Optimal Remedies in International Trade Agreements*

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Abstract

This paper takes a mechanism-design approach to characterize a politically optimal trade agreement under the assumptions that governments have private information about the political pressure they face from domestic interest groups to restrict trade. The optimal mechanism involves a remedy system for breach of trade agreements that specifies less-than-proportional retaliations against deviating parties. This result is in contrast to the conventional wisdom in the literature regarding the efficiency of the Reciprocity Principle as a rule of renegotiation in trade agreements. I also consider an institutional structure in which only commensurate retaliations are practical but governments can employ a public randomizing device to authorize retaliations. I show that it is optimal to authorize retaliations only randomly. This suggests a role for the WTO dispute settlement process as a public randomizing device.

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1 Introduction

Viewing international trade agreements as contracts among politically-motivated governments has been a popular thesis among scholars. Following this paradigm, different aspects of trade agreements have been analyzed using insights from contract theory. In particular, attempts have been made to understand the renegotiation and compensation provisions in trade agreements as mechanisms to promote efficient breach of contracts. This paper contributes to this literature by characterizing the most efficient remedy system for violation of trade agreements among politically-motivated governments.

In this paper, I take the view that by signing trade agreements, governments try to maximize their political welfare in an uncertain political and economic environment. In the absence of cooperation, each government uses its trade policy instruments too aggressively so that the political welfare reaped by one government comes at a higher cost to other governments. Governments can escape from this Prisoners' Dilemma by entering into an agreement that limits their ability to manipulate trade policy instruments.[1] Nevertheless, governments may occasionally find themselves under intense pressure from domestic interest groups to deviate from their international trade obligations. In such circumstances, taking a protectionist measure to dissipate political pressures in the importing country may cause more political gains to the government of the importing country than costs to the government of the exporting country. In other words, abiding with the agreement in the presence of intense political pressure causes a net loss in terms of joint political welfare.

Under most trade agreements, signatories are free to suspend or withdraw their obligations without the consent of other contracting parties. In response to this initial violation, however, the affected parties will be also free to suspend substantially equal obligations or concessions. Withdrawal of previously granted concessions by the victim countries can be interpreted as a form of remedy for breach of contracts. Sykes (1991) and Schwartz and Sykes (2002) interpret the authorization of reciprocal reaction to an initial deviation as an award of "expectation damages", which places the victim in as good a position as it would have been in if the violator had honored

[1] Bagwell and Staiger (1999) and Bagwell and Staiger (2002, chapter 2) provide an elegant formulation of this idea.

its obligations. Following this definition, Schwartz and Sykes (2002, p. S182) argue that "expectation damages thus deter inefficient breach because the promisor will not wish to violate and pay expectation damages unless the promisor gains more from the breach than the promisee loses, in which case breach is efficient."

In this paper, however, I argue that a system that employs expectation damages, the so-called liability rule system, is not the most efficient mechanism for handling breach of international trade agreements. The point of departure is the observation that an injured party in an international trade setting usually receives compensations by withdrawing its own concessions that have been previously granted to the offending country. This method of compensation is efficiency-reducing since, as discussed above, withdrawal of concessions in normal situations causes a net loss to the contracting parties. In fact, an important underlying assumption on which the efficiency of a liability-rule mechanism is established is the availability of cash transfer, or other efficiency-neutral side payments, as a method of compensation. When such efficiency-neutral side payments are not available, it is in the best interest of all parties, ex ante, to agree on a remedy system that awards the smallest possible damages to victims.[2]

Notwithstanding its inefficiency, awards to the victim cannot be reduced to zero if governments have private information regarding the state of the world. That is because in the absence of a system that imposes sufficient costs on breaching parties, governments will have the incentive to exaggerate the political and economic costs of honoring their trade obligations in order to legitimize their protectionist pursuits.

In Section 4 of this paper, I model a trade agreement as an optimal mechanism whose objective is to maximize the joint political welfare of the governments while it induces truthful revelation of private information by all parties. The main finding is that an optimal mechanism involves less-than-proportional retaliation against deviating parties. This result appears to be different from Bagwell and Staiger's (1999) general conclusion that the restriction of reciprocity directs the bargaining outcome toward the political optimum. Bagwell and Staiger (1999) show that under the restriction of reciprocity, negotiators have no incentive to negotiate away from a first-best trade agreement that generates the highest joint welfare under the current

[2] Feenstra and Lewis (1991) consider a situation where rents can be transfered among countries. Their findings can be interpreted as supporting a liability-rule system.

state of the world. While confirming this result, I show that when the state of the world changes so that the current agreement is no longer the first-best, the reciprocity principle does not direct the negotiators to the new first-best agreement. More importantly, I show that the outcome of renegotiations under the reciprocity rule falls short of second-best optimality.

Moreover, my finding does not support the proposals to allow for more-than-proportional retaliation against a violating country in the WTO. I argue that these proposals do not follow an efficiency rationale; instead, these are motivated by the observation that reciprocity does not compensate a breached-upon party for all of its loss. As Bagwell (2007) correctly points out, *"commensurate retaliation preserves the terms of trade but results in a reduced trade volume. Hence, [...] commensurate retaliation leaves the foreign government with less welfare than it would have enjoyed at the initially negotiated tariffs."* In other words, a liability-rule mechanism prescribes a more-than-proportional retaliation, which, as I show in this paper, is not optimal.

In Section 5, I consider an institutional setting in which disproportionate retaliation is not practical but a public randomizing device is available that can be used to authorize retaliation on a random basis. This institutional configuration may have some practical appeal. First, as Howse and Staiger (2005) and Bagwell (2007) point out, important measurement problems significantly limit the feasibility of a system with disproportionate retaliation. Second, one can interpret the WTO dispute settlement system as a public randomizing device that authorizes retaliation with a fixed probability. I find that the optimal probability of retaliation is strictly less than one. Optimality of random, rather than certain, retaliation once again indicates the fact that reciprocal retaliation is too severe to induce efficient behavior by governments.

