National Sovereignty in an Interdependent World

by

Kyle Bagwell and Robert W. Staiger*

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Abstract

What are the sovereign rights of nations in an interdependent world, and to what extent do these rights stand in the way of achieving important international objectives? These two questions rest at the heart of contemporary debate over the role and design of international institutions as well as growing tension between globalization and the preservation of national sovereignty. In this paper, we propose answers to these two questions. We do so by first developing formal definitions of national sovereignty that capture features of sovereignty emphasized in the international political economy literature. We then utilize these definitions to describe the degree and nature of national sovereignty possessed by governments in a benchmark (Nash) world in which there exist no international agreements of any kind. And with national sovereignty characterized in this benchmark world, we then evaluate the extent to which national sovereignty is compromised by international agreements with specific design features. In this way, we delineate the degree of tension between national sovereignty and international objectives and describe how that tension can be minimized – and in principle at times even eliminated – through careful institutional design.

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“Of all the rights possessed by a nation, that of sovereignty is doubtless the most important.” Emmerich de Vattel in *The Law of Nations*, as quoted in Jeremy Rabkin, *Why Sovereignty Matters*, p. 27.

I. Introduction

What are the sovereign rights of nations in an interdependent world, and to what extent do these rights stand in the way of achieving important international objectives? These two questions rest at the heart of contemporary debate over the role and design of international institutions as well as growing tension between globalization and the preservation of national sovereignty. But answers are elusive. This is attributable in part to the fact that national sovereignty is a complex notion, reflecting a number of different features. And it is attributable as well to the fact that nations interact in increasingly complex and interdependent ways, making it difficult to draw clear distinctions between international and domestic affairs.

In this paper, we propose answers to these two questions. We do so by first developing formal definitions of national sovereignty that capture features of sovereignty emphasized in the international political economy literature. We then utilize these definitions to describe the degree and nature of national sovereignty possessed by governments in a benchmark (Nash) world in which there exist no international agreements of any kind. And with national sovereignty characterized in this benchmark world, we then evaluate the extent to which national sovereignty is violated by international agreements with specific design features. In this way, we delineate the degree of tension between national sovereignty and international objectives and describe how that tension can be minimized – and in principle at times even eliminated – through careful institutional design.

We begin by describing a benchmark two-country model of international interdependence. In this benchmark model, an international “externality” variable defines the nature of interdependence between the two governments, and this variable is modeled in a way that is general enough to allow the nature of interdependence between the two governments to take a variety of possible forms, ranging from international trade to the depletion of a common-pool resource to global climate change. Within this benchmark model, we develop a working definition of sovereignty.
Our starting point for defining sovereignty is the Westphalian norm of “non-intervention in the internal affairs of other states” (Krasner, 1999, p. 20). To make this norm operational, we must define “non-intervention” and “internal affairs.” Building on the notions of sovereignty commonly discussed in the international political economy literature, we say that a governmental decision problem concerns that government’s internal affairs whenever its payoff in that decision problem does not depend on the actions of any extraterritorial agents; otherwise, we say that this decision problem concerns the government’s “external affairs.” In the context of voluntary international agreements, we then say that one state has intervened in the internal affairs of another state, and therefore that a violation of sovereignty has occurred, whenever an international agreement leads a government to make commitments over matters that concern its internal affairs or to make commitments that alter the normal operations of its domestic institutions within the domain of its internal affairs. We argue that our formal definition of sovereignty captures three key features of Westphalian sovereignty emphasized in the international political economy literature that seem especially relevant in the context of voluntary international agreements: first, commitments that result from voluntary international agreements do not necessarily violate Westphalian sovereignty (as when these commitments pertain only to a government’s external affairs); second, there are limits to the appropriate policy matters for international agreement, and negotiated commitments over policies that concern sufficiently “domestic” affairs (i.e., internal affairs) do violate Westphalian sovereignty; and third, international commitments that distort the normal operation of domestic institutions to a sufficient degree also violate Westphalian sovereignty.

With our formal definition of sovereignty in hand, we then turn to a characterization of the nature and degree of sovereignty that governments possess in various economic environments and institutional settings. We begin this characterization within our two-country benchmark model. To identify the degree of sovereignty that governments possess in this environment in the absence of an international agreement, we show that a government’s policy choices in the Nash equilibrium can be partitioned into two choice problems: a choice of the externality variable and the contribution that this country makes to the determination of the externality variable, given the other government’s policies; and a choice of how best to use its policy instruments to achieve its objectives while
delivering the given contribution level. With this partition, we are able to identify a government’s external affairs with the first choice problem, and its internal affairs with the second. Intuitively, when governments are mutually interdependent, the external affairs of each government consist of that government’s choices over its contribution to the determination of the externality variable and the equilibrium level of the externality variable, since its payoff in this choice problem depends on the actions of external actors. By contrast, the matters that concern the internal affairs of each government are that government’s choices among all its policy combinations that are consistent with a given contribution to and level of the externality variable, since its payoff in this choice problem is independent of the actions of external actors.

We put our definition of sovereignty to use by considering first the way in which a government’s sovereignty is violated within our benchmark model when it negotiates international commitments that concern its internal affairs. Such commitments directly violate a government’s sovereignty, but we show that direct violations of sovereignty can also imply further indirect violations of the government’s sovereignty as well, under which government decisions that are not the subject of international negotiation are nevertheless distorted away from the decisions that would normally have been made under the domestic institutional arrangements of the country. We argue that this “contamination effect” generally prevents governments from containing violations of sovereignty caused by international agreements to narrow subsets of policy instruments. In fact, we establish as our first main result that any international agreement that involves direct commitments over matters that are the internal affairs of a government must in general violate that government’s sovereignty over at least as many policy instruments as it preserves.

While this first result indicates the possibility of a substantial conflict between international agreements and the preservation of national sovereignty, this conflict is not inevitable. Indeed, as we have observed above, international agreements over matters that concern a government’s external affairs do not violate its sovereignty, at least not directly. The key remaining question, however, is whether it is possible to eliminate the inefficiencies that arise in the Nash equilibrium with international agreements that are limited only to the external affairs of each government, and thereby
to navigate all the way to the international efficiency frontier without violating national sovereignty by means of such agreements. Our second main result is that this is indeed possible within the benchmark model. That is, we show that it is always possible within the benchmark model to pick any point on the international efficiency frontier that could be achieved by international negotiations over all policy instruments, and to achieve that point with international negotiations that are limited only to the external affairs of each government, i.e., to the level of the externality variable and each government’s contribution to it.

This second result implies that, in principle, governments need not confront a choice between preserving their sovereignty and attaining international efficiency when they negotiate international agreements. This indicates a remarkable degree of harmony between national sovereignty and international efficiency, but it is a result derived within our benchmark model, and important questions remain as to (i) whether prominent channels of interdependence between countries can be identified which find representation in the environment described by our benchmark model, and (ii) whether the result is likely to extend to environments beyond those captured by our benchmark model. These questions are taken up in the second half of the paper.

We first consider whether this harmony survives in one particularly important extension of the benchmark model, namely, in a world of “small” countries. When all countries are small in relation to the externality variable, we show that each country’s contribution to the externality variable becomes its internal affairs. This in turn implies that, when all governments are small, any international agreement that moves governments from their Nash policy choices must violate their sovereignty. Accordingly, as we demonstrate, whether or not the apparent harmony between national sovereignty and international efficiency described above survives in a world of small countries hinges on whether governments agree or disagree in the Nash equilibrium over the direction that they would like the externality variable to move. If all governments agree, then the Nash equilibrium in the small-country case is inefficient and an international agreement will be required to reach the efficiency frontier, implying necessarily that national sovereignty and international efficiency will stand in conflict in this case. However, if there is disagreement, then the Nash equilibrium in the
small-country case is efficient, and in this case the harmony between national sovereignty and international efficiency identified above survives in a world of small countries. Of course, which of these two cases is applicable will depend on the nature of the externality variable under consideration, but as we later demonstrate, the latter case has special significance in the context of international trade agreements.

We next employ the results of our benchmark model to consider the issue of sovereignty within the particular context of international trade agreements. To this end, we begin by briefly reviewing the two-country two-good competitive general equilibrium trade model adapted to allow for the possibility of both tariff and domestic regulatory policy choices as developed in Bagwell and Staiger (2001). We establish that this model is a special case of our benchmark model, in which the international externality variable is the terms of trade, and in which each country’s contribution to the determination of the externality is the quantity of imports it demands at a given terms of trade, and so all of the results described above apply.

We then show that when the results of our benchmark model are interpreted within the context of our trade model, they indicate that the fundamental principles underlying GATT/WTO market access agreements offer a way to achieve internationally efficient policies without sacrificing national sovereignty, and that attaining international efficiency is consistent with maintaining national sovereignty in this setting regardless of whether (all) countries are big or small. We also extend our analysis of trade agreements to a multilateral setting, and establish that agreement to abide by a nondiscrimination principle such as the GATT/WTO MFN rule does not violate a government’s sovereignty. And finally, we identify a critical role for MFN if governments are to achieve internationally efficient policies without sacrificing national sovereignty when some (but not all) countries are small. In particular, we find that a non-discrimination rule can allow governments to sidestep the efficiency/sovereignty tradeoff that would otherwise exist in this extended setting, and we suggest that the MFN requirement is therefore “complementary” to preserving small-country sovereignty in the following sense: the sovereignty of small countries can be preserved under an internationally efficient agreement only if that agreement abides by the MFN requirement. More
broadly, our results therefore suggest that a non-discrimination rule coupled with a market access agreement can facilitate the attainment of internationally efficient outcomes which do not compromise national sovereignty. In light of our findings, we discuss the basic harmony between the underlying GATT/WTO principles and the maintenance of national sovereignty, and we suggest that this harmony is at risk as a result of changes that are occurring within the WTO.

Finally, we return to the benchmark model and consider further extensions in order to emphasize an important point: the harmony between national sovereignty and international efficiency that in principle exists when the interdependence between countries takes the form of trade does not necessarily carry over to other forms of interdependence across countries. In fact, as we demonstrate, trade problems appear to be rather special. This is not to say that a sovereignty/efficiency tradeoff is inevitable outside of trade problems. Indeed, as we have argued, our benchmark model is general enough to include a variety of non-trade problems as special cases, and our findings indicate that a sovereignty/efficiency tradeoff can largely be avoided in this benchmark setting. But taken together, our results indicate that the added structure that is implied by trade problems ensures the absence of an inherent conflict between international efficiency and national sovereignty in a way that cannot be claimed in the context of other forms of international interdependence.

The rest of the paper proceeds as follows. Section II describes the two-country benchmark model and develops our formal definition of sovereignty, characterizing the nature and degree of sovereignty in the Nash equilibrium and relating this characterization to notions of sovereignty found in the international political economy literature. Section III considers how national sovereignty is affected under international agreements that adopt alternative designs within the benchmark model, and considers as well an extension of the benchmark model to a world in which all countries are small. Section IV establishes that the benchmark model and all its results can be given a trade interpretation, and extends the modeling environment to a multilateral setting to consider the implications of a non-discrimination rule and of the existence of small countries for our sovereignty results. Section V illustrates the special nature of trade problems, relative to other forms of interdependence. Section VI concludes, while an Appendix contains more technical proofs.
II. Internal Affairs and Sovereignty in a Benchmark Model

In this section we adopt a general perspective in order to introduce and evaluate a notion of sovereignty. We begin by describing a benchmark two-country model of international interdependence that is general enough to allow interdependence to take a variety of forms. With the essential elements of our benchmark model described, we next turn to develop a working definition of sovereignty, drawing connections to the benchmark model at several points along the way. We then return to the model and develop it in further detail, in order to provide a formal definition of sovereignty.

II.1: A Benchmark Model

We introduce our definition of sovereignty in the context of a benchmark model consisting of two countries (territories), referred to respectively as the home and foreign country, in which private agents (home and foreign citizens) reside. We assign a government to each country, and endow each government with a set of policy instruments, represented by the $l \times l$ vector $i$ for the home government and the $l \times l^*$ vector $i^*$ for the foreign government, that are applied by each government to activities within its territory. The objectives of the home and foreign governments are represented by the respective functions $G(i, \tilde{x}(i, i^*))$ and $G^*(i^*, \tilde{x}(i, i^*))$, with the “externality” variable $\tilde{x}(i, i^*)$ defining the nature of the interdependence between the two governments. The ability to represent government objectives in this way reflects an essential assumption of our benchmark model, namely, that there exists a well-defined channel (e.g., the level of a price or the quantity of a pollutant) through which the effect of each government’s policy choices on the other government’s welfare (the externality) travels.

Aside from global concavity assumptions on the $G$ and $G^*$ functions to ensure that second-order conditions are globally satisfied, the only additional structure we impose in the benchmark model is that $\tilde{x}(i, i^*)$ is a well-behaved function defined implicitly according to

$$f(g(i, x), g^*(i^*, x), x) = 0,$$

(1)

where, with subscripts denoting derivatives, we impose $f_g \neq 0 \neq f_g^*$, and also $g_{i, i} \neq 0$ and $g_{i, i^*} \neq 0$ for
some $k$ and $k'$. In effect, $g$ represents the home country’s “contribution” to the determination of the externality variable $x$, and this contribution is defined for a given level of the externality once the home-country policy instruments are determined. An analogous interpretation holds for $g^*$. The function $f$ then aggregates the contributions of the home and foreign country to determine the equilibrium level of the externality $x$ according to $f(\cdot)=0$.

