THE VALUE OF MFN TREATMENT

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ABSTRACT

We discuss most favoured nation (MFN) treatment in trade agreements, suggesting that its value to individual countries depends critically on the relevant model solution concept used to evaluate it. We analyze both rights to MFN treatment in foreign markets, and the obligation to grant MFN treatment in home markets; the heart of the post-war GATT/WTO multilateral trading system. In a traditional competitive equilibrium framework, MFN gives benefits to small countries in being able to free ride on bilateral tariff concessions exchanged between larger countries in GATT/WTO negotiating rounds. In a non-cooperative Nash equilibrium framework, MFN restrains retaliatory actions to be non-discriminatory. In a co-operative bargaining framework in which trade policies are jointly set, MFN changes the threat point and hence affects the bargaining solution. We use a calibrated numerical model of global trade in which we compute all three solution concepts and compare MFN and non MFN equilibria for each. We use the GTAP (1992) data base, concluding that quantitatively the most significant effect of MFN seems to be in its impact on bargaining rather than on competitive and Nash equilibrium solutions; being beneficial to smaller countries.

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1. INTRODUCTION

The principle of non discrimination states that countries should grant other countries their most favoured nation (or MFN) treatment and lies at the heart of the post-war GATT/WTO trading system. It stands in GATT Article 1 as the central GATT obligation that contracting parties grant to all other contracting parties in their own market, and simultaneously as the major GATT right that contracting parties can demand of other contracting parties in markets abroad. While in practice MFN operates as a diluted principle through GATT/WTO sanctioned trade discrimination covering regional trade agreements (Article 24), trade in products such as textiles and apparel (Multi Fibre Arrangement (MFA)), and in the use of trade instruments such as anti-dumping/countervailing actions (Article 6), it is still the central benefit from system participation that is aggressively sought by potential new entrants to the WTO (such as China). It is also the principle whose application smaller countries tried to strengthen in the Uruguay Round, and the principle to which larger powers in the system are supposedly still committed.

Despite its central role, there is little literature that attempts to evaluate the significance of MFN to various types of countries. Here we suggest that different countries receive different types of benefits from and incur different costs with their MFN rights and obligations, and we use numerical simulation techniques to investigate their implications by focusing on three different model solution concepts; comparative static competitive equilibria, tariff game Nash equilibria, and bargaining solutions (with side payments), each of which is affected in different ways by the MFN commitment. We model MFN as a constraint on the relevant model solution concept, and use a 7 region global trade model calibrated to the 1992 GTAP Version 3 data base (Hertel et. al. (1996)) to compute and compare across equilibria, and hence value MFN. In so doing we draw on code and model structure used earlier by Perroni and Whalley (1994).

For smaller countries, their ability to free ride through MFN on trade concessions agreed to bilaterally by large countries in their own trade negotiations is a clear benefit of MFN. This has been extensively discussed in the literature, including in Baldwin and Murray (1977), and here we investigate this by computing comparative static competitive equilibria under MFN and non MFN bilateral tariff elimination between the large regions (North America and the EU). We compare the outcomes under each change to the base case to which the model is calibrated.

We also analyze the effects of the constraints that MFN imposes on retaliation, should it occur in the system, as restrictions which imply that small countries cannot be singled out for retaliatory trade actions. Even though a global round of trade retaliation would very likely result in violations of GATT/WTO tariff bindings, we compute MFN constrained and MFN unconstrained retaliatory Nash equilibria, again comparing outcomes for each region to the 1992 benchmark model solution.

Finally, we evaluate the effects of constraints that MFN imposes on trade bargaining. The benefit here for smaller countries is that they cannot be forced into making concessions (via side payments) through bilateral bargaining with larger countries, since under MFN all bargaining is effectively multilateral. For larger countries, this feature of MFN treatment potentially involves a significant cost; since countries forgo the opportunity to separately bilaterally bargain with a number of smaller countries. We compute both Nash (1950) and Kalai-Smorodinsky (1975) trade policy bargaining outcomes supported by appropriate side payments; the effect of MFN being to change the threat point, and hence affect the bargaining outcome. We interpret side payments in trade policy bargaining as domestic policy restraints (such as intellectual property protection) which are advantageous to large countries.

In using the 1992 base data set OECD tariffs are already low, and hence our numerical simulations suggest that for smaller countries the value of MFN treatment in the first sense is small. Incremental gains globally from MFN rather than MFN tariff elimination between the US and the EU are at most US $3-4 billion per year. Our model results also show small gains for smaller countries and small costs for larger countries from the MFN treatment in the second sense (MFN restraints on retaliation). This is because when global retaliation occurs, the influence that countries have over their terms of trade with all other countries reflects their being able to restrict their trade in aggregate rather than that with individual countries. Results suggest the benefit (if a small country) of not being selectively targeted for retaliation is relatively small.

In contrast, the benefits from MFN treatment in the third sense emerge from our model calculations are large. Smaller countries benefit substantially from not being forced to bargain bilaterally with large countries (with side payments). Bilateral bargaining with large countries, as against multilateral bargaining, gives large countries access to extreme threat points which can be used to extract maximal concessions. Multilateral non discriminatory rules prevent the use of such threat points. We suggest that this potentially explains why it is that smaller countries remain so concerned with non discrimination in the trading system, and the concerns among smaller countries emphasized during the Uruguay Round over the weakening of multilateral disciplines associated with the surge of regional trade arrangements which occurred contemporaneously to the Round.

