

12 The Elephants in the Room

No single book can cover all of the important issues that have been raised by globalization over the past several decades and with which the world trading system of the twenty-first century must contend. But omitted from the coverage of previous chapters are several issues that deserve special mention. In this chapter, I touch briefly on these “elephants in the room.”

12.1 The Clash of Sovereignty and Globalization

The conflict between openness and national sovereignty is at the forefront of contemporary debate over globalization. This conflict has been growing since the early 1990s, but it was not always present. During much of the GATT era, any hint of such a conflict would have been resolved in favor of the preservation of national sovereignty. For example, writing about the approach taken by the drafters of GATT to issue areas relating to behind-the-border measures, Hudec (1990, 24) provides a window into the subservient status of trade agreements relative to issues of national sovereignty at the time, observing that “governments would never have agreed to circumscribe their freedom in all these other areas for the sake of a mere tariff agreement.”

Of course, the evolution toward deep-integration agreements, described in chapter 1 and revisited in various chapters throughout the book, makes Hudec’s observation now appear quaint. Indeed, this evolution, taking place in regional and mega-regional negotiations around the world and to a lesser extent in the transition from GATT to the WTO, has in large part been the focus of those who feel that the sovereignty of their national governments has been eroded by globalization. But has globalization really come at the cost of national sovereignty? And what exactly is meant by sovereignty, anyway? An

answer to this second question must logically precede an answer to the first. And scholars who have thought deeply about the meaning of sovereignty don't always answer the first question in the affirmative. For example, on the particular question of whether the GATT/WTO violates traditional notions of national sovereignty, Rabkin (1998, 85–86) takes the position that it does not, stating:¹

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.

More broadly, what are the sovereign rights of nations, and to what extent do these rights stand in the way of achieving internationally efficient outcomes? Here I briefly describe the findings of Bagwell and Staiger (2018b), who propose answers to these questions and employ those answers to evaluate the design features of the GATT/WTO with respect to the issues of national sovereignty.

As Bagwell and Staiger observe, defining sovereignty is not a simple task, especially if the goal is to capture elements that feature prominently in the common usage of the term. This difficulty stems in part from the fact that the international political economy literature where 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. Krasner (1999) employs a taxonomy to represent four distinct ways in which the term “sovereignty” has been commonly used in this literature: *domestic sovereignty*, which refers to the organization and effectiveness of political authority within the state; *international legal sovereignty*, which refers to the mutual recognition of states; *interdependence sovereignty*, which refers to the scope of activities over which states can effectively exercise control; and *Westphalian sovereignty*, which maintains as its central premise the rule of nonintervention in the internal affairs of other states.

The definition of sovereignty proposed by Bagwell and Staiger builds from the Westphalian norm of nonintervention in the internal

1. See also Rodrik (2020), who articulates a similar view for GATT but less so for the WTO.

affairs of other states. To formalize this norm, the terms “nonintervention” and “internal affairs” must be defined. Bagwell and Staiger argue that three key features of Westphalian sovereignty can be ascertained from a review of the international political economy literature and that these features can serve as a guide to an acceptable definition of sovereignty. First, commitments that result from voluntary international agreements do not *necessarily* violate Westphalian sovereignty. Second, international commitments over policies that concern “sufficiently domestic” affairs (i.e., internal affairs) *do* violate Westphalian sovereignty. And third, international commitments that *distort or derange* the normal operation of domestic institutions also violate Westphalian sovereignty. Bagwell and Staiger argue that these three features should be reflected in a definition of sovereignty that is meant to capture the Westphalian norm in the context of voluntary international agreements.

To construct a definition of sovereignty that can reflect these features, Bagwell and Staiger propose a formal definition of internal affairs that augments the Westphalian emphasis on authority over the determination of institutions and policies and adds to this an emphasis on authority and control over the determination of outcomes and therefore payoffs as well, all evaluated from the perspective of the Nash policy equilibrium of a given model world. This defines the domain of a country’s sovereign rights, from which encroachment by international agreements can then be assessed. In effect, the definition of internal affairs proposed by Bagwell and Staiger combines elements of authority with elements of control/effectiveness and, in so doing, delivers a notion of sovereignty that exhibits traditional features of Westphalian sovereignty (the maintenance of authority over institutions and policies), interdependence sovereignty (the maintenance of effective control over cross-border activities), and domestic sovereignty (the maintenance of authority and effective control over activities within the territory).

The characterization of a country’s internal affairs that results according to this definition depends on the nature of interdependence across countries, which is in turn defined by the “externality” variables of the model world that capture how one country’s policy choices affect the welfare of other countries. And as the nature of interdependence changes, so too will the scope of a country’s internal affairs and hence the domain of its sovereign rights. This property resonates with

the views of Jackson (2003), who argues for the need to update the traditional Westphalian concept of sovereignty.²

Of particular relevance when applied to trade agreements is what this property means for the internal affairs of large versus small countries. Countries that are small in world markets, and that therefore have no impact on world prices when they make their unilateral policy choices, enjoy a greater degree of policy independence—and hence, according to Bagwell and Staiger’s definition, possess a wider set of policies that qualify as their internal affairs and therefore a wider domain of sovereign rights—than countries that are large in world markets and therefore impact world prices, facing the implied additional degree of interdependence when making their unilateral policy choices. I return to this property below.

In any case, with a definition of internal affairs in hand, the broad approach taken by Bagwell and Staiger to evaluate the design features of the GATT/WTO with respect to issues of national sovereignty can now be described as follows. In a first step, the normal operation of a country’s domestic institutions in the domain of its internal affairs is characterized. This amounts to a consideration of the way in which the preferences of the country’s citizens would be translated into choices over the policy instruments that lie in the domain of its internal affairs if those choices were made in the absence of any international agreement. And then, in a second step, an international agreement is said to violate the sovereignty of a member state—that is, one state has intervened in the internal affairs of another state as a result of the international agreement—whenever the international agreement leads the government of a country to make external commitments over matters that (i) concern the country’s internal affairs or (ii) alter (and therefore distort/derange) the normal operations of

2. Jackson (2003) proposes an updated concept of Westphalian sovereignty that he terms “sovereignty-modern” and that is meant to be more consistent with international efficiency and the need for international policy coordination in the modern world. The formal definition of sovereignty that Bagwell and Staiger propose achieves some of what Jackson has in mind, because according to their definition the domain of sovereignty will evolve as the nature of international interdependence evolves. But unlike Jackson, Bagwell and Staiger do not tailor their definition of sovereignty on a case-by-case basis to be in harmony with international efficiency. Instead, they evaluate formally the circumstances when a trade-off between maintaining national sovereignty according to their definition and achieving international efficiency can be avoided, and they also consider when this trade-off will necessarily arise.

the country's domestic institutions within the domain of its internal affairs.³

Adopting the perspective of the terms-of-trade theory of trade agreements and therefore working in a setting where the externality variable is the world price p^w , Bagwell and Staiger demonstrate that market access commitments—defined as a policy commitment to conditions of competition between domestic producers and foreign exporters (see chapter 3, note 2) and therefore as a commitment to a specific level of import volume when foreign exporters price at p^w —fall outside the domain of a large country's internal affairs, while the particular policies employed to deliver a level of market access are the country's internal affairs. As such, Bagwell and Staiger are able to conclude that international agreements that entail market access commitments for large countries do not by themselves violate national sovereignty. What *would* violate a country's sovereignty according to this perspective are commitments to the details of the policies that the country will employ to deliver its market access commitments, or commitments that distort the normal operation of the country's institutions relevant for the determination of these policies.

In short, for environments where the terms-of-trade theory applies, the formalization of national sovereignty developed by Bagwell and Staiger implies that shallow-integration commitments do not violate a country's sovereignty as long as those commitments are interpreted as commitments to a level of market access. But deep-integration commitments that pin down the details of the country's relevant policies on market access or distort the normal operation of the domestic institutions that determine those policies would violate the country's sovereignty.

Armed with this conclusion, and exploiting the implications of the terms-of-trade theory regarding the nature of the inefficiency that a trade agreement must solve (as described in chapter 2), it is then a short step to the further conclusion that, in a world of two large countries, a market access agreement between them can achieve the international efficiency frontier without violating the sovereignty of either country. Moreover, when a multicountry world economy is considered where

3. So as not to necessarily tie all of my statements about sovereignty in this book to the particular formalization of that term that is put forward by Bagwell and Staiger (2018b) and described here, in earlier chapters whenever I have used the term sovereignty I mean it in an informal sense along the lines consistent with common usage of the term.

all countries are large in world markets, Bagwell and Staiger demonstrate that a commitment to nondiscriminatory tariffs as implied by MFN treatment would not violate any country's sovereignty either. Intuitively, for large countries, discriminatory tariffs make possible certain market access choices that would be impossible under MFN; but as already noted, market access choices are not the internal affairs of a large country, and so restrictions can be placed on these choices through voluntary international agreement without violating national sovereignty.

