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Developing-Country Benefits from MFN Relative to Regional/Bilateral Trade Arrangements

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Abstract

Using a general-equilibrium model of world trade, this paper evaluates the benefits of most-favored-nation (MFN) treatment to developing countries in multilateral relative to bilateral or regional trade agreements, from three sources. First, developing countries may be able to free-ride on bilateral tariff concessions exchanged between larger countries in MFN-based GATT/WTO rounds. Second, MFN benefits developing countries by restricting discriminatory retaliatory actions by other countries, evaluated here by a non-cooperative Nash tariff game. Finally, MFN changes threat points in bargaining and hence affects the bargaining solution of multilateral MFN-based trade negotiation compared to a bilateral/regional arrangement. The authors find that the benefits to developing countries are small in the first case as the tariff rates are already low, and the benefits are small in the second case as the optimal tariffs under unconstrained retaliation are not very asymmetric. Benefits from the third case are large as large countries can extract large side-payments if they bargain bilaterally.

1. Introduction

Despite its central role in modern trade policy, there is little literature that attempts to evaluate the benefits and costs of most-favored-nation (MFN) treatment for various types of countries, and specifically for developing countries.[1] Here we suggest that countries receive various benefits from—and incur costs because of—their MFN rights and obligations relative to regional or bilateral agreements, 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 relative to a non-MFN world. We model MFN as a constraint on the relevant model solution concept, and use a seven-region global trade model calibrated to the 1992 GTAP version 3 database (Hertel et al., 1997) to compute equilibria, and value MFN benefits by comparing across MFN and non-MFN equilibrium outcomes. In so doing, we draw on code and a model structure used earlier by Perroni and Whalley (1994).

2. The Rationale for MFN

Most-favored-nation treatment implies that countries extend to other countries the same trade treatment as that granted to their most favored trading partners, effectively

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a rule that no country will discriminate against other countries in its use of trade measures at the border.[2] MFN has long been the source of discussion in policy-based literature as to who gains and who loses from it, and in which ways. 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. MFN first entered the trade policy world through the bilateral European trade treaties of the nineteenth century, such as the UK–France Cobden–Chevalier treaty of the 1860s. In this case, bilateral signatories to the treaty committed that third-party benefits of improved access had to accrue also to other treaty signatories as a result of third-party negotiations. Under the UK–France treaty, the UK was thus also to share in improved access to, say, Spain if France was to negotiate with Spain.

After long being opposed to unconditional MFN, the US embraced the idea in the twentieth century in its bilateral trade agreements of the 1930s. These followed the 1933 US Reciprocal Trade Agreements Act which gave the president authority to negotiate bilateral trade deals if foreign countries reciprocated US tariff cuts. MFN at this time was believed to be a vehicle for more quickly spreading the benefits of trade liberalization to other countries, and speeding the recovery of the global economy from the recession of the early 1930s, and hence to be in the interest of both the US and the world.

MFN next became the centrepiece of the GATT as it was negotiated in 1947 as effectively the multilateralization of US prewar bilateral agreements (the GATT was modeled on the 1942 US–Mexico agreement). As in prewar days, MFN was seen as a vehicle for speeding whatever trade liberalization the GATT negotiating process generated to more countries than would have been the case in a non-MFN world.

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 more beneficial trade terms from smaller trading partners through bilateral pressure.[3] This raises the issue of why it is that large countries or regions such as the US and the EU remain committed today to MFN, and why it was agreed in the first place.

A variety of explanations exist in the policy literature. One is that cooperation is difficult to establish, and once in place costly to remove and replace with non-cooperative outcomes. Under this view, large countries might no longer agree to MFN in a *de novo* negotiation today, but it is accepted as part of functioning cooperation that dominates non-cooperation. Another explanation is that the trading system is effectively a 2 or $2\frac{1}{2}$ large power system (the US, the EU, and (Japan)), and MFN means that, in principle at least, the EU and the US each share in whatever agreements are negotiated with third parties. Yet another explanation is that, in its early years, the interest of larger countries in the GATT were as much strategic as economic; OECD countries saw an MFN-based GATT as one way of pulling newly independent developing countries away from a Communist embrace. Finally, the policy-based literature notes the many ways in which MFN rule in GATT/WTO is breached in practice, allowing large countries some latitude in how it is applied.