Our simulations suggest that for larger countries MFN obligations impose a substantial cost on them insofar as they forgo the opportunity to bargain bilaterally on trade policy with small countries, or if they do so, it must be within the framework of a set of multilateral disciplines. One implication of this is the change in trade arrangements brought about by the end of the cold war. In the early post war years, when the strategic interests of the large powers overrode their immediate trade interests, MFN treatment was often granted to smaller countries as a way of securing strategic alliances. Accession to GATT by smaller post colonial countries in the 1960's occurred with little or no conditionality. In the post cold war period, however, where trade interests dominate, larger powers instead seek ways of proceeding bilaterally despite earlier MFN obligations. The system erodes, and more bilateral pressure is exerted by larger powers. In such a regime, smaller countries will need to offer asymmetric trade concessions (effectively side payments) to maintain an MFN based system, as indeed many of them have done

We conclude by noting that despite our analysis and model results, recent game theoretic literature questions the significance of any negotiated trade (or other) commitments including MFN. This is because the Folk theorem stresses how any outcome that Pareto dominates the threat point utilities can be supported as a subgame perfect equilibrium of a repeated game.[2] This theorem thus emphasizes the multiplicity of equilibria potentially emerging from trade policy games, and suggests that supporting mechanisms, not negotiated commitments, are the key to understanding trade policy. Despite these considerations, however, multilateral trade negotiations have continued apace in the postwar years, with ever widening negotiated trade commitments being linked with other international treaty networks to support their enforcement. Thus, eight postwar GATT/WTO negotiating rounds have occurred, and the central role that the resulting trade disciplines now play in modern trade policy to us justify trying to better understand the implications of MFN using the numerical simulation exercises we present.

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[2]Also see the discussion of this point in Perroni and Whalley (1996) p.59. This same argument could also be made for domestic as well as international law, namely that legal commitments are less the issue than enforceable cooperation via supporting strategies.

2. A MODEL FOR VALUING MFN TREATMENT

2.1 Background

As we note in our introduction most favoured nation treatment, or MFN, implies that countries extend to other countries the same trade treatment as that granted to their most favoured trading partners, effectively a rule that no country will discriminate against other countries in its use of trade measures at the border. In policy based literature there is a widely held presumption that small countries benefit from MFN in not being discriminated against, and large countries lose since they forgo the opportunity to extract beneficial trade terms from smaller trading partners through bilateral pressure.[3] MFN became the cornerstone of the modern GATT/WTO system in 1947 when it was enshrined as the central principle of the General Agreement in Article 1.

To assess how MFN treatment affects individual countries, both through rights to MFN in markets of trading partners and own country MFN obligations towards other countries, we use a numerical 7 region global trade model, calibrated to 1992 trade, consumption, and production data by region. The regions we consider are Australia-New Zealand Japan (ANJ), Rich Asia (RIA), Poor Asia (POA), North America (NAF), South America (SAM), Europe (EUR) and the Rest of the World (ROW). The production, consumption, and trade structure of the model is similar to that used earlier by Perroni and Whalley (1994) to evaluate the insurance component of new regional trade agreements such as NAFTA, where they compute both Nash bargaining and Nash retaliatory equilibria.

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[3]A number of recent pieces, however, touch on related issues. Bond and Syropolous (1996) discuss the size of trading blocs and the world welfare implications, Ludema (1996) discusses the value of preferential arrangements in multilateral trade negotiations, and Siedman and Winter (1997) discuss the endogenous expansion of preferential trading arrangements.

We numerically explore three solution concepts for the model, each one relevant to the three senses of MFN set out in the introduction above.

(i) *Competitive Equilibria.* We compute counterfactual competitive equilibria (without retaliation) for both MFN and non MFN trade policy changes by the large regions in the model (North America and the EU); comparing each counterfactual solution to the base case (1992) model solution. Results of these comparisons are used to value the first element of MFN treatment we stress above, namely access benefits under MFN from trade liberalization by other countries. From a small country perspective, the MFN benefit here is the ability to free ride on bilaterally agreed tariff reductions extended multilaterally to all parties through Article 1 of GATT/WTO.

(2) *Non-Cooperative Nash Equilibria.* We also compute post-retaliation non-cooperative Nash equilibria for global tariff games with and without an MFN restraint applying to retaliation by individual regions against other regions. Under such an MFN restraint, countries who use retaliatory trade actions must use the same measure against all countries, without any country differentiation in retaliatory tariff rates. These computations allow us to assess the benefits of MFN to smaller countries (and costs to larger countries) in not being selectively discriminated against in a non-cooperative retaliatory trade war.[4] These involve the admittedly strong assumption that in a trade war, even if countries violate their GATT/WTO bound tariff levels, they still abide by the terms of GATT Article 1.

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[4]This is related to the issue of how bloc size affects Nash tariffs, and hence world welfare. See Haveman (1996) for a recent discussion.

(3) *Bargaining Outcomes (with Side Payments).* We finally compute cooperative bargaining solutions to the model to enable us to assess the impact of MFN treatment on the outcome of trade negotiations. We model cooperative agreements on trade as needing supporting mechanisms to achieve mutual agreement in the form of side payments. We interpret side payments in trade policy negotiations as the value of concessions made on domestic policies (intellectual property, services regulation, GSP graduation, energy and resource royalties, domestic tax treatment and other measures) that countries can make as an accompaniment to trade bargaining rather than as payments of cash (which do not occur in current trade policy bargaining). We make calculations of what side payments might be needed by small regions to support free trade under non-MFN and MFN trade bargaining by comparing across model solutions for alternative bargains; and hence the value (or cost) of MFN as a restraint on bargaining. We trace out inter-regional utility possibility frontiers using alternative side payments, adopting alternative axiomatic bargaining solution concepts (Nash (1950), Kalai-Smorodinsky (1975)).

