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## The Free Trade Epidemic of the 1860S and Other Outbreaks of Economic Discrimination

[David Lazer](#) \*

### [Figures](#)

Preferential trade agreements (PTAs) have become an increasingly prominent feature of the international trade environment, with salient examples being the widening and deepening of the European Union (EU), the success of the Mercosur, and the formation of the North American Free Trade Association (NAFTA). In fact, a majority of the active agreements notified to gatt through 1995 were signed in the 1990s.<sup>1</sup> This systemic change, involving most of the states of the world but managed by none, echoes a period of even more dramatic change in the trade policies of the world's economies: the 1860s.

The great increase in economic openness in Europe in the 1860s was a swift break with centuries of protection. The instrument for this increase in economic openness was the unconditional most-favored-nation (MFN) clause, by which pairs of states agreed bilaterally to lower tariffs.<sup>2</sup> The fact that so many pairs of states signed MFN agreements at approximately the same time suggests that these were not independent processes. This article argues that changes wrought by the Industrial Revolution--increased scale of production and lowered transport costs--increased the costs of trade diversion to third parties left out of [End Page 447] PTAs, with the result that a change in relations between one pair of states (Britain and France) had enormous ramifications throughout the European system. The following analysis presents a formal model of contagion that offers insight into the rate and pattern of the spread of MFN treaties in the 1860s.

That explosion of economic openness has been explained by a hierarchic view of international relations, according to which the dominant country of the period, Britain, had a preference for free trade, and the international system came to reflect that preference.<sup>3</sup> The abruptness of this change is a puzzle from the perspective of a structural analysis, however.<sup>4</sup> Further, Britain was not in a dominant position in this network of treaties.

This article takes an *emergent process* view, asserting that this pattern may have emerged from the microlevel processes of the system.<sup>5</sup> It links micro and macro by connecting state motivation at the microlevel (domestic politics) to the state's relationships to other states: the assumption is that governments seek political support from interest groups, including powerful economic sectors. The macrolevel outcome is the pattern of trade agreements among states. In particular, building on work by Oye, Gilligan, and Baldwin, this article emphasizes the role of political pressures from export sectors in causing states to seek bilateral trade agreements.<sup>6</sup> A simulation model of interdependent trade games is developed to demonstrate how a preferential trade agreement that has a domestic political impact on third parties leads to a contagion of [End Page 448] similar agreements. This theoretical apparatus is then used to explore the abrupt opening up of the 1860s, while also yielding fresh insights into the explosion of regionalism in the 1990s. The analysis can also offer some insight into the current burst of PTAs, including the deepening and expansion of the EU, the formation of NAFTA, and the revitalization of regional trade agreements in South America.

The first section of this article examines the existing political economy literature on the effects of PTAs, in particular, on influencing third parties to seek similar bargains. The second section offers a formal model of contagion based on the assumption that a PTA between two states increases the interest of third parties in entering into similar agreements. The analysis indicates that contagion is more likely in a highly interdependent and interconnected world and that it operates according to certain characteristic patterns in terms of the spread and rate of spread of treaties. Those insights are then applied in the third section to the rise and fall of the MFN network of treaties in Europe in the 1860s, where the timing, pattern, and robustness of this treaty network is shown to be consistent with the propositions that emerge from the simulations. The fourth section discusses the implications for the growth of trade blocs today. Finally, the conclusion examines the broader implications for international relations theory.

## The Microlevel: The Politics of Protection and Preference

In a PTA two or more states grant each other greater access to their markets (for example, lower tariffs) than other states receive.<sup>7</sup> Examples of PTAs include customs unions, in which two or more states eliminate **[End Page 449]** trade barriers among themselves and impose a common exterior tariff (CET) on third parties, and free trade areas (FTAs), in which two or more states eliminate trade barriers among themselves but do not impose a CET.

Why do states sign PTAs? This section offers a brief discussion of the economic and political benefits of a PTA to the signatories (a dyadic perspective);<sup>8</sup> of the economic and political impact of a PTA on third parties (a triadic perspective); and, finally, of the interdependence of all PTAs and potential PTAs in the international system (a systemic perspective).

### Dyadic Perspective

What are the domestic political dynamics underlying the negotiation of a PTA? A PTA may have some distributional effects akin to unilateral changes in protection. For example, a PTA between a labor-rich country and a capital-rich country may result in various coalitions in the respective countries: the owners of the scarce factors of production may oppose the agreement, while the owners of plentiful factors of production may support it, à la Stolper-Samuelson.<sup>9</sup> Thus, in the United States labor strongly opposed NAFTA, whereas capital strongly supported it. Further, it is conceivable that a scarce factor of production that generally supports protection will also support lower barriers with a state in which that factor of production is even more scarce. Similarly, many of the variables found to be related to unilateral protection may also be related to dyadic protection/openness: import penetration by exporters in the other country, intrafirm trade between the two countries, and so on.<sup>10</sup>

From a domestic political perspective, then, why would a state pursue a PTA rather than make unilateral reductions in tariffs?<sup>11</sup> The answer **[End Page 450]** lies with the role of exporters. While exporters, along with all consumers, gain from unilateral reductions in tariffs by a state, they will gain even more when those reductions are reciprocated by another state.

Further, when a state negotiates for access to another state's market, the benefits of that access may be relatively concentrated. Unilateral tariff reductions are often successfully opposed by import-competing sectors because the benefits of protection are more concentrated than the costs of protection—allowing those sectors to overcome potential collective action problems. For bilateral tariff reductions, the benefits are similarly focused on a potentially small group of *exporters*—rather than on just a diffuse set of consumers—which allows those sectors as well to overcome potential collective action problems.<sup>12</sup>

Thus, much as unilateral tariff setting allows a government to discriminate among import competitors by offering the most protection to those sectors whose political support is most responsive to protection, a PTA allows a government to offer improved market access to those exporters whose political support is the most responsive to such redistributive measures. A government may therefore improve its political standing by gaining more political support from the exporters whose fortunes it has promoted with a PTA than it loses from the import competitors who are now subject to greater foreign competition.

Viewed as political support maximizers, governments thus *potentially* face a prisoners' dilemma when negotiating a PTA.<sup>13</sup> The preference ordering of each state would therefore be (1) preferential access to the other state's markets for no preferential treatment in return, (2) mutual preferential access, (3) mutual nonpreferential treatment, and (4) preferential treatment of the other state's exports in return for no preferential treatment for its own exports. **[End Page 451]**

## Triadic Analysis

Because of trade diversion, a PTA may harm third parties; that is, an agreement between A and B may adversely affect certain export sectors in C. <sup>14</sup> In fact, a trade-diverting PTA may be tempting to the governments of A and B, *because an agreement that displaces C's production (trade diversion) may be less politically costly than an agreement that displaces indigenous production (trade creation).* <sup>15</sup>

This may offer an answer to one puzzle in the literature on the political economy of trade: why is there an apparent redistribution bias toward import-competing sectors through protection rather than to export sectors through export subsidies? <sup>16</sup> Governments are in fact redistributing toward export sectors through PTAs, which may be the preferred instrument for this purpose because some of the costs may be shifted to third parties.

It is likely, then, that a PTA between two states will disrupt the political status quo in the third. Because exporters in the excluded state will suffer to the extent that their goods are pushed out of the markets of the parties to the PTA, export sectors will push for redistributive measures (such as a similar PTA) to compensate for their potential losses. These losses will be especially acute where production is characterized by large economies of scale and where the goods are differentiated in nature.

Baldwin has formally demonstrated that such losses will be substantial because the firms in those cases have invested in production capabilities predicated on equal access to export markets. <sup>17</sup> If those firms suddenly face discrimination in, and thus partial loss of, those export markets, they will have either to swallow those costs or to lower prices to increase sales at home. Because those firms stand to lose profits in either case, they are willing to make political investments to avoid these losses. <sup>18</sup> Further, as Milner has empirically shown, sectors characterized by increasing returns to scale are relatively more likely to seek preferred access to other states. <sup>19</sup> **[End Page 452]**

A key assumption in Baldwin's model is that C does not have alternative markets for its goods; if it did, there might simply be a trade reshuffling, where C's exports were redirected to other markets at the same price they received in the markets of A or B. However, if demand is characterized by a taste for variety (that is, the goods are differentiated in nature), C's goods will not flow to other markets for the same price they would receive in A and B's markets.

Losses will therefore be greater in those sectors where the goods are *differentiated* in nature because those goods will not flow elsewhere for the same price. <sup>20</sup> The French-Italian tariff war of 1887-92 offers two contrasting examples--Italian wine and raw silk producers--of why this is the case. "In 1887 France took from Italy 2,782,000 hectolitres of wine, and in 1888 only 817,000." <sup>21</sup> Italian wine, a differentiated good, did not find equally lucrative markets to replace the French market, which devastated the Italian wine producers. In contrast, the tariff war did not have a great impact on Italian producers of raw silk, a homogeneous good, because exports were merely diverted: "[I]n 1887 Italy exported to France 28,178 quintals of raw silk, and to Switzerland 7,300 quintals; but in 1888 France took only 9,188 quintals, whilst the amount sent to Switzerland rose abruptly to 29,621." <sup>22</sup>

An agreement between two states will therefore adversely affect third parties, increasing their motivation to sign a similar agreement--perhaps creating a bargaining space where none had existed before. This is especially likely to occur when the goods affected are differentiated in nature and their production characterized by economies of scale.