Before concluding this paper I will discuss the fairness of the optimal remedy system in Section 6. One may argue against a system that authorizes less-than-proportional retaliation by questioning the fairness of the system. In fact, as noted above, a victim is not fully-compensated under an optimal remedy system in the WTO. However, ex ante, that is, when political pressures are not yet realized, the expected value of the agreement is the same to both governments. Therefore, governments maintain a balance of concessions ex ante, although such a balance may not materialize ex post. Moreover, if governments have repeated interaction over time, a country that stands to lose from an optimal remedy system in some periods will be overcompensated in periods when it finds it optimal to suspend its obligations in response to domestic pressures. In other words, governments can maintain an intertemporal balance of concessions under an optimal trade agreement through repeated interactions.

2 Basic setup

The setup that I use here is similar to Beshkar (2007). Consider a pair of distinct goods x and y with demand functions in the home country (no *) and the foreign country (*) given by:

$$\begin{aligned} D_x(p_x) &= 1 - p_x,\ D_y(p_y) = 1 - p_y, \\ D_x^*(p_x^*) &= 1 - p_x^*,\ D_y^*\left(p_y^*\right) = 1 - p_y^*, \end{aligned} \tag{1}$$

where p (with the appropriate index) represents the price of a good in a certain country. Specific import tariffs, τ and τ^*, that are chosen by countries as the only trade policy instrument, create a gap between domestic and foreign prices. In particular, $p_x = p_x^* + \tau$ and $p_y = p_y^* - \tau^*$.

Both countries produce both goods using the following supply functions:

$$\begin{aligned} Q_x(p_x) &= p_x,\ Q_y(p_y) = bp_y, \\ Q_x^*(p_x^*) &= bp_x^*,\ Q_y^*\left(p_y^*\right) = p_y^*. \end{aligned} \tag{2}$$

Assuming $b > 1$, the home country will be a natural importer of x and a natural exporter of y.

Under this model, the market-clearing price of x (y) depends only on the home (foreign) tariff. Let $p_x(\tau)$ and $p_y(\tau^*)$ respectively denote the equilibrium prices of x and y in the home country. If import tariffs are non-prohibitive (i.e., if they are sufficiently small) trade occurs between the countries and the home consumers' surplus from the consumption of x and y will be given by

$$\psi_x(\tau) \equiv \int_{p_x(\tau)}^{1} D_x(u)\,du,\ \ \psi_y(\tau^*) \equiv \int_{p_y(\tau^*)}^{1} D_y(u)\,du.$$

Moreover, the home producers' surplus from the sale of x and y will be given by

$$\pi_x(\tau) \equiv \int_{0}^{p_x(\tau)} Q_x(u)\,du,\ \ \pi_y(\tau^*) \equiv \int_{0}^{p_y(\tau^*)} Q_y(u)\,du.$$

The government's tariff revenue is given by

$$T(\tau) \equiv \tau M_x(p_x(\tau)),$$

where $M_x(p_x) \equiv D_x(p_x) - Q_x(p_x)$ is the import demand for good x in the home country.

For reasons that will be clear later, I assume that there is another pair of goods, which are produced and consumed in an identical manner as above. This duplicate economy will make the modelling of the retaliation scheme very simple.

2.1 A Political Objective Function

Following Baldwin (1987), I assume that each government maximizes a weighted sum of its producers' surplus, consumers' surplus, and tariff revenues with a relatively higher weight on the surplus of its import-competing sector. The higher weight given to the welfare of a sector might be the result of political pressure, through lobbying for example, that a government faces. Denoting the political weight on the welfare of the import-competing sector in the home (foreign) country by θ (θ^*), where $\theta, \theta^* \geq 1$, I assume that the home government's welfare drawn from sector x as a function of the home import tariff is given by

$$u(\tau;\theta) \equiv \psi_x(\tau) + \theta\pi_x(\tau) + T(\tau),$$

and the home government's welfare from sector y as a function of the foreign import tariff is given by

$$v(\tau^*) \equiv \psi_y(\tau^*) + \pi_y(\tau^*).$$

Therefore, $u(\tau;\theta) + v(\tau^*)$ represents the political welfare of the home government, which is additively separable in functions of the home and foreign tariffs. The home government's welfare is increasing in the home tariff and decreasing in the foreign tariff when these tariffs are sufficiently low.

2.2 Private Political Pressures

I assume that political pressures can take two levels, i.e., low and high, denoted respectively by $\underline{\theta}$ and $\overline{\theta}$. Remember that each country has two import-competing industries which may exert political pressure in order to restrict imports of the like products. I assume that these pressures are realized according to the following probability distribution:

$$\begin{aligned} \Pr(\text{high pressure from both industries}) &= 0, \\ \Pr(\text{high pressure from only one industry}) &= \rho, \\ \Pr(\text{no high pressure}) &= 1-\rho, \end{aligned}$$

where, $0 < \rho < 1$.

This probability distribution ensures that in each country there is at least one import-competing industry that exerts low political pressure. I assume that this low-political-pressure industry is used by the government to retaliate against a deviating country when retaliation is authorized. This structure allows me to focus my analysis on the import tariffs of the home country in the potentially high-political-pressure sector, and the retaliatory tariffs of the foreign country in the low-political-pressure sector. Due to symmetry, the foreign (home) country's import (retaliatory) tariffs are identical to those of the home (foreign) country. Therefore, in what follows I restrict my attention to the home country's import tariff in the potentially high-political-pressure sector and the foreign country's retaliatory tariffs that are implemented in the low-political pressure sector.

