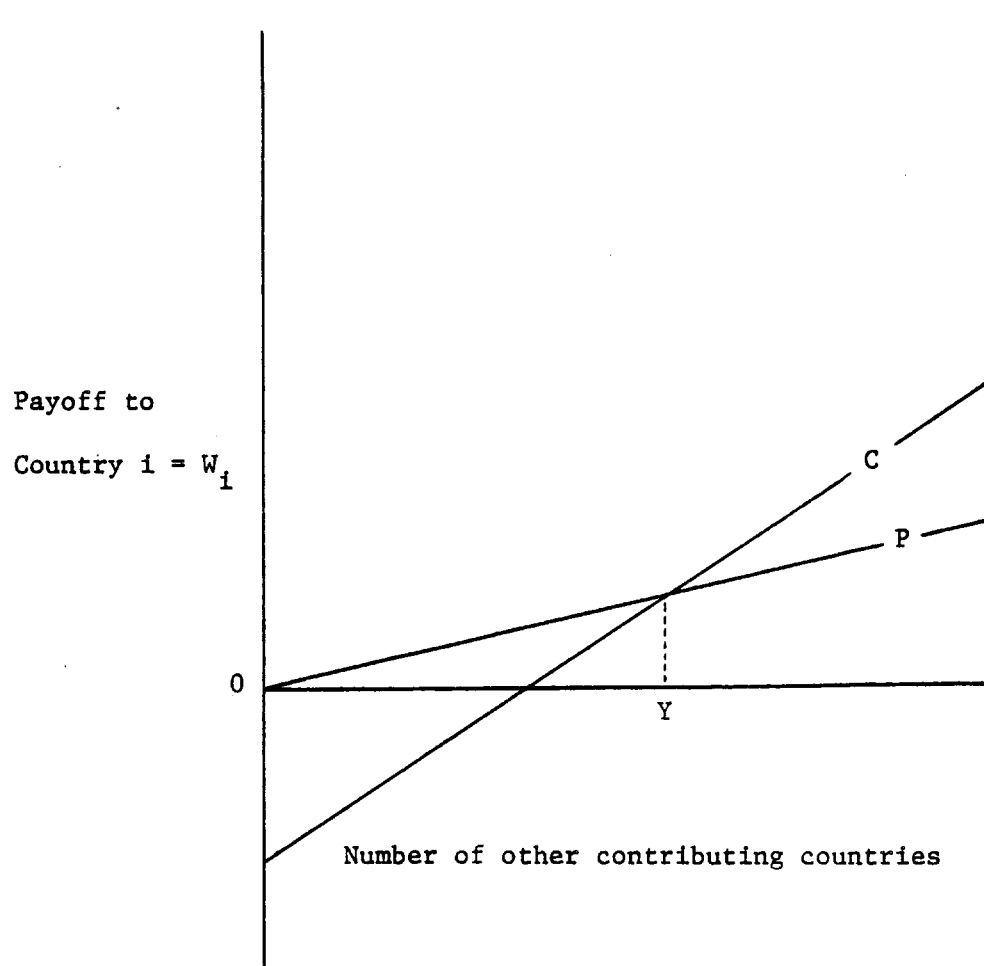
Similarly, Country B will choose 0 if

$$P_B > [C^B(1, 1) - C^B(0, 0)] / [C^B(1, 0) + C^B(1, 1) - C^B(0, 0)$$

$$- C^B(0, 1)] = b$$

If $C^A(1, 1) > C^A(0, 0)$ and $C^A(0, 1) > C^A(1, 0)$ (see Footnote 5), then $0 < a < 1$, and $0 < b < 1$. If $P_A > a$, or $P_B > b$, the outcome will be other than (1, 1), the unique Pareto-optimum. If both hold, the choice will be (0, 0), the underprovision (protectionist) equilibrium (Sen, 1969, pp. 5-6).

Figure 2



Thusfar, we have argued that a structure of reciprocal obligations, encoded in international trading rules such as GATT, provides a basis for the coordination of trade and reduction of protectionism in world agriculture. The principal reason these rules fail is the assurance problem, which is exacerbated by the heterogeneity of interests and lack of enforcement typical of international public goods. Despite these difficulties, such rules are capable of improving the welfare of all those who subscribe to them, especially if a critical mass of others is expected to do so. However, the judgements leading to this assurance involve "repeated plays", as nations formulate and reformulate their trade strategies. In order to capture this aspect of trade negotiation, a final level of analysis is now developed, expressed in the framework of a dynamic game.

5. Trade Policy as a Dynamic Game

International trade policy is formulated on the basis of a set of expectations that each nation holds regarding the strategies of other nations, based on a process that is played out over time. Viewing negotiated reductions in agricultural protectionism as a dynamic problem leads to a deeper recognition of the role of international institutions in establishing secure expectations concerning the behavior of other trading nations. Karp and McCalla (1983), in an early application of dynamic game theory to agricultural trade, argue that

"Where an agent is in a position to exercise power, it is unreasonable to suppose that he is either ignorant of this fact or acts as if he were. It is equally unlikely that he will make the mistake of assuming that he is free to act without inviting reprisals. This kind of world involves power, reaction functions, strategies, and feedback and is inherently dynamic" (Karp and McCalla, 1983, p. 641).