This last point is important because, as Bagwell and Staiger demonstrate, it allows them to conclude that if some (but not all) countries are large, then achieving international efficiency and preserving national sovereignty are mutually consistent goals of an international agreement *if and only if* the agreement is limited to MFN market access commitments. In particular, they find that "politically optimal" market access agreements (i.e., market access agreements that implement the politically optimal policies as defined in chapter 2) that are also nondiscriminatory and therefore conform to MFN provide the unique path to achieving international efficiency while preserving national sovereignty in this setting. To see why, recall that small countries enjoy a greater degree of policy independence and thus a wider domain of sovereign rights than large countries. In fact, Bagwell and Staiger show that market access choices fall into the domain of internal affairs for small countries, implying that in any international agreement that does not violate their sovereignty, small countries must be left unconstrained to choose their best-response policies and implied market access levels. This requirement is consistent with international efficiency according to the terms-of-trade theory, but as Bagwell and Staiger show, only when all tariffs are nondiscriminatory and the MFN politically optimal tariffs are implemented.

Taken together, these findings have potentially important implications for the design of the GATT/WTO and its ability to facilitate globalization while respecting the sovereignty of its member governments. As I have described in previous chapters, the GATT/WTO has from its inception been concerned most fundamentally with nondiscriminatory 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 and secured by a set of GATT articles that serve as "market access preservation rules." The findings described above suggest that this tradition

could be a winning combination for achieving international policy efficiency while preserving national sovereignty, at least in environments where the terms-of-trade theory applies.

But this tradition is being eroded on two fronts. First, the prevalence of discriminatory trade agreements has increased dramatically in recent decades, diminishing adherence to the MFN principle as a practical matter in the global economy. And second, increasingly trade agreements are becoming a forum for the negotiation of international commitments on a host of behind-the-border policies. As I have suggested in previous chapters, to some extent these developments may be the result of changes in the nature of the problems that trade agreements are being asked to solve, away from the problem identified by the terms-of-trade theory and toward novel forms of international externalities. Whatever the drivers of these developments, the findings described here convey a clear message: The further the WTO and the world trading system that it governs depart from a reliance on agreements that take the form of nondiscriminatory market access commitments, the more likely it will be that these agreements pose a threat (and possibly, an avoidable one) to the sovereignty of the member countries.

Finally, I have omitted from my discussion of sovereignty those issues that are associated with the operation of the WTO Dispute Settlement Body, but of course those issues have also become critical in the globalization debate, especially in recent years as the United States has taken actions that have led to the breakdown of the appeals process at the WTO. At issue here is the appropriate level of “activism” for the WTO court. For example, after describing the WTO Appellate Body’s (AB) interpretation of the term “public body,” which had the effect of limiting the scope for using WTO rules to respond to the competitive distortions associated with China’s state-owned enterprises, Matthes (2021, 18) describes the issue this way:

From this viewpoint, the AB acted as a normal court in interpreting rules and established a new meaning pertaining to WTO law. However, the US holds the opinion that the AB is not a usual court but should stick very closely to WTO law.

In essence, the debate is about whether to stick with the WTO legal system, possibly circumscribed in various ways to rein in the mandate of panel and appellate body judges, or rather to return to something less formal and closer to the original GATT legal system. And while

the tactics used by the United States in the context of this debate have been very disruptive to the operations of the WTO, what is at stake in this debate—namely, the appropriate level of court activism—does not pose an existential threat to the WTO in the way that the tensions between international efficiency and national sovereignty that I have highlighted here do.⁴

12.2 The Declining Hegemon

In chapter 5, I described how the Trump tariffs might be interpreted as a crude attempt by the then president's administration to implement its vision of the global trading system. In particular, as I observed in chapter 5, Mattoo and Staiger (2020) argue that these actions amount to a US-led effort to repeal the rules-based trading system and replace it with a power-based system where countries are free to bargain in a way that is not constrained by a particular set of agreed-on rules of behavior. And as Mattoo and Staiger note, while the Trump administration accelerated a move away from the rules-based trading system and toward a power-based approach, it was not the first US administration to move in this direction.⁵ In this section I elaborate further on Mattoo and Staiger's explanation for why this might be happening now.

Mattoo and Staiger begin from the observation that the rules-based system of the GATT/WTO has two main potential advantages over a power-based approach to tariff bargaining. First, the rules of the GATT/WTO can simplify the tariff bargaining problem and make it manageable, and this can help countries negotiate to more efficient policies. Chapters 4 and 5 have reviewed evidence consistent with this position, and in principle all countries could share in the implied efficiency gains generated by a rules-based system. Second, these rules tend to mitigate the power of the most powerful countries (in chapter 5 I discussed some evidence in support of this position as well) and in so doing can encourage the participation of weaker countries in the global trading system—countries that might otherwise be vulnerable to exploitation by the stronger countries and choose to opt out altogether.

4. See also the discussion of Maggi and Staiger (2011) in chapter 6, where some of the issues associated with court activism are covered.

5. Evidence of power-based bargaining could be seen in the strategy used by the major players in the GATT Uruguay Round to deal with "holdout" countries in creating the WTO—namely, withdrawing from GATT and acceding to the newly formed WTO (see Posner and Sykes 2014).

It is on this second potential advantage of a rules-based trading system that Mattoo and Staiger focus their attention. In essence, they argue that the rules-based trading system may be in peril because the dominant position of the United States in the world economy has eroded, which has implications for the rules-based system's ability to generate participation benefits of a magnitude that would justify continued US submission to the rules.

That commitment to a rules-based system could generate participation benefits that are sufficiently large to justify a powerful country's submission to those rules is illustrated in a stylistic way for a two-country world in figure 12.1, which builds on McLaren (1997) and is adapted from Bagwell and Staiger (1999). In this figure, the welfare of the domestic country, W , is plotted on the vertical axis and the welfare of the foreign country, W^* , is plotted on the horizontal axis. The dashed frontier depicted in the figure represents the combinations of domestic and foreign welfare levels achievable under efficient tariff bargaining. The welfare levels at the origin of the figure, labeled $N_{\text{ex-post}}$, represent the "disagreement point" for the two countries: These are the welfare

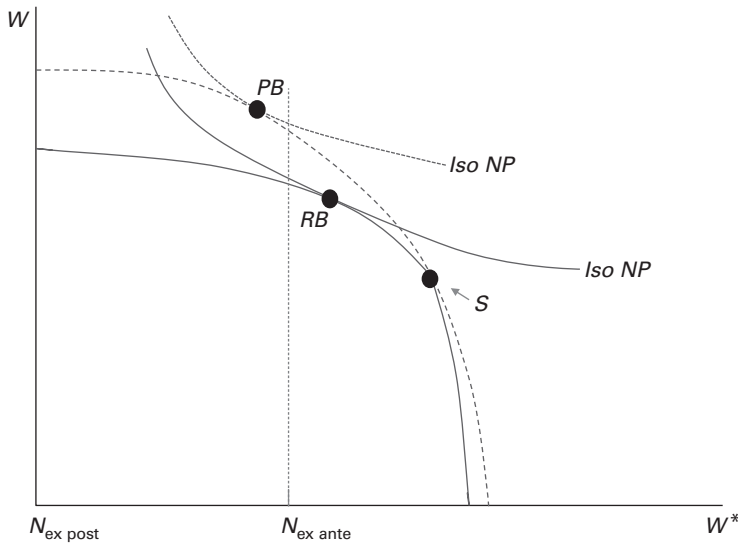


Figure 12.1

The participation benefits of a rules-based system. W = welfare of the domestic country, W^* = welfare of the foreign country, NP = Nash product, RB = rules-based bargaining outcome, PB = power-based bargaining outcome, S = politically optimal outcome. *Source:* Adapted from Bagwell and Staiger (1999, fig. 5B).

levels that the domestic and foreign country would achieve if their tariff bargaining broke down. And the point on the frontier labeled PB is the outcome of the power-based bargain, assuming that both the domestic and the foreign country participate in the bargain and that this bargain can be represented as a Nash bargain that reaches the highest iso-Nash-Product contour (the dashed iso-Nash-Product contour labeled in the figure as $Iso NP$) consistent with the dashed frontier. As depicted, at the point PB , both countries achieve higher welfare than their disagreement welfare levels at $N_{ex-post}$, indicating that each country does better under the agreement summarized by the point PB than it would do by walking away from the deal.