3 Benchmarks: The first-best agreement and non-cooperation

In this Section, I characterize the first-best agreement as well as the non-cooperative trade policies in order to set a benchmark to discuss the optimal trade agreement under information asymmetry, which will be presented in Section 4.

In the absence of cooperation, the home government would choose τ to maximize $u(\tau;\theta) + v(\tau^*)$. This is tantamount to choosing a tariff rate that maximizes the home government's welfare from its import-competing sector, $u(\tau;\theta)$. Therefore, the non-cooperative (Nash) tariff as a function of political pressure is given by

$$\tau^N(\theta) \equiv \arg\max_{\tau} \; u(\tau;\theta). \tag{3}$$

In setting its policy unilaterally, the home government ignores the impact of its tariff on the welfare of the foreign government which is captured by $v(\tau)$. The foreign country's non-cooperative tariff, $\tau^{*N}(\theta^*)$, can be defined similarly.[3]

In a first-best situation where governments have symmetric information regarding the state of the world and they can commit to their promises, the most efficient agreement is one that maximizes the joint political welfare, or $u(\tau;\theta) + v(\tau)$. In other words, the politically-efficient import tariff, $\tau^{PE}(\theta)$, is given by

$$\tau^{PE}(\theta) = \arg\max_{\tau} u(\tau;\theta) + v(\tau). \tag{4}$$

Given the two levels of political pressure, $\underline{\theta}$ and $\overline{\theta}$, a politically-efficient agreement specifies a two-step tariff schedule, namely, $l = \tau^{PE}(\underline{\theta})$ and $s = \tau^{PE}\left(\overline{\theta}\right)$, where $l < s$. The low tariff rate, l, can be interpreted as the tariff rate to be set by governments under normal situations, that is, when $\theta = \underline{\theta}$, and s can be interpreted as the safeguard-level tariff rate that governments can choose when they face high political pressure. Alternatively, setting $s = \tau^{PE}\left(\overline{\theta}\right)$ when a government truly faces

[3] My analysis relies on the assumption that any tariffs that governments may rationally choose are non-prohibitive. Since setting a tariff higher than $\tau^N(\theta)$ is not individually rational, this assumption is satisfied if $\tau^N(\theta)$ is not prohibitive. I assume that political pressures are sufficiently low such that $\tau^N\left(\overline{\theta}\right) < \tau_{proh.}$, where $\tau_{proh.}$ denotes the lowest prohibitive tariff rate.

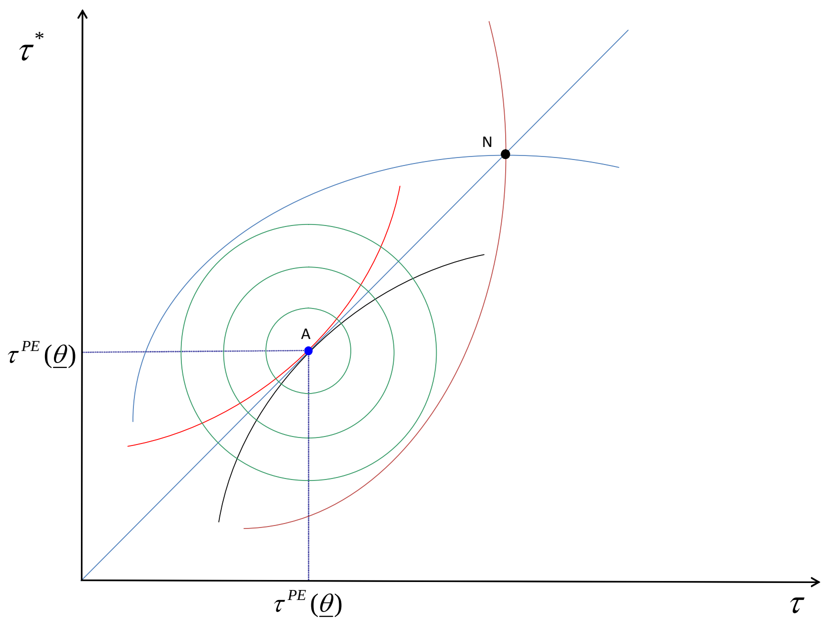

Figure 1: Nash and Politically Efficient tariffs when both governments face low political pressure

a high political pressure can be interpreted as efficient breach of an agreement that specifies a low tariff rate, that is, $l = \tau^{PE}(\underline{\theta})$.[4]

Points N and A in Figure 1 respectively show the non-cooperative and politically-efficient tariff pairs for the case where $\theta = \theta^* = \underline{\theta}$. Governments can gain by mutually reducing their tariff rates from $\tau^N(\underline{\theta})$ to $\tau^{PE}(\underline{\theta})$, or equivalently, by moving from N to A. The joint-welfare contours are also drawn in Figure 1. As can be seen on the graph, point A is at the center of the joint-welfare contours and it is associated with the highest joint welfare.

Figure 2, on the other hand, depicts a situation where the home country faces high political pressure. Note that as a result of the political shock in the home country, the iso-welfare curve of the home country has changed so that the two countries' welfare contours are no longer tangent at point A. Figure 2 also depicts the new joint-welfare contours that are centered around B. Point B is the politically-efficient tariff pair

[4] I assume that $\tau^{PE}(\overline{\theta}) < \tau^N(\underline{\theta})$. This assumption ensures that if an agreement sets a tariff binding equal to or smaller than $\tau^{PE}(\overline{\theta})$, the governments will always choose the highest tariff authorized under the agreement.