2.2 The Model

The 7 region global trade model captures trade, consumption and production, as well as tariffs by region, and is related to that used earlier by Perroni and Whalley (1994) to value the insurance component of NAFTA and other regional trade arrangements.

Production

The model assumes regionally differentiated products (the Armington assumption), with each region, *j*, producing only one good, which it both consumes and exports. Consumers in region *j* demand both the region *j* good, and a composite of goods from other regions (imports) which enter into preferences as a composite imported good. We take the single good in each region to be in fixed supply, $\bar{S}^j$, ($j = 1 \ldots\ldots\ldots K$); *K* denotes the total regions. This treatment implies that regional offer curves in the model are determined solely by endowments and preferences; effectively a pure exchange formulation.

The one good per region treatment reflects dimensionality restrictions when computing Nash retaliatory (optimal tariff) equilibria. These are discussed both in Perroni and Whalley (1994), and in Hamilton and Whalley (1983). Earlier literature (Johnson (1954), Gorman (1957), Kuga (1973)) has typically used simple functional forms (constant elasticity excess demand functions) in which optimal tariff setting elicits no further response, and computation of Nash equilibria is trivial. Subsequent literature has used more conventional demand functions, for which Nash equilibrium computation requires repeated iteration. The difficulty of calculation increases rapidly both with regions and goods. Most other literature uses 2 x 2 or 3 x 3 formulations; and so in using 7 regions here we generalize earlier analyses.

Preferences

Demands in region *j* are determined by utility maximization subject to a regional budget constraint. We assume a representative consumer for each region and use CES preferences, where

$$U^j = (\alpha_D^j \ D_j^{\frac{\sigma_j - 1}{\sigma_j}} \ + \alpha_c^j \ C_j^{\frac{\sigma_j - 1}{\sigma_j}} \ )^{\frac{\sigma_j}{\sigma_j - 1}} \qquad (j \ = \ 1 \ldots\ldots\ldots K) \qquad (1)$$

and U^j defines utility, D_j and C_j are quantities of the domestic (own region) good and the composite import good consumed by region j. α_D^j and α_c^j are share parameters in region j's preferences applying to the domestic and composite import good, and σ_j is the top level CES substitution elasticity in region j's preferences.

The import composite for region j, C_j, is, in turn, treated as a CES aggregate over the imports M_i^j purchased by region j from region i, ie.

$$C_j = \left[\sum_{i \neq j} \beta_i^j \ M_i^{j \ \frac{\lambda_j - 1}{\lambda_j}} \right]^{\frac{\lambda_j}{\lambda_i - 1}} \qquad (j = 1 , \ldots\ldots\ldots\ldots K) \qquad (2)$$

where β_i^j are CES share parameters on imports by region j from region i, and λ_j is the bottom level CES substitution elasticity parameter in region j. Tariffs affect demands by raising the price of imported goods, and generate a substitution effect away from imports towards domestic products. Tariffs also raise revenues, which are treated as recycled to consumers as lump sum transfers, and hence affect incomes.

Policy Interventions

In non-MFN case, we consider each region to have available to them the use of regionally discriminatory tariffs, t_i^j, i.e. tariff rates on imports by region j from region i. Revenues raised by these tariffs are given by

$$R_j = \sum_i \ t_i^j P_i M_i^j \qquad (3)$$

where R_j refers to aggregate tariff revenues raised in region j, and P_i is the sellers price (the world price) of good i (sold by region i to region j).

In the various model solutions where we consider the effect of MFN treatment on individual regions, we impose the condition on tariff setting that

$$t_i^j = t_k^j \ ; \ \forall i,k \ ; \ i \neq j, k \neq j. \tag{4}$$

In non MFN cases tariff rates in all regions remain unrestrained by condition (4).

Competitive Equilibria

For given tariff rates in all regions (treated as exogenous), we compute global competitive equilibria for the model. These involve market clearing in each country specific product, government budget balance in each region, $(K - 1)$ relative goods prices, and K revenue levels in each country; with all of these endogenously determined in equilibrium. We make equilibrium computations using the GAMS (Generalized Algebraic Modelling System) Software due to Brooke, Kendrick and Meeraus (1988)).

More concretely, if income in region j, I^j, is given by

$$I^U = P_j \bar{s}^j + R^j \tag{5}$$

where tariff revenues in region j R^j are given by

$$R^j = \sum_{i \neq j} t_i^j P_i M_i^j, \tag{6}$$

and domestic demands in each region are

$$D_j = \frac{{\alpha_D^j}^{\sigma_j} I^j}{\left[(\alpha_D^j)^{\sigma_j} P_j^{1-\sigma_j} + (\alpha_c^j)^{\sigma_j} (P_j^M)^{(1-\sigma_j)} \right] P_j^{\sigma_j}} \tag{7}$$

where P_j^M is the composite import price in region j given by

$$P_j^M = \left[\sum_{i \neq j} (\beta_i^j)^{\lambda_j} [(1 + t_i^j) P_i]^{(1-\lambda_j)} \right]^{\frac{1}{(1-\lambda_j)}} \tag{8}$$

it follows that exports by region j, X_j, are given by

$$X_j = \bar{S}^j - D_j \ . \tag{9}$$

The demand in region j for the regional import composite, C_j, is given by

$$C_j = \frac{(\alpha_c^j)^{\sigma_j} I^j}{(P_j^M)^{\sigma_j} [(\alpha_D^j)^{\sigma_j} (P_j)^{(1-\sigma_j)} + (\alpha_c^j)^{\sigma_j} (P_j^M)^{(1-\sigma_j)}]} \tag{10}$$

and demands in region j for imports from region i are given as

$$M_i^j = \frac{(\beta_i^j)^{\lambda_j} (P_j^M C_j)}{((1 + t_i^j) P_i)^{\lambda_j} \left[\sum_{i \neq j} (\beta_i^j)^{\lambda_j} [(1 + t_i^j) P_i]^{(1-\lambda_j)} \right]} \tag{11}$$

The total demand for the exports of any region, l, is given by

$$T_l = \sum_{j \neq l} M_l^j \ ; \ \forall l \tag{12}$$

and, in equilibrium, prices of the K regional products P_i and the K tariff revenues R^j, are such that

$$T_l = X_l \qquad ; j \forall l. \tag{13}$$

As only relative product prices matter in this system, a numeraive (the price of one of the regional products) can be chosen, or a price normalization (such as $\sum_i P_i = 1$) can be used.