But these disagreement welfare levels may not be the relevant welfare levels for assessing whether the decision to *participate* in the bargain is worthwhile. This is because the act of showing up at the bargaining table to participate in the bargain may itself imply incurring some sunk costs, economic or political, which cannot then be recouped should the bargaining break down, and which are therefore netted out from the welfare levels at $N_{ex-post}$. Under the assumption that the foreign country is the weaker, smaller country of the two and that it experiences such sunk costs when it agrees to participate in a tariff bargain with the larger, more powerful domestic country (perhaps because its exporters will sink investments into serving the large domestic-country market once it is known that the two countries have agreed to bargain), the disagreement point relevant for the participation decision—which excludes the sunk costs that would be incurred by showing up—is labeled in figure 12.1 as $N_{ex-ante}$. The figure depicts the case where, under power-based bargaining, the foreign country does worse than if it had not shown up to the bargaining table; hence, anticipating this, it will choose not to participate in such a bargain and the two countries will be stuck at their (ex ante) disagreement welfare levels.

This is where the commitment to a rules-based system could benefit all countries, including the most powerful countries. Here I illustrate the impact of committing to the reciprocity rule as it arises in the context of GATT Article XXVIII renegotiation. Recall from the discussion in chapter 4 that if a powerful country pushes for better-than-reciprocal terms in an efficient bargain, its trading partner can subsequently renegotiate subject to reciprocity, introducing inefficiencies in the bargaining outcome that are borne by the powerful country and serve to penalize it for exercising its power in the bargain. The implications of this are illustrated in figure 12.1 by the solid welfare frontier, which lies

everywhere inside the dashed frontier except at the point marked *S*, where each country has set its tariffs at the levels it would have chosen if it were a small country, and therefore where no country is exerting bargaining power to push the deal in its favor.⁶ The Nash bargain in the presence of this reciprocity-constrained frontier would then deliver the rules-based bargaining outcome labeled *RB* in figure 12.1, which marks the highest iso-Nash-Product contour (the solid iso-Nash-Product contour labeled in the figure as *Iso NP*) consistent with the solid frontier. As illustrated in figure 12.1, the rules-based bargaining outcome *RB* penalizes the powerful domestic country and favors the weaker foreign country relative to the power-based bargaining outcome *PB*; but for the powerful domestic country this is no loss, since it could not get the foreign country to participate in power-based bargaining in any event. And relative to their ex ante disagreement welfare levels, both countries now do better under the rules-based bargaining outcome *RB*.

The discussion here suggests that the most powerful countries may benefit from a rules-based multilateral trading system precisely because they *are* so powerful. This may help explain why the United States was, along with the United Kingdom, the champion of the rules-based system at its creation in 1947 with the birth of GATT. But it is not hard to see from figure 12.1 that, if the domestic country were the more powerful of the two but not so dominantly more powerful as I have illustrated in the figure, the foreign country could well choose to participate in trade bargaining even under a power-based system. And in that case, the more powerful domestic country would prefer to escape from the rules and pursue power-based trade bargaining with the now-participating foreign country (assuming that the efficiency benefits of rules-based bargaining noted above were not large enough to carry the day on their own).

This suggests the possibility that, with the rise of the large emerging and developing economies and the decline in hegemonic status that the United States has experienced in recent decades, its enthusiasm for the rules-based system it helped to create could wane: Being far less dominant in the global economy than it was in 1947, the United States is no longer in need of a set of international rules to help it commit not to exploit other countries in trade bargaining so that they feel comfortable engaging in the global economy. And if the declining hegemonic position of the United States is indeed a primary cause of the challenges

6. This point corresponds to the political optimum as defined in chapter 2.

now facing the rules-based multilateral trading system, to repair that system the world may have to wait for the rise of another hegemon. It is this possibility that Mattoo and Staiger describe, and which is illustrated in stylistic fashion in figure 12.2.

With the passage of time measured from left to right on the horizontal axis, figure 12.2 depicts in a schematic way a hypothetical evolution in the world trading system, from a rules-based system to a power-based system and back again. This evolution is driven by an exogenous process in which one country, referred to as “the US,” experiences an erosion over time in its position of hegemony atop the world economy, while a second country, referred to as “China,” ascends to this position of hegemony. For simplicity, countries are assumed to be myopic, and the choice between a rules-based and a power-based trading system in any period is assumed to be determined by the more powerful country in that period, who decides whether it will subject itself to rules for the period under consideration.⁷ The thick solid lines in figure 12.2 depict the equilibrium payoffs of each country under the equilibrium regime choice in each period, and as depicted, the periods can be separated into four phases that reflect these equilibrium regime choices.

In the US hegemony phase, the United States chooses to tie its hands in a rules-based regime. This is because during this phase, the weak country (China) can credibly threaten not to bargain with the United States in the absence of rules, and hence the United States must rely on rules to induce China’s participation, much like the situation illustrated in figure 12.1. This feature is reflected in figure 12.2 by the fact that in the US hegemony phase, the payoff to China under power-based bargaining (dashed upward-sloping thick line), while above China’s ex post once-the-bargaining-has-begun Nash payoff (dotted upward-sloping thin line), is below its ex ante Nash payoff (solid upward-sloping thin line)—that is, it is below the payoff China could expect if it simply stayed away from the bargaining table and never let the bargaining process get off the ground. And so the payoffs for the two countries under a power-based regime would be their (ex ante) Nash payoffs (solid downward-sloping thin line for the United States, solid upward-sloping thin line for China) which, reflecting the

7. As Mattoo and Staiger note, the assumption that the relatively more powerful country determines the regime can be formalized in a two-stage game: in stage 1, the more powerful country decides whether or not to commit to rules for bargaining, and then in stage 2, the more powerful country invites the weaker country to bargain, an invitation that the weaker country can either accept or reject.

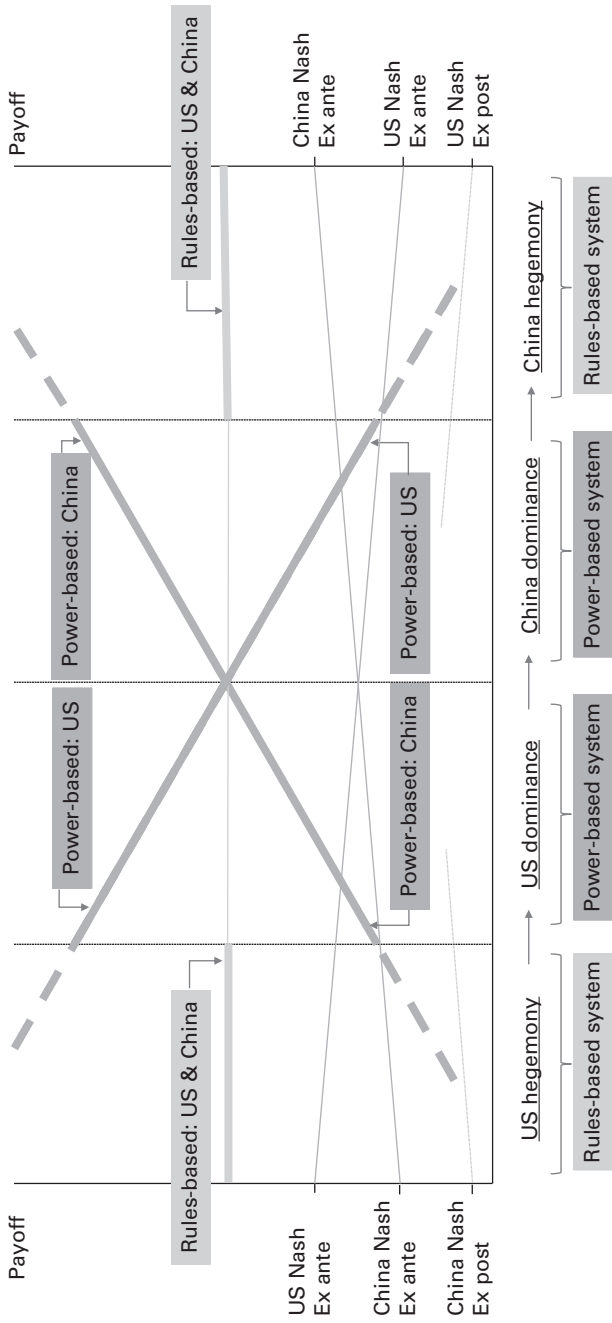


Figure 12.2 Hegemonic transition of the world trading system. *Source:* Reproduced from Matttoo and Staiger (2020, fig. 2).

positive-sum gains from bargaining and the assumption that these gains are split evenly in the rules-based bargain, are below the payoffs that each country would receive when bargaining under the rules-based regime, depicted by the horizontal thick line in the figure. Hence the rules-based regime will be implemented in the US hegemony phase.