## Systemic Analysis

The three-state analysis demonstrates that the international system is not simply decomposable into the pairwise interactions of its members, *because the payoffs in each pairwise interaction are contingent on what other pairs in the system do.* It is therefore necessary to build a systemic theory of PTAs that models the impact of one PTA on the behavior of other states. <sup>23</sup> **[End Page 453]** The three-state analysis also demonstrates one likely impact of a treaty between two states: it will increase the desirability of similar treaties to other states.

Where the potential trade among states is largely in differentiated goods, and/or where the production of goods is subject to economies of scale, the trading system is *highly interdependent*.

This article advances the beginnings of a systemic theory of PTAs, outlining a very simple model to explore the systemic patterns that will emerge when A's agreement with B increases the desirability of a similar deal to C. In a highly interdependent trade system, it is far more likely that one PTA will spur further PTAs, possibly resulting in rapid growth in the number of PTAs.

## The Macrolevel: A Threshold Model of Diffusion

The key assumption of this article is that a PTA between two states increases the likelihood of additional PTAs. As state A signs more PTAs, other states feel additional pressure to seek a similar agreement with A. At some threshold number of treaties, there will be a potential agreement that will improve the (domestic political) well-being of the governments of both state A and any given third party.

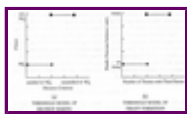
This article therefore proposes a threshold model of contagion.<sup>24</sup> In the classic model of diffusion (of innovation), actors may be in one of two states, one of which is terminal (informed) and one of which is potentially transitory (not informed). The number of people shifting from the transitory state to the terminal one is proportional to the product of the fraction of the population in the transitory state and the fraction in the terminal state. The plot of the fraction of the people who are in the terminal state will therefore produce a logistic-shaped (S-shaped) curve. For example, with the spread of innovation, there will be slow change at first, with a few informed individuals spreading the word to the many uninformed. Change will accelerate as more individuals spread the word, until half of the population is informed. At this point, with progressively fewer uninformed people, change will slow, until 100 percent of the population is informed. This simple model of diffusion assumes [End Page 454] that the probability of shifting to the terminal state is a linear function of exposure, where exposure of all individuals at a given time is the same and is determined by the number of people already in the terminal state.

The model presented in this article differs from that model in two key ways: first, the probability of shifting from a transitory state (no treaty) to a terminal state (treaty) is assumed to be a step-function (that is, there is a threshold exposure level at which the state shifts); and second, different dyads have different levels of exposure. This section advances a threshold model of treaty contagion and develops a number of propositions from this model.

### Threshold Models

In the model presented here it is assumed that two states will sign a treaty if and only if a Pareto-improving bargain can be struck.<sup>25</sup> Because of the interdependence of payoff functions, the following model assumes that the desire for a PTA with another state is positively related to the number of treaties the second state has. At some threshold number of treaties with third parties, two states will sign a PTA.

Threshold models have a long history in models of decision making. Simon introduced the idea that individuals "satisfice": an individual stays with his current consumption choice until it is determined to be unsatisfactory, at which point he changes his choice.<sup>26</sup> Essentially, there is a threshold up to which there is no change; when that threshold is reached, behavior changes. In models of collective behavior Schelling's model of segregation included a similar assumption of a threshold: each individual remained in his current residence until the proportion of different-race neighbors reached some predetermined threshold—at which point the individual moved. In a similar vein, individuals in cascade models do not engage in a particular activity until a predetermined fraction of the remaining population engages in that activity (where that fraction typically varies at the individual level).<sup>27</sup> And in an application [End Page 455] formally similar to that in this article, there are network threshold models of the diffusion of innovations, where individuals are disinclined to adopt an innovation until a certain fraction of people *with whom they interact* adopt that innovation (where individuals vary in how disinclined they are).<sup>28</sup>



In each of these models it is assumed that there is a threshold at which change occurs at the individual level (see Figure 1a). Similarly, in the formal analyses of the spread of PTAs below, it is assumed for each pair of potential treaty partners,  $i$  and  $j$ , that there is some threshold number of treaties with third parties ( $g_{ij} = g_{ji}$ ), at which  $i$  and  $j$  will sign a treaty. The transition rule for whether

two states that do not have a treaty at time  $t$  sign a treaty at time  $t + 1$  is therefore: *If the number of treaties  $i$  and  $j$  have signed with third parties is greater than  $g_{ij}$ , then  $i$  and  $j$  will sign a treaty.* (See Figure 1b.)

A variety of factors would presumably affect this threshold, including the nature of the sectors involved, the political institutions of the states involved, the access each state has to the other's markets in the absence of a treaty, and so on. Ideally this would be directly modeled in  $g_{ij}$ . However, for the analyses below this threshold is simply drawn from a uniform distribution between 0 and  $\delta$ .<sup>29</sup> [End Page 456]

$\delta$  is a systemwide parameter that captures the interdependence of the international markets. That is, the lower  $\delta$ , the more dependent states are (on average) on access to other states' markets, and the less they can tolerate being

discriminated against in those markets. For the reasons discussed above, interdependence, in a political sense, will be especially great (that is, a low  $\delta$ ) in a world economy where production is characterized by economies of scale and traded goods are differentiated in nature.

In any model of contagion, it is necessary to specify (1) the probability of transmission (captured by  $\delta$ ) and (2) the social structure in question. This leads to the question of how the interaction pattern of states is structured.

A	B	C
D	E	F
G	H	I

In fact, states do not interact equally with all other states. One of the more robust empirical findings in international economics (from gravity models) is that states trade disproportionately with nearby states. This pattern occurs in part because transport costs and linguistic/cultural and other communication barriers are closely connected to distance. In the context of this model, for example, one would expect Belgium to be sensitive to its access to the Netherlands' market and relatively oblivious to its access to New Zealand's market. Thus, in the simulations below, except where noted otherwise, states are assumed to be arranged on a lattice and to interact only with their immediate neighbors.<sup>30</sup> For example, in [Figure 2](#) state E is assumed to interact only with states B, D, F, and H; state A is assumed to interact only with states B and D.

Finally, it is necessary to specify the conditions under which the simulation begins and ends. It is assumed that prior to  $t = 0$  no pair of states has signed a treaty and that therefore no dyad has exceeded the threshold number of treaties with other states. At  $t = 0$ , the system is given an exogenous kick, so that one state suddenly becomes more desirable as a treaty partner--by lowering the thresholds of dyads involving **[End Page 457]** this state by 1.<sup>31</sup> This initial state is labeled the "first mover." If the threshold of this state with any other state(s) drops below 0, it is assumed that the first mover and the other state(s) will sign a treaty at time  $t = 1$ . As outlined above, this increases the likelihood of other treaties involving those two states. The simulation reaches an equilibrium when no more treaties are signed.

A	B	C	D	E
F	G	H	I	J
K	L	M	N	O
P	Q	R	S	T
U	V	W	X	Y

To illustrate how the simulation works, it is useful to examine one run of the simulation. In this example it is assumed that twenty-five states exist on a 5 x 5 lattice. The parameter  $\delta$  is set to 3, so that all  $g_{ij}$  are therefore drawn from a uniform distribution between 0 and 3. That is, different dyads have thresholds between 0 and 3, with an average threshold of 1.5. At time  $t = 0$ , none of the states on the lattice have treaties with each other. This is represented in [Figure 3](#); in this and following figures, the absence of a treaty is represented by a heavy line, and presence of a treaty is represented by a thin line.

A	B	C	D	E
F	G	H	I	J
K	L	M	N	O
P	Q	R	S	T
U	V	W	X	Y

Suppose that, for exogenous reasons, at time  $t = 0$  a treaty with state A becomes more likely (state A is the "first mover"). Specifically, it is assumed that the thresholds in dyads including state 1 ( $g_{AF}$  and  $g_{AB}$ ) are lowered by 1. In each case, there is a 1 in 3 chance ( $= 1/\delta$ ) that  $g < 1$  and a treaty will be reached in the first round. In this run of the simulation, state F signed a treaty with state A in the first round ([Figure 4](#)).

A	B	C	D	E
F	G	H	I	J
K	L	M	O	P
Q	R	S	T	U
V	W	X	Y	Z

This treaty increases the likelihood of treaties between states A and F and their neighbors. In fact, in subsequent runs, state A signed a treaty with state B, and state F signed a treaty with state G. After six rounds, a total of eight treaties was signed ([Figure 5](#)). **[End Page 458]**

A	B	C	D	E
F	G	H	I	J
K	L	M	N	O
P	Q	R	S	T
U	V	W	X	Y

At this point the process of treaty contagion accelerated, with fifteen treaties signed in the following five rounds ([Figure 6](#)).

A	B	C	D	E
F	G	H	I	J
K	L	M	N	O
P	Q	R	S	T
U	V	W	X	Y

Thirteen more treaties were signed in the next five rounds ([Figure 7](#)).

A	B	C	D	E
F	G	H	I	J
K	L	M	N	O
P	Q	R	S	T
U	V	W	X	Y

Finally, the system reached an equilibrium, where two more treaties were signed in the following two rounds, leaving one state

(E) without any treaties, where 95 percent (thirty-eight out of forty) of the potential treaties had been consummated ([Figure 8](#)).

### Some Propositions

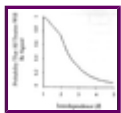
This simple model of contagion allows the experimenter to study the impact of changes in model parameters on the probability of potential equilibria. Where possible, this probability will be deductively derived. Otherwise, this probability will be inductively derived, using sets of simulations based on certain scenarios. The outcome focused on below will be the proportion of potential treaties in the system that are signed, where at time  $t = 0$  that proportion is 0. At time  $t = 0$  a system otherwise in equilibrium is given the small exogenous kick: the thresholds involving a particular state are reduced by 1. The following are a set of propositions regarding the dynamics of what results.