Non-cooperative Nash Equilibria

We compute non-cooperative Nash equilibria in this model using a tariff game structure similar to set out in Johnson (1954). Unlike in the competitive equilibria above, for this solution concept tariff rates are endogenously determined rather than set exogenously, and reflect country utility maximization across global competitive equilibria. Tariff rates for each region are obtained by maximizing own country welfare subject to global market clearing; in effect, solving a series of optimization problems across regions in which other region tariffs are successively taken as exogenous. These optimization exercises are repeated until mutual consistency is obtained i.e. tariff rate values for regions taken as exogenous in other regions optimization problems are the solutions for the corresponding own region's optimization problem.

More formally, when computing non-cooperative Nash equilibria, given tariff rates, t^k_j, in all other countries $k \neq j$, and the competitive equilibrium conditions (13) for each region j, we repeatedly maximize (1) to generate a set of endogenously determined optimal tariffs, t_j^l, as a best response to the other region tariff rates t^k_j, $k \neq j$. We represent these reactions functions as

$$\hat{t}_j^l = r(t_j^k; k \neq j) \tag{14}$$

In a non-cooperative Nash equilibrium, best response tariff rates generated by regional optimizing behaviour are mutually consistent across all regions i.e.

$$\hat{t}_j^l = r(\hat{t}_j^k) \;\; k \neq l \quad \forall_l \tag{15}$$

We compute Nash equilibria for cases where both MFN restraints (4) apply to retaliation (best responses) by region (i.e. t_j^l are the same for all j) and also for cases where MFN restraints are absent.

Bargaining and Side Payments

We also compute both Nash (1950) and Kalai-Smorodinsky (1975) bargaining solutions for the model to evaluate the impact of MFN treatment on trade policy bargaining. MFN treatment excludes pairwise bargaining between regions because of its non-discrimination provisions, and is advantageous to small countries since they cannot be selectively pressured by larger countries using threats of bilateral actions against them. The effect of MFN is thus to constrain admissible threat points in bargaining. By the same token, MFN treatment is disadvantageous to large countries since they forgo their opportunity to bilaterally pressure small countries into asymmetric trade concessions.

We compute solutions to the model under different bargaining solution concepts so as to give a range of measures of bargaining outcomes. Thompson (1994, p. 1242) surveys axiomatic bargaining solution concepts and describes 9 different axiomatic solution concepts, suggesting that Nash and Kalai-Smorodinsky are the most widely used. We implement these two model solution concepts by tracing out a utilities possibility frontier for the parties to the bargain, which we generate by parametrically varying side payments between them and computing Pareto optimal (zero tariff competitive equilibria) allocations. We take the Nash non-cooperative equilibrium to be the threat point, and compute bargaining outcomes under both Nash and Kalai-Smorodinsky axioms.

As with non-cooperative Nash equilibrium computation, there are difficulties with dimensionality in computing such outcomes. Generating the utilities possibility frontier in high dimensional space is tedious, because it does not reflect an analytical solution. We limit ourselves to various pairwise bilateral bargaining between large and small countries, arguing that such bargaining would be ruled out by MFN treatment, and that the value of MFN for small countries in the third sense above lies in avoiding such bilateral bargaining, or for large countries lies in the cost of forgoing such opportunities. We approximate the frontier for each pairwise bargain by the utilities generated in a sequence of computed equilibria under pairwise bilateral transfers.

More specifically, for the two regions that are party to the bargain, we compute mixed cooperative/non-cooperative equilibria in which the parties to the bargain can potentially engage in trade retaliation one against another, while the other non-bargaining parties play passively and maintain their base year tariff levels. This equilibrium defines the threat point for the bilateral bargain. Using iterative permutations of side payments, we then trace out a frontier of feasible utilities for the parties to the bargaining by computing cooperative equilibria in which the regions involved eliminate their tariffs. Each point on the frontier is supported by a particular configuration of side payments between the parties; the threat point being given by utility levels in the non-cooperative (retaliation) equilibrium.

Thus, if T_i^j represents the payment received (or made, if negative) by j from i, the income equation (5) is modified to

$$I^j = P_j\bar{S}^j + T_i^j \tag{16}$$

where, by construction

$$\sum_i \sum_j T_i^j = 0. \tag{17}$$

Appealing to Nash's (1951) axioms, we use a Nash criterion for a bargaining solution to the model. As noted above, this is the best known of the various axiomatic bargaining solution concepts and maximizes