In addition to a structure of reciprocal obligation, a basic purpose of GATT rules is to define those forms of protectionism that are valid (e.g., tariffs) and to fix, over the relevant future, the levels of protection which each nation may employ. By "binding" these levels of protection, it is possible for GATT signatories to be assured that the policies of other nations will not suddenly be changed once a commitment to lowered protection has been made. In a dynamic context, solving the assurance problem requires such rules, for in their absence, a decision to lower protection can simply victimize the country that does so.

This problem is known formally as the "time inconsistency of optimal plans" (Kydlund and Prescott, 1977). It is illustrated by the case of "zero-binding" tariffs on U.S. soybean and livestock feed exports to the European Community. During 1961-62, the "Dillon Round" of trade negotiations provided for the largest concession ever granted to the U.S. in GATT. In granting zero duties to soybeans, vegetable oils, and nongrain feed items such as corn gluten feed, the U.S. bound GATT signatories, including the countries of the emerging European Community (EC), to a policy which allowed access to the large European market for American feed products. The EC was not then in a position to supply their feed demands from domestic production. Over time, however, as European production of livestock feed grew, it became increasingly obvious to EC producers that they could capture this market by changing the rules and erecting protectionist barriers to these U.S. imports. Under Article XXVIII of the GATT Treaty, however, once the "binding" had been given, it could not be reneged without acceptable compensation, and retaliation is explicitly allowed if no such compensation is forthcoming. When livestock

feed interests within the EC, in subsequent attempts to "complete the Common Agricultural Policy," have argued in favor of closing the European market to U.S. soybeans and corn gluten feed, they have been deterred largely due to the GATT binding (Paarlberg, 1987).

More formally, consider the case in which a "dominant player", (such as the EC) commits itself to a particular policy, such as the zero duty binding provisions of 1961-62. Let the objective function of Country A, the dominant player, be defined over the "bliss point" A^* in Figure 1, such that the optimal policy is to minimize deviations from A^* . In a dominant player game, the leader minimizes deviations from the objective A^* , taking into account the existing conditions affecting trade and the other players' decision rules. Given an initial state, the dominant player, exercising Stackelberg leadership, solves the following 2-period problem:

$$\min_{(X_{A1}, X_{A2})} W_A \sum_{t=1}^2 (y_t - A^*_t)' K_{At} (y_t - A^*_t) \quad (7)$$

Subject to (in the open loop case):

$$y_t = b_{y0} + H_A X_{At} + H_B X_{Bt} \quad (8)$$

$$X_{B1} = r_{B1} (y_0, X_{A1}, X_{A2})$$

$$X_{B2} = r_{B2} (y_0, X_{A1}, X_{A2})$$

$$y_0 \text{ given}$$

or

Subject to (in the feedback case):

$$y_t = b_{yt-1} + H_A X_{At} + H_B X_{Bt} \quad (9)$$

$$X_{B1} = V_{B1} (y_{t-1}, X_{A1})$$

$$X_{B2} = V_{B2} (y_{t-1}, X_{A2})$$

$$y_0 \text{ given}$$

W_A expresses the sum of deviations for Country A from its bliss points, A^*_t , in the two periods ($t = 1, 2$). It seeks to minimize these deviations through policies (decision rules) X_{A1} and X_{A2} , one for each of two periods, given a vector of state variables Y_t . K_{At} is a given (symmetric positive semi-definite) matrix of coefficients reflecting the effect of the current state on the objective function value. H_A , H_b , and b are vectors of coefficients (Chow, 1983). X_{B1} and X_{B2} are the policies (decision rules) of Country B in periods one and two. In the open loop case, Country B's policies are a function of the initial state, y_0 , and the policies of Country A in both periods. In the feedback case Country B's policies are a function of the current state and Country A's policy in that period.

The difference between the open loop and feedback cases is the nature of the constraints. In an "open loop" solution, the dominant player announces policies that are intended to hold for the relevant future (here two periods) as functions of the initial state. However, an "open loop" structure creates incentives to renege on this policy in subsequent periods. In a "feedback" solution, policies are pursued that are optimal given the initial state, and "rolling plans" are formulated at each point in time to reflect the conditions of the (then) current state. The key distinction between feedback and open loop solutions is that the dominant player's decisions in the case of feedback are time consistent because there is no incentive to renege. The incentive to renege makes the open loop solution time-inconsistent.¹⁰

¹⁰Time inconsistency also arises in "closed loop" dominant player games. Closed loop decision rules are functions of the current state as are feedback rules but give very different answers in general. The

Which solution is used is of critical importance. The feedback solution is inferior to the open loop solution because the dominant country does not take into account in period 2 the influence X_{A2} has on X_{B1} . The feedback solution is, however, time consistent while the open loop solution is not. In fact, any systematic relationship between expected and actual future decisions can cause time inconsistency. Time inconsistency arises when the original decision rules for X_{A1} and X_{A2} are no longer optimal if Country A resolves the problem in period 2. If Country A is continually tempted to renege on its level of protection then the game may fall into disorder as early as the first period (Kyland, 1977).