As we confirm in section IV below, this structure is consistent with a setting in which the interdependence across countries takes the form of international trade, but it is general enough as well to include many other forms of interdependence. For example, $x$ might represent the density of the fish population in a common fishery, with $g$ representing the home catch when the home fleet operates in the regulatory environment $i$ and faces a fish population density $x$, and with $g^*$ representing the foreign catch when the foreign fleet operates in the regulatory environment $i^*$ and faces a fish population density $x$. The equilibrium density of the fish population, given the regulatory environment faced by home and foreign fleets, $\bar{x}(i,i^*)$, is then determined according to $f(\cdot)=0$, where $f(\cdot)$ in this case might for example take the form $f(\cdot) = Ae^{-[g(i,x) + g^*(i^*,x)]} - x$. Alternatively, $x$ might represent the temperature of the globe, with $g$ representing the home country’s carbon output when the home industry operates in the regulatory environment $i$ and faces a global temperature $x$, and with $g^*$ representing the carbon output of the foreign country when the foreign industry operates in the regulatory environment $i^*$ and faces a global temperature $x$. The equilibrium temperature of the globe, given the regulatory environment faced by home and foreign industries, $\bar{x}(i,i^*)$, is then determined according to $f(\cdot)=0$, where $f(\cdot)$ might take the form $f(\cdot) = \alpha + \beta g(i,x) + \gamma g^*(i^*,x) - x$.

II.2 What is Sovereignty?

With the essential elements of our benchmark model described, we now turn to develop a working definition of sovereignty. We draw connections to the benchmark model at several points along the way.

Defining sovereignty is not a simple task. On the one hand, to be operational, our definition of sovereignty must be amenable to formal analysis. On the other hand, to be relevant, our definition
of sovereignty must capture elements that feature prominently in the common usage of this term. This latter requirement is particularly difficult, because the international political economy literature within which sovereignty has been most discussed is not always clear about the precise meaning of the term and, when clear, does not always adopt a uniform meaning. In fact, Krasner (1999) identifies four distinct ways in which the term “sovereignty” has been commonly used in this literature. Krasner refers to these as domestic sovereignty, international legal sovereignty, interdependence sovereignty, and Westphalian sovereignty. Domestic sovereignty refers to the organization and effectiveness of political authority within the state. International legal sovereignty refers to the mutual recognition of states. Interdependence sovereignty refers to the scope of activities over which states can effectively exercise control. And Westphalian sovereignty reflects as its central premise the rule of nonintervention in the internal affairs of other states.

Our starting point for defining sovereignty is the Westphalian norm of “non-intervention in the internal affairs of other states” (Krasner, 1999, p. 20). To operationalize this definition, however, we must define “non-intervention” and “internal affairs.” We first discuss and interpret the conventional usage of these terms, and then introduce and motivate our proposed working definition of sovereignty.

In the international political economy literature, the internal affairs of a state are synonymous with its “domestic authority structures,” a phrase which in turn has been interpreted to mean the state’s authority to determine the institutions and policies that apply within its territorial boundaries. For example, according to Krasner (1999, p. 20), the concept of Westphalian sovereignty can be characterized as “...an institutional arrangement for organizing political life that is based on two principles: territoriality and the exclusion of external actors from domestic authority structures. Rulers may be constrained, sometimes severely, by the external environment, but they are still free to choose the institutions and policies they regard as optimal. Westphalian sovereignty is violated when external actors influence or determine domestic authority structures.” Here Krasner is drawing a distinction between the effectiveness with which control over outcomes can be exerted on the one hand, and the authority to choose institutions and policies on the other. The former is a concern of
domestic sovereignty and interdependence sovereignty, but it is the latter that defines the internal affairs with which Westphalian sovereignty is concerned. In the international political economy literature, then, a nation’s internal affairs – over which, according to Westphalian sovereignty, it must enjoy freedom from intervention by external actors – are considered to be its choice of domestic institutions and the operation of these institutions to translate the preferences of its citizens into policy choices.

To draw a connection between this notion of internal affairs and our benchmark model, we observe that our representation of each government’s objective function can be said to reflect the particular set of “domestic authority structures” relevant for determining the levels of policy instruments within the territory of that government. For example, domestic authority may be concentrated in the hands of one individual, whose preferences are then the government objective function for that country. If that individual is subjected to lobbying by interest groups, then these interest groups also comprise a part of the domestic authority structure, and the government objective function for that country will reflect as well the influence wielded by these interest groups. Alternatively, domestic authority may be dispersed in the hands of the electorate and take the form of a direct democracy, in which case under appropriate assumptions the preferences of the median voter are then the government objective function for that country. Or domestic authority over different policies may be allocated across different domestic institutions: as long as coordination across domestic institutions (e.g. bargaining among them) is possible, our representation of government objectives allows a valid description of the domestic policy environment in this setting as well. The point is, a government’s objective function as we have defined it reflects both the underlying preferences of the citizens of that country and the domestic authority structures under which those preferences are translated into choices over policy instruments.

As for what constitutes intervention by external actors, Krasner (1999, Chapters 6 and 7) observes that coercion (as in international armed conflict) has frequently resulted in constitutional changes that explicitly alter the domestic institutions of a country and thereby violate its Westphalian sovereignty. Such explicit changes in domestic institutions could be interpreted within our
benchmark model as alterations in the $G$ and/or $G^*$ functions, reflecting for example the forced removal of a dictator and the introduction of democratic institutions. However, our focus here is not on armed conflict, but rather on voluntary international agreements. Hence, violations of Westphalian sovereignty that would result in changes in the $G$ and/or $G^*$ functions are not our central concern. But Krasner observes that *invitation* (as in international contracts and conventions) can also violate Westphalian sovereignty, not necessarily by explicitly altering domestic institutions, but by “...subjecting internal authority structures to external constraints” (Krasner, p. 22). Rabkin (1998, p. 34) puts the point slightly differently: (Westphalian) sovereignty is violated by international commitments that “distort or derange the normal workings of our own system...”. In effect, international commitments need not go all the way to altering the domestic institutions of a country in order to violate its Westphalian sovereignty: international commitments that distort the operation of domestic institutions to a sufficient degree will also violate Westphalian sovereignty.

Implicit in the above discussion is the notion that specific commitments arising out of voluntary international agreements would not ordinarily be viewed as violations of Westphalian sovereignty. For Westphalian sovereignty to be violated by invitation, a “deeper” intervention into the internal affairs of the state is required. Even here though, both Krasner (1999) and Rabkin (1998) suggest that there are limits to the appropriate matters for international agreement, and that a nation’s Westphalian sovereignty would be violated by negotiated commitments over policies that cross these limits and stray into sufficiently “domestic” affairs. For instance, Krasner (1999, pp. 146-148) observes that the IMF routinely violates the norm of Westphalian sovereignty, in part because “...A country entering into negotiations with the IMF could basically consider any aspect of its domestic economic policy open to discussion.” Similarly, in the Preface to his book, Rabkin (1998, p. x) states that efforts to delineate the appropriate limits of international commitments are “...particularly urgent now because, in the absence of any clear understandings on the matter, we seem to be letting international agreements and international authorities determine more and more of our policies.” Neither Krasner nor Rabkin offer a precise method for defining the limits of proper subjects of international negotiation, though Rabkin (pp. 69-70) proposes several criteria.
Summarizing, three key features of Westphalian sovereignty that seem especially relevant in the context of voluntary international agreements can be identified from our discussion of the international political economy literature to this point: first, commitments that result from voluntary international agreements do not necessarily violate Westphalian sovereignty; second, there are limits to the appropriate policy matters for international agreement, and negotiated commitments over policies that concern sufficiently “domestic” affairs do violate Westphalian sovereignty; and third, international commitments that distort the normal operation of domestic institutions to a sufficient degree also violate Westphalian sovereignty. We wish to construct a working definition of sovereignty that reflects these three features.

To accomplish this, we maintain as our essential focus the Westphalian norm of non-intervention in the internal affairs of other states. And we adopt a definition of non-intervention that is well-reflected in the discussion above. But in proposing a formal definition of internal affairs, we depart from the Westphalian emphasis on authority over the determination of institutions and policies, and focus instead on authority over the determination of outcomes and therefore payoffs. In effect, this departure melds elements of authority with elements of control/effectiveness, and in so doing results in a notion of sovereignty that combines traditional features (Krasner, 1999, p. 10) of Westphalian sovereignty (authority over institutions and policies), interdependence sovereignty (effective control over cross-border activities) and domestic sovereignty (authority and effective control over activities within the territory). As a result, the characterization of a government’s internal affairs according to our definition will depend on the nature of interdependence across countries. With internal affairs defined, our broad approach is then to characterize the normal operation of a government’s domestic institutions in the domain of its internal affairs, and to say that a violation of sovereignty occurs whenever an international agreement leads a government to make external commitments over matters that concern its internal affairs or to make external commitments that influence/distort/derange (alter) the normal operations of its domestic institutions within the domain of its internal affairs.

Our working definition of sovereignty has both advantages and disadvantages. On the minus
side, our definition of sovereignty does not conform precisely to any of the four notions of sovereignty commonly discussed in the international political economy literature: as we noted above, it combines elements of a number of these notions. On the plus side, however, our working definition of sovereignty admits several advantages. First and foremost, as we demonstrate below this definition provides an analytically tractable way to capture the three key features of Westphalian sovereignty identified above. In addition, by focusing on authority over outcomes/payoffs rather than authority over institutions/policies, our definition of sovereignty may have a more direct link to issues of accountability in an interdependent world than do existing notions of sovereignty, and may thus be of some interest in its own right. For example, a government might exercise sole authority over its institutions and policies (and therefore maintain Westphalian sovereignty) and yet claim that it cannot be held accountable for its choices, as a consequence of a “race to the bottom” that external constraints have forced upon it. But in matters where the government has sole authority over outcomes/payoffs (and hence in matters that are its internal affairs according to our definition), this possibility of avoiding accountability by appealing to external constraints does not arise. As a consequence, our working definition of sovereignty can be used to forge a tighter link between international agreements that can be said to avoid an erosion of sovereignty and those that can be said to avoid an erosion of accountability.

II.3 Sovereignty Defined

We now proceed to develop our formal definitions in detail. To this end, we return to the benchmark model presented in subsection II.1, and consider the policy choices made by each government. In the absence of any international agreements, we assume that each government makes choices over its own set of policy instruments, taking as given the policy levels of the other government. This problem defines, for each government, its best-response policy choice problem, and the solution to this problem defines its best-response policy choices. The joint solutions to these problems for the two governments define the Nash equilibrium. Throughout we assume that the Nash equilibrium exists and is unique.

As noted above, we propose a definition of internal affairs which equates the internal affairs
of a government with the matters in which it has sole authority over outcomes/payoffs (in the Nash
equilibrium). To develop this definition, we wish to consider alternative representations of a
government’s best-response policy choice problem that break this problem down into a number of
sub-problems. A valid partition $P$ of a government’s best-response policy choice problem is any
such representation that yields the original best-response policy choices of the government. A choice
problem for the government is then an element of any such partition $P$. A collection of choice
problems $\tilde{s}$ contained in the partition $\tilde{P}$ is a subset of the collection of choice problems $\bar{s}$ contained
in the partition $\bar{P}$ provided that there exists a collection of choice problems $\bar{s}'$ such that \{$\bar{P}\backslash\bar{s} \cup \bar{s}'$\} is also a valid partition of the government’s best-response policy choice problem and every choice
problem in $\tilde{s}$ is also in $\bar{s}'$. Finally, a collection of choice problems $\tilde{s}$ contained in the partition $\tilde{P}$ is equivalent to the collection of choice problems $\bar{s}$ contained in the partition $\bar{P}$ provided that there exists a collection of choice problems $\bar{s}'$ such that \{$\bar{P}\backslash\bar{s} \cup \bar{s}'$\} is also a valid partition of the government’s best-response policy choice problem and a choice problem is in $\tilde{s}$ if and only if it is also in $\bar{s}'$.

We first define authority:

**Definition:** A government has *sole authority* in a choice problem if and only if the determination
of its payoff in that choice problem is independent of the actions of “external actors.”

We next define internal affairs and external affairs, conditional on the partition under consideration:

**Definition:** For any partition $P$ of a government’s best-response policy choice problem, the
government’s $P$-*internal affairs* are the collection of choice problems in $P$ over which the
government has sole authority, and its $P$-*external affairs* are the remaining choice problems in $P$.

And finally, we propose an unconditional definition of internal and external affairs. To this end, we
first define a *minimal partition*:

**Definition:** A *minimal partition* $\hat{P}$ of a government’s best-response policy choice problem is a
partition for which the government’s $\hat{P}$-*external affairs* are a subset of its $P$-*external affairs* for all $P$.

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1By the actions of external actors, we mean the setting of all policy instruments by the government of the other
country and all decisions by private agents in the other country.
We now define internal and external affairs unconditionally:

**Definition:** If there exists a minimal partition \( \hat{P} \) of a government’s best-response policy choice problem, then the government’s *internal affairs* are its \( \hat{P} \)-internal affairs and the government’s *external affairs* are its \( \hat{P} \)-external affairs.