#### Proposition 1

*Small stimuli can result in a large number of treaties being signed.* As the preceding example illustrated, the small (relative to the sum of the thresholds in the system) initial exogenous shock may have dramatic ramifications. <sup>32</sup> This raises the issue of what conditions facilitate huge systemic change. Analysis of simulations below suggests proposition 2. **[End Page 459]**

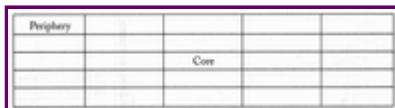
#### Proposition 2

*The likelihood that a large number of treaties will be signed is positively related to (a) the interdependence of the world; (b) the centrality of the first mover; (c) the size of the first mover; and negatively related to (d) transportation costs.* These four factors are discussed in turn below.

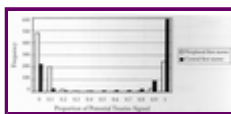


*Interdependence.* A simple version of the above model will suffice to illustrate the relationship between interdependence (defined as the dependence of states on access to other markets) and the potential for maximum systemic change. Assume  $N = 3$  and all three states are interconnected. At time  $t = 0$  the system is given the exogenous kick. The number of treaties in the resulting equilibrium may be 0, 1, 2, or 3. [Figure 9](#) plots the probability that all three potential treaties will be signed as a function of  $\delta$ . <sup>33</sup> **[End Page 460]**

[Figure 9](#) demonstrates the relationship between  $\delta$  and the probability of dramatic systemic change. As one would expect, there is a monotonically negative relationship between the two and therefore a positive relationship between the probability of systemic change and system interdependence.



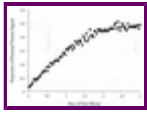
*Centrality.* In the last example of the previous section, states were aligned on a 5 x 5 lattice, where the first mover was in the most peripheral position on the lattice (the corner). What might the impact on the system be if the first mover were relatively central? Centrality is defined as the number of neighbors a state has, and secondarily, the number of neighbors a state's neighbors have, and so on. The most central position in a 5 x 5 lattice is therefore the spot in the third row, third column (see [Figure 10](#)). **[End Page 461]**



[Figure 11](#) presents histograms of the frequency of the proportion of treaties signed in the final equilibrium for two sets of one thousand simulations each: the first in which the first mover is assumed to be in the corner; the second in which the first mover is assumed to be in the most central position. In both cases, the system is assumed to be a 5 x 5 lattice and  $\delta = 3$ .

[Figure 11](#) clearly illustrates that the centrality of the first mover has a large impact on the proportion of treaties signed in the final equilibrium, where a dramatically higher proportion of systems with a central first mover converges to a state where all potential treaties are signed. An alternative way of viewing the data is to compare the average number of treaties signed when the first mover is highly central (28.0) to when the first mover is peripheral (11.6). <sup>34</sup>

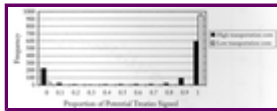
*Size of first mover.* In the preceding simulations all states were assumed to be the same size. However, one may ask what difference the relative size of the first mover would make to the likelihood that treaties will spread through the system. What if, for example, the first mover were a particularly large state? A treaty between large state A **[End Page 462]** and state B would likely have a particularly large impact on the exports of third parties to state B, making third parties especially desirous of similar treaties with B. Thus the larger the first mover the more likely contagion.



In order to examine the impact of the size of the first mover on the likelihood of contagion, the effect of a treaty between the first mover and other states on third parties is varied. The impact of a treaty between the first mover A (from [Figure 3](#)) and state B on the likelihood of treaties between B and G and B and C is varied. The amount an A-B treaty will lower  $g_{BC}$  and  $g_{BG}$  will vary between 0 and 3 (rather than being fixed at 1). If the impact on third parties is 0, then an A-B treaty does not change  $g_{BC}$  and  $g_{BG}$ , and there will be no additional treaty contagion after an A-B treaty. If the impact is 3, an A-B treaty guarantees that there will at least be treaties between B and G and B and C. [Figure 12](#) plots the proportion of potential treaties signed, varying the impact of a treaty with a (peripheral) first mover between 0 and 3, in increments of .03 with 1,000 replications per increment.

As expected, as the first mover increases in size, contagion becomes more likely. Notably, the incremental impact of an increase in size decreases as size increases. [35](#)

**Transportation costs.** The parameter  $\delta$  captures one aspect of interdependence: the impact of a PTA on third parties that interact with the signatories of the PTA. Another dimension of interdependence is connectedness, for example, the effective number of neighbors each state has. In a world with low transportation costs, each state effectively has more neighbors than it would have in a world with high transportation [\[End Page 463\]](#) costs. With very low transportation costs, every state is effectively the neighbor of every other state. More states will potentially be affected by trade diversion when a PTA is signed; further, in the limit, international trade would potentially dwarf intranational trade in importance. In contrast, with very high transportation costs, there are fewer potential trade partners.



Imagine that there are two types of worlds: a high-transportation-costs world and a low-transportation-costs world. In the high-transportation-costs world, states interact only with their immediate four neighbors (as in the scenarios discussed above). In the low-transportation-costs world states interact with their diagonal neighbors (for example, in [Figure 2](#), if state E interacted with A, C, G, and I, in addition to B, D, F, and H). [36](#) Then imagine running "history" one thousand times for each of these types of worlds. [Figure 13](#) repeats the histogram summarizing the set of simulations associated with the central first mover in [Figure 11](#) (high-transportation-cost simulations) and also includes a histogram summarizing the set of simulations under the assumption that states interact with their diagonal neighbors (low transportation costs, again assuming a central first mover).

[Figure 13](#) clearly indicates that a much higher proportion of treaties are signed in the low-transportation-costs condition than in the high-transportation-costs condition. Another way of viewing these data is to [\[End Page 464\]](#) consider the average proportion of treaties signed in the highly connected world, 96 percent, as compared with 70 percent in the less highly connected world. [37](#)

As a further illustration of this dynamic, if it is assumed that there are zero transportation costs—that is, every actor may potentially sign a treaty with every other actor—the simulation is virtually certain to converge on an equilibrium where every state has signed a treaty with every other state. For example, in one thousand runs of the simulation under this assumption, it converged to such an equilibrium every time. [38](#)

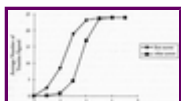
The key intuition here is that when transportation costs are low, states have more potential trading partners. When a PTA is signed, there are more third parties to be affected by trade diversion and more dyads to whom the contagion might spread. [\[End Page 465\]](#)

**Rate and Pattern of Diffusion.** This model should also give some insight into where and when treaties spread:

#### Proposition 3

*When treaties do spread in the system, they will spread slowly at first, then rapidly, and then slowly again. An S-shaped propagation pattern is standard for an actor-to-actor diffusion process, as discussed above.*

#### Proposition 4



*The first mover will initially tend to occupy a relatively core position in the network of treaties, as that network emerges. The first mover is in a unique position in the system, a position that is reflected in the emerging network of treaties. [Figure 14](#) summarizes a set of simulations that illuminates this*

issue. In this set of one thousand simulations,  $\delta$  was set at 10,  $N$  to 25, and transportation costs were assumed to be 0 (that is, every actor is connected to every other actor).<sup>39</sup> In 927 of the 1,000 simulations, every possible treaty was signed.<sup>40</sup> For these cases, [Figure 14](#) plots the round number against (1) the average number of treaties the first mover had signed by that round and (2) the average number of treaties all other actors had signed by that round.

[Figure 14](#) indicates that while the network of treaties is emerging, the first mover is party to significantly more treaties than are other **[End Page 466]** states. After one round the first mover is party to 2.5 treaties, on average, as compared with .1 for other states. After two rounds these numbers are 8.5 and .8, respectively; and after three, 18.9 and 4.6. First-mover advantage largely disappears after the fourth round, by which time almost all pairs of states have signed treaties.

In terms of *network stability*, it might be asked whether the resulting network of treaties unravels as easily as it formed. Each simulation is started with an exogenous shock, where it is assumed that two states sign a treaty. As the simulations above have illustrated, this shock is often sufficient to result in every possible pair of states signing equivalent treaties. Would an equivalent negative shock be sufficient to cause the network of treaties to unravel? The answer is a strong no: the model unambiguously suggests that the resulting network of treaties should be stable.

#### *Proposition 5*

*An equilibrium where every state has signed a treaty with every potential partner is robust.* An example will illustrate why. Consider the simulations summarized in [Figure 14](#): a small increase in the desirability of a treaty (lowering thresholds of dyads involving that state by 1) with one state resulted in all pairs of states signing treaties in 92.7 percent of the simulations. In these cases it becomes especially difficult for pairs of **[End Page 467]** states to eliminate a given treaty, because those two states will then be at special disadvantage in each other's markets; that is, in each case, twenty-three other states will be given preferred access to the other's market. If one assumed that the thresholds ( $g_{ij}$ ) randomly changed on occasion and that a treaty would be abrogated if  $g_{ij}$  exceeded the number of treaties  $i$  and  $j$  have with third parties,  $g_{ij}$  would need to increase by between 36 and 46 in order for  $i$  and  $j$  to abrogate their treaty.<sup>41</sup> Thus, if one were to ask what stimulus would need to be applied to the first mover in order to reverse any treaties, the minimum amount would be thirty-six times the initial shock! Further, even if all treaties involving the first mover were subsequently abrogated, no other treaties would be affected--there would not be a reverse contagion.<sup>42</sup> Generally, the only circumstances under which there would be a reverse contagion is if there were a huge, *systemic* (for example, due to depression or war) reduction in the desirability of treaties (for example, if the thresholds of *all* treaties increased on the order of 36 in the above example). Simply a disruption of the trading relationship of one pair of states (for example, because of a trade war) would certainly not be enough to cause a collapse of the system.