In the US dominance phase, the United States does better in a power-based regime than a rules-based regime and chooses to withdraw support from the rules-based regime and escape from the constraints of the rules-based system that it once created. During this phase, China would like to threaten not to bargain with the United States in the absence of rules, but unlike in the US hegemony phase, this threat is not credible, and hence the United States does not need to rely on rules to induce China's participation. This is because in the US dominance phase, the payoff to China under power-based bargaining (solid upward-sloping thick line) has now risen above China's ex ante Nash payoff (solid upward-sloping thin line), and so China is willing to participate in power-based bargaining with the United States; and initially, at the border between the US hegemony and US dominance phases, the United States payoff (solid downward-sloping thick line) captures all the gains from the bargain relative to the ex ante Nash payoffs. The power-based payoffs of the two countries converge in figure 12.2 at the border between US dominance and China dominance where the two countries are equally powerful, and then the payoffs of the United States and China play mirror-image roles as the world moves through the China dominance phase and finally to the China hegemony phase.⁸ The remaining phases are then mirror images of the first two phases just described. In the China dominance phase, China now does better in a power-based regime than a rules-based regime and chooses not to support a rules-based regime. And finally, in the China hegemony phase, China chooses to tie its hands in a rules-based regime.

According to Mattoo and Staiger's interpretation, the erosion of US support for the rules-based system is not likely to be a short-term temporary phenomenon that will be reversed now that the Trump administration has ended. Moreover, if figure 12.2 embodies the correct diagnosis, it is a diagnosis that is full of irony. The design of the

8. That the power-based payoffs of the two countries converge to their rules-based payoffs at the border between US dominance and China dominance in figure 12.2 reflects an assumption that power-based and rules-based bargaining are equally efficient. See Mattoo and Staiger (2020) for a depiction of the case where rules-based bargaining is more efficient than power-based bargaining.

rules-based multilateral trading system has proved effective in solving an important and still-relevant problem, yet the system will inevitably collapse. While there may be nothing fundamentally wrong with the existing rules-based system, there are certainly important improvements in the design of the rules that could be made, yet such improvements will likely do nothing to save the system. And while China is seen by many as a source of some of the greatest challenges for the rules-based trading system of the twenty-first century, if this diagnosis is correct, it may be that the rise of China is the world's best hope for the return of a viable rules-based multilateral trading system.

12.3 The WTO's Role in Preparing for the Next Pandemic

The COVID-19 pandemic that began in the winter of 2020 has shaken the entire world, and the world trading system has certainly not been spared. The challenges created for the WTO by this pandemic are many and varied, though they are not new: Public health researchers and economists have been concerned for some time that the growing interdependence engendered by globalization carries increasing risks of disease transmission across countries, and there have been calls for the WTO to address this concern (see Mackey and Liang 2012; Hoekman 2020). But the COVID-19 pandemic has brought these risks into sharp focus, laying bare for the world trading system a number of serious and interrelated challenges that have the potential to erupt during pandemics, ranging from supply chain disruption to issues relating to erratic vaccine distribution and associated patent rights to the imposition of export restrictions on personal protective equipment (PPE).

What is the WTO's role in meeting these challenges, and in helping countries prepare for the next pandemic? The World Health Organization (WHO) is the institution tasked with addressing international health issues, and the appropriate role for issue linkage between the WTO and the WHO as well as other international agencies must be a central concern in any comprehensive answer to this question.⁹ Here I focus on a narrow slice of this question: Can WTO rules be effective in preventing governments from imposing export restrictions during a pandemic? And relatedly, what is the appropriate balance for the

9. On the role that the WHO and other international agencies can play in prevention, preparedness, and response to pandemics, see National Research Council (2016 chap. 4).

WTO between that goal and the goal of encouraging trade-related public health measures that would reduce the probability of a pandemic in the first place?

I examine these questions through the lens of the enforcement constraints with which a trade agreement such as the GATT/WTO must contend (see Dam 1970; Bagwell and Staiger 2002, chap. 6). In particular, because there is no world jail where national leaders can be thrown if they violate GATT/WTO commitments, meaningful commitments in the GATT/WTO, like meaningful commitments in any international trade agreement, must be self-enforcing so that the member governments see it in their self-interest to follow through on commitments. Adopting a modeling approach to self-enforcing trade agreements similar to Bagwell and Staiger (1990) and highlighting the basic incentive constraint that a self-enforcing agreement must obey, I argue that there are good reasons to expect export restraints to move closer to noncooperative levels during a pandemic, reflecting the fact that during a pandemic, efforts to maintain fully cooperative export policy will be especially fraught. Further, when the possibility of encouraging policy commitments that could reduce the probability of a pandemic is also considered, looking to a trade agreement as a forum for blunting the use of export restraints during a pandemic can be counterproductive.

These points can be formalized with the aid of a simple model. To keep the analysis focused, I consider a two-country partial equilibrium “endowment-economy” world, where the home country is endowed with a fixed amount of good y and the foreign country is endowed with a fixed amount of good x , and where x and y might be thought of as two different forms of PPE (or possibly one form of PPE and a vaccine, but I will use the term PPE as shorthand). Aside from their endowment structure, I will assume that the two countries are otherwise identical in every way, and therefore the home country will import x and export y while the foreign country imports y and exports x . For simplicity, I focus on the use of tax instruments to restrict trade rather than quotas, though the qualitative nature of the conclusions I emphasize below do not depend on this.¹⁰ And I abstract from import tariffs and focus instead on the use of export taxes, with the home-country tax on exports of good y denoted by τ_y and the foreign-country tax

10. The modeling framework of Bagwell and Staiger (1990) on which I build can handle both tariffs and quotas, and as they demonstrate, the qualitative predictions of the model are robust to the choice of policy instrument.

on exports of good x denoted by τ_x^* . The simplification of endowment economies means that an export tax is equivalent to a subsidy to local consumption of the export good. This simplification allows me to focus on export taxes while abstracting from the production distortions that would otherwise arise with their use.

In each period, there is a chance that a new virus will be introduced into the human population and lead to a pandemic. If a pandemic occurs in a period, I assume that it lasts for the period and then exogenously ends. Hence, governments can do nothing to impact the duration of a pandemic if it occurs. But I assume that governments can impact the chance that a pandemic occurs in the first place.

In particular, at the beginning of each period, the home and foreign countries have an opportunity to invest in public health measures I and I^* for the period and incur costs $c(I)$ and $c(I^*)$, respectively. These investments determine the probability that a new virus jumps from the animal to the human population and leads to a pandemic in the period, which I summarize with the reduced-form pandemic probability function $\rho(I, I^*)$, with $\rho(I, I^*) \in (0, 1)$ for all I and I^* . I assume that $c(\cdot)$ is increasing and convex in its argument, and I assume that $\rho(I, I^*)$ is decreasing and concave in each of its arguments. Therefore, the probability that a pandemic occurs in any period, $\rho(I, I^*)$, is jointly determined by the public health investments made by the two countries in that period and falls as those investments rise. These investments are a stand-in for public health measures designed to prevent a virus of animal origin from jumping to the human population or for standards and regulations that could help stop a new virus of animal origin that has jumped to the human population from taking hold in the population sufficiently to become a pandemic. Of course, in reality, these same kinds of investments might impact the duration of a pandemic, not just the chance that a pandemic occurs in the first place; but by assuming that the probability of a pandemic in any period is endogenous while the duration of a pandemic if it occurs is exogenous, I keep the model simple and focused on the main points.¹¹

11. Such measures are covered under the WTO Agreement on Technical Barriers to Trade (TBT) and the Agreement on the Application of Sanitary and Phytosanitary Measures (SPS). For a discussion in the context of COVID-19 of public health measures that are aimed at preventing a virus of animal origin from jumping to the human population, see WTO (2020a). For a discussion of standards and regulations that could help prevent a new virus of animal origin that has jumped to the human population from taking hold in the population sufficiently to become a pandemic, see WTO (2020b). See Burris, Anderson,

In a period where the pandemic occurs, the home country suffers a welfare loss equal to $C(D_x, D_y)$, where C is the pandemic loss function assumed to be positive, decreasing, and convex in both of its arguments, and where D_x and D_y are the home-country consumption levels of good x and y , respectively, that correspond to points on downward-sloping demand curves. I have in mind that the welfare cost of a pandemic to the home country is diminished when its consumption of either form of PPE is increased during the pandemic, but that these benefits are (local) externalities when viewed by the individual consumer in the home country (and hence enter into the function $C(D_x, D_y)$ rather than into home-country consumer surplus). Similarly, for the foreign country, I assume that in a period where the pandemic occurs it suffers a welfare loss equal to $C(D_x^*, D_y^*)$ with D_x^* and D_y^* the foreign-country consumption levels of good x and y , respectively. I will sometimes refer to a period where the pandemic occurs as the “pandemic state” of the world and to the no-pandemic state as “normal times.”