These definitions permit any choice problem to be assigned either to a government’s internal affairs or to its external affairs. But each choice problem is itself an element of a valid partition of the government’s best-response policy choice problem, and there may be many such partitions. Hence, as a general matter, the internal affairs of a government as we have defined them will depend on the partition under consideration, a dependence we indicate with the terms \( P \)-internal affairs and \( P \)-external affairs. However, if there exists a way to partition the government’s best-response policy choice problem so that a *minimal* set of external affairs can be identified – a partition we denote by \( \hat{P} \) – then we select this partition among all possible partitions for purposes of defining a government’s internal and external affairs. This partition seems the reasonable choice, because it would identify the smallest collection of choice problems over which the government does not enjoy sole authority in the Nash equilibrium, and by implication as well the largest collection of choice problems over which the government does enjoy sole authority in the Nash equilibrium. And so in this case, the reference to dependence on the particular partition under consideration can be suppressed, and we refer simply to internal and external affairs.\(^2\)

Importantly, as we demonstrate next, in our benchmark model there indeed exists a minimal partition \( \hat{P} \), and so the dependence of a government’s internal and external affairs on the partition under consideration can be suppressed in this setting. To establish this, we begin with a formal statement of each government’s best-response policy choice problem. Specifically, the home government chooses its best-response policies by solving

**Program 1:** \( \max_i G(i, \hat{x}(i, i^*)) \)

\(^2\)We observe as well that, if there exists more than one minimal partition \( \hat{P} \), then by the definition of \( \hat{P} \) both the external and the internal affairs of the government must be invariant (equivalent) across the \( \hat{P} \) partitions, and so the selection of a particular \( \hat{P} \) is immaterial.
taking $i^*$ as given, at the same time that the foreign government chooses its best-response policies by solving

**Program 1**:  $\max_{i^*} G^*(i^*, \tilde{x}(i,i^*))$

taking $i$ as given. The $I$ first-order conditions associated with Program 1 that define the home government’s best-response policy choices are (with subscripts denoting derivatives) given by

$$G_{i_k} + G_{\tilde{x}_{i_k}} \tilde{x}_{i_k} = 0 \quad \text{for } k=1,\ldots,I,$$

while the $I^*$ first-order conditions associated with Program 1* that define the foreign government’s best-response policy choices are given by

$$G_{i^*_k} + G_{\tilde{x}^*_{i^*_k}} \tilde{x}^*_{i^*_k} = 0 \quad \text{for } k=1,\ldots,I^*.$$

The joint solutions to (2) and (3) define the Nash equilibrium of the benchmark model, which as noted above we assume exists and is unique. In what follows, we characterize each government’s internal and external affairs with reference to the Nash policy choices.

When applied directly to the choice problems defined by Programs 1 and 1*, our definitions would indicate that, according to these partitions, neither government would confront any choices that concern its internal affairs, as long as neither $\tilde{G}_x$ nor $\tilde{G}_x^*$ is zero when evaluated at the Nash policy choices. This can be seen more clearly if (1) is used to rewrite Programs 1 and 1* in the equivalent form:

$$\max_{i, x} G(i, x)$$
\[\text{s.t. } f(g(i,x),g^*(i^*,x),x)=0\]

taking $i^*$ as given, and

$$\max_{i^*, x} G^*(i^*, x)$$
\[\text{s.t. } f(g(i,x),g^*(i^*,x),x)=0\]

taking $i$ as given. Written in this way, it is clear that each government would have sole authority over its payoff in this problem – and hence this choice problem would concern its $P$-internal affairs for this partition – if and only if it faced a non-binding constraint, which cannot occur as long as $G_x$
and \( G^*_x \) are non-zero.\(^3\)

But as we have indicated above, different partitions can lead to different characterizations of internal affairs. Consider now the alternative 2-step representation of Program 1:

**Program 1':** Step 1. For a given \((g, x)\): Max \( i \) \( G(i, x) \)

s.t. \[ g(i,x) - g = 0. \]

Step 2. For a given \( i^* \): Max \( g, x \) \( L(\hat{i}(g,x), g, x) \)

s.t. \[ f(g, g^*(i^*,x), x)=0, \]

where \( \hat{i}(g,x) \) is the solution from Step 1 and \( L \) is the Step-1 Lagrangean.\(^4\) The Step-1 choice problem in Program 1' is solved conditional on a given level of the “externality” variable \( x \) and the home-country’s “contribution” \( g \) to the externality variable, and has the home government making its preferred choices over domestic policy instruments \( i \) so as to deliver this contribution. The Step-2 choice problem has the home government then making its preferred choices over \( g \) and \( x \) subject to the constraint placed on its choices which is implied by a vector of foreign policy instruments \( i^* \).

Our first result is that Program 1' is indeed a valid partition of Program 1. We record this in:

**Lemma 1:** Program 1 and Program 1' are equivalent ways of characterizing the home-government’s best-response policies, and so Program 1' is a valid partition of Program 1.

**Proof:** See Appendix.

We prove Lemma 1 by establishing that the first-order conditions associated with Program 1' are given by (2), the first-order conditions associated with Program 1. While we have developed this partition from the perspective of the home government’s problem Program 1, an exactly analogous partition (which we denote henceforth by Program 1**) can be developed for the foreign

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\(^3\)Forming the Lagrangean associated with each problem, it is direct to confirm that the expressions for the Lagrange multipliers for the home and foreign problems are \( \lambda = G_x/f_g, g_x + f_x \) and \( \lambda^* = G_x^*/f_g^*, g_x^* + f_x^* \), respectively. From these expressions, the statement above can be confirmed.

\(^4\)It should be understood that the set of \( g \) and \( x \) for which Step-1 is solved are those for which there exists a vector of instruments \( i \) such that \( g(i,x) - g = 0 \) is satisfied.
government’s problem Program 1*. For future reference, we denote by $P_0$ the partition of the home-government’s best-response policy choice problem defined by Program 1’, and by $P_0^*$ the partition of the foreign-government’s best-response policy choice problem defined by Program 1*'.

We next use Program 1’ (and the analogous Program 1*’ of the foreign government) to assess the internal affairs of each government according to these alternative partitions $P_0$ and $P_0^*$. It is immediate from Program 1’ that the home government has sole authority over its payoff in the choice problem defined by Step 1, and hence the Step-1 choice problem concerns the home-government’s $P_0$-internal affairs for this alternative partition. We refer henceforth to the home-government’s Step-1 choice problem in the partition $P_0$ as its choices over $i(g,x)$, and as noted above we denote its Step-1 choices by $i(g,x)$. On the other hand, the home government would have sole authority over its payoff in the choice problem defined by Step 2 – and hence the Step-2 choice problem would concern its $P_0$-internal affairs for this alternative partition – if and only if the home government faced a non-binding constraint in its Step-2 choice problem, which cannot occur as long as $G_x$ is non-zero.\(^5\) We refer henceforth to the home-government’s Step-2 choice problem in the partition $P_0$ as its choices over $g$ and $x$. Completely analogous statements hold for the foreign government. Hence we have:

**Lemma 2**: The home government’s $P_0$-internal affairs are its choices over $i(g,x)$, and also its choices over $g$ and $x$ if and only if $G_x=0$ when evaluated at the Nash policy choices. The foreign government’s $P_0^*$-internal affairs are its choices over $i^*(g^*,x)$, and also its choices over $g^*$ and $x$ if and only if $G_{x^*}=0$ when evaluated at the Nash policy choices.

Finally, we now establish that the partitions $P_0$ and $P_0^*$ are minimal partitions of the home and foreign government best-response choice problems, respectively. This is stated in:

**Lemma 3**: The partition $P_0$ is a minimal partition of the home-government’s best-response choice problem, and the partition $P_0^*$ is a minimal partition of the foreign-government’s best-response choice problem.

\(^5\)Forming the Lagrangean associated with the home government’s Step-2 problem, it is direct to confirm that the expression for the Lagrange multiplier is $\lambda = G_x[f_x g + f_x^* g^* + f_y^*]$, from which the statement above can be confirmed.
**Proof:** If $G_x=0$ and $G_x^*=0$ when evaluated at the Nash policy choices, then according to $P_0$ and $P_0^*$ there are no choices for either the home- or the foreign- government that concern its external affairs, and so $P_0$ and $P_0^*$ must be minimal partitions in this case. Consider, then, the case in which $G_x \neq 0$ when evaluated at the Nash policy choices. According to $P_0$, the home government’s choices over $g$ and $x$ are its external affairs in this case. Suppose that $P_0$ is not a minimal partition. Then there must exist a partition $P'$ of the home government’s best-response choice problem in which the home government’s choices over $g$ and $x$ are not both included in its external affairs. In the partition $P'$, it must then be possible for the home government to alter either $g$ or $x$ or both $g$ and $x$ in at least one choice problem contained in its internal affairs. Consider, then, any choice problem contained in the home government’s $P'$-internal affairs for which either $g$ or $x$ or both $g$ and $x$ can be altered. With $i^*$ fixed and with $f_g \neq 0$ by assumption, $g$ cannot be determined independently of $x$. Therefore, in this choice problem, the home government must face a constraint of the form $f(g,g^*(i^*,x),x)=0$ if it chooses $g$ directly, or a constraint of the form $f(g(i,x),g^*(i^*,x),x)=0$ if it instead chooses $g$ indirectly through its choice of elements of $i$. But either way, this is inconsistent with the claim that this choice problem concerns a matter of internal affairs for the home government, as long as $G_x \neq 0$ when evaluated at the Nash policy choices, which we have assumed. Hence, we have derived a contradiction, and so $P_0$ must be a minimal partition. An analogous argument holds for the foreign government. **QED**

Let us henceforth refer to the case in which $G_x \neq 0$ and $G_x^* \neq 0$ at the Nash policy choices as the case in which governments are **mutually interdependent**. As a result of Lemmas 1-3, we may then state:

**Proposition 1:** In the benchmark model, the home government’s choices over $i(g,x)$ are its internal affairs and the foreign government’s choices over $i^*(g^*,x)$ are its internal affairs. If governments are mutually interdependent, then choices over $g$ and $x$ ($g^*$ and $x$) represent the external affairs of the home- (foreign-) government. If governments are not mutually interdependent, then: (a) if $G_x=0$ at the Nash policy choices, the home government’s internal affairs include as well its choices over $g$ and $x$; and (b) if $G_x^*=0$ at the Nash policy choices, the foreign government’s internal affairs include as well its choices over $g^*$ and $x$. 

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Intuitively, when governments are mutually interdependent, the external affairs of each government consist of that government’s choices over its contribution to the determination of the externality variable and the equilibrium level of the externality variable, since its payoff in this choice problem depends on the actions of external actors. By contrast, the matters that concern the internal affairs of each government are that government’s choices among all its policy combinations that are consistent with a given contribution to and level of the externality variable, since its payoff in this choice problem is independent of the actions of external actors. Finally, note that the choices made by the home (foreign) government in matters that concern its internal affairs, namely $\hat{i}(g,x)\ (\hat{i}^*(g^*,x))$, reflect both the underlying preferences of the citizens of that country and the normal operation of its domestic institutions under which those preferences are translated into choices over policy instruments.

In light of Proposition 1, we are now ready to define external intervention as it relates to voluntary international agreements. We say that the internal affairs of a government are subjected to external influence by an international agreement if and only if: (i) the government makes commitments in that agreement over matters that concern its internal affairs; and/or (ii) the agreement has the effect of altering the choices in any choice problem that concerns the internal affairs of the government. With this, we then say that a government’s sovereignty is violated by an international agreement when its internal affairs are subjected to external influence by that agreement.

This, then, is our working definition of sovereignty. Returning now to the three key features of Westphalian sovereignty that we described at the end of section II.2 above, we observe that our working definition of sovereignty reflects each of these features. First, commitments that result from voluntary international agreements do not necessarily violate sovereignty since, according to Proposition 1, international agreements over $g, x$ and $g^*$ do not violate sovereignty as long as governments are mutually interdependent. Second, there are limits to the appropriate policy matters for international agreement since, according to Proposition 1, negotiated commitments over the elements of $\hat{i}(g,x)$ and/or $\hat{i}^*(g^*,x)$ always violate sovereignty. And third, international commitments
that distort the normal operation of domestic institutions also violate sovereignty, if these distortions result in unilateral policy choices that do not conform to the corresponding elements of \( \hat{i}(g,x) \) and/or \( \hat{i}^*(g^*,x) \).

III. Sovereignty, International Agreements and Efficiency

We now make use of our working definition of sovereignty. In particular, in this section we explore within our benchmark model the nature of the tradeoff between the preservation of sovereignty and the attainment of international efficiency that is embodied in international agreements of various kinds. We first characterize the violation of sovereignty that occurs when international agreements involve direct commitments over elements of \( i(g,x) \) and \( i^*(g^*,x) \). We then consider the possibility that international efficiency might be attained without violating sovereignty through international agreements involving direct commitments over \( g, x \) and \( g^* \). Throughout we assume that, subsequent to the conclusion of negotiations of an international agreement, each government chooses its best-response policies unilaterally given the policies of the other government and subject to the constraints placed on it by the international agreement.