The above analysis has examined the implications of an assumption that an agreement between two states increases the likelihood of similar agreements between those states and third parties. Below is a discussion of the emergence of the MFN network of treaties that existed in Europe from 1860 to 1929.

## The Rise of the MFN Network of Treaties <sup>43</sup>

As noted above, the MFN network of treaties exploded onto the scene in the 1860s, consistent with proposition 1 above. The above propositions offer insight into (1) the timing of this explosion, (2) the rate and **[End Page 468]** pattern of the spread of treaties, and (3) the robustness of the treaty network.

### Setting the Stage: The Industrial Revolution

The most prominent feature of nineteenth-century Europe was the spread of the Industrial Revolution throughout the Continent. At the end of the eighteenth century "Europe was a conglomeration of small, semi-autarkic markets, each with its own fairly complete array of trades. The scale of operations of the individual enterprise was small enough to make locational resource and supply considerations almost irrelevant."<sup>44</sup>

By the mid-nineteenth century the spread of technology and industry had reached the point of takeoff. Consider, for example, the following changes in Germany, France, and Belgium in the period 1850-69: a three to sixfold increase in pig iron output, a two to fivefold increase in coal production/consumption, and a five to ninefold increase in (fixed)

steam-power capacity. The United Kingdom, having started the industrialization process earlier, had somewhat less dramatic changes (see [Table 1](#)). Further, the scale of production at the firm level, driven by technological developments, had undergone a dramatic increase. <sup>45</sup>

Europe had also become a much smaller place. Railroad mileage increased dramatically, greatly reducing the costs of transportation within Europe. [Table 1](#) illustrates the increase in railroad mileage in some of the major economies at this time; in all, fifty thousand miles of track were laid in Europe between 1850 and 1870, in contrast to fifteen thousand before 1850. <sup>46</sup> Similarly, advances in the steam engine spurred commerce. Important technological advances during this period include the single-screw steamer (1839), the double-screw steamer (1862), and the compound engine (1850s). The latter was especially important because its greater efficiency allowed more room to be devoted to cargo. <sup>47</sup>

By the 1860s, therefore, reduced transportation costs and increased economies of scale in production had substantially increased the possibilities and benefits of trade. What were the implications for the treaty system regulating (or not) commercial relations among states in Europe **[End Page 469]** at this time? As of 1860 there were virtually no significant treaties regulating commerce among European states. Propositions 2a and 2c above suggest that the dramatic reduction in transportation costs and greater economic interdependence increase the probability of the spread of PTAs. That is, to mix metaphors, the Europe of the mid-nineteenth century was nearing a level at which some trigger event could set off an avalanche of commercial treaties. <sup>48</sup>

### The Emergence of Economic Openness in the 1860s

Every new Commercial Treaty was at once a model and a starting point, a pattern for imitation and a basis for further development.

*--Lord Napier.* <sup>49</sup>

That trigger event occurred in 1860, when Britain and France signed the Cobden-Chevalier treaty, in which each state agreed to impose a **[End Page 470]** lower set of tariffs on the other. <sup>50</sup> Consistent with the analyses of political economists in the 1990s, Napoleon III, seeking to balance export-oriented interests against offended import-competing interests in 1860, did not unilaterally extend to other states the concessions France had made to Britain. <sup>51</sup> The net result was that third-party exporters were at a decided disadvantage in the French market. Thus, for example, "Edged tools from treaty states paid a duty into France of 18 francs per 100 kilo., but from the Zollverein [and other nontreaty states] 160 francs; the duties on paper were respectively 10 and 160 francs, on iron tools 12 and 60 francs." <sup>52</sup>

The preceding analysis suggests that third parties would seek similar treaties to avoid having their goods pushed out of France's markets. Note that due to France's geographic centrality in Europe, quite a few third parties were affected, further increasing the likelihood that additional treaties would be signed. The size of the British economy meant that there would likely be significant trade diversion in the French market, while the size of the French economy meant there would likely be trade diversion in the markets of states with which it signed treaties (propositions 2b and 2c). Belgium was the state that likely had the most to lose, due in part to its geographic proximity to France and also because, like Britain, it was highly industrialized (per capita it was the most industrialized state on the Continent at the time). <sup>53</sup> Its proximity made it especially dependent on the French market, <sup>54</sup> and, as argued above, the economies of scale in its industrial production meant that trade diversion would have been especially harmful to its producers. In **[End Page 471]** fact, in 1861 Belgium was the first state after Britain to sign an MFN treaty with France.

This put additional pressure on other states, especially those with substantial manufactures. The Zollverein (the German customs union) is a case in point. As Ashley states:

The inauguration of this treaty system in 1860, and the avowed intention to extend it as widely as possible, made it absolutely necessary for the Zollverein to take action. . . . The German manufacturers hoped that by a treaty they would secure a greatly developed market in France for their iron and steel, textiles, leather goods, etc., many of which were practically prohibited by the French "autonomous," as distinct from the "conventional" or treaty tariff. <sup>55</sup>

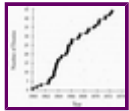
As a result, as one British diplomat in Leipzig observed, iron and steel exports of the Zollverein to France

disappeared shortly after the Cobden-Chevalier treaty. As this diplomat remarked, "Unless a speedy arrangement [is made] . . . between the states of the Zollverein and France a similar result will be produced as regards other products and manufactures." <sup>56</sup>

The ramifications of the Cobden-Chevalier treaty were not lost on German decision makers. As Rudolf von Delbrück, "president of the federal chancellory and probably most responsible for the detailed formulation of the Zollverein's tariff policy in this period," <sup>57</sup> stated: "Due to our position and our developed industry, we could not have permitted our exclusion from the market of the richest country on the continent, located before our very door, *if this market would be opened, as it was expected, to everybody else.*" <sup>58</sup>

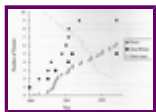
The Zollverein was therefore motivated to sign an MFN treaty with France shortly after Belgium (in 1862). Between 1863 and 1866 most European states had entered into this network of MFN treaties. <sup>59</sup> Among the major states only Russia and the United States remained at the periphery of this network of treaties. Russia signed only some minor agreements at the end of the decade, and the United States signed no significant treaties. **[End Page 472]**

### The Rate of Diffusion



The above model also makes specific predictions about the rate of diffusion of treaties, specifically, that the spread of treaties should follow an S-shape--slow, fast, slow. **Figure 15** plots the number of treaties signed from 1860 to 1872 in Europe. <sup>60</sup> As predicted, the rate of diffusion follows an S-shape. There were three distinct periods in the spread of commercial treaties. In the first two and a half years, only 3 treaties were signed, or 1.2 treaties per year. In the next three and a half years, 25 treaties were signed--7 treaties a year. And finally, in the next seven years, 19 treaties were signed--2.7 treaties a year.

### The Pattern of Diffusion: The Position of France and Britain in the Network of Treaties



This analysis should offer insight not only into the growth rate of openness in the system but also into the *pattern* of openness. **Figure 16** plots the number of treaties signed by Great Britain, France, and the **[End Page 473]** average of other states over this time. A critical issue, from the perspective of hegemonic stability theory, is the position of Britain in the network of treaties--was it, for example, in a privileged position in the network?

The answer is an emphatic no. It was France, not Britain, that was the pivot of the MFN treaty network. In the 1860s France signed eight more MFN agreements; Britain signed only four more, and France had signed a treaty with three of those four countries before Britain. <sup>61</sup> By the end of the period examined Britain had signed fewer treaties than the average of the other European states. Similarly, in the 1890s, while the Caprivi treaties improved Britain's access to Central European economies by virtue of Britain's MFN treaties with many of the states there, Germany gained tariff concessions that helped it disproportionately. <sup>62</sup> **[End Page 474]**

France's relatively pivotal position in the MFN treaty network in the 1860s is consistent with proposition 4 from the simulations above: first movers will tend to occupy a core position in the treaty system.

The relatively poor position of Britain is particularly striking, when one considers that it was the hegemon and therefore expected to be in a uniquely advantaged position. <sup>63</sup> Further, Britain was a first mover in the same sense that France was; the initial treaty should have increased the desirability of Britain as a treaty partner and spurred additional treaties with it. This relatively poor position apparently contradicts proposition 4. However, this is the exception that proves the rule. The above model assumed that all  $g_{ij}$  were randomly distributed. Although this assumption was clearly a poor match to reality, it was useful for illustrating basic systemic dynamics. In pairs of states involving Britain, Britain was repeatedly hamstrung in commercial negotiations because of its already low tariffs. *Other states did not need to pay the domestic political price of reciprocal tariff reductions in order to gain access to Britain's market because they received much of that access for free.* In the terms of this model, the  $g_{ij}$  involving Britain were relatively high because of Britain's low tariffs. As Fuchs states:

In regard to all the nations with which France had concluded such treaties, and with which England had no previous treaty containing the most favoured nation clause, she stood at a decided disadvantage compared with France, who enjoyed under those treaties differential duties in her favour. It was the same in the case of treaties which these countries made among themselves. Here was a state of affairs which seriously threatened English industry in her most important continental markets, and it had to be

remedied. Thus it came about that England, in spite of the aversion of her prevailing Free Trade school towards commercial and tariff treaties, found herself obliged, like the rest, to make other commercial treaties of the same sort. At once, however, a difficulty presented itself. By extending independently to all countries the tariff changes conceded to France, she had almost lost her "bargaining power."<sup>64</sup>

The domestic politics by which Britain came to seek MFN treaties is consistent with the trade diversion analysis above. There is strong evidence that export sectors in Britain played an important role in driving British trade policy in the 1860s. Marsh, in the most comprehensive diplomatic history of the trade treaties of this period, documents the **[End Page 475]** intimate involvement of woolen textiles centered in Bradford in British trade negotiations in the 1860s, beginning with the 1860 Cobden-Chevalier treaty.<sup>65</sup> Representatives from the Bradford Chamber of Commerce accompanied Cobden in his negotiations for the original 1860 treaty, successfully securing important concessions from the French.