Consider now the welfare measures for the two countries. At the time that the export taxes τ_y and τ_x^* for the period are chosen, public health investments for the period are a bygone, and the state of the world (pandemic or no pandemic) for the period is known. In normal times, home and foreign welfare for the period are given by the usual economic surplus measures

$$\omega = \sum_{i \in \{x, y\}} CS_i(\bar{\tau}_y, \bar{\tau}_x^*) + PS_y(\bar{\tau}_y) + TR_y(\bar{\tau}_y) \equiv \omega(\bar{\tau}_y, \bar{\tau}_x^*) \quad (12.1)$$

$$\omega^* = \sum_{i \in \{x, y\}} CS_i^*(\bar{\tau}_y, \bar{\tau}_x^*) + PS_x^*(\bar{\tau}_x^*) + TR_x^*(\bar{\tau}_x^*) \equiv \omega^*(\bar{\tau}_y, \bar{\tau}_x^*),$$

with world welfare then given by

$$\omega^w(\bar{\tau}_y, \bar{\tau}_x^*) \equiv \omega(\bar{\tau}_y, \bar{\tau}_x^*) + \omega^*(\bar{\tau}_y, \bar{\tau}_x^*), \quad (12.2)$$

where CS_i is home-country consumer surplus associated with good $i \in \{x, y\}$ and PS_y and TR_y are, respectively, home-country producer surplus and trade tax revenue, and where CS_i^* , PS_x^* and TR_x^* are similarly defined for the foreign country, and where I use $\bar{\tau}_y$ and $\bar{\tau}_x^*$ to denote the home and foreign export taxes that are applied in normal times. In the pandemic state, home and foreign welfare for the period are given by economic surplus minus the welfare loss from the pandemic,

and Wagenaar (2021) on the importance of appropriate laws and regulations for effective pandemic control more generally.

$$\begin{aligned} \omega_{PAN} &= \sum_{i \in \{x,y\}} CS_i(\hat{\tau}_y, \hat{\tau}_x^*) + PS_y(\hat{\tau}_y) + TR_y(\hat{\tau}_y) - C(D_x(\hat{\tau}_x^*), D_y(\hat{\tau}_y)) \\ &\equiv \omega_{PAN}(\hat{\tau}_y, \hat{\tau}_x^*) \quad (12.3) \\ \omega_{PAN}^* &= \sum_{i \in \{x,y\}} CS_i^*(\hat{\tau}_y, \hat{\tau}_x^*) + PS_x^*(\hat{\tau}_x^*) + TR_x^*(\hat{\tau}_x^*) - C(D_x^*(\hat{\tau}_x^*), D_y^*(\hat{\tau}_y)) \\ &\equiv \omega_{PAN}^*(\hat{\tau}_y, \hat{\tau}_x^*), \end{aligned}$$

with world welfare in the pandemic state then given by

$$\begin{aligned} \omega_{PAN}^w(\hat{\tau}_y, \hat{\tau}_x^*) &\equiv \omega_{PAN}(\hat{\tau}_y, \hat{\tau}_x^*) + \omega_{PAN}^*(\hat{\tau}_y, \hat{\tau}_x^*) \quad (12.4) \\ &= \sum_{i \in \{x,y\}} CS_i(\hat{\tau}_y, \hat{\tau}_x^*) + PS_y(\hat{\tau}_y) + TR_y(\hat{\tau}_y) \\ &\quad + \sum_{i \in \{x,y\}} CS_i^*(\hat{\tau}_y, \hat{\tau}_x^*) + PS_x^*(\hat{\tau}_x^*) + TR_x^*(\hat{\tau}_x^*) \\ &\quad - [C(D_x(\hat{\tau}_x^*), D_y(\hat{\tau}_y)) + C(D_x^*(\hat{\tau}_x^*), D_y^*(\hat{\tau}_y))], \end{aligned}$$

where $\hat{\tau}_y$ and $\hat{\tau}_x^*$ are the home and foreign export taxes applied during a pandemic.

Unlike export taxes, at the time that the public health investment levels I and I^* are chosen in each period the state of the world for the period has not yet been determined, and so what is relevant for the choice of investment levels is ex ante expected welfare. Each country's ex ante expected welfare for the period is given by its expected economic surplus minus its expected loss from a pandemic, or

$$\begin{aligned} W &= [1 - \rho(I, I^*)] \times \left\{ \sum_{i \in \{x,y\}} CS_i(\bar{\tau}_y, \bar{\tau}_x^*) + PS_y(\bar{\tau}_y) + TR_y(\bar{\tau}_y) - c(I) \right\} \\ &\quad + \rho(I, I^*) \times \left\{ \sum_{i \in \{x,y\}} CS_i(\hat{\tau}_y, \hat{\tau}_x^*) + PS_y(\hat{\tau}_y) + TR_y(\hat{\tau}_y) - c(I) \right. \\ &\quad \left. - C(D_x(\hat{\tau}_x^*), D_y(\hat{\tau}_y)) \right\} \equiv W(\bar{\tau}_y, \bar{\tau}_x^*, \hat{\tau}_y, \hat{\tau}_x^*, I, I^*) \quad (12.5) \end{aligned}$$

for the home country and

$$\begin{aligned} W^* &= [1 - \rho(I, I^*)] \times \left\{ \sum_{i \in \{x,y\}} CS_i^*(\bar{\tau}_y, \bar{\tau}_x^*) + PS_x^*(\bar{\tau}_x^*) + TR_x^*(\bar{\tau}_x^*) - c(I^*) \right\} \\ &\quad + \rho(I, I^*) \times \left\{ \sum_{i \in \{x,y\}} CS_i^*(\hat{\tau}_y, \hat{\tau}_x^*) + PS_x^*(\hat{\tau}_x^*) + TR_x^*(\hat{\tau}_x^*) - c(I^*) \right. \\ &\quad \left. - C(D_x^*(\hat{\tau}_x^*), D_y^*(\hat{\tau}_y)) \right\} \equiv W^*(\bar{\tau}_y, \bar{\tau}_x^*, \hat{\tau}_y, \hat{\tau}_x^*, I, I^*) \quad (12.6) \end{aligned}$$

for the foreign country. Ex ante world welfare is given by

$$\begin{aligned}
 W^w(\bar{\tau}_y, \bar{\tau}_x^*, \hat{\tau}_y, \hat{\tau}_x^*, I, I^*) &\equiv W(\bar{\tau}_y, \bar{\tau}_x^*, \hat{\tau}_y, \hat{\tau}_x^*, I, I^*) + W^*(\bar{\tau}_y, \bar{\tau}_x^*, \hat{\tau}_y, \hat{\tau}_x^*, I, I^*) \\
 &= [1 - \rho(I, I^*)] \times \left\{ \sum_{i \in \{x, y\}} CS_i(\bar{\tau}_y, \bar{\tau}_x^*) + PS_y(\bar{\tau}_y) + TR_y(\bar{\tau}_y) \right. \\
 &\quad + \sum_{i \in \{x, y\}} CS_i^*(\bar{\tau}_y, \bar{\tau}_x^*) + PS_x^*(\bar{\tau}_x^*) + TR_x^*(\bar{\tau}_x^*) - [c(I) + c(I^*)] \left. \right\} \\
 &\quad + \rho(I, I^*) \times \left\{ \sum_{i \in \{x, y\}} CS_i(\hat{\tau}_y, \hat{\tau}_x^*) + PS_y(\hat{\tau}_y) + TR_y(\hat{\tau}_y) \right. \\
 &\quad + \sum_{i \in \{x, y\}} CS_i^*(\hat{\tau}_y, \hat{\tau}_x^*) + PS_x^*(\hat{\tau}_x^*) + TR_x^*(\hat{\tau}_x^*) - [c(I) + c(I^*)] \\
 &\quad \left. - [C(D_x^*(\hat{\tau}_x^*), D_y^*(\hat{\tau}_y)) + C(D_x^*(\hat{\tau}_x^*), D_y^*(\hat{\tau}_y))] \right\}. \tag{12.7}
 \end{aligned}$$

To characterize efficient (i.e., ex ante world welfare maximizing) policy choices in this setting, I first consider the choice of export taxes conditional on each state of the world and then the choice of (ex ante) investment policies. In normal times, as expected, there is no efficiency role for trade tax intervention, and hence the efficient export taxes that maximize the expression for ω^w in (12.2) are given by $\bar{\tau}_y^e = 0 = \bar{\tau}_x^{*e}$. In the pandemic state, the first-order conditions associated with (12.4) that maximize ω_{PAN}^w reduce to

$$\begin{aligned}
 \frac{\partial \omega_{PAN}^w}{\partial \hat{\tau}_y} &= - \left[\frac{\partial C(D_x, D_y)}{\partial D_y} \frac{\partial D_y}{\partial \hat{\tau}_y} + \frac{\partial C(D_x^*, D_y^*)}{\partial D_y^*} \frac{\partial D_y^*}{\partial \hat{\tau}_y} \right] = 0 \tag{12.8} \\
 \frac{\partial \omega_{PAN}^w}{\partial \hat{\tau}_x^*} &= - \left[\frac{\partial C(D_x, D_y)}{\partial D_x} \frac{\partial D_x}{\partial \hat{\tau}_x^*} + \frac{\partial C(D_x^*, D_y^*)}{\partial D_x^*} \frac{\partial D_x^*}{\partial \hat{\tau}_x^*} \right] = 0,
 \end{aligned}$$

which given the convexity of C and the cross-country symmetry assumptions I have imposed imply that, again, $\hat{\tau}_y^e = 0 = \hat{\tau}_x^{*e}$ and there is no efficiency role for trade tax intervention. Intuitively, in the pandemic state, there is no role for trade taxes for the purpose of maximizing worldwide economic surplus because cross-country symmetry ensures that under free trade, the supply (endowment) of each form of PPE in the world will be allocated equally across countries, and therefore allocated so as to minimize the worldwide cost of the pandemic ($C(D_x, D_y) + C(D_x^*, D_y^*)$).