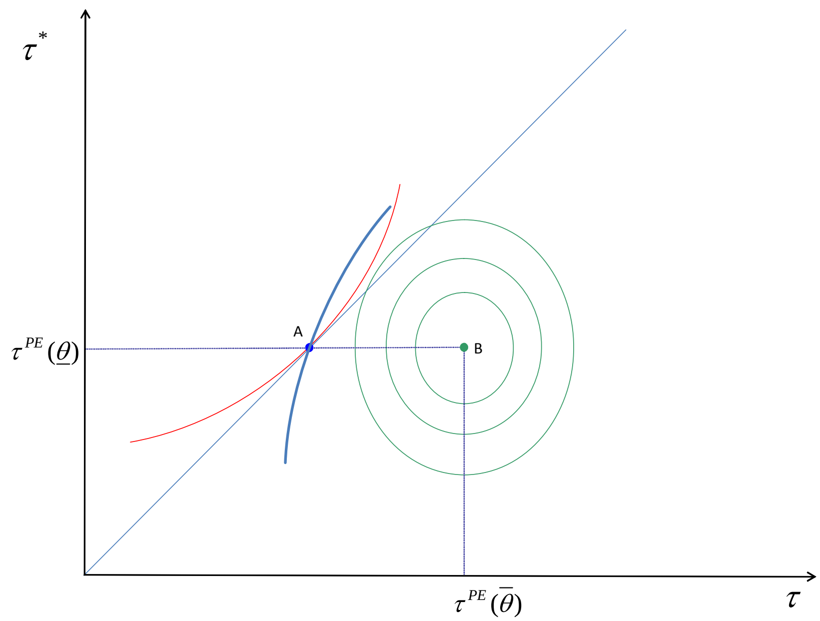

Figure 2: The initial tariff pair, A, is no longer optimal when the home government faces high political pressure

when the home country is faced with high political pressure.

A politically-efficient agreement is thus a complete contract that prescribes the tariff pair A to the contingency where the home country is facing low political pressure, and the tariff pair B to the contingency where the home country is facing high political pressure.[5] Note that since retaliation is efficiency-reducing the politically-efficient agreement prescribes no retaliation against a safeguard-imposing country. However, this first-best agreement is feasible only if political pressures are publicly observable. In the next Section, I characterize the most efficient contract in the presence of information asymmetry regarding political pressure.

[5]Remember that my analysis is focused on the case where the home country is a potential safeguard-imposing country and the foreign country is the potential affected party (see subsection 2.2).

4 Optimal remedies and efficient breach

The first-best agreement set out above can be achieved only if political pressures are publicly observable and, hence, contractible. However, in the presence of information asymmetry regarding political pressure, the agreement must operate as a revelation mechanism that gives the governments proper incentives to reveal their private information truthfully. To find the optimal mechanism, or the second-best tariff levels, I assume that the agreement will specify a three-step tariff schedule, denoted by (l, s, r), where l and s have the same interpretation as before and r denotes the tariff rates that the exporting country (i.e., the foreign country) can choose in response to a safeguard in the importing country (i.e., the home country). I assume that the negotiators choose (l, s, r) to maximize the expected joint political welfare of the governments, or,

$$\max_{l,s,r} 2(1-\rho)\left[u(l;\underline{\theta}) + v(l)\right] + \rho\left[u\left(s;\overline{\theta}\right) + v(r) + u(r;\underline{\theta}) + v(s)\right], \tag{5}$$

subject to incentive compatibility constraints, which are given by

$$u(s;\underline{\theta}) + v(r) \leq u(l;\underline{\theta}) + v(l), \tag{6}$$

and

$$u\left(l;\overline{\theta}\right) + v(l) \leq u\left(s;\overline{\theta}\right) + v(r). \tag{7}$$

The first term in (5) is the joint welfare of the governments when the home country faces low political pressure multiplied by the probability of this contingency, $(1-\rho)$. Similarly, the second term in this objective function is the joint welfare of the governments when the home country faces high political pressure multiplied by the probability of this contingency, ρ. Inequality (6) represents the truth-telling, or incentive compatibility, condition for the home government when it faces a low political pressure. The left-hand side of this inequality shows the political welfare of the government that misrepresents its political pressure when it actually faces low political pressure. The first term on the left-hand side, $u(s;\underline{\theta})$, is the political welfare that the home government derives from the import sector by imposing a safeguard when $\theta = \underline{\theta}$. The second term, $v(r)$, is the political welfare driven from the export sector that faces retaliatory tariff rates from the foreign country. Inequality (7), which is the truth-telling condition when $\theta = \overline{\theta}$, has a similar interpretation.

Denoting the optimal solution to the above problem with superscript *Optimal*, we can state the following:

Proposition 1 $\tau^{PE}(\underline{\theta}) = l^{Optimal} < r^{Optimal} < s^{Optimal} < \tau^{PE}(\overline{\theta})$.

This Proposition is illustrated in Figure 3. This figure depicts the welfare contours of the home country and the joint-welfare contours when the home country faces high political pressure. The optimal agreement is given by two tariff pairs at points A and C. Point $A = (l^{Optimal}, l^{Optimal})$ is the politically optimal (and politically efficient) tariff pair when political pressure in the home country is low. On the other hand, point $C = (s^{Optimal}, r^{Optimal})$ is the politically optimal tariff pair under high political pressure in the home country. The politically optimal agreement maximizes the joint political welfare while it leaves the home country indifferent between the two tariff schedules, A and C, when it faces low political pressure. As can be seen in Figure 3, points A and C are located on the same welfare contour of the home country under low political pressure. This welfare contour is also tangent to the joint-welfare contour at point C, which ensures that point C generates the highest joint welfare among the incentive compatible tariff schedules.