Subsequently, in 1862, this sector was mobilized to push for a treaty with Belgium. Belgium and France had signed a treaty that reduced Belgian tariffs on French woollens: French woollens faced less than half the duty levied on British goods in Belgium.<sup>66</sup> This pattern was repeated in 1863, after France signed treaties with Italy<sup>67</sup> and the Zollverein.<sup>68</sup>

The importance of woolen manufactures in British trade negotiations fits the economic logic outlined earlier: the worsted woollens centered in Bradford had undergone a dramatic increase in scale of production in the 1850s.<sup>69</sup> Further, textiles at this time were a differentiated good, with different states and regions producing markedly different products.<sup>70</sup>

The cases in which Britain was able to sign treaties are consistent with the underlying theory. Where there was the threat of trade diversion, particularly where economies of scale and differentiated products were involved, Britain was able to sign treaties. Because it had maintained significant tariffs in a few areas, notably wine (a differentiated good), it was able to conclude some treaties. These tariffs were then in part bargained away in the initial treaty with France.<sup>71</sup> While Britain unilaterally extended these concessions to third parties, it had maintained higher tariffs on different types of wines, creating de facto discrimination in favor of France, which put pressure on other wine exporters to make concessions to Britain, for example, Austria (1865)<sup>72</sup> and Spain (1886).<sup>73</sup> In addition, states were afraid of trade diversion with Britain in respect to its dominions. Thus Britain was able to offer a guarantee to states that their goods would be subject to the same duties **[End Page 476]** as British goods in British colonies. Notably, the two treaties that included this guarantee were states with a similar profile of industrial (high economies of scale) exports as Britain: Belgium (1862) and the Zollverein (1865).<sup>74</sup>

## Network Stability

As Irwin points out, one of the most striking things about the MFN treaty network was its relative robustness.<sup>75</sup> In the 1880s, under the onslaught of recession and a flood of cheap agrarian products from the U.S. and Russia, the system bent but did not break. The trade war between France and Italy had no broader impact on the system. In the 1890s, at Germany's initiative, the system went through a significant expansion into Central Europe. At this time Germany had been experiencing sharp increases in food prices, hampering manufacturers' competitiveness and reducing the agrarian demand for protection.<sup>76</sup> As a result, with the replacement of Bismarck by Caprivi, Germany sought "to imitate the example of France in 1860, and take the lead in a readjustment for a definite period of the economic relations of the European states."<sup>77</sup> Germany concluded a series of treaties, starting with the 1891 treaty with Austria-Hungary, "which for some time had been desirous of entering into closer relations with Germany, since the latter country was its most important market."<sup>78</sup> That treaty also induced other countries to seek agreements with Germany, and treaties with Italy, Belgium, Switzerland, Serbia, Spain, and Romania soon followed. Russia followed in 1894, which was particularly interesting, since it had largely avoided commercial treaties prior to that year. But because of its geographic proximity to Germany and the similarity of its exports to those of the signatories of the Caprivi treaties, Russia, unlike in previous years, now had an incentive to reach a similar agreement:

Russia had hitherto stood apart from the treaty system, in her unwillingness to bind her customs tariff for any definite time, but now she was not disinclined to modify her policy, particularly as the treaties already made by Germany put her in an extremely difficult position. Those treaties had given reductions of duties on agricultural produce to other nations, who thereby enjoyed a distinct advantage over Russia. After the conclusion of the first series of treaties, Russian corn **[End Page 477]** paid a duty 43 per cent higher than that imposed on the products of the favoured nations.<sup>79</sup>

The Caprivi treaties again highlight the contagion effect resulting from the threat of trade diversion. The series of treaties that Germany had signed increased the relative payoff of a treaty to Russia.

The First World War wrecked the MFN network, which was slow to reassert itself after the war. Arguably, this was because one of the major actors of the system, Germany, was required by the Treaty of Versailles to extend most-favored-nation status to all of the Allies. Because it was unable to discriminate, it could not threaten other states with trade diversion. In effect this requirement eliminated the possibility of contagion of MFN agreements in relations with one of the key actors of the international system (in terms of both geography and size), reducing the likelihood that MFN treaties would spread through the whole system. Germany was released from this obligation in 1925, and as a result, France abandoned its policy of a two-tiered autonomous tariff and signed an MFN agreement with Germany in 1927. This treaty had significant ramifications throughout the international system, in which "the number of countries linked by commercial treaties rose from thirty in 1927 to forty-two in 1928."<sup>80</sup> Because tariff rates were set in the treaties, this had a significant stabilizing effect on European tariffs.<sup>81</sup> For example, half the rates of the French tariff were set in the treaty with Germany; by the end of 1928 nearly three-quarters of the rates were set by international agreements.<sup>82</sup> Under the weight of the depression, however, the reborn MFN network collapsed.

While there were a number of trade wars between major actors of the system during this period, the only events that threatened the network were the First World War and the depression in 1929, the latter ultimately destroying it. This is consistent with proposition 5: the system of treaties, once formed, became self-reinforcing. It took truly systemic and cataclysmic events to undo the network.

## Discussion

### Implications: Snowballing Trade Blocs

Current PTAs are predominantly *multilateral* rather than *bilateral*, as they had been in the 1860s. These multilateral efforts should be characterized [End Page 478] by the same contagion dynamics as those of bilateral PTAs.<sup>83</sup> As trade blocs grow, pressure should increase on nonmembers to join in order to prevent trade diversion.<sup>84</sup> Three cases will be briefly discussed below: the growth of the Zollverein, the EC/EU, and Western hemisphere PTAs.

The rapid creation of the Zollverein in the 1820s and 1830s offers some insight into bandwagoning effects that might result from the microlevel dynamics discussed in this article.<sup>85</sup> Once a few German states had formed a customs union (in the 1820s three unions were formed--between Bavaria and Wurttemberg, between Prussia and Hesse-Darmstadt, and one that included Saxony and a number of smaller German states), there was a rapid movement of German states to join the unions, and eventually to consolidate the customs unions into the Zollverein. The quandary of Saxony, which was a holdout in joining the Prussian-led bloc because it greatly desired to maintain its autonomy, captures the importance of trade diversion in its choice:

In fact, Saxony had scarcely any course to take but to join the Union. She had lost many of her richest provinces by the peace; she was hemmed in by unfriendly tariffs; her manufacturing population found insufficient outlets for their productions. . . .<sup>86</sup> On the whole, Saxony is the portion of Germany which has most profited by the Commercial League, for in Saxony manufacturing industry was most developed, and in the competition with other states of the League Saxony had the vantage-ground. To her especially it has opened a market of 26,000,000 of consumers, and closed the gates to a great extent against foreign rivals.<sup>87</sup> [End Page 479]

Similarly, in the case of Baden: "With the establishment of the Zollverein it became clear that Baden's agriculture and commerce would suffer. Trade with Switzerland and Holland was not adequate compensation for the loss of German markets."<sup>88</sup> Generally, the expansion of the Prussian-led customs union increased the isolation of nonmember German states. The threat of trade diversion to exporters within the Zollverein led to the eventual adhesion of these states.<sup>89</sup>

These factors can be generalized in an analysis of trade bloc formation today. The growth potential of a trade bloc depends on the threat of trade diversion in markets within the trade bloc. Britain in the 1950s is a case in point. Although Britain initially stayed out of the EEC to maintain political autonomy, it eventually sought membership when its share of intra-European trade declined due to trade diversion. These dynamics applied to intra-EC interactions as well. In negotiations over the future of the EC, Britain resisted plans that would have strengthened the power of the EC vis-à-vis its constituent states. Germany and France threatened to go ahead with a "two-tier" EC, in which the

first tier (including Germany and France) would effectively have removed more barriers among each other than to the second tier. <sup>90</sup> Britain eventually acceded to most of France and Germany's demands. Arguably, the fear of trade diversion to potential first-tier members was an important factor in its decision.