Now consider the efficient choice of public health investments I^e and I^{*e} . These are the choices of I and I^* that maximize the ex ante world welfare W^w defined in (12.7) when W^w is evaluated at the efficient

export taxes (i.e., free trade in all states). The associated first-order conditions imply that I^e and I^{*e} must satisfy

$$\frac{\partial W^w}{\partial I} = -\frac{\partial \rho(I, I^*)}{\partial I} \times [C(D_x^e, D_y^e) + C(D_x^{*e}, D_y^{*e})] - c'(I) = 0 \tag{12.9}$$

$$\frac{\partial W^w}{\partial I^*} = -\frac{\partial \rho(I, I^*)}{\partial I^*} \times [C(D_x^e, D_y^e) + C(D_x^{*e}, D_y^{*e})] - c'(I^*) = 0,$$

where I use the superscript “e” to denote a magnitude that is evaluated at the efficient export taxes. As (12.9) indicates, the efficient choice of public health investment in each country, I^e and I^{*e} , equates the marginal benefit of a small increase in investment in terms of reduced expected worldwide welfare loss from a pandemic in the period to the marginal cost of the investment.

What are the noncooperative policies in this setting? The noncooperative (Nash) export tax choices in normal times, which I denote by $\bar{\tau}_y^N$ and $\bar{\tau}_x^{*N}$, are defined by the first-order conditions

$$\frac{\partial \omega}{\partial \bar{\tau}_y} = \frac{\partial [CS_i(\bar{\tau}_y, \bar{\tau}_x^*) + PS_y(\bar{\tau}_y) + TR_y(\bar{\tau}_y)]}{\partial \bar{\tau}_y} = 0 \tag{12.10}$$

$$\frac{\partial \omega^*}{\partial \bar{\tau}_x^*} = \frac{\partial [CS_i^*(\bar{\tau}_y, \bar{\tau}_x^*) + PS_x^*(\bar{\tau}_x^*) + TR_x^*(\bar{\tau}_x^*)]}{\partial \bar{\tau}_x^*} = 0.$$

The first-order conditions in (12.10) describe the export taxes that each country would choose to maximize its own economic surplus, and these export taxes amount to the usual Johnson (1953–1954) optimal tariffs. By contrast, the noncooperative export tax choices in the pandemic state, which I denote by $\hat{\tau}_y^N$ and $\hat{\tau}_x^{*N}$, are defined by the first-order conditions

$$\frac{\partial \omega_{PAN}}{\partial \hat{\tau}_y} = \frac{\partial [CS_y(\hat{\tau}_y, \hat{\tau}_x^*) + PS_y(\hat{\tau}_y) + TR_y(\hat{\tau}_y)]}{\partial \hat{\tau}_y} - \frac{\partial C(D_x, D_y)}{\partial D_y} \frac{\partial D_y(\hat{\tau}_y)}{\partial \tau_y} = 0 \tag{12.11}$$

$$\frac{\partial \omega_{PAN}^*}{\partial \hat{\tau}_x^*} = \frac{\partial [CS_i^*(\hat{\tau}_y, \hat{\tau}_x^*) + PS_x^*(\hat{\tau}_x^*) + TR_x^*(\hat{\tau}_x^*)]}{\partial \hat{\tau}_x^*} - \frac{\partial C(D_x^*, D_y^*)}{\partial D_x^*} \frac{\partial D_x^*(\hat{\tau}_x^*)}{\partial \hat{\tau}_x^*} = 0.$$

In each expression of (12.11), the second term on the right-hand side is a product of two terms: a negative term by the properties of the pandemic loss function, and a positive term given downward-sloping demand and the impact of export taxes on local prices.

As a comparison of (12.10) and (12.11) makes clear, in a pandemic state the same optimal tariff incentives are at work as those that define the non-cooperative export taxes in normal times, but in the pandemic state there is also something more: Each country has an incentive to use its export tax to keep more PPE for its own citizens, in order to reduce the welfare losses experienced by its citizens during the pandemic. The two incentives reinforce each other and push toward higher export taxes, ensuring that $\hat{\tau}_y^N > \bar{\tau}_y^N$ and $\hat{\tau}_x^*N > \bar{\tau}_x^*N$. But the optimal tariff incentives that prevent the export tax from becoming prohibitive in normal times can be swamped in the pandemic state by the incentive to hoard PPE, leading a country to adopt prohibitive export taxes in the pandemic state if this latter incentive is strong enough. Whether this occurs or not will depend on the properties of the pandemic loss function C , and in particular on the magnitude of $\frac{\partial C(D_x, D_y)}{\partial D_y}$ and $\frac{\partial C(D_x^*, D_y^*)}{\partial D_x^*}$, reflecting the degree to which this loss function is sensitive to the amount of PPE its citizens consume.

Finally, the Nash public health investment levels I^N and I^{*N} are defined by the first-order conditions

$$\begin{aligned} \frac{\partial W}{\partial I} &= -\frac{\partial \rho(I, I^*)}{\partial I} \times C(D_x^N, D_y^N) - c'(I) = 0 & (12.12) \\ \frac{\partial W^*}{\partial I^*} &= -\frac{\partial \rho(I, I^*)}{\partial I^*} \times C(D_x^{*N}, D_y^{*N}) - c'(I^*) = 0, \end{aligned}$$

where I use the superscript “N” to denote a magnitude that is evaluated at the noncooperative trade taxes for the relevant state, which in the context of (12.12) is the pandemic state. As is intuitive, (12.12) implies that, unlike the efficient investment levels defined by (12.9), the noncooperative levels of investments in public health only take into account the benefits experienced by the country making the investment and are therefore too low relative to efficient levels, as each country ignores the beneficial impact of its investment on its trading partner.

Given the unilateral incentives that each country has to make inefficient public health investment and export tax choices, can efficient choices be sustained in a self-enforcing agreement in this setting? The answer is “yes,” but only if the future cost borne by a country that

deviates from efficient policy choices is large enough to outweigh the one-time gain that it can achieve from the deviation. This describes the basic incentive constraint that a self-enforcing agreement must obey.

To see whether efficient choices can be sustained in a self-enforcing agreement in this setting, it is necessary to consider in some detail the incentive constraints that are implied by the self-enforcement requirement. To this end, I will assume that policy deviations from the agreement are only observed by the other party at the end of the period. Moreover, for simplicity, I will follow Bagwell and Staiger (1990) and assume that any deviation from the policies that the countries agree to will be met by infinite Nash reversion beginning in the next period. These assumptions ensure that if a country were to deviate in a period from its agreed public health investment level, it would deviate in that period also with respect to its agreed export tax level, regardless of which state of the world prevails (because once it deviates from the agreed investment level in a period, it will trigger the punishment beginning next period no matter what export tax it chooses for the period, so it might as well choose its unilaterally optimal export tax). This feature is special, but it helps to illustrate in stark terms the more general points that I highlight below, and it reduces the taxonomy of deviation and punishment possibilities that I would otherwise need to consider.

What is the future cost borne by a country that deviates from the policy choices specified in the agreement? When viewed from a period in which a government is considering deviating, the cost to the country of the infinite Nash reversion that would follow this deviation beginning in the next period is the discounted difference between its expected future welfare under the cooperative policies dictated by the agreement and its expected future welfare under the Nash policies. Assuming for the moment that the agreement calls for efficient public health investments and export tax levels, the per-period cost to the home country of forgoing the agreement and reverting to Nash is then

$$Y^e \equiv W(\bar{\tau}_y^e, \bar{\tau}_x^e, \hat{\tau}_y^e, \hat{\tau}_x^e, I^e, I^{*e}) - W(\bar{\tau}_y^N, \bar{\tau}_x^N, \hat{\tau}_y^N, \hat{\tau}_x^N, I^N, I^{*N}) > 0,$$

where W is defined by (12.5). And discounting the infinite stream of per-period costs with the discount factor $\delta \in (0,1)$, back to the current period where the deviation is under consideration, yields the future cost borne by the home country if it deviates in the current period from

the efficient policy choices specified in the agreement,

$$\frac{\delta}{1-\delta} Y^e. \quad (12.13)$$

In light of the cross-country symmetry of the model, (12.13) also gives the future cost borne by the foreign country if it deviates from the policy choices specified in the agreement. Importantly, as (12.13) reflects, regardless of whether the current period where the deviation is under consideration corresponds to a pandemic or to normal times, the future cost borne by a country that deviates from the policy choices specified in the agreement always looks the same.¹²

What is the one-time gain that a country can achieve from deviating? Focusing again on the home country, there are three relevant possibilities for a deviation from the efficient policies called for in the agreement. The home country could deviate from its agreed public health investment level, which it would have to do before the state of the world for the period is determined; then, as noted above, it would deviate as well from its agreed export tax regardless of which state of the world obtains in that period. Alternatively, the home country could make the agreed public health investment and then deviate from the agreed export tax only if a pandemic occurs, or only during normal times.