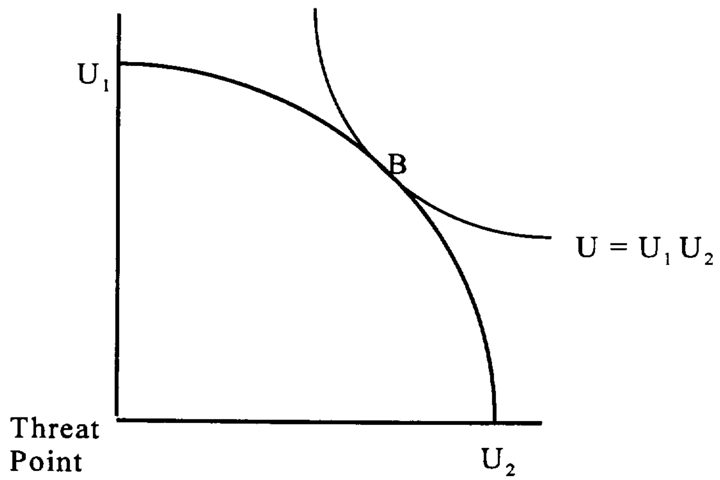
$$\mathrm{U} = \prod_l (U_l - U_l^R) \tag{18}$$

with U_l representing region l's utility on the generated utility possibility frontier (l referring to the regions involved in the bargaining), and U_l^R referring to region l's utility at the threat point, R. This and other axiomatic bargaining solution concepts are discussed in more detail in Thompson (1994), who among other things points out that such bargaining solutions are not invariant to a monotonic transformation of individual region utilities.

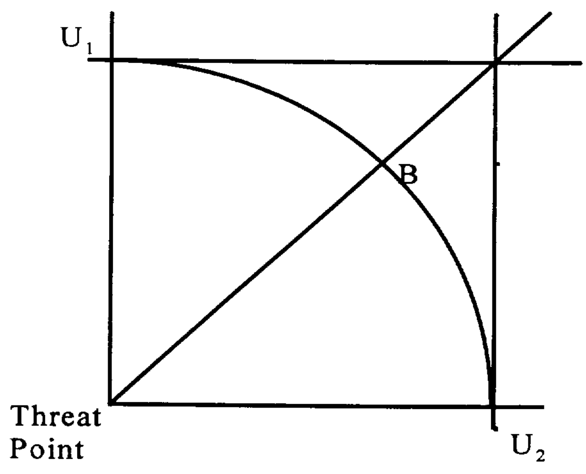
We also make computations using the Kalai-Smorodinsky (1975) solution concept. The difference between this concept and Nash is shown in Figure 1. While Nash maximizes a criterion function subject to the utilities possibility frontier, Kalai-Smorodinsky takes maximal utilities for regions and constructs a ray through the utilities possibilities set from the origin to the point B on the frontier. Thompson (1994) also discusses the properties of this solution concept.

Figure 1
Nash and Kalai-Smorodinsky Bargaining Solutions
(B denotes Bargaining Outcome)

Nash



Kalai-Smorodinsky



3. PARAMETERIZING AND IMPLEMENTING THE MODEL

We have numerically implemented the model set out above using calibration to a benchmark global equilibrium covering consumption, production, trade, and tariffs for seven regions for 1992.[5] Calibration is the procedure described in Mansur and Whalley (1984) and Shoven and Whalley (1992) under which the first use of the model is to solve for model parameter values given an initial (or base case) equilibrium represented by data, rather than the more usual computation of equilibrium given model parameters. This procedure, in effect, imposes equilibrium as an identifying restriction on the model parameterization used. If simple functional forms (Cobb-Douglas) are used, calibration is sufficient to exactly identify all model parameter values. With the CES forms used here, substitution elasticity parameters are required prior to implementing calibration procedures. We draw here on literature values of import demand elasticities by region to guide the key trade elasticities in the model.

In producing a data set to which we calibrate the model, we first aggregate unadjusted GTAP country data into regional data. The classification linking countries for which data is reported in the GTAP data base and the regions used in the model is shown in Table 1. We have chosen the seven regions in the model to reflect both large trade entities and significant geographical groupings. We make adjustments to the raw GTAP data so as to satisfy both trade balance conditions and other equilibrium conditions required by the model, including market clearing by product.

Table 2 reports the resulting base case data for 1992 on production and bilateral trade for the seven regions in the model. The value of production in these regions implies a gross world product

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[5]As noted above, the regions are Australia, New Zealand, Japan (ANJ), Rich Asia (RIA), Poor Asia (POA), NAFTA (NAF), South America (SAM), Europe (EUR), and the Rest of the World (ROW). We use data from the GTAP (Version 3) data base (see Hertel et al (1996)) for 1992.

of $20.6 trill. in 1992. The large regions are NAF and EUR; the small regions are RIA, POA, and SAM. Our base period tariff data come from the same GTAP source, and are shown in Table 3. These include both tariffs and ad valorem equivalents of quotas and other trade policy interventions. In reality, MFN trade rules already apply in the base case, but in the data in Table 3 some element of discrimination in tariff rates across regional imports already appears. This reflects the differing product composition of bilateral trade between regions, and elements of non discrimination formally allowed within the system (such as the Generalized System of Preferences, and arrangements under the Lomé Convention).

Table 1
Regional Aggregation of GTAP Country Data Used in Constructing Model Base Case Data

Regions in the Model		**Countries in GTAP Data Base Included in the Region**
1. ANJ	Australia, New Zealand and Japan	Australia, New Zealand and Japan
2. RIA	Rich Asia	Korea, Indonesia, Malaysia, Philippines, Singapore, Thailand, Hong Kong and Taiwan
3. POA	Poor Asia	China, India, Rest of South Asia
4. NAF	NAFTA	Canada, USA and Mexico
5. SAM	South America	Central American and Caribbean, Argentina, Brazil, Chile, Rest of South America
6. EUR	Europe	European Union of the 12, Austria, Finland, Sweden, European Free Trade Area and Central European Countries with EU Association Agreements
7. ROW	Rest of the World	Former Soviet Union, Middle East and North Africa, Sub Saharan Africa and Rest of the World