The recent deepening of the EC/EU also increased pressures on nonmembers to join. A key political dynamic underlying the push toward the Single European Act originated with industrialists who saw the unification of the European market as essential for firms to reach the scale necessary to be competitive in the world market. <sup>91</sup> The deepening process thus created the possibility of trade diversion, <sup>92</sup> which increased pressure to join on third parties that exported goods characterized by economies of scale in production. In fact, among European Free Trade Agreement (EFTA) countries that considered joining the EU, there was a strong correlation between public support for membership and the importance of manufactured exports to the EU and EFTA. <sup>93</sup> **[End Page 480]**

The case of the EU also highlights an additional contagion dynamic that may be more important today than trade diversion in causing the spread of trade agreements: investment diversion. In the above analysis it was assumed that producers of differentiated goods and goods characterized by economies of scale in production in a given state would, in response to a PTA among other states, exercise their voice and put pressure on their government to reach a similar agreement. However, exit is an increasingly viable option through foreign direct investment, and it can place great pressure on a government to join a PTA in order to prevent domestic producers from leaving. Further, the nonentry of foreign producers would place similar pressures on a government. Sweden in the 1980s is a case in point: what had begun in the early 1980s as a small gap between outward and inward investment had widened by 1990 to a 9:1 chasm. At the beginning of this period very little Swedish fdi was directed to the EC; by the end of this period, almost all of Swedish outward investment was headed in that direction. <sup>94</sup> The Swedish decision to join the EU may be contrasted to Norway's decision not to join. Norway's largest export is oil, and there is relatively little threat of trade diversion with respect to this good within the EU, nor is there any possibility that oil companies would move their production elsewhere in the EU.

In a more recent example of the snowball potential for trade blocs, the formation of the Canada-United States Free Trade Area diverted some trade from Mexico to the United States, increasing the payoff for Mexico to join the free trade area. <sup>95</sup> NAFTA, in turn, seems to be spurring increased efforts for treaties between the United States and Latin America, Europe and Latin America, and the U.S. and Europe. <sup>96</sup>

There have been many trade blocs that have not snowballed, especially among Third World states. In these cases current and potential members had less to worry about regarding trade diversion to states within a nascent trade bloc. These sets of states had similar endowments of factors of production, with a particular emphasis on primary production (in which there will be relatively little intraindustry trade). Further, the economies involved were much smaller. **[End Page 481]**

For the same reason, attempts to tighten trade blocs among these countries (for example, by eliminating nontariff barriers)--two-tier types of threats, such as were used by France and Germany in the 1980s--would probably not have worked.

It is noteworthy that preferential trade agreements that were signed among South American states in the 1960s failed, when the main exports of the economies involved were largely commodities. Far more successful were preferential trade agreements by these same states in the 1990s, by which time their economies had undergone a substantial transition toward producing industrial goods.

The key distinction between the bilateral arrangements of the 1860s and current multilateral arrangements is that the former did not forbid concessions to third parties. In fact, any such agreement would have violated the MFN clauses of existing treaties with third parties. Some current multilateral arrangements, notably customs unions, explicitly forbid such bilateral treaties with third parties (for example, the EU). Other multilateral agreements implicitly reject additional treaties in the near future because certain producers benefit from the trade diversion effects of the treaty (arguably, the Mercosur). <sup>97</sup> It is therefore unclear whether snowballing will ultimately lead to a world with freer trade or to a beggar-thy-neighbor world full of exclusive PTAs. <sup>98</sup>

## Conclusion: Bottom-Up Models of International Relations

The economic openness of the 1860s marked the beginning of the first relatively open international economic system. France was able to pursue commercial negotiations with Britain because of the presence of a free-trade

executive who did not have to submit treaties to a protectionist legislature. The resulting Cobden-Chevalier treaty of 1860 increased the incentive of continental European states to sign commercial treaties with France to avoid trade diversion resulting from the 1860 treaty. Similarly, these treaties increased the incentive of additional states to sign treaties with each other. The ensuing network of treaties resulted in dramatically lower tariffs in most of Europe. [End Page 482]

Young, in discussing the origins of regimes, distinguished among three regime types: spontaneous, negotiated, and imposed.<sup>99</sup> Negotiated and imposed regimes are both centrally planned, where imposed regimes are dictated by the elite power(s) of the system and negotiated regimes involve a more inclusive "explicit consent on the part of individual participants."<sup>100</sup> As mentioned earlier, the relative economic openness of the 1860s in Europe is sometimes interpreted as the result of such a central plan. It is, however, more plausible that the MFN network spontaneously emerged from each state's response to its particular placement in the system, and the opportunities and constraints that this placement created. Similarly, the explosion of regionalism today suggests that a contagion type of analysis might offer some insight into the growth of free trade areas and customs unions--where fear of being left out in the cold is driving the formation and growth of PTAs. Finally, it is increasingly apparent that such bottom-up processes account for important phenomena in the international system.

[David Lazer](#) is Assistant Professor of Public Policy at the Kennedy School of Government at Harvard University. He has written on the dynamics of network formation in a variety of political contexts and is currently completing a book manuscript on the spread of preferential trade agreements.

## Notes

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1. World Trade Organization, *Regionalism and the World Trading System* (Geneva: World Trade Organization, 1995).
2. Note that concessions became effectively multilateral because the unconditional (as compared with the conditional) MFN clause specifies that concessions made by the signatories to third parties must be granted to signatories of the treaty for no additional compensation; see S. K. Hornbeck, "The Most-Favored-Nation Clause in Commercial Treaties," *Bulletin of the University of Wisconsin* (February 1910), 343. States did develop means to keep concessions bilateral, for example, through minute subdivisions in tariff categories; see, e.g., D. C. M. Platt, *Finance, Trade, and Politics in British Foreign Policy, 1825-1914* (Oxford: Clarendon Press, 1971), 93.
3. This matches the argument of hegemonic stability theory. For example, see C. P. Kindleberger, *The World in Depression, 1929-1939* (Berkeley: University of California Press, 1973); and Robert Gilpin, *War and Change in World Politics* (Cambridge: Cambridge University Press, 1981). Also, for a valuable critique of hegemonic stability theory, see David Lake, "Leadership, Hegemony, and the International Economy: Naked Emperor or Tattered Monarch with Potential?" *International Studies Quarterly* 37 (December 1993).
4. Notably, the tariff levels of European states in the nineteenth century were not correlated with the degree of concentration of power in the international system. See Timothy J. McKeown, "Hegemonic Stability and the Nineteenth Century Tariff Levels in Europe," *International Organization* 37 (Winter 1983).
5. The first major work in the study of emergent systems was Thomas Schelling, *Micromotives and Macrobehavior* (New York: W. W. Norton, 1978). Recent efforts in this direction include Robert Axelrod, *The Complexity of Cooperation: Agent-Based Models of Competition and Collaboration* (Princeton: Princeton University Press, 1997); and Joshua M. Epstein and Robert A. Axtell, *Growing Artificial Societies: Social Science from the Bottom Up* (Washington, D.C.: Brookings Institution, 1996). For economic models of this genre, see Paul Krugman, *The Self-Organizing Economy* (Cambridge: Blackwell Publishers, 1996); and J. A. Scheinkman and M. Woodford, "Self-Organized Criticality and Economic Fluctuations," *American Economic Review* 84 (May 1994), 417-21.
6. Kenneth Oye, *Economic Discrimination and Political Exchange: World Political Economy in the 1830s and 1980s* (Princeton: Princeton University Press, 1992); Michael J. Gilligan, *Empowering Exporters* (Ann Arbor: University of Michigan Press, 1997); and Richard Baldwin, "A Domino Theory of Regionalism," in Jagdish Bhagwati, Pravin Krishna, and Arvind Panagariya, *Trading Blocs: Alternative Approaches to Analyzing Preferential Trade Agreements*

(Cambridge: mit Press, 1999).

7. There is a large literature on the economics of customs unions, with a welter of findings (often contradictory) regarding exactly when customs unions may be harmful to the welfare of members. The starting point of modern research on customs unions is Jacob Viner, *The Customs Union Issue* (New York: Carnegie Endowment for International Peace, 1950). More recent landmarks include Raymond Riezman, "A 3 x 3 Model of Customs Unions," *Journal of International Economics* 9 (August 1979); P. J. Lloyd, "3 x 3 Theory of Customs Unions," *Journal of International Economics* 12 (February 1982); and Ian Wooton, "Preferential Trading Agreements: An Investigation," *Journal of International Economics* 21 (August 1986). For a striking illustration of the fact that a world dominated by a few customs unions may be associated with lower world welfare than a world of no trade blocs (even holding tariffs constant), see Paul Krugman, "The Move toward Free Trade Zones," in *Policy Implications of Trade and Currency Zones: A Symposium Sponsored by the Federal Reserve Bank of Kansas City* (Kansas City, Mo.: Federal Reserve Bank of Kansas City, 1991); and Eric Bond and Constantinos Syropoulos, "The Size of Trading Blocs: Market Power and World Welfare Effects," *Journal of International Economics* 40 (May 1996). Kemp and Wan demonstrate, however, that there is always a level of postunion tariffs that is Pareto-improving for both PTA members and nonmembers; see Murray C. Kemp and Henry Y. Wan, Jr., "An Elementary Proposition Concerning the Formation of Customs Unions," *Journal of International Economics* 6 (February 1976), 95-97.

8. In principle, dyadic in this context incorporates PTAs with more than two members. None of the treaties signed during the 1860s had more than two parties, however.

9. See Ronald Rogowski, *Commerce and Coalitions: How Trade Affects Domestic Political Alignments* (Princeton: Princeton University Press, 1989). Notably, however, Rogowski demonstrated how long-run coalitions form around trade issues, whereas a coalition resulting from a particular PTA would presumably reflect a short-run congruence of interests.

10. For example, Daniel Treffer, "Trade Liberalization and the Theory of Endogenous Protection," *Journal of Political Economy* 101 (February 1993); M. Finger and A. Harrison, "The mfa Paradox: More Protection and More Trade?" (Manuscript, World Bank, 1995); and Helen Milner, *Resisting Protectionism: Global Industries and the Politics of International Trade* (Princeton: Princeton University Press, 1988).

11. There is a third alternative--multilateral reductions in tariffs, as has occurred under the auspices of gatt in the post-World War II period. There was no equivalent forum to pursue multilateral reductions in tariffs in the 1860s. Why there was no equivalent of gatt during the 1860s is an interesting question but one not pursued here.