III.1 Violations of Sovereignty in International Agreements

When international agreements involve direct commitments over elements of \( i(g,x) \) and/or \( i^*(g^*,x) \), a government’s sovereignty may be violated in two ways according to our definition. First, sovereignty is violated whenever a government makes direct commitments in an international agreement over elements of \( i(g,x) \) and/or \( i^*(g^*,x) \), since these are matters that concern its internal affairs. In what follows, we say that the home (foreign) government’s sovereignty over a policy instrument in \( i(g,x) \) (\( i^*(g^*,x) \)) is violated directly by an international agreement whenever limits on this policy instrument are determined directly as a result of international negotiations. But a more subtle violation of sovereignty may also occur, if direct international commitments over elements of \( i(g,x) \) and/or \( i^*(g^*,x) \) result in unilateral domestic choices over the remaining (non-negotiated) policy instruments that do not conform to the corresponding elements of \( \hat{i}(g,x) \) and/or \( \hat{i}^*(g^*,x) \). We will say that the home (foreign) government’s sovereignty over a policy instrument is violated indirectly by an international agreement whenever the government’s sovereignty over this instrument
is not violated directly by the international agreement but the government’s unilateral choice for this policy instrument differs from the corresponding element of \( \hat{L}(g,x) \) evaluated at the level of \((g,x)\) delivered under the agreement. Finally, we say that a government’s sovereignty over a policy instrument is violated (preserved) whenever its sovereignty is violated directly or indirectly (neither directly nor indirectly).

As it turns out, direct violations of sovereignty often imply further indirect violations as well, a feature that generally prevents governments from containing violations of sovereignty caused by international agreements to narrow subsets of policy instruments. Indeed, as we now establish, this “contamination effect” implies that any international agreement that involves direct commitments over elements of \( i(g,x) \) and \( i^*(g^*,x) \) must in general violate each government’s sovereignty over at least as many instruments as it preserves. To establish this, we first introduce a notion of “interrelatedness” between policies. Taking the perspective of the domestic government, and recalling that \( L \) denotes the Step-1 Lagrangean for Program 1', we say that two policies \( u \) and \( v \) are interrelated if \( L_{uv} \neq 0 \) when \( L \) is evaluated at the maximized Step-1 choices \( \hat{L}(g,x) \). In words, when \( u \) and \( v \) are interrelated, a change in \( v \) alters the level of \( u \) preferred by the domestic government for delivering a given level of contribution \( g \) to the (given level of the) externality variable \( x \). An exactly analogous interpretation applies for the foreign government.

Consider then an international agreement that specifies the levels for a subset of the elements of \( i(g,x) \) and \( i^*(g^*,x) \). Let the elements of \( i(g,x) \) that are not determined directly by the international agreement be contained in the set \( H \), and let the elements of \( i^*(g^*,x) \) that are not determined directly by the international agreement be contained in the set \( F^+ \). We may now state:

**Proposition 2**: An international agreement that specifies levels for a subset of the elements of \( i(g,x) \) and \( i^*(g^*,x) \) must (generically), for each government, violate that government’s sovereignty over at least as many policy instruments as it preserves, provided that: (i) the agreement specifies at least one policy instrument for each government at a level different from its best-response level; and (ii) all policies are interrelated.

**Proof**: We adopt the perspective of the domestic government. If \( H \) is empty, then it is immediate
that the statement of the proposition is satisfied, since in this case the sovereignty over all home-
country instruments is violated (directly). If instead $H$ is non-empty, then the proposition is proved
if it can be established that, to preserve the sovereignty of $m$ home-country policy instruments, at
least $m$ home-country policy instruments must be directly negotiated (and therefore the home
government’s sovereignty over these instruments is violated directly). Let $h$ be the vector of non-
negotiated home-country policies, and let $\bar{n}$ be the vector of negotiated home-country policies whose
levels are specified by the international agreement. Given any foreign policies $i^*$, the home
government’s unilateral best-response choice of $h$ must solve the program:

**Program 2:** $\max_h G(h, \bar{n}, \tilde{x}(h, \bar{n}, i^*))$

taking $i^*$ as given. The first-order conditions for Program 2 are given by the analogue of (2) for the
home government’s instrument choices contained in $H$. Now consider the partition of this program
into the alternative two-step program:

**Program 2’:**

1. **Step 1:** For a given $(g, x)$: $\max_h G(h, \bar{n}, x)$
   
   s.t. $[g(h, \bar{n}, x) - g] = 0$.

2. **Step 2:** For a given $i^*$: $\max_{g, x} Q(\hat{h}(g, x, \bar{n}), \bar{n}, g, x)$
   
   s.t. $f(\hat{g}, g^*(i^*, x), x) = 0$,

where $\hat{h}(g, x, \bar{n})$ is the solution from Step 1 and $Q$ is the Step-1 Lagrangean. Arguments identical
to those in the proof of Lemma 1 establish that Program 2 and Program 2’ are equivalent ways of
characterizing the home government’s unilateral best-response choice of $h$. Hence, to complete the
proof we need only observe that: (a) preserving the sovereignty of $m$ home-country policy
instruments requires that, with $(g, x)$ set at the level delivered under the agreement, it must be
possible to satisfy the Step-1 first-order conditions when evaluated at the corresponding $m$ elements
of $\hat{h}(g, x)$, with $\hat{h}(g, x)$ itself evaluated at the level of $(g, x)$ delivered under the agreement; and (b) with
all policies interrelated, this in turn requires (generically) that there exist at least $m$ policy
instruments that are directly negotiated and can be used to “target” $m$ of these Step-1 first-order
The qualifier to generic cases refers to the possibility that optimal unilateral choices for some instruments might by chance happen to correspond to the policy levels needed for "targeting" other first-order conditions as described in the proof. An analogous argument applies to the foreign government.

Hence, if governments negotiate commitments over policy instruments in \( i \) and \( i^* \), their sovereignty will be violated, and the extent of the violation will in general not be limited only to those policy instruments that are directly negotiated. Rather, such commitments will in general alter other policy choices from the choices that would normally have been made under the domestic institutional arrangements of each country. In this sense, international agreements that entail commitments over matters that concern the internal affairs of a government are likely to cause collateral violations of its sovereignty by introducing further distortions into the normal workings of its own system.

III.2 Preservation of Sovereignty in Efficient International Agreements

While Proposition 2 indicates the possibility of a substantial conflict between international agreements and the preservation of national sovereignty, this conflict is of course not inevitable. Indeed, as we have observed above, international agreements over \( g, x \) and \( g^* \) do not violate sovereignty as long as governments are mutually interdependent. The key remaining question, however, is whether it is possible to eliminate the inefficiencies that arise in the Nash equilibrium with international agreements over \( g, x \) and \( g^* \) – and thereby to navigate all the way to the international efficiency frontier by means of such agreements – without violating national sovereignty.

To answer this question, we first characterize the international efficiency frontier and evaluate the efficiency properties of the Nash equilibrium. We define the international efficiency

\[ \text{QED} \]

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\(^6\) The qualifier to generic cases refers to the possibility that optimal unilateral choices for some instruments might by chance happen to correspond to the policy levels needed for "targeting" other first-order conditions as described in the proof.
frontier with respect to the objectives of each government. Accordingly, the international efficiency frontier solves the following program:

**Program 3:**  
\[ \max_{i, x} \ G(i, x) \]
\[ \text{s.t.} \]
\[ (i) \ G^{*}(i^*, x) \geq \ G^*, \text{ and} \]
\[ (ii) \ \bar{f}(g(i, x), g^*(i^*, x), x) = 0. \]

Using Program 3, and letting \( k = 1 \) denote a domestic and foreign policy instrument for which \( g_{i, k} \neq 0 \) and \( g_{i, x}^* \neq 0 \), it is direct to derive the first-order conditions that characterize the international efficiency frontier:

\[ (4) \quad G_{i, k} = \frac{g_{i, k}G_{j, l}}{G_{i, l}} \quad \text{for} \ k = 2, \ldots, I, \]

\[ (5) \quad G_{i, k}^* = \frac{g_{i, k}^*G_{j, l}^*}{G_{i, l}^*} \quad \text{for} \ k = 2, \ldots, I^*, \text{ and} \]

\[ (6) \quad G_{i, k}G_{i, k}^* + G_{j, l}G_{x, k}^*\tilde{x}_{i, k} + G_{j, l}^*G_{x, k}^* = 0, \]

along with the complementary slackness conditions ensuring that the Kuhn-Tucker multiplier on constraint (i) of Program 3 is non-negative:

\[ (7a) \quad -\frac{G_{x}}{G_{x}^*} + \frac{G_{i, l}[f_{g}g_{x}^*f_{g}^*]}{G_{x}^*f_{g}g_{i, l}} \geq 0 \text{ if } G_{x}^* \neq 0 \text{ and} \]

\[ (7b) \quad \frac{G_{i, l}f_{g}g_{i, k}^*}{G_{i, l}^*f_{g}g_{i, l}} \geq 0 \text{ for each } k \text{ for which } G_{i, k}^* \neq 0. \]

The efficiency properties of the Nash equilibrium may now be assessed. Using (2) and (3), whose joint solutions define the Nash equilibrium in our benchmark model, we may state:

**Proposition 3:** The Nash equilibrium of the benchmark model is inefficient if and only if governments are mutually interdependent.
We observe that the required conditions for inefficiency of the Nash equilibrium in the benchmark model would be weakened if the ability to make explicit international transfers were introduced. This can be done without changing the nature of any of our results, but we prefer to keep explicit international transfer instruments out of the benchmark model for simplicity.

**Proof:** See Appendix.7

Together, Propositions 1 and 3 indicate that international agreements over \( g, x \) and \( g^* \) do not violate sovereignty as long as the Nash equilibrium of the benchmark model exhibits an international inefficiency, and therefore as long as there is an international “problem” that might be addressed by such an agreement. But can an international agreement over \( g, x \) and \( g^* \) allow governments to reach the international efficiency frontier? The answer within our benchmark model is provided in the following:

**Proposition 4:** If the Nash equilibrium is inefficient, then by negotiating commitments over \( g, x \) and \( g^* \), the home and foreign government can achieve the international efficiency frontier without violating their sovereignty.

**Proof:** If the home and foreign government negotiate commitments over \( g, x \) and \( g^* \), then subsequent to the conclusion of negotiations the home government will, for the negotiated level of \( (g, x) \), choose its vector of policies \( i \) subject to the implied constraint \( [g(i,x)-g]=0 \), and therefore solve Step 1 of Program 1*, and similarly the foreign government will, for the negotiated level of \( (g^*, x) \), choose its vector of policies \( i^* \) subject to the implied constraint \( [g^*(i^*,x)-g^*]=0 \), and therefore solve Step 1 of Program 1*'. With \( L \) and \( L^*\) the Step-1 Lagrangeans for the home and foreign government, respectively, negotiations over \( g, x \) and \( g^* \) then solve the following program for some \( L^* \):

**Program 4:** \[ \begin{align*}
\text{Max}_{g, x, g^*} & \quad L(i(g,x), g, x) \\
\text{s.t.} \quad & (i) \quad L^*(i^*(g^*,x), g^*, x) \geq L^*, \quad \text{and} \\
& (ii) \quad f(g, g^*, x) = 0.
\end{align*} \]

It is now direct to derive that the first-order and complementary slackness conditions associated with Program 4 are identical to those associated with Program 3, and given by (4)-(6) and (7a)-(7b) respectively. Hence, negotiations over \( g, x \) and \( g^* \) achieve the international efficiency frontier

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7We observe that the required conditions for inefficiency of the Nash equilibrium in the benchmark model would be weakened if the ability to make explicit international transfers were introduced. This can be done without changing the nature of any of our results, but we prefer to keep explicit international transfer instruments out of the benchmark model for simplicity.
Proposition 4 implies that, in principle, governments need not confront a choice between preserving their sovereignty and attaining international efficiency when they negotiate international agreements. This is a strong result, derived within our benchmark model, and important questions remain as to (i) whether prominent channels of interdependence between countries can be identified which find representation in the environment described by our benchmark model, and (ii) whether the result is likely to extend to environments beyond those captured by our benchmark model. We devote the next two sections to these respective questions. But before turning to these questions, we consider briefly whether the result of Proposition 4 continues to hold in one particularly important extension of the benchmark model, namely, in a world of “small” countries.