Since C is located below the 45-degree line from the origin, the politically optimal retaliatory tariff, $r^{Optimal}$, is smaller than the politically optimal safeguard tariff, $s^{Optimal}$. Given symmetric countries, the fact that $r^{Optimal} < s^{Optimal}$ implies that:

Corollary 1 *Optimal retaliation is less than proportional to the offense committed by the safeguard-imposing country.*

This result suggests that the reciprocity principle as a rule of renegotiation does not induce the second-best tariff schedule that is implementable when countries have private information about the state of the world. This result seems to be in contrast with Bagwell and Staiger's (1999) general conclusion that "the restriction of reciprocity directs the bargaining outcome toward the political optimum" (p. 231). In fact, under the restriction of reciprocity, the most efficient tariff level that is attainable when the home country faces high political pressure is given by point D in

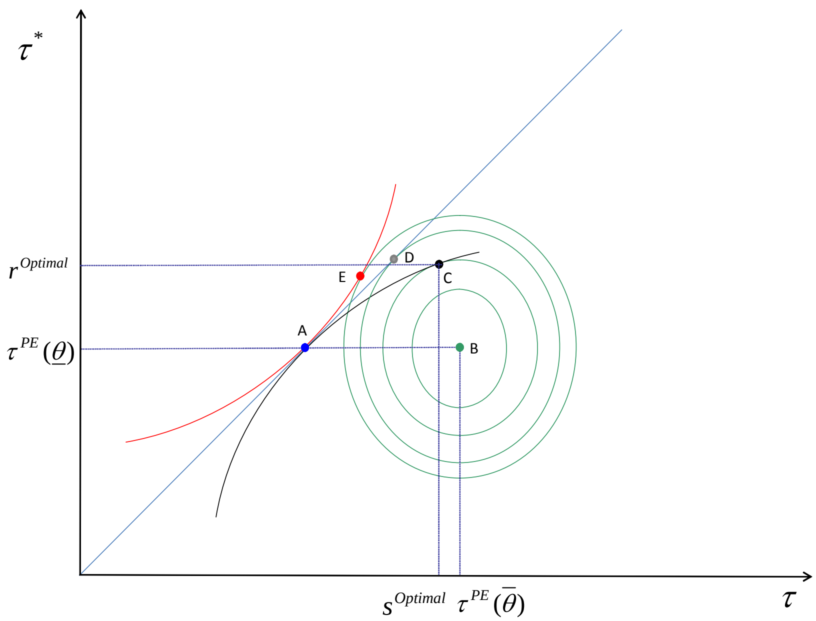

Figure 3: Graphical illustration of Proposition 1

Figure 3, at which the 45-degree line is tangent to the joint-welfare contour.[6] As can be seen on the graph, point D is located on a lower joint welfare contour compared to point C. As a result, the bargaining outcome under reciprocity, which is given by (A, D), is worse than the second-best tariff schedule, which is given by (A, C).

It is worthwhile to discuss the results of Bagwell and Staiger (1999) in more details. Proposition 5 of their paper (p. 230) states that "*[a Pareto] efficient trade agreement can be implemented [i.e., it is renegotiation-proof] under reciprocity if and only if it is characterized by tariffs [that maximize joint welfare].*"[7] An interesting insight from this proposition is that if renegotiations are restricted by reciprocity, the governments have no incentive to negotiate away from a joint-welfare-maximizing tariff level. In

[6]Note that the tariff schedule (A, D) is incentive compatible because the home government prefers A to D when $\theta = \underline{\theta}$, and prefers D to A when $\theta = \overline{\theta}$.

[7]In the language of Bagwell and Staiger (1999), the words "efficient" and "Pareto efficient" are used synonymosly. Moreover, they refere to a joint-welfare-maximizing agreement as a politically optimal agreement. In this paper, however, an agreement is called efficient (or, politically efficient) if it maximizes the joint welfare of the governments in a first best situation, while political optimality is used to refer to the second-best outcomes. Finally, note that they refer to an agreement that is impervious to renegotiations as an implementable agreement.

other words, the governments will not enter renegotiation as long as their tariffs are set at the first-best efficient level. However, my results show that when the state of the world changes, the reciprocity principle does not direct the negotiators to the new joint-welfare-maximizing tariff level. This can be seen on Figure 3. Points A and B represent the joint-welfare-maximizing tariff levels when the home country faces low and high political pressures, respectively. It can be easily verified that, consistent with Bagwell and Staiger's proposition, when political pressure is high (low), the tariff pair B (A) is the only Pareto efficient point that is renegotiation-proof under the reciprocity rule. However, as I discussed above, the first best tariff schedule, (A, B), is not incentive-compatible. In other words, if renegotiations are restricted by the principle of reciprocity, joint-welfare maximizing tariffs are not implementable in all states of the world. More importantly, the outcome of renegotiations under the reciprocity rule falls short of second-best optimality.

A second observation from Proposition 1 is that the safeguard tariff, $s^{Optimal}$, is smaller than the politically-efficient tariff, $\tau^{PE}\left(\overline{\theta}\right)$, when a government faces high political pressure. In fact, point B in Figure 3, which is the politically-efficient tariffs pair when the home country faces high pressure, is not incentive compatible. Therefore, as a second corollary to Proposition 1, we have:

Corollary 2 *When governments have asymmetric information, the optimal safeguard tariff is smaller than the politically efficient tariff under high political pressure.*

In other words, it is optimal to force a country with high political pressure to set tariffs that are lower than politically efficient levels. That reflects the fact that if a higher safeguard tariff is authorized under the agreement, a higher retaliatory tariff is required to maintain incentive compatibility.

It is worth noting that one critical assumption behind this result is the unavailability of cash payments or other efficiency-neutral methods of compensation. If such side payments are available and enforceable, an agreement can ensure efficient breach by requiring a breaching party to fully compensate the affected party through side payments. That is, a liability rule can ensure efficient performance of the agreement if, and only if, side payments such as cash are available.[8]

[8] Feenstra and Lewis (1991) consider a situation where rents can be transfered among countries. Their findings can be interpreted as supporting a liability-rule system.