12. Oye (fn. 6); and Gilligan (fn. 6). Closely related are the arguments of I. M. Destler and John Odell, *Anti-Protection: Changing Forces in the United States Trade Politics* (Washington, D.C.: Institute for International Economics, 1987). While they do not directly discuss PTAs, they do point out that potential retaliation from country A in response to protectionist measures in country B may have a very focused distributional impact on exporters in B.

13. Political economy models illustrating the possibility of a prisoners' dilemma structure of payoffs of a PTA include Robert Pahre, "Reactions, Reciprocity, and Retaliation: A Model of Tariff Policy Linking State and Domestic Interests" (Manuscript, 1994); and Gene Grossman and Elhanan Helpman, "Trade Wars and Trade Talks," *Journal of Political Economy* 103 (August 1995). See also Robert Putnam, "Diplomacy and Domestic Politics: The Logic of Two-Level Games," *International Organization* 42 (Summer 1988). Closely related are H. G. Johnson, "Optimum Tariffs and Retaliation," *Review of Economic Studies* 21, no. 55 (1954); Raymond Riezman, "Tariff Retaliation from a Strategic Viewpoint," *Southern Economic Journal* 48 (January 1978); and John Conybeare, *Trade Wars: The Theory and Practice of International Commercial Rivalry* (New York: Columbia University Press, 1987). These last three assert that states may face a prisoners' dilemma with respect to the imposition of optimal tariffs to improve terms of trade.

14. Oye (fn. 6) labels these "divertable externalities," in that the costs to a particular third party may be diverted to fourth parties by extending the market access to that third party.

15. For example, Grossman and Helpman showed, using a median voter model, that free-trade areas are more likely to garner political support when trade diversion outweighs trade creation; see Gene Grossman and Elhanan Helpman, *The Politics of Free Trade Agreements*, Working Paper 4597 (Cambridge: National Bureau of Economic Research, 1993).

16. For an insightful discussion of this point, see Dani Rodrik, "Political Economy of Trade Policy," in Gene Grossman

and Kenneth Rogoff, eds., *Handbook of International Economics* (New York: Elsevier, 1995).

[17.](#) Baldwin (fn. 6).

[18.](#) Ibid.

[19.](#) Helen Milner, "Industries, Governments, and the Creation of Regional Trade Blocs," in John G. Ruggie, ed., *The Political Economy of Regionalism* (New York: Columbia University Press, 1997).

[20.](#) For an early and insightful discussion of the interrelationship between preference/discrimination and product differentiation, see Frederic Benham, *Great Britain under Protection* (New York: Macmillan, 1941). For a discussion of why political mobilization of sectors is more likely when the goods produced are differentiated, see also Michael Gilligan, "Lobbying as a Private Good with Intra-Industry Trade," *International Studies Quarterly* 41 (September 1997).

[21.](#) Percy Ashley, *Modern Tariff History: Germany-United States-France* (New York: E. P. Dutton, 1926), 326.

[22.](#) Ibid., 327.

[23.](#) For an intriguing analysis that applies coalition theory to customs-union formation, see Sang-Seung Yi, "Endogenous Formation of Customs Unions under Imperfect Competition: Open Regionalism Is Good," *Journal of International Economics* 41 (August 1996).

[24.](#) See Thomas Valente, *Network Models of the Diffusion of Innovations* (Cresskill, N.Y.: Hampton Press, 1995). For a discussion of diffusion processes and a consideration of diffusion through some central source versus diffusion via contagion, see Charles Lave and James March, *An Introduction to Models in the Social Sciences* (New York: Harper and Row, 1975). For a classic analysis of diffusion processes, see James Coleman, E. Katz, and H. Menzel, *Medical Innovation: A Diffusion Study* (Indianapolis, Ind.: Bobbs-Merrill, 1966). For a recent discussion, see Everett Rogers, *Diffusion of Innovations* (New York: Free Press, 1995).

[25.](#) This is a relatively reasonable assumption in the domain of trade, where iteration is high, fostering mutual cooperation. See Robert Axelrod, *The Evolution of Cooperation* (New York: Basic Books, 1984). Of course, there may be substantial conflict over the distribution of the gains of cooperation, sometimes leading to mutual defection, as the occasional trade wars of the 1880s and 1890s attest (e.g., France-Italy, Germany-Russia).

[26.](#) Herbert Simon, *Models of Man* (New York: Wiley, 1957).

[27.](#) Susanne Lohmann, "The Dynamics of Informational Cascades: The Monday Demonstrations in Leipzig, East Germany, 1989-91," *World Politics* 47 (October 1994); Mark Granovetter, "Threshold Models of Collective Behavior," *American Journal of Sociology* 83 (May 1978); Mark Granovetter and R. Soong, "Threshold Models of Diversity: Chinese Restaurants, Residential Segregation, and the Spiral of Silence," in C. Clogg, ed., *Sociological Methodology*, vol. 18 (Washington, D.C.: American Sociological Association, 1988).

[28.](#) Valente (fn. 24).

[29.](#) As discussed below, this assumption regarding the distribution of  $g_{ij}$  greatly facilitates interpretation of the model. All thresholds are also assumed to be independent of each other. Note that in reality this is not likely to be the case; e.g., some states might be especially likely to sign treaties, and some especially unlikely, so one might expect  $g_{ij}$  to be correlated with  $g_{ik}$ .

[30.](#) A lattice also has the advantage of making it easier to visualize the process of contagion, as the example below illustrates.

[31.](#) The exact amount the thresholds should be lowered is arbitrary. Lowering thresholds by 1 has the benefit in terms of ease of interpretation of the simulations in that when a state has  $\delta$  partners, it will definitely sign treaties with its remaining neighbors.

32. The sum of the thresholds  $\cong 40$  (number of dyads)  $\times$  1.5 (average threshold) = 60.

33. The probability that three treaties will be signed is  $\frac{6}{\delta^3} + \frac{2}{\delta^2} \left(1 - \frac{2}{\delta}\right) \text{Min} \left[1, \frac{1}{\delta-2}\right]$  for  $\delta > 2$  and otherwise  $1 - \left(1 - \frac{1}{\delta}\right)^2$ .

34. Note that there are six distinct degrees of centrality in a 5  $\times$  5 lattice. Additional simulations indicate that centrality of the first mover is monotonically related to the average number of treaties signed in equilibrium.

35. The probability that A will sign a treaty with either B or F in the first round is  $1 - (2/3)^2 \approx .56$ . The proportion of treaties signed in Figure 12 reaches a maximum of approximately .5, which means that if the first mover were large and signed a treaty with at least one other state in the first round, subsequently 90 percent of potential treaties would be signed (on average).

36. Note that this increases the number of potential treaties from forty to seventy-two; the analysis below, of course, examines the proportion of potential treaties that are signed.

37. If the initial actor to sign a treaty is in the corner, the analogous numbers are 29 percent and 69 percent, respectively.

38. While it is prohibitively difficult in this model to analytically derive the probability that a certain number of treaties will be reached in equilibrium, it is simple to calculate the probability that zero treaties will be reached under a given

set of assumptions. Specifically, that number is  $\left(1 - \frac{1}{\delta}\right)^p$ , where p is the number of treaty-eligible neighbors the first mover has. Thus, for  $\delta = 3$ , in the highly connected scenario (p = 8), this is 3.9 percent; in the less connected scenario (p = 4) this is 20 percent; in the totally connected scenario (p = 24), .006 percent.

39. Note this is different from the preceding assumptions regarding interconnectedness. The reason for this last assumption was that this way all actors in the system have the same level of interactions, thus eliminating geographic centrality as a factor in determining centrality in the network of treaties.

40. There were 0 treaties 82 times ( $\cong .924 \times 1000 = 80$ ), and 1 treaty once.

41. At t = 0,  $g_{ij}$  is drawn from a uniform distribution between 0 and 10. After the system reaches an equilibrium where every state has a treaty with every other state, the member of each dyad has 23 treaties with nondyad members, so  $g_{ij} =$  the initial  $g_{ij} - (2 \times 23)$ . Thus, to increase the postequilibrium  $g_{ij}$  to a positive number, one would need to add between 36 and 46. To put this in more general terms, in a system which has reached an equilibrium where every state has signed a treaty with every other state, and every state has M trading partners, and the initial  $g_{ij}$  is drawn from a uniform distribution between 0 and  $\delta$ , in order to eliminate the treaty between i and j,  $g_{ij}$  will need to be increased by  $(2 \times M)$ --the initial  $g_{ij}$ . Thus, notably, the more interconnected the world (the larger M), the more robust the equilibrium where every state has signed a treaty with every other state.

42. If all treaties with one state, l, were removed,  $g_{kl}$  would equal the initial  $g_{kl}$  (drawn from between 0 and 10) -  $(2 \times 22)$ , which would be between -34 and -44.

43. For a perceptive discussion of the MFN network of treaties from 1860 to 1929, see Douglas Irwin, "Multilateral and Bilateral Trade Policies," in Jaime de Melo and Arvind Panagariya, eds., *New Dimensions in Regional Integration* (Cambridge: Cambridge University Press, 1993).

44. David Landes, "Technological Change and Development in Western Europe, 1750-1914," in J. H. Clapham, ed., *The Cambridge Economic History of Europe: The Industrial Revolution and After*, pt. 1 (Cambridge: Cambridge University Press, 1965), 363.

45. Ibid., 450.

[46.](#) Ibid., 429.