Specifically, we now consider an extension of the benchmark model in which there are many home and many foreign countries, each of which individually is “small” in relation to the externality variable $x$. Formally, we assume that there is a continuum of home countries indexed by $j \in [0,1]$, with each home country $j$ contributing $g(j)$ to the externality variable $x$, and with

$$
g = \int_0^1 g(j) dj.
$$

Similarly, we assume that there is a continuum of foreign countries indexed by $j \in [0,1]$, with each foreign country $j$ contributing $g^*(j)$ to the externality variable $x$, and with

$$
g^* = \int_0^1 g^*(j) dj.
$$

In this setting, we have $g_{(j)} = 0 = g^*_{(j)}$, and so each home-country $j$’s contribution $g(j)$ to the externality variable $x$ is vanishingly small in the sense that $f_{g(j)} = f_{g^*_{(j)}} = 0$, and similarly each foreign-country $j$’s contribution $g^*(j)$ to the externality variable $x$ is vanishingly small in the sense that $f_{g^*(j)} = f_{g^*_{(j)}} = 0$. A direct implication is then that no single government acting alone can alter $x$ with its policy choices. For simplicity, we assume that each home country is identical, and that each foreign country is identical, so that we may refer to “representative” home and foreign governments, but this is not essential for our results. All other features of the benchmark model remain the same.
It is direct to confirm two important implications of the extended benchmark model. First, suppressing the $j$ superscript, the Nash policy choices of a representative home and foreign government solve $G_{k'}=0$ for $k=1,...,I$ and $G_{i',k'}=0$ for $k=1,...,I'$. And second, letting $i^j$ denote the vector of policies of the $j$th home government, letting $i^j$ denote the vector of policies of all home governments other than $j$, and letting $i^*$ denote the vector of policies of all foreign governments, the minimal partition of the representative home government’s best-response policy choice problem is:

**Program S:**

**Step 1.** For a given $x$: $\max_{i^j} G(i^j, x)$.

**Step 2.** For a given $(i^j, i^*)$: $\max_x Z(\hat{\vec{i}}(x), x)$

\[ \text{s.t. } f(g(i^j,x), g^*(i^*, x)) = 0, \]

where $\hat{\vec{i}}(x)$ is the solution from Step 1 and $Z$ is the Step-1 Lagrangean. An analogous Program $S^*$ defines the minimal partition of the representative foreign government’s best-response policy choice problem.

According to Programs S and $S^*$, each government’s contribution to the externality variable $x$ is a matter of its internal affairs when this contribution is vanishingly small. To understand why, consider home government $j$. In effect, as compared to the minimal partition $P_0$ described by Program $1'$ in the large-country case, the key difference in the case of small countries is that $g$ is unaffected by the choice of $g(j)$, and so the home-government $j$’s choice of $g(j)$ can be moved from Step 2 to Step 1 without affecting the validity of the partition. This results in a minimal partition for the small-country case – described by Program S – that treats the choice of $g(j)$ as the internal affairs of home-government $j$. An analogous interpretation applies for foreign government $j$. As a consequence, when all countries are small in relation to the externality variable, any international agreement that moves governments from their Nash policy choices must violate their sovereignty.

Together, these two implications lead to the following:

**Proposition 5:** When all countries are small in relation to the externality variable $x$, attaining international efficiency is consistent with maintaining national sovereignty if and only if (i) governments are not mutually interdependent, or (ii) governments are mutually interdependent and
\( \text{sign}[G_x] \neq \text{sign}[G_x^*] \) when evaluated at the Nash policy choices.

**Proof:** As implied by Programs S and S*, when all countries are small in relation to the externality variable \( x \), sovereignty demands that each government be left to select its Nash policy choices. Hence, attaining international efficiency is consistent with maintaining sovereignty in the small-country case if and only if the associated Nash policy choices are efficient. If governments are not mutually interdependent, then arguments analogous to the proof of Proposition 3 establish that the Nash policy choices are efficient in the small-country case. Suppose, then, that governments are mutually interdependent. Evaluating the conditions for efficiency at the Nash policy choices of a representative home- and foreign- government, defined by \( G_i = 0 \) for \( k=1,\ldots,I \) and \( G_i^* = 0 \) for \( k=1,\ldots,I^* \), it is direct to confirm that (4)-(6) and (7b) are satisfied while (7a) is satisfied if and only if \( \text{sign}[G_x] \neq \text{sign}[G_x^*] \).

The interesting feature of Proposition 5 relates to the condition in part (ii). According to this condition, whether or not the apparent harmony between national sovereignty and international efficiency identified in Proposition 4 survives in a world of small countries hinges on whether governments agree or disagree in the Nash equilibrium over the direction that they would like the externality variable \( x \) to move. If all governments agree, then the Nash equilibrium in the small-country case is inefficient and an international agreement will be required to reach the efficiency frontier, implying necessarily that national sovereignty and international efficiency will stand in conflict in this case. However, if there is disagreement, then the Nash equilibrium in the small-country case is efficient, and in this case the harmony between national sovereignty and international efficiency identified in Proposition 4 survives in a world of small countries. Of course, which of these two cases is applicable will depend on the nature of the externality variable \( x \) under consideration, but as we demonstrate in the next section, the latter case has special significance in the context of international trade agreements.

**IV. Sovereignty, International Trade Agreements and the GATT/WTO**

In this section we consider issues of sovereignty within the particular context of international trade agreements. We begin in the next subsection by briefly reviewing the two-country two-good
competitive general equilibrium trade model adapted to allow for the possibility of both tariff and domestic regulatory policy choices as developed in Bagwell and Staiger (2001). We establish that this model is a special case of the benchmark model developed in the previous section, and so all the results of sections II and III apply. We then show that when the results of sections II and III are interpreted within the context of this model, they indicate that the fundamental principles underlying GATT/WTO market access agreements offer a way to achieve internationally efficient policies without sacrificing national sovereignty, and that attaining international efficiency is consistent with maintaining national sovereignty in this setting regardless of whether (all) countries are big or small.

Then, in section IV.2, we extend our analysis of trade agreements to a multilateral setting, establish that agreement to abide by a nondiscrimination principle such as the GATT/WTO MFN rule does not violate a government’s sovereignty, and identify a critical role for MFN if governments are to achieve internationally efficient policies without sacrificing national sovereignty when some (but not all) countries are small.8 And finally, in light of our findings, we discuss in section IV.3 the basic harmony between underlying GATT/WTO principles and the maintenance of national sovereignty, and we suggest that this harmony is at risk as a result of changes that are occurring within the WTO.

IV.1 Sovereignty in the Basic Two-Country Trade Model

We first describe the essential features of the two-country trade model of Bagwell and Staiger (2001). The home country exports good \( y \) to the foreign country in exchange for imports of good \( x \). The local relative price of good \( x \) to good \( y \) in the home (foreign) country is denoted by \( p ( p^* ) \). The “world price” (i.e., relative exporter price or terms of trade) is denoted by \( p^w \), and international arbitrage links each country’s local price to the world price in light of its tariff according to

\[
p = p^w = p(\tau, p^w) \quad \text{and} \quad p^* = p^w / \tau^* = p^*(\tau^*, p^w),
\]

where \( \tau \) (\( \tau^* \)) is one plus the ad valorem import tariff of the home (foreign) country. In addition to its tariff, each country also imposes a vector of local regulations, \( r \) (with length \( R \)) for the home country and \( r^* \) (with length \( R^* \)) for the foreign country, that may impact local production and/or consumption decisions at given prices. Each country’s

---

8The other important non-discrimination rule in the GATT/WTO is that of “national treatment,” which applies to non-border measures. In our formal model, the MFN rule would apply to tariffs, while the national treatment rule would apply to regulations. We focus here on the implications of the MFN rule for national sovereignty, but analogous findings could be formalized with regard to national treatment.
vector of local regulations therefore acts as a vector of “shift” parameters in its import demand and export supply functions, and we assume that these functions are differentiable in their respective regulation levels.

Incorporating each country’s vector of regulations into its import demand and export supply functions, we denote these functions for the home country by \( M(r,p,p^w) \) and \( E(r,p,p^w) \), respectively, and for the foreign country by \( M^*(r^*,p^*,p^w) \) and \( E^*(r^*,p^*,p^w) \), respectively. The home and foreign budget constraints, which must hold for any \( p^w \), may then be written as

\[
\begin{align*}
M(r,p,p^w) &= E(r,p,p^w) \quad (8) \\
M^*(r^*,p^*,p^w) &= E^*(r^*,p^*,p^w) \quad (9)
\end{align*}
\]

The equilibrium world price, \( \tilde{p}^w(r,\tau,r^*,\tau^*) \), is determined by the \( x \)-market-clearing requirement,

\[
\begin{align*}
M(r,p(\tau,p^w),p^w) &= E^*(r^*,p^*(\tau^*,p^w),p^w) \quad (10)
\end{align*}
\]

where we have made explicit the dependence of the local prices on the tariffs and the world prices, and market clearing for good \( y \) is then implied by (8), (9) and (10).

Finally, we represent the objectives of the home and foreign governments with the general functions \( W(r,p,\tilde{p}^w) \) and \( W^*(r^*,p^*,\tilde{p}^w) \), respectively. These objective functions reflect an important assumption: governments care about the regulatory (and tariff) choices of their trading partners only because of the trade impacts of these choices (and therefore only because of the impacts of these choices on the equilibrium world price \( \tilde{p}^w \)). We assume that, holding its regulations and its local price fixed at levels that do not imply autarky, each government would prefer an improvement in its terms of trade,

\[
\begin{align*}
W(r,p,\tilde{p}^w) < 0 \quad \text{for} \quad M(r,p,\tilde{p}^w) > 0 , \quad \text{and} \quad W^*(r^*,p^*,\tilde{p}^w) > 0 \quad \text{for} \quad M^*(r^*,p^*,\tilde{p}^w) > 0
\end{align*}
\]

According to (11), governments like transfers of revenue from their trading partners. In the case of autarky, a change in the terms of trade holding its regulations and local price fixed should be irrelevant to a government, since there is no trade volume and continues to be no trade volume after the change, and so we assume as well that
We leave government objectives otherwise unrestricted, and observe that these objectives are consistent with a wide variety of models of government behavior (see Bagwell and Staiger, 1999).

To establish that the trading environment we have just described is a special case of the benchmark model described in section II, we define $i = [r \tau]$ and $i^* = [r^* \tau^*]$, and then define $G(i, \hat{p}^w) = W(r, p, \hat{p}^w)$, $G^*(i^*, \hat{p}^w) = W^*(r^*, p^* (\tau^*, \hat{p}^w), \hat{p}^w)$, $m(i, p^w) = M(r, p^w, \hat{p}^w)$, $m^*(i^*, p^w) = M^*(r^*, p^* (\tau^*, p^w))$. We then substitute (9) into (10) to rewrite the $x$-market-clearing requirement as

$$ p^w m(i, p^w) - m^*(i^*, p^w) = 0. $$

It is now direct to confirm that (12) is a special case of (1) in which $x = p^w$, $g(i, x) = m(i, p^w)$, $g^*(i^*, x) = m^*(i^*, p^w)$, and where $f(g(i, x), g^*(i^*, x)) = [xg(i, x) - g^*(i^*, x)]$. Also, it is natural to impose restrictions on the import demand functions $m(i, p^w)$ and $m^*(i^*, p^w)$ so that $g, g^* > 0$ and $g_{i, x}^* > 0$ for some $k$ and $k'$, and to impose as well the restriction that $p^w > 0$ which then ensures $f^*_g > 0$, as required in the benchmark model. In words, the Basic Two-Country Trade Model is a special case of our benchmark model in which the international externality variable is the terms of trade, in which each country’s contribution to the determination of the externality is the quantity of imports it demands at a given terms of trade, and in which these contributions are aggregated according to a market-clearing condition to determine the equilibrium level of the externality.

The minimal partition of the home government’s best-response policy choice problem in the international trade setting, corresponding to Program 1' in the benchmark model, is then:

**Program 1' (Trade): Step 1. For a given $(m, p^w)$: Max$_i G(i, p^w)$

s.t. $[m(i, p^w) - m] = 0.$

Step 2. For a given $i^*$: Max$_{m, p^w}$ $L(\hat{\ell}(m, p^w), m, p^w)$

s.t. $[p^w m - m^*(i^*, p^w)] = 0,$

where $\hat{\ell}(m, p^w)$ is the solution from Step 1 and $L$ is the Step-1 Lagrangean. The analogous minimal
partition for the foreign government’s best-response policy choice problem in the international trade setting is:

**Program 1** (Trade):  

**Step 1.** For a given \((m^*, p^w)\):  

\[
\max_{i^*} G(m^*, p^w)
\]

\[\text{s.t. } [m^*(i^*, p^w) - m^*] = 0.
\]

**Step 2.** For a given \(i^*\):  

\[
\max_{m^*, p^w} L(i^*(m^*, p^w), m^*, p^w)
\]

\[\text{s.t. } [p^w m(i^*, p^w) - m^*] = 0,
\]

where \(\hat{i}^*(m^*, p^w)\) is the solution from Step 1 and \(L^*\) is the Step-1 Lagrangean.

Provided governments are mutually interdependent, which according to (11) and (11a) will be the case in this setting if and only if they trade positive amounts in the Nash equilibrium, we may then conclude from Propositions 1-4 that, when the nature of interdependence across countries takes the form of international trade: (i) if governments negotiate commitments over policy instruments in \(i\) and \(i^*\), their sovereignty will be violated, and the extent of the violation will in general not be limited only to those policy instruments that are directly negotiated; and (ii) governments may negotiate commitments over \(m, p^w\) and \(m^*\) which then hold the home (foreign) government to policy choices satisfying \([m(i,p^w) - m^*] = 0\) and attain a position on the international efficiency frontier without violating their sovereignty.