Despite these various explanations of large-country acceptance, the fact remains that MFN is a central part of the GATT/WTO system and has been so for over 50 years. They also leave in place the question for developing countries as to whether and how this rule is in their interest. Here, we evaluate three sources of benefit from MFN for developing countries. One is that MFN allows them to free-ride on bilateral agreements to lower trade barriers among large countries. A second is that any trade retaliation a large country engages in must be nondiscriminatory. A third is that MFN changes the threat points entering any trade bargaining by effectively eliminating bilateral bargaining. It is these that we investigate in this paper.

3. Model for Evaluating MFN Benefits

We use a seven-region numerical 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), US/Canada/Mexico (NAF), South America (SAM), Europe (EUR), and the rest of the world (ROW). Developing countries dominate "poor Asia," South America, and the rest of the world. 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.

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 preferences as a composite imported good. We take the single good in each region j to be in fixed supply, $\overline{S}^j$ ($j = 1, \ldots, K$), where K denotes the number of regions. This treatment implies that regional offer curves in the model are determined solely by endowments and preferences—effectively a pure exchange formulation. Importantly, we do not consider production distortions in our analysis, and were they to be incorporated results would differ.

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) 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 2×2 or 3×3 formulations; and so in using seven regions here we numerically 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

$$U^j = \left[\alpha_D^j D_j^{\frac{\sigma_j - 1}{\sigma_j}} + \alpha_c^j C_j^{\frac{\sigma_j - 1}{\sigma_j}} \right]^{\frac{\sigma_j}{\sigma_j - 1}}, \quad j = 1, \ldots, K. \tag{1}$$

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 CES substitution elasticity in region j's preferences.

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

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

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 among imports.

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. σ_j determines the import demand elasticity in region j, and λ_j the ease of substitution among import types.

Trade Barriers

We consider each region to have available the use of (potentially regionally discriminatory) tariffs, t_i^j; i.e., tariff rates on imports by region j from region i. In the various model solutions where we consider the effect of MFN treatment on individual regions, we impose the condition on tariff-setting that

$$t_i^j = t_k^j; \quad \forall i, k; \quad i \neq j, k \neq j. \tag{3}$$

In non-MFN cases, tariff rates in all regions remain unrestrained by condition (3). Revenues raised by these tariffs are

$$R_j = \sum_i t_i^j P_i M_i^j, \tag{4}$$

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

4. Model Solution Concepts

We numerically explore three alternative solution concepts using the model, each one relevant to one of the three senses of MFN benefits for developing countries we set out above. 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 source of developing-country benefit from MFN treatment we listed above, namely access benefits generated by free-riding under MFN on trade liberalization agreed among larger countries. From a small-country perspective, the MFN benefit here is the ability to gain improved market access from bilaterally agreed tariff reductions extended multilaterally to all parties through Article 1 of GATT/WTO.

We also compute post-retaliation non-cooperative Nash equilibria for global (seven-region) tariff games in the model with and without an MFN restraint applying to retaliation by individual regions against other regions. With MFN in place, countries that 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 developing 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 own GATT/WTO bound tariff levels, they still abide by the terms of GATT Article 1.

We also 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 in the form of side-payments to achieve mutual agreement to lower trade barriers. 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 interregional utility possibility frontiers using alternative side-payments, adopting alternative axiomatic bargaining solution concepts (Nash, 1950; Kalai and Smorodinsky, 1975). We interpret side-payments in trade policy negotiations as the value of concessions made on domestic policies (intellectual property, services regulation, general system of preferences 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).

Competitive Equilibria

We compute global competitive equilibria for the model for given tariff rates in all regions (treated as exogenous). We use these to assess developing-country benefits from free-riding on exogenous large-country tariff cuts. These equilibria 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 modeling system) software due to Brooke et al. (1988).