Table 2

Base Case (1992) Regional Data Used in Global General Equilibrium Model

A. Production Data[1]

	Region	Production in ($B)
1.	ANJ	3451.7
2.	RIA	900.7
3.	POA	641.8
4.	NAF	6099.0
5.	SAM	792.0
6.	EUR	7158.7
7.	ROW	1491.1
	TOTAL	20595.0

1992 Benchmark Trade Flows (US Billions)

	Importing Region						
Exporting Region	ANJ	RIA	POA	NAF	SAM	EUR	ROW
ANJ		112.5	27.1	115.8	12.2	92.5	27.6
RIA	91.3		35.3	91.8	7.6	82.3	22.0
POA	25.7	28.9		26.7	2.5	37.2	12.9
NAF	114.9	74.9	19.0		41.1	202.8	42.8
SAM	12.5	6.9	2.7	37.0		41.8	6.4
EUR	85.1	80.3	35.3	187.3	37.6		181.6
ROW	58.2	26.6	14.5	37.0	6.3	150.6	

[1]Based on data from GTAP (Version 3) 1992 data base, with adjustments made to satisfy model consistency conditions.

Table 3

Data on 1992 Tariff and Tariff Equivalents by Region Used in Base Case Model Solution

	Ad Valorem Equivalent Import Tariffs[1] on Imports from Each Region						
Region	ANJ	RIA	POA	NAF	SAM	EUR	ROW
ANJ	-----	14.0	34.0	19.0	22.0	13.0	21.0
RIA	12.0	-----	38.0	10.0	21.0	8.0	24.0
POA	16.0	15.0	-----	10.0	18.0	9.0	22.0
NAF	21.0	17.0	20.0	-----	14.0	6.0	13.0
SAM	12.0	10.0	14.0	10.0	-----	16.0	13.0
EUR	9.0	10.0	26.0	6.0	15.0	-----	16.0
ROW	4.0	7.0	17.0	3.0	7.0	6.0	-----

[1]Based on data drawn from 1992 GTAP data base (Version 3).

The key behavioural parameters in the model are the elasticities of substitution in preferences for the two levels specified. These control the ease of substitution, first, between types of imports (by region of origin), and, second, between imports as a composite and domestic production. These are important parameters in the model since they determine the strength of terms of trade effects across competitive equilibria, and through these terms of trade effects, both the level of optimal tariffs in non-cooperative Nash equilibria and the levels of side payments in bargaining solutions (through their impacts on threat points) are determined.

The substitution elasticity values used in the model are obtained by calibrating implied point estimates of import price elasticities by region evaluated at the base case equilibrium to literature values of trade elasticities. The model parameters generated in this way are, thus, a reflection of literature based estimates of trade elasticities; the values we use by region are reported in Table 4.

Values such as these, in the neighbourhood of one, are widely used in other trade modelling literature (see the discussion in Whalley (1985)), and reflect the range of estimated import price elasticity values that have been generated for over 40 years, going back to Orcutt's (1950) classic work on trade elasticities. Despite their widespread use, values such as these continue to strike many trade economists as low. and in this present model are the source or strong inter-regional effects from trade policy changes in the model. As a result, we conduct limited sensitivity analyses exploring the impacts of alternative import elasticity parameter values on model results.

Table 4

Import Price Elasticity Estimates by Region Used in Model Calibration

Region	Uncompensated Import Demand Elasticity[1]
ANJ	-1.15
RIA	-1.12
POA	-0.95
NAF	-1.50
SAM	-0.85
EUR	-1.25
ROW	-0.85

[1]The sources used for these values include Marques (1990); and Stern, Francis and Schumacher (1976).

4. MODEL RESULTS

We have used the model and the associated 1992 calibration based parameterization generated through to compute the three types of model solutions we set out above; competitive equilibria, non-cooperative Nash equilibria in tariffs, and bargaining solutions with side payments. We use these solution concepts in turn to assess the value of MFN treatment to the various regions identified in the model.

Table 5 presents the first of these model solutions, competitive equilibria under alternative tariff regimes. In both of the cases considered the EU and North America engage in bilateral tariff elimination. In one case this is done on an MFN basis, so that the benefits of bilateral EU-North America tariff elimination are automatically extended to all the other five regions in the model. In the other, bilateral tariff elimination is restricted to bilateral trade between North America and the EU. Computing these equilibria allow us to compare the two different counterfactual equilibria to the benchmark equilibrium.

Results in Table 5 show that under non-MFN bilateral tariff elimination North America and the EU both gain, while all other regions lose due to trade diversion and adverse terms of trade effects. But when MFN based bilateral tariff elimination occurs between North America and the EU, the other five regions all gain due to improved market access to the EU and North America, while the EU and North America lose from a worsened terms of trade as their tariffs against the other five regions fall further below their optimal tariffs. There are thus differences in the sign of the welfare effects for individual regions (measured in terms of Hicksian Equivalent Variations between the counterfactual and benchmark equilibria). The benefit of MFN over non MFN liberalization for poor

Asia is $4 bill., for rich Asia is around $10 billion, and for South America is around $11 bill. As a fraction of GDP, however, these effects are small.