Consider now what these findings suggest regarding the implication for national sovereignty of commitments negotiated in the GATT/WTO. In Bagwell and Staiger (2001), we observed that, when a government agrees to “bind” a tariff in a GATT/WTO negotiation, this government is not making a commitment that (i) holds it rigidly to its bound tariff level in the future and (ii) implies no obligations regarding future choices over its remaining policy instruments. Rather, the government is making a *market access commitment*, which is interpreted in the GATT/WTO as a commitment by the home (foreign) government to establish and maintain certain “conditions of competition for exporters into the domestic market.” Two important observations follow. First, a government can in principle fulfill a market access commitment with any combination of policy instruments that implies the agreed-upon conditions of competition for exporters into the domestic
market. And second, a commitment to certain conditions of competition for exporters into the
domestic market implies in turn a commitment to an import level \( m \) \((m^*)\) in the home (foreign)
market when exporters price at \( p^w \), and hence subjects the home (foreign) government to an implied
constraint of the form \([m(i,p^w)-m]=0\) \(([m^*(i^*,p^w)-m^*]=0)\) when making its policy choices. From
these two observations, we may conclude that the fundamental commitments negotiated in the
GATT/WTO are best interpreted as commitments over \( m, p^w \) and \( m^* \) rather than as commitments
over policy instruments in \( i \) and \( i^* \) (see Bagwell and Staiger, 2002, for further elaboration on the
interpretation of GATT/WTO market access commitments along these lines).

Under this interpretation, then, Propositions 1-4 lend some formal support to the fundamental
approach that rests at the heart of the GATT/WTO, in the sense that the negotiation of market access
commitments can in principle allow governments to attain the international efficiency frontier
without sacrificing their sovereignty.\(^9\) We summarize this finding in:

**Proposition 6**: A market access agreement between the home and the foreign government can
achieve the international efficiency frontier without violating the sovereignty of either government.

Finally, we observe that the harmony between national sovereignty and international
efficiency survives in a world of (all) small countries when the nature of interdependence across
countries takes the form of international trade. To see this, note that by our definitions we have
\[ G_{p^w} = \tau W_p + W_p \] \((G_{p^w}^*= (1/\tau)W_p^* + W_p^*)\). When the two-country trade model is extended to allow

---

\(^9\)This is not to say that the GATT and now the WTO poses no threat to the national sovereignty of its member
governments. Rather, our claim here is simply that market access commitments are consistent with the preservation of
national sovereignty, and that the GATT/WTO can in principle steer clear of violations of the sovereignty of its member
governments by adhering closely to the market access approach. Even then, in practice the process by which market
access commitments are interpreted and enforced may place the sovereignty of member governments at risk in ways that
are not captured by our formal modeling. For example, Keohane (2002, p. 8) points out that “...the classic conception of
[Westphalian] sovereignty prohibits a government from agreeing to rules defining a process, over which it does not
have a veto, that can confer obligations not specifically provided for in the original agreement,” and Barfield (2001,
pp. 42-69) argues that in practice the WTO Dispute Settlement Body may pose just such a threat to the Westphalian
sovereignty of its member governments (though see also Keohane, 2002, p. 17, for a more qualified view). While such
threats to sovereignty may indeed be real in practice, it is clear that in principle the WTO is designed not to pose such
a threat: as Article 3.2 of the WTO Dispute Settlement Understanding states, “Recommendations and rulings of the
[WTO Dispute Settlement Body] cannot add to or diminish the rights and obligations provided in the covered
agreements.”
for many small home and foreign countries as in the analogous extension of our benchmark model, it is direct to show that the Nash equilibrium policy choices satisfy $W_p = 0$ ($W^*_p = 0$) for a representative home (foreign) government. Hence, when all countries are small we have $G_{\rho^w} = W_{\rho^w}$ and $G^*_{\rho^w} = W^*_{\rho^w}$ when evaluated at the Nash equilibrium. But using (11) and (11a), Proposition 5 then implies that, when the nature of interdependence across countries takes the form of international trade, the harmony between national sovereignty and international efficiency survives in a world of (all) small countries: the key point is that, in the international trade setting, governments generally disagree in the Nash equilibrium over the direction they would like the terms of trade (the externality variable) to move, as (11) indicates.

Together with Proposition 6, this last result is suggestive of a broad compatibility between maintaining national sovereignty and achieving international efficiency in trade matters. However, these findings fall short of establishing this claim in the multilateral setting in which real trade agreements (e.g., the GATT/WTO) operate, where some countries may be large, others small, and the non-discrimination (MFN) rule plays a prominent role. In the next subsection, we extend the Basic Two-Country Trade Model in order to consider these issues.

IV.2 MFN and Sovereignty in a Three-Country Trade Model

We now consider a three-country trade model analogous to Bagwell and Staiger (1999), extended to include standards. The home country exports good $y$ to foreign countries 1 and 2 and imports good $x$ from each of them. For simplicity, we do not allow trade between the two foreign countries, and so only the home country has the opportunity to set discriminatory tariffs across its trading partners. The local relative price of good $x$ to good $y$ in the home country (foreign country $j$) is denoted by $p_j (p^ j, j=1,2)$. The “world price” (i.e., relative exporter price) for trade between the home country and foreign country $j$ is denoted by $p^w_j$, and international arbitrage links each country’s local price to the relevant world price in light of its tariff according to $p = \tau^{\prime} p^w = p(\tau^j, p^w)$, and $p^j = p^w_j / \tau^j = p^w_j (\tau^j, p^w)$ for $j=1,2$, where $\tau^\prime (\tau^j)$ is one plus the ad valorem import tariff that the home country (foreign country $j$) applies to the imports from foreign country $j$ (the home country). This implies in turn that world prices are linked across bilateral relationships:
We note in particular that an MFN rule requires \( \tau^1 = \frac{\tau^2}{\tau^1} \) and therefore implies \( p^{wl} = p^{w2} = p^w \) by (13). As in the two-country model in section IV.1 above, in addition to its tariff, each country also imposes a vector of local regulations, \( r \) (with length \( R \)) for the home country and \( r^j \) (with length \( R^j \)) for foreign country \( j \), that may impact local production and/or consumption decisions at given prices. Each country’s vector of local regulations will therefore act as a vector of “shift” parameters in its import demand and export supply functions, and as before we assume that these functions are differentiable in their respective regulation levels. For future reference, we denote the home government’s vector of policy instruments by \( i = [\tau^1, \tau^2] \), and we denote the vector of policy instruments for foreign government \( j \) by \( i^j = [r^j, \tau^j] \).

Incorporating each country’s vector of regulations into its import demand and export supply functions, we denote these functions for the home country by \( M(r^1, p^1, T) \) and \( E(r^1, p^1, T) \), respectively, and for foreign country \( j \) by \( M^j(r^j, p^j, p^{wj}) \) and \( E^j(r^j, p^j, p^{wj}) \), respectively, where \( T \) is the home-country’s *multilateral terms of trade*, and is defined by

\[
T(r^1, p^1, r^2, p^{wl}, p^{w2}) = \sum_{k=1,2}^{1,2} s^k(r^1, p^1, r^2, p^{wl}, p^{w2}) p^w \]

with

\[
s^j(r^1, p^1, r^2, p^{wl}, p^{w2}) = \frac{E^j(r^j, p^j, p^{wj})}{\sum_{k=1,2}^{1,2} E^k(r^k, p^k, p^{wk})} \text{ for } j=1,2.
\]

Observe that an MFN rule requiring \( \tau^1 = \frac{\tau^2}{\tau^1} \) implies \( p^{wl} = p^{w2} = T = p^w \) by (13). In any event, with \( T \) defined, the home and foreign budget constraints may then be written as

\[(14) \quad T \cdot M(r, p, T) = E(r, p, T), \text{ and } \]

\[(15) \quad M^j(r^j, p^j, p^{wj}) = p^{wj} E^j(r^j, p^j, p^{wj}) \text{ for } j=1,2. \]

The pair of equilibrium world prices, \( \tilde{p}^{wj}(i, i^1, i^2) \) for \( j=1,2 \), are then determined by the linkage condition (13) together with the requirement of market clearing for good \( x \),

\[(16) \quad M(r, p, T) = \sum_{k=1,2}^{1,2} E^k(r^k, p^k, p^{wk}), \]

with market clearing for good \( y \) then implied by (14) and (15).
Finally, in analogy with the two-country model of section IV.1, we represent the objectives of the home and foreign government \( j = 1, 2 \) with the general functions \( W(r, p, T) \) and \( W^{*j}(r^{*j}, p^{*j}, \tilde{p}^{wj}) \), respectively. As before, we assume that, holding its regulations and its local price fixed, and provided that its regulations and local price do not imply autarky, each government would prefer an improvement in its terms of trade,

\[
(17) \quad W(r, p, T) < 0 \quad \text{for} \quad M(r, p, T) > 0, \quad \text{and} \quad W^{*j}(r^{*j}, p^{*j}, \tilde{p}^{wj}) > 0 \quad \text{for} \quad M^{*j}(r^{*j}, p^{*j}, \tilde{p}^{wj}) > 0.
\]

For simplicity in this subsection we consider only the case where Nash policy choices do not imply autarky. We leave government objectives otherwise unrestricted.

In the Nash equilibrium of the three-country trade model, the home government chooses its best-response policies by solving

**Program 5:** \( \max \_ i \ W(r, p(\tau^{wij}, \tilde{p}^{wij}), T) \)

taking \( i^{*1} \) and \( i^{*2} \) as given, at the same time that foreign government \( j \), for \( j = 1, 2 \), chooses its best-response policies by solving

**Program \( 5^j \):** \( \max \_ i \ W^{*j}(r^{*j}, p^{*j}(\tau^{wij}, \tilde{p}^{wij}), \tilde{p}^{wij}) \)

taking as given \( i \) and \( i^{*k} \) for \( k = 1, 2 \) and \( k \neq j \). We next show that the Nash policy choices defined by the simultaneous solutions to Program 5 and Program \( 5^j \) may be written in an equivalent form in which each government’s best-response program is partitioned into a two-step choice problem. Because foreign countries 1 and 2 each trade with only one partner (the home country), they each face a single international externality variable (\( \tilde{p}^{wij} \)), and so the partition of Program \( 5^j \) into a two-step choice problem is analogous to that of the foreign country in the Basic Two-Country Trade Model. However, the international externality faced by the home country is more complicated, owing to the possibility that it trades with two trading partners at two different bilateral world prices. Nevertheless, as we now demonstrate, an analogous 2-step partition can be developed for the home government’s best-response problem.

In particular, consider the following 2-step program for the home government:
**Program 5'**:  

**Step 1.** For a given \((M, T)\):  
\[
\begin{align*}
\text{Max}_{r, p} & \quad W(r, p, T) \\
\text{s.t.} & \quad [M(r,p,T) - M] = 0.
\end{align*}
\]

**Step 2.** For a given \((i^{*1}, i^{*2})\):  
\[
\begin{align*}
\text{Max}_{M, p^{w1}, p^{w2}} & \quad Y(\hat{r}(M,T(\cdot)), \hat{p}(M,T(\cdot)), M, T(\cdot)) \\
\text{s.t.} & \quad [M - \sum_{k=1,2} E^{*k}(r^{*k}, p^{*k}(\tau^{*k}p^{wk}), p^{wk})] = 0,
\end{align*}
\]

where \(\hat{r}(M,T)\) and \(\hat{p}(M,T)\) are the solutions from Step 1 and \(Y\) is the Step-1 Lagrangean, and where \(T(\cdot)\) denotes \(T(r^{*1}, p^{*1}(\tau^{*1}p^{w1}), r^{*2}(\tau^{*2}p^{w2}), p^{w1}, p^{w2})\). Observe that a value for \(T\) is determined for given \(i^{*1}\) and \(i^{*2}\) once \(p^{w1}\) and \(p^{w2}\) are determined, and so the Step-2 choice problem determines a value for \(M\) and \(T\), which are each taken as given in the Step-1 choice problem. We first state:

**Lemma 4**: Program 5' describes a minimal partition of the home-government’s best-response choice problem defined by Program 5.