More concretely, income in region j is

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

and tariff revenues in region j are

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

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:

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

It follows that exports by region j are

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

The demand in region j for the regional import composite is

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

and demand in region j for imports from region i are

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

The total demand for the exports of any region l is

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

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

$$T_l = X_l. \tag{13}$$

As only relative product prices matter in this equilibrium formulation, a *numéraire* can be chosen: say the price of one of the regional products; or a price normalization such as $\Sigma_i P_i = 1$ can be used.

Non-cooperative Nash Equilibria

We compute non-cooperative Nash equilibria in this model to evaluate developing-country benefits from MFN restraints on retaliation using a tariff game structure similar to that set out in Johnson (1954). Unlike for competitive equilibria above, under this solution concept tariff rates are endogenously determined rather than set exogenously, and reflect country utility maximization across global competitive equilibria for alternative own-country tariff rates which change country or region in terms of trade. In this case, 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 regions' tariffs are successively taken as given. These optimization problems are repeatedly solved 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, given tariff rates t_j^k in all other countries $k \neq j$, and the competitive equilibrium conditions (13) for each region j, when computing non-cooperative Nash equilibria, we repeatedly maximize (1) to generate a set of endogenously determined optimal tariffs, t_j^l, as a best response to the other regions' tariff rates t_j^k, $k \neq j$. We represent these in the form of reaction functions as

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

In a non-cooperative Nash equilibrium, best-response tariff rates generated by regional optimizing behavior need to be mutually consistent across all regions:

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

We compute Nash equilibria for cases where both the MFN restraints (3) 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 developing countries since they cannot be selectively pressured in negotiation by larger countries using threats of bilateral actions against them. The effect of MFN in this case is to limit the admissible threat points that can be used in bargaining. We compute solutions from the model under different bargaining solution concepts so as to give a range of measures of bargaining outcomes.

Thompson (1994) surveys axiomatic bargaining solution concepts and describes nine different concepts, suggesting that Nash and Kalai–Smorodinsky are the most widely used. We implement these two 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. MFN treatment constrains the threat point and hence changes the bargaining solution. We consider single-period one-shot games. No repeated game structure enters this analysis, and issues of subgame perfection do not arise.

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

As a result, we compute mixed cooperative/non-cooperative equilibria in which two regions bargain and can potentially engage in trade retaliation one against another, while the parties not involved in bargaining play passively and maintain their base-year tariff levels. This equilibrium yields the threat points for the participants in bilateral bargaining. Using permutations of side-payments between the two regions involved in bargaining, we then trace out the utility frontier for the parties to the bargaining by computing cooperative equilibria in which these regions eliminate their tariffs. Each point on the frontier is supported by a 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 side-payment received (or made, if negative) by j from i in such an equilibrium, the income equation (5) is modified to

$$I^j = P_j \overline{S}^j + T_i^j \qquad (16)$$

where, by construction

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

We use a Nash criterion for a bargaining solution to the model, appealing to Nash's axioms. This is the best known of the various axiomatic bargaining solution concepts and maximizes

$$\cup = \prod_l (U_l - U_l^R), \tag{18}$$

with U_l representing region l's utility on the utility possibility frontier we generate (l referring to the regions involved in the bargaining), and U_l^R representing 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 points out, among other things, that such bargaining solutions are not invariant to a monotonic transformation of individual region utilities.

We also make computations using the Kalai–Smorodinsky (1975) bargaining solution concept. While Nash maximizes a criterion function subject to the utilities possibility frontier, Kalai and Smorodinsky take maximal utilities for regions and construct a ray through the utilities possibilities set from the origin to the point B on the frontier. Thompson also discusses the properties of this solution concept.

We also compute power indices for regions on the basis of marginal contribution to broader coalitions in the spirit of Shapley (1953) values.[5] Here we show that the marginal contribution of larger regions in a coalition is higher, indicating that such a region could extract a larger share of the surplus from trade bargaining with the rest of the world.