5 Randomized retaliation

In the previous Section, I assumed that trade negotiators specify a retaliatory tariff rate, r, to be used against a safeguard-imposing country. Then I showed that an optimal trade agreement should prescribe less-than-proportional retaliation against a violating country. However, most international trade agreements follow a principle of reciprocity that specifies commensurate retaliation. For example, Article XIX of GATT allows a country that is affected by a safeguard measure to withdraw "substantially equivalent concessions" against the safeguard-imposing country. One practical appeal of the reciprocity principle is its simplicity compared to a disproportionate retaliation scheme. That is because, as pointed out by Howse and Staiger (2005), the use of a disproportionate remedy system may cause important measurement problems due to the subtle political and economic welfare effects of trade policy adjustments.

In this Section, I impose a reciprocity constraint, that is, $s = r$, on the negotiators' problem, but allow for randomized retaliation against a violating country. Specifically, I assume that the negotiators can design a public randomizing device that authorizes retaliation with probability $\alpha \in [0, 1]$. In fact, according to the WTO Agreement on Safeguards, commensurate retaliation is subject to the approval of the WTO dispute settlement system whose rulings are uncertain. Therefore, one may interpret the WTO dispute settlement system as a randomizing device. This way of modeling the dispute settlement system is similar to that of Reinhardt (2001) and Rosendorff (2005), but they stop short of finding the optimal randomization strategy.

I assume that the negotiators choose α, l, and s to maximize the expected joint welfare of the governments, that is,

$$\max_{l,s,\alpha} \quad 2(1-\rho)\left[u(l;\underline{\theta}) + v(l)\right] \tag{8}$$

$$+\rho\left[u\left(s;\overline{\theta}\right) + v(s) + \alpha\left[u(s;\underline{\theta}) + v(s)\right] + (1-\alpha)\left[u(l;\underline{\theta}) + v(l)\right]\right], \tag{9}$$

subject to incentive compatibility constraints, which are given by

$$u(s;\underline{\theta}) + \alpha v(s) + (1-\alpha)v(l) \leq u(l;\underline{\theta}) + v(l), \tag{10}$$

and

$$u\left(l;\overline{\theta}\right)+v\left(l\right)\leq u\left(s;\overline{\theta}\right)+\alpha v\left(s\right)+\left(1-\alpha\right)v\left(l\right). \tag{11}$$

Denoting optimal values with superscript R, the following can be stated about an optimal agreement with commensurate but randomized retaliation:

Proposition 2 *$l^R < s^R$ and $0 < \alpha^R < 1$.*

Since α^R is strictly less than 1, a safeguard-imposing country may face no retaliation. In fact, this random retaliation scheme that involves commensurate retaliation and non-retaliation with positive probabilities, can be interpreted as less-than-proportional retaliation against an initial offense. Therefore, this proposition provides a similar intuition as Proposition 1.

In the absence of a randomizing device, that is, when α is set equal to 1, a remedy system that is based on the principle of reciprocity is similar to the GATT escape clause, which prescribes commensurate retaliation against a violating country with certainty. On the other hand, the WTO dispute settlement system can be interpreted as a public randomizing device that authorizes commensurate retaliation with a probability less than one. Therefore, this proposition suggests that the dispute settlement system of the World Trade Organization can improve the value of trade agreements by reducing the rate of retaliation.

6 Fairness and the balance of concessions

Under the politically optimal trade agreement characterized in Proposition 1, an exporting country that is adversely affected by a safeguard measure will not be fully compensated for its loss. Therefore, the "liability rule" that requires a breaching party to make the breached-upon party whole, is not an optimal remedy scheme for the breach of trade agreements. In fact, as pointed out by Bagwell (2007), in order for the injured country to remain whole, it should be allowed to retaliate more than proportionately against an offending country. This is shown graphically in Figure 3. Remember that point A represents the optimal tariffs pair when both countries face low political pressure. When there is a high political pressure in the home country, the tariff pair that maximizes the joint welfare while leaves the foreign (that is, the affected exporting country) whole is given by point E at which the foreign country's welfare contour through A is tangent to the joint-welfare contour. At point E, which is located above the 45-degree line, the offending country's tariff is smaller than the injured country's retaliatory tariff. Therefore, retaliation is more than proportional at point E. In contrast, the optimal tariff pair is given by point C at which retaliation is less than proportional and the injured country is worse off compared to its initial situations at point A.

The above discussion shows that when governments face different political pressures, an optimal tariff schedule violates the balance of concessions between the parties. Nevertheless, ex ante, that is, when political pressures are not yet realized, the expected value of the agreement is the same to both governments. Therefore, the governments maintain a balance of concessions ex ante, although such a balance may not materialize ex post.

Moreover, in a changing environment where political pressures are swinging over time, a country that is affected by a safeguard measure in one period may turn out to be a safeguard-imposing country in another period. Therefore, while a country may stand to lose from an optimal remedy system in some periods, it would be overcompensated in periods when it finds it optimal to violate its obligations in response to domestic pressures. In other words, governments can maintain an intertemporal balance of concessions under an optimal trade agreement even though an instantaneous balance is not maintained.

It is, however, important to note that an optimal agreement results in an intertemporal balance of concessions only if countries are symmetric in size and political environment. For example, consider an extreme case where the foreign country never faces high political pressure while the home country faces high pressure with probability $\rho \in (0, 1)$. An optimal agreement for this pair of countries will be exactly the same as the agreement derived in Section 3. Nevertheless, by signing such an agreement, the foreign country is giving more concessions to the home country than it receives. Therefore, if negotiations follow a reciprocity norm (even in an intertemporal or ex ante sense), governments with asymmetric political environments would fail to achieve an optimal agreement if side payments are not available. In practice, however, a major trade agreement may be reached in conjunction with a few side agreements. These side agreements may be more favorable to the party who stands to gain less from the trade agreement so that an overall balance of concessions is achieved between the two parties.