**Proof**: See Appendix.

According to Lemma 4, we may conclude that the external affairs of the home government are its choices over \(M, p^{w1}\) and \(p^{w2}\) (and by implication \(T\)). In analogy with the Basic Two-Country Trade Model, these choices can be interpreted as determining the level of market access that the home government affords to each of its trading partners (as defined by the volume of imports it would accept at a particular multilateral terms of trade). The matters that concern the home government’s internal affairs are then its choices over \(r(M,T)\) and \(p(M,T)\). However, observing that \(p = \tau^1 p^{w1} = \tau^2 p^{w2}\), we may write the internal affairs of the home government equivalently as its choices over \(r(M,T), \tau^1(M,T,p^{w1})\) and \(\tau^2(M,T,p^{w2})\), where \(\tau^1(M,T,p^{w1}) = p(M,T)/p^{w1}\) and \(\tau^2(M,T,p^{w2}) = p(M,T)/p^{w2}\). Recalling now that the MFN rule requires \(\tau^1 = \tau^2 = \tau\) and therefore \(p^{w1} = p^{w2} = T = p^w\) by (13), but that the MFN rule leaves the level of \(\tau\) and therefore \(p\) unrestricted, it follows that the MFN rule places restrictions on the home government’s external affairs (its Step-2 choices) but places no restrictions nor introduces any distortions in the home government’s internal affairs (its Step-1 choices). We may therefore state:

**Proposition 7**: Abiding by the non-discrimination rule does not violate national sovereignty.
Proposition 7 reflects the following intuition. Discriminatory tariffs make possible certain market access choices that would be impossible under MFN. But market access (Step-2) choices are the external affairs of a government, and so restrictions can be placed on these choices through voluntary international agreement without violating national sovereignty. And given any market access choices that would be feasible under MFN, discriminatory tariffs do not create any additional possibilities for delivering these market access levels. This feature is reflected in the fact that the Step-1 choices of Program 5’ may be expressed as choices over domestic regulations $r$ and the domestic price level $p$, and for these choices the MFN restriction has no bearing. Hence, a government’s sovereignty is violated neither directly nor indirectly when it agrees to abide by the MFN rule.$^{10}$

According to Proposition 7, an agreement to abide by the MFN rule in the Three-Country Trade Model does not violate the sovereignty of any government. But once the MFN rule is imposed, it is direct to show that the Three-Country Trade Model is a straightforward extension of the Basic Two-Country Trade Model, and exhibits all the same properties. In particular, it then follows by Propositions 6 and 7 that a market access agreement between the home and foreign governments in the Three-Country Trade Model that also imposes an MFN requirement can achieve the international efficiency frontier without violating the sovereignty of any government. This, of course, falls short of the stronger claim that the MFN rule is required to make the attainment of internationally efficient outcomes compatible with the maintenance of national sovereignty. But as we next show, this stronger claim can be made when the Three-Country Trade Model is extended to allow that some (but not all) countries are small.

To see this, let us suppose that foreign country *2 in the Three-Country Trade Model is now decomposed into a region of small foreign countries as with our small-country extensions of the previous models, so that no single foreign government $k$ in region *2 can, acting alone, alter $P^w$ with its policy choices. As we have indicated above, any international agreement that moves the

$^{10}$We also note that Proposition 7 is in line with Rabkin (2004, pp. 131-134) who, arguing from an historical and legal perspective, concludes that MFN obligations are consistent with the preservation of national sovereignty.
governments in region *2 from their best-response policy choices must violate their sovereignty. It is easy to see from Program 5\textsuperscript{j} that the best-response policy choices of a representative government in region *2 (suppressing the individual country superscript \( k \)) solve

\[
\begin{align*}
W_p^* &= 0 \quad & \text{and} & \quad W_{r_i}^* &= 0 \quad \text{for} \quad i = 1, 2, \ldots, R^2.
\end{align*}
\]  

The question, then, is whether the home government and foreign government *1 can undertake commitments which (i) do not violate their sovereignty and (ii) attain a position on the international efficiency frontier when the foreign governments in region *2 choose policies that satisfy (18).

We first establish:

**Proposition 8**: An international agreement can attain a point on the international efficiency frontier and satisfy (18) if and only if it satisfies the MFN rule.

**Proof**: See Appendix.

As we establish in the Appendix, to achieve international efficiency and satisfy (18), the home government and foreign government *1 must adopt policies that abide by the MFN rule and satisfy

\[
\begin{align*}
W_p &= 0 = W_p^*, \quad W_r = 0 \quad \text{for} \quad i = 1, 2, \ldots, R, \quad \text{and} \quad W_{r_i}^* &= 0 \quad \text{for} \quad i = 1, 2, \ldots, R^1.
\end{align*}
\]  

Referring to *non-discriminatory politically optimal market access agreements* as market access agreements that achieve the market access levels implied by (18), (19) and the MFN restriction, and utilizing Propositions 6, 7, and 8, we may now state:

**Proposition 9**: If some (but not all) countries are “small,” then achieving international efficiency and preserving national sovereignty are mutually consistent goals of an international agreement if and only if the agreement satisfies the MFN requirement. In particular, non-discriminatory politically optimal market access agreements provide the unique path to achieving international efficiency while preserving national sovereignty in this setting.

In effect, if small countries are asked to make market access commitments, their sovereignty will be violated. If this is to be avoided, then small countries must be left unconstrained to choose their best-response policies in any international agreement. This requirement, though, is consistent with international efficiency only when tariffs also conform to the MFN requirement, as indicated
by Proposition 8. As a consequence, in an international trade setting Proposition 9 suggests that a non-discrimination rule is “complementary” to preserving the national sovereignty of small countries in the following sense: the sovereignty of small countries can be preserved under an internationally efficient agreement only if that agreement abides by the MFN requirement. More broadly, and in light of our finding in Proposition 7 that the MFN requirement itself involves no compromise of national sovereignty, our three-country results therefore suggest that a non-discrimination rule coupled with a market access agreement can facilitate the attainment of internationally efficient outcomes which do not compromise national efficiency.

IV.3 Sovereignty, GATT and the WTO

When viewed together, the results from the previous two sub-sections have potentially important implications for the design of the WTO and its predecessor, the GATT. The GATT/WTO has from its inception been concerned most fundamentally with non-discriminatory market access commitments, and it has traditionally sought to anchor these commitments with negotiations over border measures (e.g., tariffs) that are “multilateralized” through the MFN requirement. But this tradition is being eroded on two fronts. First, the extent and importance of discriminatory trade agreements (permitted by GATT/WTO exceptions to its MFN requirement) has increased dramatically in recent decades. And second, increasingly the WTO is thought of as a potential forum for the negotiation of international commitments on a host of non-border policies that are deemed to have important market access consequences, ranging from labor standards to environmental regulations to domestic subsidies to competition policy. Our results highlight the fundamental implications of these developments for the potential conflicts between international efficiency and national sovereignty within the WTO. Specifically, as these results indicate, the further the WTO departs from facilitating agreements that take the form of non-discriminatory market access commitments, the more it is likely to pose a (direct and indirect – and in principle, unnecessary) threat to the sovereignty of its member governments.

V. Sovereignty and International Agreements more Generally

In the previous section we focused on issues of sovereignty as they are raised in connection
with international trade agreements. We showed that trade creates international externalities that are
in line with our benchmark model of section II, and we derived and interpreted an extended set of
results within the trade context to shed light on issues for national sovereignty that may arise with
international trade agreements. We now return to consider the issues for sovereignty raised by
international agreements more generally. Our point here is simply to emphasize that the degree of
harmony between maintaining national sovereignty and attaining a position on the international
efficiency frontier that in principle exists when the interdependence between countries takes the form
of trade is unlikely to carry over in general to other forms of interdependence. To some extent this
point is already anticipated by our small-country results, but we now provide a more direct treatment.

A simple extension of our benchmark model developed in section II suffices to illustrate the
point. In particular, we introduce a second externality variable, $y$, whose determination can be
characterized in an analogous fashion to the determination of $x$, but we now assume that $x$ is a
concern only to the home government, while $y$ is a concern only to the foreign government. That
is, in this extension of the benchmark model, the objectives of the home and foreign governments
are represented by the respective functions $G(\mathbf{i}, \mathbf{x}(\mathbf{i}, \mathbf{i}^*))$ and $G^*(\mathbf{i}^*, \mathbf{y}(\mathbf{i}, \mathbf{i}^*))$, with the two externality
variables $\mathbf{x}(\mathbf{i}, \mathbf{i}^*)$ and $\mathbf{y}(\mathbf{i}, \mathbf{i}^*)$ defining the nature of the interdependence between the two
governments. For example, the variable $\mathbf{x}(\mathbf{i}, \mathbf{i}^*)$ could be the level of air pollution, which flows in
one direction from the “upwind” foreign country (who is therefore not affected by the polluted air)
to the “downwind” home country (who is affected by the polluted air), while the variable $\mathbf{y}(\mathbf{i}, \mathbf{i}^*)$
might be the level of water pollution, which flows in one direction from the “upstream” home
country (who is therefore not affected by the polluted water) to the “downstream” foreign country
(who is affected by the polluted water). The externality variables $\mathbf{x}(\mathbf{i}, \mathbf{i}^*)$ and $\mathbf{y}(\mathbf{i}, \mathbf{i}^*)$ are defined
implicitly according to

\begin{align}
  (20a) & \quad f(g(\mathbf{i}, \mathbf{x}), g^*(\mathbf{i}^*, \mathbf{x}), \mathbf{x}) = 0, \text{ and} \\
  (20b) & \quad c(q(\mathbf{i}, \mathbf{y}), q^*(\mathbf{i}^*, \mathbf{y}), \mathbf{y}) = 0.
\end{align}

As in the benchmark model, with regard to the determination of the externality variables $x$ and $y$ we
impose $f_g = 0 \neq f_{g^*}$ and $c_q = 0 \neq c_{q^*}$, and also $g_{i^*, k^*} \neq 0$ and $q_{i^*, k} \neq 0$ for some $k$ and $g_{i^*, k} \neq 0$ and $q_{i^*, k} \neq 0$ for
By construction, in this extended benchmark model the home government’s best-response policy choice problem can be represented by Program 1’ as in the original benchmark model of section II, and so it is direct to confirm that the home government’s external affairs continue to be its choices over \( g \) and \( x \), and do not include its choices over \( q \) and \( y \). In an analogous fashion, it is direct to confirm that the foreign government’s external affairs in this extended benchmark model are its choices over \( q^* \) and \( y \), and do not include its choices over \( g^* \) and \( x \).

In this setting, with each government affected by the other government’s policy choices according to a distinct externality, it is easy to see that a requirement for international efficiency is that the home government’s policy instruments be set so that the home government is indifferent to small changes in its policies that leave the externality variable \( y \) unaltered (since the foreign government would be indifferent to such changes). Formally, and letting \( k = 1 \) denote a domestic policy instrument for which \( g_{i,k} \neq 0 \) and \( q_{i,k} \neq 0 \), this condition may be written as:

\[
\frac{G_{f_{g}}}{f_{g}x_{g} + f_{g}x_{g} + f_{x}}[g_{i,i}][g_{i,k} - q_{i,k}] = q_{i,i}[G_{f_{i,k}} - g_{i,i}G_{i,i}] \quad \text{for } k = 2, 3, \ldots, I.
\]

But as we have just observed, the external affairs of the home government are limited to its choices over \( g \) and \( x \). Consequently, the international commitments that the home government can take on without violating its sovereignty are limited to commitments over \( g \) and \( x \), and result in unilateral choices over its instruments \( i \) in light of any such commitments which solve Step 1 of Program 1’ for the given \((g, x)\):

\[
\text{Max}_{i} \quad G(i, x) \\
\text{s.t.} \quad [g(i, x) - g] = 0.
\]

The first order conditions associated with this problem are:

\[
(G_{i,k} - g_{i,k}) = 0 \quad \text{for } k = 2, 3, \ldots, I.
\]

Consider now the home government’s Nash policy choices. These choices solve Step 1 of Program 1’ for the Nash levels of \((g, x)\), and they must therefore satisfy (22). But these choices then
violate (21), and must therefore be inefficient from an international perspective, unless

\[ g_i \left[ \frac{G_i k}{G_i \bar{k}} - \frac{q_i k}{q_i \bar{k}} \right] = 0, \text{ for } k=2,3,...,I, \]

which is to say unless all adjustments of the home-government policies which leave \( \bar{x} \) unchanged also leave \( \bar{y} \) unchanged. Intuitively, the home government will only be indifferent in the Nash equilibrium over small changes in its policies that leave \( \bar{y} \) unchanged if these same policy changes leave \( \bar{x} \) unchanged, because the home government cares about changes in \( \bar{x} \) but does not care about changes in \( \bar{y} \). But in fact, since (22) must hold for the domestic choices of \( \bar{i} \) given any level of \((g, \bar{x})\), it follows that any international agreement that commits the home government to a level of \((g, \bar{x})\) must fail to attain the international efficiency frontier unless (23) holds. With the sovereignty of the home government violated by any international agreement that goes further than commitments over \( g \) and \( x \), and with (23) violated except by chance, a conflict between national sovereignty and international efficiency is effectively unavoidable.

We may conclude that, in the extended benchmark model just described, there is an inherent conflict between achieving international efficiency through international agreement and maintaining national sovereignty. In this light, the degree of harmony between sovereignty and efficiency that in principle exists in the context of international trade issues appears rather special. We summarize with:

**Proposition 10:** The harmony between national sovereignty and international efficiency that in principle exists when the interdependence between countries takes the form of trade does not necessarily carry over to other forms of interdependence across countries.

Proposition 10 serves to emphasize the special nature of trade problems. This is not to say that a sovereignty/efficiency tradeoff is inevitable outside of trade problems. Indeed, as we have argued, the benchmark model of section II is general enough to include a variety of non-trade problems as special cases, and we have shown that the sovereignty/efficiency tradeoff can largely be avoided in this setting. But the added structure that is implied by trade problems ensures the absence of an inherent conflict between international efficiency and national sovereignty in a way that cannot be claimed in the context of other forms of international interdependence.
VI. Conclusion

What are the sovereign rights of nations in an interdependent world, and to what extent do these rights stand in the way of achieving important international objectives? In this paper, we have proposed answers to these two questions. Our answers, of course, depend on the definition of national sovereignty. We have formalized the Westphalian norm of “non-intervention in the internal affairs of other states” in a way that we believe captures several key features of Westphalian sovereignty emphasized in the international political economy literature, features that seem especially relevant in the context of voluntary international agreements. And using this formalization, we have shown how Nash choice problems can be partitioned in a way that allows a characterization of the degree and nature of sovereignty that governments possess in the Nash equilibrium. This characterization, in turn, provides a benchmark from which to formally assess the implications for national sovereignty of international agreements of various designs. In regard to this assessment, we report two broad findings.