Table 5

Model Results For Competitive Equilibria Under MFN And Non MFN Bilateral Trade Barrier Elimination

	Hicksian Equivalent Variations by Region in 1992 when MFN and non MFN Bilateral Trade Liberalization occurs			
Region	(1) EU and NAFTA engage in MFN Tariff Elimination		(2) EU and NAFTA engage in non MFN Tariff Elimination	
	$Bill, 1992	% of GDP	$Bill, 1992	% of GDP
ANJ	32.1	0.93	-2.1	-0.061
RIA	8.3	0.92	-1.7	-0.189
POA	3.6	0.56	-0.6	-0.093
NAF	-27.6	-0.45	2.5	0.041
SAM	9.7	1.22	-1.0	-0.126
EUR	-26.8	-0.37	5.5	0.077
ROW	9.2	0.62	-2.8	-0.188
WORLD	8.5	0.04	-0.09	-0.000

Table 6 reports computations of Nash non-cooperative equilibria using the model, reporting the outcome of global trade wars under full retaliatory tariff setting. We consider cases where the retaliatory process either is and is not constrained by MFN. As we note above, these scenarios both assume that MFN treatment (GATT Article 1) will survive increases in tariffs beyond current GATT tariff bindings, and that retaliation continues to a full Nash equilibrium, rather than stopping through arbitration in some trigger supported cooperative equilibrium.[6]

[6]Also see the discussion in Perroni and Whalley (1996).

We consider two different cases. In one, MFN restraints apply to retaliation, implying non discriminatory treatment across import sources into any region from the other regions in the model. In the other case, no MFN restraints apply to such retaliation. Strikingly, the differences between results with and without MFN constrained retaliation in Table 6 are small. In each case, Hicksian equivalent variations relative to the benchmark equilibrium are reported; and in each case all regions lose. As a proportion of national income, losses are smallest in the large regions (North America and the EU). However, the differences between the two cases remain small.

Table 6

Effect of MFN Restraints on Nash Non-Cooperative (Tariff) Equilibria Under Global Retaliatory Trade War Scenarios

	Hicksian Equivalent Variations relative to 1992 base case under Global Retaliatory Trade War Outcomes Relative to Model Base			
	(1) With no MFN Restraint on Tariff Retaliation by Region		(2) With MFN Restraints on Tariff Retaliation by Region	
Region	$Bill, 1992	% of GDP	$Bill, 1992	% of GDP
ANJ	-112.2	-3.3	-108.1	-3.1
RIA	-132.0	-14.7	-132.9	-14.8
POA	-68.3	-10.6	-68.0	-10.6
NAF	-90.0	-1.5	-100.8	-1.7
SAM	-78.5	-9.9	-75.9	-9.6
EUR	-31.4	-0.4	-26.7	-0.4
ROW	-281.4	-18.9	-299.1	-20.1
WORLD	-793.8	-3.9	-811.4	-4.0

The reason why MFN restraints on retaliation seem to have such small effects on the outcome from a Nash non-cooperative equilibrium is that MFN only limits country specific retaliation rather than retaliation in general. The gains to importing countries from retaliation occur from driving down the price of all other products against that of their own product i.e. restricting trade in their own good relative to all imports. The benefit to any region from retaliation in the model thus occurs from restricting trade in general for a country (as also occurs in the MFN case), more than from restricting trade along particular bilateral channels. MFN restraints, in this case, have little direct effect on the outcome, and both the value of MFN treatment to small regions and the cost of MFN to large regions in the second sense set out above appear small.

In Table 7, we report a further set of model results which show the impact of MFN on bargaining outcomes. We analyze these impacts in an indirect way because of the dimensionality problems involved in generating utility possibility frontiers for the model. As noted above, these frontiers are not analytic, and are instead generated by computing a sequence of distortion free (Pareto Optimal) competitive equilibria, where transfers (side payments) occur between the parties to the bargain. Because of the implications of MFN treatment for small and large regions bargaining on trade policy, we consider various combinations of two region bargaining using the model and compute a number of model solutions..

In these, we treat poor Asia, rich Asia and South America as the small regions in the model, and consider the implications of bilateral bargaining alternatively for each with the large regions, Europe and NAFTA. In each case, side payments need to be made by the small to the large countries to support bilateral free trade as a bargained outcome. We treat the benefit to smaller countries (cost to larger countries) of MFN treatment that such bilateral negotiations are excluded, and that these side payments will not be made. As we comment above, side payments in this case are to be interpreted as the value of concessions made in non trade areas in linked trade and non-trade bargaining, such as in intellectual property protection, domestic energy policies, and foreign investment policy. As noted by Perroni and Whalley (1994) these are additional areas that have entered recent bilateral trade negotiations, and represent in kind payment by smaller to larger countries for conventional trade benefits.

In each case considering the model we use an aggregation of the 7 region model into a more manageable 4 region sub-model (i.e. Poor Asia/EU/NAFTA/ROW; Rich Asia/EU/NAFTA/ROW; South America/EU/NAFTA/ROW), and consider bilateral bargaining between the small (Poor Asia, Rich Asia, South America) and large regions (EU, NAFTA). In each case, we compute both the Nash and Kalai-Smorodinsky bargaining solutions discussed earlier. From these solutions we are also able to determine the side payments made by each region to the other party to the bilateral bargain to support bilateral free trade with the larger region.

Table 7
Bilateral Side Payments Needed to Support Bargained Free Trade Between Small and Large Countries[1]

Payment by	Nash Bargaining		Kalai-Smorodinsky Bargaining	
	$Bill, 1992	% of GDP	$Bill, 1992	% of GDP
POA to NAF	13.3	2.1	17.2	2.7
POA to EU	29.3	4.6	54.2	8.4
RIA to NAF	55.5	6.2	55.5	6.2
RIA to EU	109.5	12.2	109.5	12.2
SAM to NAF	9.5	1.2	21.6	2.7
SAM to EU	46.9	5.9	62.9	7.9

[1]The model solutions reported on in this table use aggregations of the full seven region model, as discussed in the text.