5. Parameterizing and Implementing the Model

We have numerically implemented the model set out above by calibrating it to a benchmark global equilibrium dataset for 1992 covering consumption, production, trade, and tariffs for the seven regions. 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. The effect of this procedure is to impose 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-related substitution elasticities in the model.

In producing a dataset to which we calibrate the model, we first aggregate unadjusted GTAP country data into the regional classification we use here. The country classifications under which data are reported in the GTAP database and the regions used in the model are shown in Table 1. Table 2 reports the base-case data for 1992 on production and bilateral trade and *ad valorem* tariff rates on imports for the seven regions. We have chosen the seven regions 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

Table 1. Regional Aggregation of GTAP Country Data used in Constructing Base-Case Data

Regions in the model		*Countries in GTAP database included in the region*
ANJ	Australia, New Zealand, and Japan	Australia, New Zealand, Japan
RIA	"Rich Asia"	Korea, Indonesia, Malaysia, Philippines, Singapore, Thailand, Hong Kong, Taiwan
POA	"Poor Asia"	China, India, rest of South Asia
NAF	NAFTA	Canada, USA, Mexico
SAM	South America	Central America and Caribbean, Argentina, Brazil, Chile, rest of South America
EUR	Europe	European Union of the 12, Austria, Finland, Sweden, European Free Trade Area, Central European Countries with EU Association Agreements
ROW	Rest of the world	Former Soviet Union, Middle East, North Africa, sub-Saharan Africa, rest of the world

Table 2. Base-Case (1992) Production and Trade Flows (US$ billions) and Tariff Rates (%)[a]

	Production ($b)	*Importing region*						
		ANJ	RIA	POA	NAF	SAM	EUR	ROW
ANJ	3,451.7	—	112.5	27.1	115.8	12.2	92.5	27.6
RIA	900.7	91.3	—	35.3	91.8	7.6	82.3	22.0
POA	641.8	25.7	28.9	—	26.7	2.5	37.2	12.9
NAF	6,099.0	114.9	74.9	19.0	—	41.1	202.8	42.8
SAM	792.0	12.5	6.9	2.7	37.0	—	41.8	6.4
EUR	7,158.7	85.1	80.3	35.3	187.3	37.6	—	181.6
ROW	1,491.1	58.2	26.6	14.5	37.0	6.3	150.6	—
	Elasticity[b]	*Ad valorem equivalent of import tariffs on imports from each region* (%)						
ANJ	–1.15	—	14	34	19	22	13	21
RIA	–1.12	12	—	38	10	21	8	24
POA	–0.95	16	15	—	10	18	9	22
NAF	–1.50	21	17	20	—	14	6	13
SAM	–0.85	12	10	14	10	—	16	13
EUR	–1.25	9	10	26	6	15	—	16
ROW	–0.85	4	7	17	3	7	6	—

[a] Based on data from GTAP (version 3) 1992 database, with adjustments made to satisfy model consistency conditions.
[b] Uncompensated import demand elasticities. The sources used for these values include Marquez (1990), and Stern et al. (1976).

model, including market clearing by product. The value of production in these regions implies a gross world product of $20.6 trillion in 1992. The large regions are NAF and EUR; the small regions are RIA, POA, and SAM.

In reality, MFN trade rules already apply to the base-case data, but in the data in Table 2 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 nondiscrimination formally allowed within the system (such as the Generalized System of Preferences, and arrangements under the Lomé Convention).

The key behavioral parameters in the model are the elasticities of substitution in preferences for the two levels we specify. These determine 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 size of side-payments in bargaining solutions (through their impacts on threat points).

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 2.

Values such as these, in the neighborhood of one, are widely used in other trade modeling 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, such values continue to strike many trade economists as low, and in this present model are the source of strong interregional effects from trade policy changes in the model. As a result, we conduct some sensitivity analyses exploring the impacts of alternative import elasticity parameter values on model results.