First, in the context of international trade relations, we find that in principle there is no inherent conflict between the twin objectives of attaining international efficiency through international agreements and preserving national sovereignty. And we find that a number of the foundational aspects of the GATT/WTO, such as its emphasis on market access commitments and the MFN rule, are in harmony with these twin objectives. In this regard, we give formal support to the observation of Rabkin (1998):

“Probably the single most effective and consequential international program of the postwar era has been the mutual reduction of trade barriers under the General Agreement on Tariffs and Trade, initiated in 1947. Reasonable questions may be raised about certain aspects of the World Trade Organization, established in 1995 to help administer GATT norms. But, fundamentally, the trading system is quite compatible with traditional notions of sovereignty. It was developed on the foundations of much older sorts of international agreement, which would have been quite recognizable to the Framers of the Constitution.” Rabkin, pp. 85-86.

However, our results also suggest that the maintenance of this compatibility depends crucially on being true to these fundamental principles: the further away the WTO moves from a market-access focus and adherence to MFN, the more likely will conflicts arise within the WTO between international efficiency and national sovereignty.
Our second broad finding is that, in the universe of international relations among national governments, trade relations are special, because trade problems that warrant international attention reflect international externalities with a distinctive structure that, as we have demonstrated, suggests a natural harmony between national sovereignty and international efficiency. In contrast, to the extent that governments are interdependent as a result of non-trade externalities, we suggest that the conflicts between international efficiency and national sovereignty may often be inescapable.
References


Appendix

In this Appendix, we provide proofs of all lemmas and propositions that are not proved in the body of the paper.

Lemma 1: Program 1 and Program 1’ are equivalent ways of characterizing the home-government’s best-response policies, and so Program 1’ is a valid partition of Program 1.

Proof: We prove this by establishing that the first-order conditions associated with Program 1’ are equivalent to the first-order conditions associated with Program 1, given by (2). Letting $\lambda_1$ denote the Lagrange multiplier associated with the constraint in Step 1 of Program 1’, and letting $\lambda_2$ denote the Lagrange multiplier associated with the constraint in Step 2 of Program 1’, the first-order conditions associated with Step 1 are given by

(A1) \[ G_{i,k} - \lambda_1 g_{i,k} = 0 \] for \( k=1,2,...,I \),

while the first order conditions associated with Step 2 are given by

(A2) \[ \lambda_1 - \lambda_2 f_g = 0 \], and

(A3) \[ G_x - \lambda_1 g_x - \lambda_2 [f_g g_x^* f_x] = 0 \].

Eliminating $\lambda_1$ and $\lambda_2$ from (A1)-(A3) yields (2). QED

Proposition 3: The Nash equilibrium of the benchmark model is inefficient if and only if governments are mutually interdependent.

Proof: Using (1), we may derive that

(A4) \[ \tilde{x}_{i,k} = \frac{-f_g g_{i,k}}{f_g g_x + f_g' g_x^* + f_x} \] for \( k=1,2,...,I \),

(A5) \[ \tilde{x}_{i,k} = \frac{-f_g' g_{i,k}^*}{f_g g_x + f_g' g_x^* + f_x} \] for \( k=1,2,...,I^* \).

With (A4) and (A5), it is direct to show that the Nash conditions (2) and (3) imply efficiency conditions (4) and (5). Further, substituting the Nash conditions (2) and (3) into efficiency condition (6) yields

(A6) \[ G_{i,k} \tilde{x}_{i,k}^* G_{x,k} \tilde{x}_{k} = 0 \],

which is violated at Nash choices if and only if governments are mutually interdependent (i.e., if and
Lemma 4: Program 5' describes a minimal partition of the home-government’s best-response choice problem defined by Program 5.

Proof: We first establish that Program 5' is a valid partition of Program 5 (Part I). We then argue that it is a minimal partition (Part II).

Part I: The first-order conditions associated with Program 5 are
\begin{align}
A7) \quad & W_{r_i} + \tau W_p x \frac{\partial \bar{p}^{wl}}{\partial r_i} + W_T \frac{dT}{dr_i} = 0 \text{ for } i=1,2,...,R, \text{ and} \\
A8) \quad & W_p + \theta W_T = 0, \text{ for } j=1,2,
\end{align}
where \( \theta = [dT/d\tau]/[dp/d\tau] \). Observe that by (13), \( \tau [\partial \bar{p}^{wl}/\partial r_i] = \tau^2 [\partial \bar{p}^{wl}/\partial r_i] \), and so (A7) may be equivalently evaluated for either \( j=1,2 \). The first-order conditions associated with Step 1 and Step 2 of Program 5', with \( \gamma_1 \) and \( \gamma_2 \) denoting the Lagrange multiplier on the constraints in Step 1 and Step 2, respectively, are
\begin{align}
A9) \quad & W_{r_i} + \gamma_1 M_{r_i} = 0 \text{ for } i=1,2,...,R, \text{ and} \\
A10) \quad & W_p + \gamma_1 M_p = 0, \\
A11) \quad & -\gamma_1 + \gamma_2 = 0, \\
A12) \quad & \tau^1 W_p + \gamma_1 \tau^1 M_p + [W_T + \gamma_1 M_T] \times \left[ \frac{1}{\tau^1} \frac{\partial T}{\partial p^{wl}} + \frac{\partial T}{\partial \bar{p}^{wl}} \right] - \gamma_2 \left[ \frac{1}{\tau^1} E_{p^{wl}} + E_{\bar{p}^{wl}} \right] = 0, \text{ and} \\
A13) \quad & [W_T + \gamma_1 M_T] \times \left[ \frac{1}{\tau^2} \frac{\partial T}{\partial p^{w2}} + \frac{\partial T}{\partial \bar{p}^{w2}} \right] - \gamma_2 \left[ \frac{1}{\tau^2} E_{p^{w2}} + E_{\bar{p}^{w2}} \right] = 0.
\end{align}
By using (A11) and (A13) to derive an expression for \( \gamma_1 \), (A10) may be written as
\begin{align}
A14) \quad & W_p + \frac{M_p [dT/d\bar{p}^{w2}]}{[dE^{w2}/d\bar{p}^{w2}] - M_T [dT/d\bar{p}^{w2}]} W_T = 0.
\end{align}
Next, we observe that (A8) implies \( \theta^1 = \theta^2 \), which can be manipulated to yield
\begin{align}
A15) \quad & \frac{\partial \bar{p}^{w1}}{\partial \tau^2} = \frac{\bar{p}^{w2}}{\bar{p}^{w1}} \left[ \frac{dT/d\bar{p}^{w2}}{dT/d\bar{p}^{w1}} \right] \left[ \frac{\partial \bar{p}^{w2}}{\partial \tau^1} \right],
\end{align}
which in turn allows \( \theta^2 \) to be written as
Using the linkage condition (13) and the market-clearing condition (16), expressions for \(\frac{\partial p^{w2}}{\partial \tau^1}\) and \(\frac{\partial p^{w2}}{\partial \tau^2}\) may be derived which, when substituted into (A16), yield

\[
\theta^2 = \frac{\partial p^{w2}}{\partial \tau^2} \left[ \frac{\partial^2 p^{w2}}{\partial \tau^2} \right] + \left( \frac{\partial p^{w2}}{\partial \tau^1} \right) \left[ \frac{\partial^2 p^{w2}}{\partial \tau^1} \right].
\]

Therefore, by substituting (A17) into (A8) and observing that the resulting expression is identical to (A14), we may conclude that (A11), (A13) and (A10) imply (A8). Similarly, we use (A11) and (A12) to derive an alternative expression for \(\gamma_1\), which allows (A9) to be written as

\[
W_{r_i} + \frac{\partial^2 p^{w1}}{\partial \tau^1} = 0.
\]

Now using (13) and (16), we may derive that

\[
\frac{\partial^2 p^{w1}}{\partial \tau^1} = \frac{M_{r_i}}{[dE^{w1}/d\tilde{p}^{w1}] - [dM/d\tilde{p}^{w1}]}.
\]

Substituting (A19) into (A18) yields an expression identical to (A7). Hence, we may conclude that (A11), (A12) and (A9) imply (A7).

**Part II:** The proof that Program 5' is a minimal partition of Program 5 proceeds in the same way as the proof of Lemma 3.

**QED**

**Proposition 8:** An international agreement can attain a point on the international efficiency frontier and satisfy (18) if and only if it satisfies the MFN rule.

**Proof:** To prove this proposition, we first characterize the efficiency frontier of the 3-country model (that is, for notational simplicity, we treat the foreign governments in region *2 as if they were all identical, but this is not essential for the result). To this end, fix foreign welfare levels \(\bar{W}^{r_j}\) for \(j = \{1,2\}\) and define \(\tilde{p}^{w1}(r^{*j},\tau^{w1},\bar{W}^{r_j})\) implicitly by \(W^{w1}(r^{*j},p^{w1}(\tau^{w1},\tilde{p}^{w1})) = \bar{W}^{r_j}\) for \(j = \{1,2\}\). Observe that

\[
\frac{\partial \tilde{p}^{w1}}{\partial \tau^{w1}} = \frac{p^{w1}(r^{*j},\tau^{w1},\bar{W}^{r_j})}{W^{w1}(r^{*j},p^{w1}(\tau^{w1},\tilde{p}^{w1}))} - \frac{\tau^{w1}W^{w1}}{p^{w1}(r^{*j})}; \quad \text{and} \quad \frac{\partial \tilde{p}^{w1}}{\partial \tau^{w1}} = \frac{-\tau^{w1}W^{w1}}{p^{w1}(r^{*j})},
\]

for \(i = 1,2,\ldots,R^{w1}\) and \(j = \{1,2\}\). We may now define
\[
T(\{r^{ij}\}, \{\tau^{ij}\}, \{\tilde{W}^{ij}\}) \equiv T(\{r^{ij}\}, \{p^{ij}(\tau^{ij}, \tilde{p}^{ij}(r^{ij}, \tau^{ij}, \tilde{W}^{ij}))\}, \{\tilde{p}^{ij}(r^{ij}, \tau^{ij}, \tilde{W}^{ij})\}),
\]

and observe that, by the market-clearing condition (16), a value of \( p \) is implied, which we denote by \( \tilde{p}(r, \{r^{ij}\}, \{\tau^{ij}\}, \{\tilde{W}^{ij}\}) \). We may thus write domestic government welfare as a function of the domestic regulatory choices, the foreign regulatory choices and foreign tariffs, and the foreign welfare levels, or

(A21) \( W(r, \tilde{p}(r, \{r^{ij}\}, \{\tau^{ij}\}, \{\tilde{W}^{ij}\}), \tilde{T}(\{r^{ij}\}, \{\tau^{ij}\}, \{\tilde{W}^{ij}\})) \).

Fixing foreign welfare levels and choosing domestic and foreign regulations and foreign tariffs to maximize domestic welfare given by (A21) then defines a point on the efficiency frontier. The first order conditions that define the efficiency frontier are

(A22) \( W_r + W_p \frac{\partial \tilde{p}}{\partial r_i} = 0 \) for \( i = 1, 2, \ldots, R \),

(A23) \( W_p \frac{\partial \tilde{p}}{\partial r_i^{ij}} + W_r \frac{\partial \tilde{T}}{\partial r_i^{ij}} = 0 \) for \( i = 1, 2, \ldots, R^{ij} \) and \( j = 1, 2 \), and

(A24) \( W_p \frac{\partial \tilde{p}}{\partial \tau^{ij}} + W_r \frac{\partial \tilde{T}}{\partial \tau^{ij}} = 0 \) for \( j = 1, 2 \).

Now consider the efficiency properties of policy choices that satisfy (18) and also (19). By (A22)-(A24), these policies are efficient if and only if

(A25) \( \frac{\partial \tilde{T}}{\partial \tau^{ij}} = 0 = \frac{\partial \tilde{T}}{\partial \tau^{ij}} \) for \( i = 1, 2, \ldots, R^{ij} \) and \( j = 1, 2 \).

But by (A20), (A25) is satisfied at policies that satisfy (18) and (19) if and only if

(A26) \( \frac{E^{ij}}{M} [\tilde{p}^{wij} - \bar{T}] = 0 = \frac{E^{ij}}{M} [\bar{p}^{wij} - \bar{T}] \) for \( i = 1, 2, \ldots, R^{ij} \) and \( j = 1, 2 \).

Hence, by (A26), policy choices that satisfy (18) and (19) are efficient if and only if the tariffs conform to MFN (so that \( \bar{p}^{wij} = \bar{T} \) for \( j = 1, 2 \)). Further, at policies satisfying (18), (A20)-(A26) can be used to show that efficiency requires that these policies satisfy (19) as well and abide by MFN. Hence, an international agreement can attain a point on the international efficiency frontier and satisfy (18) if and only if it satisfies the MFN rule.

QED