The striking feature of the results in Table 7 is the size of the side payments involved; often 8-10 times larger than the benefits of MFN treatment in the first two senses computed earlier and described above. The implication seems to be that the main advantage (cost) to smaller (larger) countries from MFN treatment may well lie in avoiding bilateral trade bargaining (regional arrangements), rather than in the conventionally discussed benefits of free riding on other countries tariff cuts. There are differences in results across bargaining solution concepts, and these are more pronounced in some cases (such as POA to EUR and SAM to NAF) than others, but the main theme of the results is common to the two solution concepts.

We have performed some sensitivity analyses with the model to test out the robustness of the model results reported in Table 7. In Table 8 we report results for the case of bilateral bargaining between poor Asia and North America. We vary model elasticities increasing some by 50%, and cutting others by 25%. These elasticity variations have a large effect on non-cooperative Nash equilibrium tariff levels (not reported here), but they have more limited effects on the side payments needed to support free trade.

A weakness of the calculations reported in Tables 7 and 8 is that they do not reflect comprehensive measures of the value of MFN treatment, merely illustrating the importance of MFN in the sense of restraints on bargaining for particular pairwise bargains. Another way to proceed is by appealing to notions of marginal contributions of regions to broader coalitions implicit in Shapley's (1953) measure of power; the Shapely value. We have thus also used the model to construct power indices in the spirit of Shapely values, on which we report in Table 9. These measure the marginal contribution individual regions can make to the joint gain a larger coalition can receive from trade bargaining with the rest of the world. These are still not comprehensive measures of the value of MFN, but nonetheless show how an alternative measure to that used in Tables 8 and 9 points to the same conclusion as to the source of major benefit from MFN for smaller countries.

Table 8

Sensitivity Analysis of Side Payment Calculations Reported in Table 7

Bilateral Side Payments made by POA to NAF ($bill., 1992)				
	Nash Bargaining		**Kalai-Smorodinsky Bargaining**	
	$Bill, 1992	% of GDP	$Bill, 1992	% of GDP
A. Central Case Model Specification	13.3	2.1	2.7	17.2
B. Increase Top Level Preference Substitution Elasticities (Domestic/Composite Imports) by 50% in all regions	20.5	3.2	2.8	18.2
C. Cut Top and Bottom Level Preference Substitution Elasticities (Domestic/Composite Imports) by 25% in all regions	22.7	3.5	3.5	22.7
D. Increase Bottom Level Preference Substitution Elasticities (Among Imports) by 50% in all regions	14.7	2.3	2.3	14.7

We use the same four region version of the model as above, but instead consider Nash non-cooperative equilibrium outcomes rather than bargained outcomes. We compute Nash equilibria for a no coalition case, for the 3 pairwise coalitions between Poor Asia, Europe, and NAFTA, and also for the grand coalition of the three. ROW is treated as passive in the Nash retaliatory process, and does not enter into any coalitional activity.

Comparing the Nash outcomes for the three region coalition and the three two region coalitions, we can calculate the marginal contribution of each region to the joint three region gain from forming the coalition. These measures are in the spirit of Shapely values and can be thought of as a measure of region power in wider trade negotiations. Table 9 indicates a small measure for Poor Asia, with much larger measures for Europe and NAFTA. These, in turn indicate limited bilateral bargaining power for Poor Asia relative to the larger Europe and NAFTA regions, a situation which MFN redresses for Poor Asia by effectively ruling out bilateral bargaining.

Table 9

Marginal Contributions to Three Region Joint Coalitional Gains from Strategic Trade Policy Setting Against ROW by Individual Regions

Marginal Contribution to the Joint Gain of a Three Region (Poor Asia, Europe, NAFTA) Coalition from Trade Retaliation against ROW (1992 US$bill)		
	Gain in $bill, 1992	**Gain As % of Combined 3 Region GDP**
Poor Asia	238.6	1.72
Europe	636.4	4.58
NAFTA	611.0	4.40

Thus, the conclusion that we draw from our combined results is that MFN treatment in the trading system seems to have its largest effects on the trade bargaining process; and thus occurs by effectively ruling out explicit bilateral bargaining between large and small countries. These effects seem to dominate free riding for smaller countries on MFN tariff cuts by large countries, and any non discrimination restraints on global retaliation. These results also seem to explain why small countries have been extremely concerned about new regional trade arrangements in the trading system such as NAFTA, even though the computed comparative static trade effects against these countries are small in most studies. Their concern is the weakening implied of MFN, and the potential adverse effect on them in terms of trade bargaining, rather than the direct trade effects.

5. CONCLUSIONS

This paper reports on numerical simulation results which shed light on the value of MFN treatment under global trade rules for both large and small countries, (or regions). We use a 7 region global trade model, calibrated to a 1992 base case data set, in which we are able to compute not only traditional comparative static competitive equilibria under different tariff regimes (and assess free rider benefits), but also non-cooperative Nash equilibria with and without MFN restraints on retaliation; and both Nash and Kalai-Smorodinsky bargaining solutions, supported by side payments. Previous literature has stressed the free rider benefits to small countries, who benefit through MFN from large country tariff cuts. Here we emphasize other dimensions of MFN captured by these other solution concepts, evaluating each through numerical solution.

Model results indicate large effects from MFN in influencing bargaining outcomes (and associated side payments), and only small direct effects from free riding and retaliation constraining considerations. The main benefit (cost) to smaller (larger) countries from MFN treatment thus seems to be the effective restraint it imposes on regional or bilateral trade policy bargaining to be equivalent to multilateral bargaining. We suggest this also explains why smaller countries (such as India) have been concerned about recent regional trade agreements, such as NAFTA, even though repeated studies show that the direct trade effects from diversion are negligible. The issue is the erosion they see of MFN through these arrangements, and the implied impacts on bargaining within the trading system.

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