If, as Karp (1982) argues, GATT negotiations are akin to open loop solution strategies, the need for assurance provided by GATT rules is of paramount importance due to the incentive to renege. Kyland and Prescott (1977) have argued that whenever such time inconsistency arises, policy rules such as the GATT binding are superior to the use of "discretion". If GATT is in fact an "open loop" dynamic game, one of the dangers of new rounds of negotiations is the temptation to renege on earlier agreements that appear suboptimal to groups such as the EC in light of changed market conditions. If EC interests are successful in "completing the CAP" by countermanding the zero-duty binding, for example, they will further

feedback decision rules are obtained by a dynamic programming algorithm.

In the open loop solution Country A's decision rules are of the form:

$$X_{At} = z^*_{At}(y_0) \quad (t = 1, 2)$$

Where z^* is an equilibrium solution to Country A's policy problem. Country A "announces" both X_{A1} and X_{A2} to Country B at the beginning of the game. In the feedback solution decision rules are of the form:

$$X_{At} = C^*_{At}(y_{t-1}) \quad (t = 1, 2)$$

where C^* is again an equilibrium solution to Country A's policy problem. Country A announces X_{A1} in the first period and X_{A2} in the second.

reduce the level of free trade in agriculture. While narrowly self-interested, this loss in trade will be borne by all trading nations as the cost of granting such discretion rather than holding to GATT rules. In this light, it is clear that the GATT rules provide assurance of continued benefits in a dynamic framework.

6. Conclusions

In the years since the GATT treaty was signed, agriculture has been transformed. Increasing integration of world markets, accompanied by shifting patterns of production and substantial instability in both supply and demand, have led to disequilibrium in world agriculture. Domestic efforts to protect agricultural sectors from this instability have raised barriers to trade, leading agriculture to be regarded as increasingly out of step with trade liberalization in other sectors. The Uruguay Round of trade negotiations offers an opportunity for institutional innovations that can bring greater freedom to world markets, reducing the international and domestic costs of protectionism in agriculture. However, it is highly unlikely that this liberalization will be achieved through hegemonic authority or international institutions alone, neither of which is sufficient to provide the impetus for reform.

The reasoning of this paper may be summarized as five key points. First, gains from more open agricultural trade are in large part public goods. Benefits are distributed and costs are concentrated on non-competitive sectors, leading to incentive problems which pose fundamental challenges to trade negotiators. These challenges can be faced only by acknowledging the difficult domestic reforms necessary for more open trade, and the considerable political and economic effort that must be

expanded to overcome interest groups threatened by the process of liberalization.

Second, the position of the U.S. in the GATT is based on the 1955 waiver and a variety of general exclusions granted to agriculture. These reflect an earlier influence which has faded with U.S. hegemony in world markets. However, the U.S. remains disproportionately influential as a source of trade policy reform, in part because the "marginal productivity" of removing the 1955 waiver is large. Nonetheless, unilateral trade policy reform is far less likely to succeed than coordinated efforts inside (and outside) of GATT.

Third, the need for coordination arises from the reciprocal obligations encoded in the GATT treaty itself. The theory of reciprocity outlined above emphasizes that such rules of obligation can provide the basis for trade liberalization, if the assurance exists that the effort will be jointly pursued by all members of the GATT. It predicts that the lower the level of support for domestic trade liberalization that is signaled by the U.S., the less likely other countries are to pursue similar strategies. A critical mass of countries favoring such liberalization, perhaps in the form of the U.S. and the "Cairns Group", would appear to be necessary to overcome this assurance problem. Even so, the heterogeneity of country interests will make the process exceedingly difficult.

Fourth, the problem of clearly establishing obligations under GATT suggests the importance of "transparent" measures of effort, such as "subsidy equivalents". Without these measures, it will be difficult to determine whether obligations defined under GATT rules are in fact being

observed. Recent work in this area by OECD and the U.S. Department of Agriculture represent a promising beginning.

Fifth, the "binding" character of GATT rules provides a vital degree of assurance in the face of dynamic changes in world market conditions which would otherwise lead nations to renege on earlier agreements. This "time-inconsistency" underscores the instability and backsliding which would characterize world trade in the absence of GATT rules.

If the analytical description we have offered is accurate, it suggests that clear gains are possible from policy coordination in world agriculture. These gains can be achieved in principle. Whether they will be achieved in practice is a question of the skill and resolve of the GATT participants.

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