[47.](#) See Ernest Bogart, *Economic History of Europe, 1760-1939* (London: Longmans, Green, 1942), 109, 118.

[48.](#) Per Bak and K. Chen, "Self-Organizing Criticality," *Scientific American* 264 (January 1991).

[49.](#) Lord Napier, British ambassador to Berlin, to Lord Russell, British foreign secretary, March 24, 1865; originally cited in Peter Marsh, *Bargaining on Europe: Britain and the First Approach to a European Economic Community, 1860-1892* (New Haven: Yale University Press, forthcoming), chap. 3.

[50.](#) An important antecedent condition to this treaty was the general increase in power of Napoleon III and a French constitution that gave the executive (Napoleon III) power to set tariffs in treaties that did not require ratification by the legislature. This institutional setting of executive autonomy determined what Nelson labeled the "supply" conditions of protection and would be exogenous in the model above; see Douglas Nelson, "Endogenous Tariff Theory: A Critical Survey," *American Journal of Political Science* 32 (August 1988). A second factor that increased Napoleon's desire to strike a deal with Britain was his aim to acquire Britain's cooperation with respect to his objectives in Italy. See McKeown (fn. 4); and Barrie M. Ratcliffe, "The Origins of the Anglo-French Commercial Treaty: A Reassessment," in Ratcliffe, ed., *Great Britain and Her World, 1759-1914: Essays in Honour of W. O. Henderson* (Manchester: Manchester University Press, 1975). As noted above, for each dyad there will be a variety of idiosyncratic factors that affect the tendency of that pair to sign a treaty.

[51.](#) Arthur Louis Dunham, *Anglo-French Treaty of Commerce of 1860* (Norwood: Plimpton Press, 1930).

[52.](#) Max Schippel, *Grundzuge der Handelspolitik* (Berlin: Akademischer Verlag für sociale Wissenschaften, 1902), 171, as cited in Ashley (fn. 21), 32.

[53.](#) Paul Bairoch, "European Trade Policy, 1815-1914," in J. H. Clapham et al., *The Cambridge Economic History of Europe* (Cambridge: Cambridge University Press, 1989).

[54.](#) More than a third of Belgian exports went to France at this time--162m francs out of total exports of 470m francs; see Mitchell (1975), 489, 506. It exported about as much to France as to its next two largest trading partners combined; e.g., in 1860 its exports to France were valued at 162m francs, and to Germany and the U.K., at 169m francs.

[55.](#) Ashley (fn. 21), 32.

[56.](#) Memo, Joseph Crowe (consul-general for the Kingdom of Lower Saxony) to Lord Russell, May 15, 1861, as originally cited in Marsh (fn. 49), chap. 3.

[57.](#) Ivo Nikolai Lambi, *Free Trade and Protection in Germany, 1869-1879* (Wiesbaden: Franz Steiner, 1963), 35.

[58.](#) Rudolf von Delbrück, *Lebenserinnerungen, 1817-1867*, vol. 2 (Leipzig: Duncker und Humblot, 1905), 201-3, as cited in Lambi (fn. 57), 5, emphasis added.

[59.](#) Bairoch (fn. 53), 40; see also [Figure 15](#).

[60.](#) This period was chosen because many of the treaties stated that they would come up for renewal in ten to twelve years, and the data on the renewal of particular treaties are incomplete. It is at least possible to say with some reliability that the treaties captured in [Figure 15](#) were actually in force during this time.

[61.](#) On this point, see also Arthur Stein, "The Hegemon's Dilemma: Great Britain, the United States, and the International Economic Order," *International Organization* 38 (Spring 1984). The four states with which both Britain and France signed treaties were Germany/Zollverein, Italy, Belgium, and Austria-Hungary. The last was the one state that Britain signed a treaty with first. The four states with which France signed treaties during this period and with which Britain did not were Spain, Norway-Sweden, Switzerland, and the Netherlands.

[62.](#) Carl Johannes Fuchs, *The Trade Policy of Great Britain and Her Colonies since 1860*, trans. Constance H. M. Archibald (London: Macmillan, 1905), 76.

[63.](#) Of course, this is less puzzling if one views Britain as the benevolent hegemon rather than as an exploitative hegemon; see Duncan Snidal, "The Limits of Hegemonic Stability Theory," *International Organization* 39 (Autumn 1985). One might hypothesize that Britain encouraged other states to sign treaties as part of its effort to decrease trade barriers in the international system. There is no evidence to support this hypothesis, and some that contradicts it, e.g., Fuchs (fn. 62); and Marsh (fn. 49).

[64.](#) Fuchs (fn. 62), 29.

[65.](#) Marsh (fn. 49), chap. 2.

[66.](#) *Ibid.*, chap. 3.

[67.](#) *Ibid.*

[68.](#) *Ibid.*

[69.](#) Landes (fn. 44), 440.

[70.](#) Thus, for example: "The particular blend of worsted wear in which Bradford specialized included warps of cotton, which remained cheaper than wool, to produce a hard and lustrous cloth which went well over the crinolines of the day, better than the more expensive all-woolen worsteds in which the French specialized"; Marsh (fn. 49), chap. 3.

[71.](#) Dunham (fn. 51), 88.

[72.](#) Fuchs (fn. 62), 31-32.

[73.](#) *Ibid.*, 59.

[74.](#) *Ibid.*, 30-31.

[75.](#) Irwin (fn. 43).

[76.](#) Fuchs (fn. 62), 64.

[77.](#) *Ibid.*, 65.

[78.](#) *Ibid.*, 66.

[79.](#) *Ibid.*, 70.

[80.](#) Irwin (fn. 43), 105.

[81.](#) Note that these levels were significantly higher than pre-World War I levels.

[82.](#) Frank A. Haight, *A History of French Commercial Policies* (New York: Macmillan, 1941).

[83.](#) There are, of course, other processes at work that might confound contagion. For example, in the case of the EC/EU, members at any given time will need to evaluate the policy preferences of potential members. If those preferences differ substantially from those of current members, current members may delay membership of potential members until those differences matter less. See George Downs, David Rocke, and Peter Barsoom, "Managing the Evolution of Multilateralism," *International Organization* 52 (Spring 1998). Also, since the EU allows free movement of factors, some potential members raise the possibility of large (and politically costly to current members) migrations to current EU members. The EU has developed "second class" citizenship for Turkey and many of the countries in Central Europe, offering, that is, much of the access to goods but not to people. From a research design perspective, the system of bilateral treaties conveniently eliminates some of the messiness involved in the process of adhesion to multilateral PTAs.

[84.](#) See also Yi (fn. 23).

[85.](#) For an intriguing analysis of the Zollverein and other multilateral PTAs, see also Walter Mattli, *The Logic of Regional Integration: Europe and Beyond* (Cambridge: Cambridge University Press, 1999). Mattli's argument is that (1) customs unions represent an attempt to internalize externalities that cross borders within the customs union; and (2) decreased transportation costs increase externalities across borders (increasing the payoffs to a customs union) and decrease the costs of administering a larger geographic unit.

[86.](#) John Bowring, *Report on the Prussian Commercial Union* (London: W. Clowes, 1840), 33-34, as cited in Ashley (fn. 21), 11.

[87.](#) Bowring (fn. 86), 37, as cited in Ashley (fn. 21), 11.

[88.](#) William Otto Henderson, *The Zollverein* (London: Frank Cass, 1984), 107.

[89.](#) *Ibid.*, 103-49.

[90.](#) Andrew Moravcsik, "Negotiating the Single European Act: National Interests and Conventional Statecraft in the European Community," *International Organization* 45 (Winter 1991).

[91.](#) Maria Green Cowles, "Setting the Agenda for a New Europe: The ERT and EC, 1992," *Journal of Common Market Studies* 33 (December 1995), 507.

[92.](#) Organization for Economic Cooperation and Development, *Regionalism and Its Place in the Multilateral Trading System* (Paris: oecd, 1996), 76.

[93.](#) Baldwin (fn. 6), 489.

[94.](#) Karl-Orfeo Fioretos, "The Anatomy of Autonomy: Interdependence, Domestic Balances of Power, and European Integration," *Review of International Studies* 23 (July 1997), 313-14.

[95.](#) Oye (fn. 6), 164. Note that customs unions also have the analytically distinct property that because there is a common exterior tariff, the collective might be able to reap gains through the imposition of an optimal tariff. Further, it is clear that at least in the case of the EC, a major objective of members was to allow EC firms to achieve economies of scale that would allow them to compete with U.S. firms; see Bela Balassa, *The Theory of Economic Integration* (Homewood, Ill.: Richard Irwin, 1961).

[96.](#) Robert Z. Lawrence, *Regionalism, Multilateralism, and Deeper Integration* (Washington, D.C.: Brookings Institution, 1996), 77.

[97.](#) Yeats finds that trade within Mercosur has grown fastest in those products that do not have a comparative advantage and concludes that Mercosur is therefore trade diverting; see Alexander Yeats, *Does Mercosur's Trade Performance Raise Concerns about the Effects of Regional Trade Arrangements*, Policy Research Working Paper, no. 1729 (Washington, D.C.: World Bank, 1997).

[98.](#) Yi finds that if agreements are open to new members, trade blocs will snowball so that eventually all states will belong to one PTA (i.e., there will be multilateral free trade); see Yi (fn. 23).

[99.](#) Oran Young, "Regime Dynamics: The Rise and Fall of International Regimes," in Stephen Krasner, ed., *International Regimes* (Ithaca, N.Y.: Cornell University Press, 1983).

[100.](#) *Ibid.*, 99.