Consider the last option first—that is, the home country invests in public health as prescribed under the agreement and then deviates from the agreed export tax $\bar{\tau}_y^e$ (free trade) if times turn out to be normal (there is no pandemic for the period). In this case the one-period gain from deviating to $\bar{\tau}_y^N$ when times are normal is given by $\omega(\bar{\tau}_y^N, \bar{\tau}_x^{*e}) - \omega(\bar{\tau}_y^e, \bar{\tau}_x^{*e})$, where ω is defined by (12.1), implying that this deviation is not profitable for the home country and $\bar{\tau}_y^e$ can be part of a self-enforcing agreement if and only if

$$[\omega(\bar{\tau}_y^N, \bar{\tau}_x^{*e}) - \omega(\bar{\tau}_y^e, \bar{\tau}_x^{*e})] \leq \frac{\delta}{1-\delta} Y^e. \quad (12.14)$$

The inequality in (12.14) is the incentive constraint associated with the home-country choice of $\bar{\tau}_y$, with an analogous incentive constraint applying to the foreign-country choice of $\bar{\tau}_x^*$. As (12.1) confirms, the left-hand side of (12.14) reflects the usual incentive to manipulate the

12. This property reflects the i.i.d. nature of the pandemic shock as I have modeled it, a feature that is also shared by the shocks studied by Bagwell and Staiger (1990). See Bagwell and Staiger (2003) for an analysis of self-enforcing trade agreements in the presence of persistent shocks.

terms of trade with an export tax, and if the one-period gain from such opportunistic behavior is not too large and/or the discount factor δ is large enough, the inequality in (12.14) will be met, the home country will see it in its own self-interest to follow through on its export-tax commitment, and the efficient home-country export tax $\bar{\tau}_y^e$ will be sustainable as part of a self-enforcing agreement, with an identical statement holding for $\bar{\tau}_x^{*e}$.

Next, suppose that the home country invests in public health as prescribed under the agreement and then deviates from the agreed export tax $\hat{\tau}_y^e$ (free trade) if there is a pandemic. In this case, the one-period gain from deviating to $\hat{\tau}_y^N$ if the pandemic arrives is given by $\omega_{PAN}(\hat{\tau}_y^N, \hat{\tau}_x^{*e}) - \omega_{PAN}(\hat{\tau}_y^e, \hat{\tau}_x^{*e})$, where ω is defined by (12.3), implying that this deviation is not profitable for the home country and $\hat{\tau}_y^e$ is sustainable as part of a self-enforcing agreement if and only if

$$[\omega_{PAN}(\hat{\tau}_y^N, \hat{\tau}_x^{*e}) - \omega_{PAN}(\hat{\tau}_y^e, \hat{\tau}_x^{*e})] \leq \frac{\delta}{1-\delta} Y^e. \tag{12.15}$$

The inequality in (12.15) is the incentive constraint associated with the home-country choice of $\hat{\tau}_y$, with an analogous incentive constraint applying to the foreign-country choice of $\hat{\tau}_x^*$. Notice, though, that with $\bar{\tau}_y^e = 0 = \hat{\tau}_y^e$ and $\bar{\tau}_x^{*e} = 0 = \hat{\tau}_x^{*e}$, and hence with free trade the efficient export tax in both normal times and during a pandemic, we have by (12.1) and (12.3) that

$$\begin{aligned} \omega_{PAN}(\hat{\tau}_y^e, \hat{\tau}_x^{*e}) &= \omega_{PAN}(\bar{\tau}_y^e, \bar{\tau}_x^{*e}) \\ &= \omega(\bar{\tau}_y^e, \bar{\tau}_x^{*e}) - C(D_x(\bar{\tau}_x^{*e}), D_y(\bar{\tau}_y^e)), \end{aligned}$$

while with $\hat{\tau}_y^N > \bar{\tau}_y^N$ we must also have

$$\begin{aligned} \omega_{PAN}(\hat{\tau}_y^N, \hat{\tau}_x^{*e}) &= \omega_{PAN}(\hat{\tau}_y^N, \bar{\tau}_x^{*e}) \\ &> \omega_{PAN}(\bar{\tau}_y^N, \bar{\tau}_x^{*e}) \\ &= \omega(\bar{\tau}_y^N, \bar{\tau}_x^{*e}) - C(D_x(\bar{\tau}_x^{*e}), D_y(\bar{\tau}_y^N)), \end{aligned}$$

and it then follows that

$$\begin{aligned} [\omega_{PAN}(\hat{\tau}_y^N, \hat{\tau}_x^{*e}) - \omega_{PAN}(\hat{\tau}_y^e, \hat{\tau}_x^{*e})] &> [\omega(\bar{\tau}_y^N, \bar{\tau}_x^{*e}) - \omega(\bar{\tau}_y^e, \bar{\tau}_x^{*e})] \\ &+ [C(D_x(\bar{\tau}_x^{*e}), D_y(\bar{\tau}_y^e)) - C(D_x(\bar{\tau}_x^{*e}), D_y(\bar{\tau}_y^N))] \\ &> [\omega(\bar{\tau}_y^N, \bar{\tau}_x^{*e}) - \omega(\bar{\tau}_y^e, \bar{\tau}_x^{*e})]. \end{aligned} \tag{12.16}$$

Therefore, while the right-hand sides of the incentive constraints in (12.15) and (12.14) are the same, (12.16) indicates that the left-hand side of the incentive constraint that applies during a pandemic, (12.15), must be bigger than the left-hand side of the incentive constraint that applies during normal times, (12.14), implying that in a self-enforcing agreement it will be harder to sustain efficient export taxes during a pandemic than in normal times. For example, if the discount factor δ is such that the incentive constraint on $\bar{\tau}_y$ described by (12.14) holds with equality, then (12.16) indicates that the incentive constraint on $\hat{\tau}_y$ described by (12.15) must be violated. Intuitively, this reflects two key ingredients. First, the noncooperative export tax $\bar{\tau}_y^N$ is higher than the efficient level $\bar{\tau}_y^e$ even in normal times, due to the unilateral incentive to manipulate the terms of trade. And second, even if it deviated only to $\bar{\tau}_y^N$ during a pandemic, the one-time gain from this deviation for the home country would rise during the pandemic, because in addition to enjoying the same terms-of-trade gains that the home country would enjoy in normal times, in a pandemic the home country would also enjoy the PPE-hoarding gains that come from the higher-than-efficient export tax; deviating to the optimal deviation-export-tax level $\hat{\tau}_y^N$ that applies during a pandemic can only further increase this one-time gain.

This does not mean that cooperation over export restrictions must break down during a pandemic. As Bagwell and Staiger (1990) show, countries can *manage* the incentive to defect from an agreement by adjusting the trade policies that they agree to implement under the agreement toward the non-cooperative levels, thereby preventing the incentive constraints from ever being violated and keeping the agreement intact, even as it is buffeted by various external shocks. In the present context, that would mean building in to the agreement the flexibility to allow export taxes to rise somewhat during pandemics, in an implicit acknowledgment that the agreement must be self-enforcing and that the implied incentive constraints on export restrictions are especially demanding in a pandemic.¹³ Indeed, this provides one interpretation of the “escape” provisions included in GATT that have become the main avenue through which countries

13. Such an adjustment in the agreed policies reduces the one-time gain from deviation, but it also reduces the per-period benefits from maintaining the agreement. As Bagwell and Staiger (1990) show, in their model the former effect is larger than the latter so that an adjustment of this kind can always be found that brings the incentive constraint into compliance. The same property can be shown to hold in the present setting.

have imposed export restrictions during the COVID-19 pandemic.¹⁴ Note, however, that unless the discount factor is sufficiently high so that incentive constraints never bind at the efficient policies, this does mean that some efficiency will by necessity be sacrificed during a pandemic. Further, depending on the properties of the pandemic loss function C , it is possible that the “most-cooperative” agreement (i.e., the agreement that implements the policies closest to the efficient policies while not violating any incentive constraints) would by necessity permit export taxes during a pandemic that are almost as high as the noncooperative levels.