6. Results

We have used the model and its associated 1992 calibration-based parameterization to compute the three forms of model solutions 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 developing countries in the model in the three senses discussed above: free-riding on large-country liberalization, constraints on retaliation, and impacts on bargaining.

Table 3 presents results from the first of these model solutions showing benefits from free-riding, with competitive equilibria under alternative tariff regimes. In both of two cases we consider that the EU and North America engage in bilateral tariff elimination. In one 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 allows us to compare the two different counterfactual equilibria to the benchmark equilibrium and gauge the incremental effects of MFN compared to an exclusionary regional trade agreement.

Table 3. Results for Competitive Equilibria under MFN and Non-MFN Bilateral Trade Barrier Elimination

Hicksian equivalent variations by region when MFN and non-MFN bilateral trade liberalization occurs

	(1) *EU and NAFTA engage in MFN tariff elimination*		(2) *EU and NAFTA engage in non-MFN tariff elimination*	
	($b, 1992)	(% of GDP)	($b, 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

Results in Table 3 show that, under non-MFN bilateral tariff elimination, North America and the EU both gain, while all other regions lose through 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 through 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 to "poor Asia" is $4 billion, for "rich Asia" is around $10 billion, and for South America is around $11 billion. As a fraction of GDP, however, these effects are small primarily because initial tariff levels in the 1992 base-case data are low reflecting the global tariff liberalization that occupied under the GATT between 1947 and 1992.[6]

Table 4 reports computations of Nash non-cooperative equilibria using the model, reporting the outcome of global trade wars under retaliatory tariff setting by all regions in the model. We consider cases where this retaliatory process either is or is not constrained by MFN. MFN-restrained retaliation here means that tariff rates imposed by a region on imports from any region are the same, while under non-MFN retaliation they could differ depending upon the origin of the imports. As we noted above, these scenarios assume both 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.[7] We consider two different cases. In one, MFN restraints apply to retaliation, implying nondiscriminatory treatment across import sources in any region importing 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 4 are small, in part because unconstrained retaliatory tariff rates

Table 4. Effect of MFN Restraints on Nash Non-cooperative (Tariff) Equilibria under Global Retaliatory Trade War Scenarios

Hicksian equivalent variations 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*	
	($b, 1992)	(% of GDP)	($b, 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	–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

are not very different across country sources into any importing country. 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.

The reason why MFN restraints on retaliation seem to have such small effects on the outcome in a Nash non-cooperative equilibrium is that MFN limits only 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 in the model from retaliation occurs from restricting trade in general (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 benefits of MFN to smaller regions in the second sense set out above appear small.

Table 5 reports post-retaliation tariff rates for the same case considered in Table 4. Rates are reported on a pairwise regional basis. For any importing region, tariff rates across export sources do not vary very much, consistent with the welfare results on MFN constraints on retaliation set out in Table 4.

In Table 6, we report model results which show the impacts of MFN on bargaining outcomes. We analyze these in an indirect way because of the dimensionality problems involved in generating utility possibility frontiers for the model. 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.

Table 5. Non-MFN Tariff Rates under Global Retaliatory Trade War Scenarios

	ANJ	RIA	POA	NAF	SAM	EUR	ROW
ANJ	—	152.8	125.3	187.7	107.8	250.9	21
RIA	138.9	—	129.3	189.2	107.4	249.7	24
POA	140.6	147.9	—	191.5	107.3	253.6	22
NAF	135.5	136.7	121.5	—	109.6	250.7	13
SAM	136.2	137.2	122.3	201.8	—	278.3	13
EUR	133.9	138.8	124.4	174.1	109.4	—	16
ROW	149.9	143.1	124.3	181.4	107.0	272.1	—

Note: ROW is treated as a passive region in the model and hence does not participate in retaliation. The tariff rates imposed by regions under MFN-restrained retaliation are 142.0, 147.0, 127.2, 188.3, 108.0, and 278.9%, respectively, by ANJ, RIA, POA, NAF, SAM, and EUR.