7 Conclusion

This paper is the first to show that an optimal remedy system in the WTO constitutes a less-than-proportional retaliation scheme against an offending country. This remedy system implies that the injured parties are not fully compensated for their loss. This is in contrast to the findings of the contract theory literature regarding optimal remedies in domestic settings. In particular, I show that a liability rule does not result in the most efficient remedy system. The analysis of this paper, therefore, indicates discords with the proposals to allow for more-than-proportional retaliation against a violating country in the WTO.

The main result of this paper hinges on the assumption that governments are unable to transfer cash between themselves as a method of compensation, and as a result an injured country may receive compensation only by imposing tariffs on the imports from the violating country. This assumption implies that a) compensating an injured country is efficiency-reducing and b) a compensation award smaller than the initial harm is sufficient to induce a government to reveal truthfully its private political pressures.

Under a politically optimal agreement, governments maintain an intertemporal balance of concessions if they are symmetric in size and political environment. If one government is faced more frequently with high political pressure its gain is relatively higher from a politically optimal agreement and a balance of concession is not maintained between the two countries. An interesting extension to this paper would be to impose an intertemporal reciprocity constraint in the negotiators' problem when countries are politically asymmetric, that is, when the probability of a high political pressure is different across countries. A similar analysis when countries are asymmetric in size will be interesting as well.

8 Appendix

Proof of Proposition 1. The Lagrangian of the maximization problem is as follows

$$\begin{aligned} L &= 2(1-\rho)\left[u(l;\underline{\theta})+v(l)\right] \\ &\quad +\rho\left[u\left(s;\overline{\theta}\right)+v(s)+u(r;\underline{\theta})+v(r)\right] \\ &\quad -\lambda_1\left[u(s;\underline{\theta})+v(r)-u(l;\underline{\theta})-v(l)\right] \\ &\quad -\lambda_2\left[u\left(l;\overline{\theta}\right)+v(l)-u\left(s;\overline{\theta}\right)-v(r)\right] \end{aligned}$$

First-order necessary conditions for optimality are:

$$\begin{aligned} \frac{\partial L}{\partial l} &= \left[2(1-\rho)+(\lambda_1-\lambda_2)\right]\left[u'(l;\underline{\theta})+v'(l)\right]=0 \\ \frac{\partial L}{\partial s} &= \rho\left[u'\left(s;\overline{\theta}\right)+v'(s)\right]-(\lambda_1-\lambda_2)\,u'(s;\underline{\theta})=0 \\ \frac{\partial L}{\partial r} &= \rho\left[u'(r;\underline{\theta})+v'(r)\right]-(\lambda_1-\lambda_2)\,v'(r)=0 \end{aligned}$$

$$\begin{aligned} u(s;\underline{\theta})+v(r) &\leq u(l;\underline{\theta})+v(l)\,, \\ u\left(l;\overline{\theta}\right)+v(l) &\leq u\left(s;\overline{\theta}\right)+v(r)\,. \\ \lambda_1 &\geq 0 \\ \lambda_2 &\geq 0 \end{aligned}$$

$$\begin{aligned} \lambda_1\left[u(s;\underline{\theta})+v(r)-u(l;\underline{\theta})-v(l)\right] &= 0 \\ \lambda_2\left[u\left(l;\overline{\theta}\right)+v(l)-u\left(s;\overline{\theta}\right)-v(r)\right] &= 0 \end{aligned}$$

First, remember that the unconstrained maximization yields optimal values that do not satisfy the constraints of the problem and, hence, we cannot have $\lambda_1=\lambda_2=0$. Moreover, at most one of the constraints is binding and we cannot have $\lambda_1,\lambda_2>0$. In what follows I consider the remaining cases, which are $(\lambda_1>0,\lambda_2=0)$ and $(\lambda_1=0,\lambda_2>0)$

Case 1: $\lambda_1 > 0, \lambda_2 = 0$

$$u(s;\underline{\theta}) + v(r) = u(l;\underline{\theta}) + v(l) \tag{12}$$

$$\frac{\partial L}{\partial l} = [2(1-\rho) + \lambda_1][u'(l;\underline{\theta}) + v'(l)] = 0 \tag{13}$$

$$\frac{\partial L}{\partial s} = -\lambda_1 u'(s;\underline{\theta}) + \rho u'\left(s;\overline{\theta}\right) + \rho v'(s) = 0 \tag{14}$$

$$\frac{\partial L}{\partial r} = \rho[u'(r;\underline{\theta}) + v'(r)] - \lambda_1 v'(r) = 0. \tag{15}$$

Condition (13) implies that:

$$u'(l;\underline{\theta}) + v'(l) = 0.$$

That is $l^{Optimal} = \tau^{PE}(\underline{\theta})$. Moreover, condition (14) implies that $u'\left(s;\overline{\theta}\right) + \rho v'(s)$ is strictly positive, which in turn, implies that $s^{Optimal} < \tau^{PE}\left(\overline{\theta}\right)$. Condition (15) implies that $u'(r;\underline{\theta}) + v'(r) < 0$, which in turn implies that $r^{Optimal} > \tau^{PE}(\underline{\theta})$, or $r^{Optimal} > l^{Optimal}$.