Finally, consider the first deviation possibility listed above—namely, the home country deviates from its agreed public health investment level, which it would have to do before the state of the world for the period is determined, and then it deviates as well from its agreed export tax regardless of which state of the world obtains in that period. In this case, and continuing to suppose for the moment that the agreement calls for efficient public health investments and export tax levels, the incentive constraint becomes

$$[W(\bar{\tau}_y^N, \bar{\tau}_x^{*e}, \hat{\tau}_y^N, \hat{\tau}_x^{*e}, I^{BR}, I^{*e}) - W(\bar{\tau}_y^e, \bar{\tau}_x^{*e}, \hat{\tau}_y^e, \hat{\tau}_x^{*e}, I^e, I^{*e})] \leq \frac{\delta}{1-\delta} Y^e, \quad (12.17)$$

where W is defined by (12.5) and where I^{BR} denotes the home country’s optimal unilateral best-response choice of public health investment given that the foreign country invests the efficient amount I^{*e} .¹⁵ The inequality in (12.17) is the incentive constraint associated with the home-country choice of I , with an analogous incentive constraint applying to the foreign-country choice of I^* . As (12.17) together with (12.5) indicate, whether or not efficient public health investments, can be part of a self-enforcing agreement will depend on the elasticity of

14. See Sykes (2020) and Congressional Research Service (2021). For example, though GATT Article XI provides for the general elimination of quantitative restrictions on trade, including limitations on exports, it exempts “export prohibitions or restrictions temporarily applied to prevent or relieve critical shortages of foodstuffs or other products essential to the exporting contracting party.” And GATT Article XX carves out from GATT/WTO commitments more generally any measures “necessary to protect human, animal, or plant life or health,” as long as nondiscrimination is upheld and such measures are not merely “disguised restriction[s] on international trade.”

15. I did not need to introduce a separate notation for best-response export taxes in addition to Nash export taxes because given the absence of import tariffs and the separability of the x and y sectors, the Nash and best-response export taxes are one and the same.

pandemic risk mitigation with respect to public health investments, as reflected in $\rho(I, I^*)$ and the properties of the investment cost function $c(\cdot)$, as well as on the magnitude of the discount factor δ .

Something more interesting can be said, however, once it is recalled that the incentive constraints for $\bar{\tau}_y$ and $\hat{\tau}_y$ will also have to be met in any self-enforcing agreement. In particular, suppose that at the most-cooperative export taxes the incentive constraints for $\bar{\tau}_y$ and $\hat{\tau}_y$ hold with equality. Then, denoting the most-cooperative home-country export taxes as $\bar{\tau}_y^c$ and $\hat{\tau}_y^c$, we would have

$$[\omega(\bar{\tau}_y^N, \bar{\tau}_x^{*c}) - \omega(\bar{\tau}_y^c, \bar{\tau}_x^{*c})] = \frac{\delta}{1 - \delta} Y^c \tag{12.18}$$

$$[\omega_{PAN}(\hat{\tau}_y^N, \hat{\tau}_x^{*c}) - \omega_{PAN}(\hat{\tau}_y^c, \hat{\tau}_x^{*c})] = \frac{\delta}{1 - \delta} Y^c,$$

where Y^c is defined by

$$Y^c \equiv W(\bar{\tau}_y^c, \bar{\tau}_x^{*c}, \hat{\tau}_y^c, \hat{\tau}_x^{*c}, I^c, I^{*c}) - W(\bar{\tau}_y^N, \bar{\tau}_x^{*N}, \hat{\tau}_y^N, \hat{\tau}_x^{*N}, I^N, I^{*N}) > 0,$$

with I^c satisfying the incentive constraint

$$[W(\bar{\tau}_y^N, \bar{\tau}_x^{*c}, \hat{\tau}_y^N, \hat{\tau}_x^{*c}, I^{BR}, I^{*c}) - W(\bar{\tau}_y^c, \bar{\tau}_x^{*c}, \hat{\tau}_y^c, \hat{\tau}_x^{*c}, I^c, I^{*c})] \leq \frac{\delta}{1 - \delta} Y^c. \tag{12.19}$$

In (12.19), I^{BR} is the home country's best-response choice of public health investment given that the foreign country invests the amount I^{*c} , and I^c is uniquely defined by (12.19) when this incentive constraint is binding and therefore holds with equality; $\bar{\tau}_x^{*c}$, $\hat{\tau}_x^{*c}$ and I^{*c} are similarly defined for the foreign country.

But now recall that defection from I^c will be accompanied by a defection from the cooperative export tax which, by (12.18), would by itself yield a one-time gain equal to $\frac{\delta}{1 - \delta} Y^c$, regardless of whether the world ends up in normal times for the period—and therefore the top line of (12.18) applies—or in a pandemic, in which case the bottom line of (12.18) applies. Hence there can be no additional gain for the home country in deviating from I^c if the incentive constraint (12.19) is to hold. In other words, if the agreement achieves the most-cooperative export taxes and leaves no slack in those incentive constraints, then it must implement the noncooperative Nash levels of public health investment.¹⁶

16. This follows from my assumption that policy deviations from the agreement are only observed by the other party at the end of the period.

It is intuitive and easy to establish that the optimal (ex ante world welfare maximizing) agreement in this setting would never allocate all enforcement power to cooperation only on export taxes in the way I have just described.¹⁷ The upshot is that an optimal self-enforcing agreement that faces constraints on enforcement power, and that for this reason cannot implement the fully efficient policies, will leave some slack in the export tax incentive constraints in order to allow countries to cooperate at least to some degree on their choices of public health investments. This provides an additional reason why looking to a trade agreement as a forum for blunting the use of export taxes during a pandemic can be counterproductive, and it suggests that the WTO might better allocate its scarce enforcement power toward helping countries cooperate over measures that could reduce the probability of pandemics in the first place, perhaps partnering with the WHO in this effort.

Notice, too, that the difficulties in cooperating over export restraints during a pandemic have potentially important ramifications for the organization of supply chains related to the production of vaccines, PPE, and other products and materials whose demand is likely to surge during a pandemic. If the incentive to hoard during a pandemic cannot be controlled by international agreements, countries would be wise to acknowledge this and organize their supply chains accordingly. Put differently, while I have not attempted to model it here, the efficient organization of supply chains for pandemic-related products and materials is itself likely to be affected in important ways by the enforcement-constraint limitations that governments face when attempting to cooperate over export restraints during a pandemic.

17. In fact, in a setting that features terms-of-trade externalities and both trade and behind-the-border policies, Ederington (2001) shows that scarce enforcement power would be allocated first to nontariff instruments to secure their efficient setting and only then used to reduce trade taxes toward efficient levels as the incentive constraint allows. The setting I consider here includes as well international (nonpecuniary) externalities through the pandemic probability function $\rho(I, I^*)$ that extend beyond the terms-of-trade externality, so Ederington's result does not apply. But it nonetheless points in the same direction—namely, that in a setting with multiple policy instruments that can generate international externalities, an optimal self-enforcing agreement would never allocate all enforcement power to cooperation only on export taxes.

This is a section of [doi:10.7551/mitpress/13574.001.0001](https://doi.org/10.7551/mitpress/13574.001.0001)

A World Trading System for the Twenty-First Century

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Citation:

A World Trading System for the Twenty-First Century

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DOI: 10.7551/mitpress/13574.001.0001

ISBN (electronic): 9780262371292

Publisher: The MIT Press

Published: 2022

The open access edition of this book was made possible by generous funding and support from MIT Press Direct to Open



The MIT Press

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The MIT Press would like to thank the anonymous peer reviewers who provided comments on drafts of this book. The generous work of academic experts is essential for establishing the authority and quality of our publications. We acknowledge with gratitude the contributions of these otherwise uncredited readers.

This book was set in Palatino LT by Westchester Publishing Services.

Library of Congress Cataloging-in-Publication Data

Names: Staiger, Robert W., author.

Title: A world trading system for the twenty-first century / Robert W. Staiger.

Description: Cambridge, Massachusetts : The MIT Press, [2022] | Series:

Ohlin lectures | Includes bibliographical references and index.

Identifiers: LCCN 2022000723 (print) | LCCN 2022000724 (ebook) |

ISBN 9780262047302 (hardcover) | ISBN 9780262371292 (pdf) |

ISBN 9780262371308 (epub)

Subjects: LCSH: International economic relations. | Commercial treaties. |

Foreign trade regulation. | Foreign trade regulation—Developing countries. | Globalization.

Classification: LCC HF1365 .S73 2022 (print) | LCC HF1365 (ebook) |

DDC 337.1—dc23/eng/20220310

LC record available at <https://lcn.loc.gov/2022000723>

LC ebook record available at <https://lcn.loc.gov/2022000724>