Table 6. Bilateral Side-payments Needed to Support Bargained Free Trade between Small and Large Countries

	Nash bargaining		*Kalai–Smorodinsky bargaining*	
Payment by:	($b, 1992)	(% of GDP)	($b, 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

Note: The model solutions reported on in this table use aggregations of the full seven-region model to more manageable four-region sub-models as discussed in the text.

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 occurring for each alternatively 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. The benefit to smaller developing countries of MFN treatment (and the cost to larger countries) is that such bilateral negotiations are effectively excluded, and hence that these side-payments will not be made. As we comment above, we interpret side-payments in this case as the value of concessions made in nontrade areas in linked trade and nontrade 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 we use aggregations of the seven-region model into a more manageable four-region 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 and large regions. 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.

Results are reported in Table 6 and their striking feature is the size of the side-payments involved. These are sometimes 8–10 times larger than the benefits of MFN treatment in the first two senses computed earlier and described above. The implication would seem 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 these 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 results from the two solution concepts.

We have performed a number of sensitivity analyses with the model to test out the robustness of the model results reported in Tables 3, 4 and 6. In Table 7 we report a sample of these 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 multilaterally negotiated free trade.

A weakness of the calculations reported in Tables 6 and 7 is that they do not represent 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 8. These measure the marginal

Table 7. Sensitivity Analysis of Bilateral Side-payments made by POA to NAF Reported in Table 6

	Nash bargaining		*Kalai–Smorodinsky bargaining*	
	($b, 1992)	(% of GDP)	($b, 1992)	(% of GDP)
A. Central case model specification	13.3	2.1	17.2	2.7
B. Increase top-level preference substitution elasticities (domestic/composite imports) by 50% in all regions	20.5	3.2	18.2	2.8
C. Cut top- and bottom-level preference substitution elasticities (domestic/composite imports) by 25% in all regions	22.7	3.5	22.7	3.5
D. Increase bottom-level preference substitution elasticities (among imports) by 50% in all regions	14.7	2.3	14.7	2.3

Table 8. Marginal Contributions to the Joint Gain of a Three-region Coalition from Trade Retaliation against ROW

	Gain ($b, 1992)	*Gain* (% of combined three-region GDP)
"Poor Asia"	238.6	1.72
Europe	636.4	4.58
NAFTA	611.0	4.40

contributions 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 6 and 7 points to the same conclusion that the source of major benefit from MFN for smaller countries lies in its impacts on bargaining.

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 three 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 regional power in wider trade negotiations. Table 8 indicates a small measure for "poor Asia," with much larger measures for Europe and NAFTA. These, in turn, suggest more 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.

7. Conclusions

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 seems to be the effective restraint it imposes on regional or bilateral trade policy bargaining to be equivalent to multilateral bargaining. This is because large countries could do better in a case-by-case bilateral bargaining with the small countries rather than a multilateral one. Thus the small countries are better off under the MFN as it does not allow bilateral bargaining.[8] We suggest this also explains why developing 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 concern is the erosion they see of MFN through these arrangements, and the implied impacts on bargaining within the trading system, more so than the direct trade effects.

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Notes

1. Here we have in mind literature that values MFN from different country perspectives (small, large, for example).
2. For further discussion of the merits and demerits of MFN as free-riding, see Baldwin and Murray (1977), Jackson (1987), Caplin and Krishna (1988), Ludema (1991), and Staiger (1995).
3. A number of recent papers, 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.
4. These model analyses are also relevant to the issue of how bloc size affects Nash tariff levels, and hence world welfare. See Haveman (1996) for a recent discussion.
5. Shapley values are preferable to bilateral bargaining solutions in that they are consistent with multilateral bargaining (Hart and Mas-Colell, 1996).
6. This is an extreme event that may or may not take place. Here we evaluate the potential benefits under MFN if the event takes place. Thus the benefits from this notion of MFN would be even smaller if trade wars do not occur.
7. Also see the discussion in Perroni and Whalley (1996).
8. On the other hand, the large country derives nonpecuniary benefits through effective enforcement of the agreements under the MFN. See Perroni and Whalley (1996).