To complete the proof, I need to show that $s^{Optimal} > r^{Optimal}$. On the contrary, suppose that $s^{Optimal} = r^{Optimal}$ or $s^{Optimal} < r^{Optimal}$. If $s^{Optimal} = r^{Optimal}$ then, given that $l^{Optimal} = \tau^{PE}(\underline{\theta})$ and $u(\tau;\underline{\theta}) + v(\tau)$ is concave with its peak at $\tau^{PE}(\underline{\theta})$, we have $l^{Optimal} = s^{Optimal} = r^{Optimal}$. Substituting $l^{Optimal}$ for r in (15) and noting that $u'\left(l^{Optimal};\underline{\theta}\right) + v'\left(l^{Optimal}\right) = 0$ implies that This result implies that $\lambda_1 = 0$, which is in contradiction with the assumption that $\lambda_1 \neq 0$. On the other hand, if $s^{Optimal} < r^{Optimal}$. then $v\left(s^{Optimal}\right) > v\left(r^{Optimal}\right)$. Therefore, we can substitute $r^{Optimal}$ for $s^{Optimal}$ in the following inequality that holds because $l^{Optimal}$ maximizes $u(\tau;\underline{\theta}) + v(\tau)$:

$$u\left(s^{Optimal};\underline{\theta}\right) + v\left(s^{Optimal}\right) < u\left(l^{Optimal};\underline{\theta}\right) + v\left(l^{Optimal}\right).$$

In other words,

$$u\left(s^{Optimal};\underline{\theta}\right) + v\left(r^{Optimal}\right) < u\left(l^{Optimal};\underline{\theta}\right) + v\left(l^{Optimal}\right).$$

This inequality is in contradiction with condition (12). Therefore, $s^{Optimal} > r^{Optimal}$.

Case 2: $\lambda_1 = 0, \lambda_2 > 0$

This case is not possible since the relevant first-order conditions imply that $\lambda_2 < 0$. The first-order conditions for this case are as follows:

$$u\left(l;\overline{\theta}\right) + v\left(l\right) = u\left(s;\overline{\theta}\right) + v\left(r\right) \tag{16}$$

$$\frac{\partial L}{\partial l} = 2\left(1-\rho\right)\left[u'\left(l;\underline{\theta}\right) + v'\left(l\right)\right] - \lambda_2\left[u'\left(l;\overline{\theta}\right) + v'\left(l\right)\right] = 0 \tag{17}$$

$$\frac{\partial L}{\partial s} = \rho\left[u'\left(s;\overline{\theta}\right) + v'\left(s\right)\right] + \lambda_2 u'\left(s;\overline{\theta}\right) = 0 \tag{18}$$

$$\frac{\partial L}{\partial r} = \rho\left[u'\left(r;\underline{\theta}\right) + v'\left(r\right)\right] + \lambda_2 v'\left(r\right) = 0 \tag{19}$$

From conditions (18) and (19) we have

$$-\frac{u'\left(r;\underline{\theta}\right) + v'\left(r\right)}{u'\left(s;\overline{\theta}\right) + v'\left(s\right)} = -\frac{v'\left(r\right)}{u'\left(s;\overline{\theta}\right)}.$$

The left-hand side of this equation is the slope of the joint-welfare contours that are ellipses centered at $\left(\tau^{PE}\left(\underline{\theta}\right), \tau^{PE}\left(\overline{\theta}\right)\right)$, and the right-hand side is the slope of the home country's welfare contours when it faces high political pressure. If $\lambda_2 > 0$, then (18) implies that $u'\left(s;\overline{\theta}\right) + v'\left(s\right) < 0$, or $s^{Optimal} > \tau^{PE}\left(\overline{\theta}\right)$. Similarly, (19) implies that $u'\left(r;\underline{\theta}\right) + v'\left(r\right) > 0$, or $r^{Optimal} < \tau^{PE}\left(\underline{\theta}\right)$. Therefore, the slope of the home country's welfare contour under high pressure is positive. Moreover, this welfare contour goes through $r^{optimal} < \tau^{PE}\left(\underline{\theta}\right)$ and $\tau^{PE}\left(\overline{\theta}\right) < s^{optimal} < \tau^{N}\left(\overline{\theta}\right)$. Therefore, the home country's welfare contour that goes through the optimal point does not cross the 45-degree line. This means that the first-order condition (16) does not hold. Therefore, $\lambda_2 < 0$. ■

Proof of proposition 2. I first show that $s \geq l$. On the contrary assume that $s < l$. Since $u\left(\tau;\theta\right) + \alpha v\left(\tau\right)$ is a quadratic function of τ, conditions (10) and (11) can be written, respectively, as $\frac{s+l}{2} \leq m\left(\underline{\theta};\alpha\right)$ and $\frac{s+l}{2} \geq m\left(\overline{\theta};\alpha\right)$, where, $m\left(\theta,\alpha\right) = \arg\max_{\tau} u\left(\tau;\theta\right) + \alpha v\left(\tau\right)$. Now since $m\left(\theta,\alpha\right)$ is increasing in θ, and $\underline{\theta} < \overline{\theta}$, we have

$$\frac{s+l}{2} \leq m\left(\underline{\theta};\alpha\right) < m\left(\overline{\theta};\alpha\right) \leq \frac{s+l}{2},$$

or $\frac{s+l}{2} < \frac{s+l}{2}$, which is not possible. Hence $s \geq l$.

The maximization problem in the Lagrangian form is given as follows

$$\begin{aligned} L &= [2-\rho(1+\alpha)]\left[u\left(l;\underline{\theta}\right)+v(l)\right]+\rho\left[u\left(s;\overline{\theta}\right)+v(s)\right]+\alpha\rho\left[u\left(s;\underline{\theta}\right)+v(s)\right] \\ &\quad -\lambda_1\left[u\left(s;\underline{\theta}\right)+\alpha v(s)-u\left(l;\underline{\theta}\right)-\alpha v(l)\right] \\ &\quad -\lambda_2\left[u\left(l;\overline{\theta}\right)+\alpha v(l)-u\left(s;\overline{\theta}\right)-\alpha v(s)\right] \end{aligned} \tag{20}$$

Case 1: $\lambda_1 > 0$ *and* $\lambda_2 = 0$

The first-order conditions:

$$\frac{\delta L}{\delta l} = [2-\rho(1+\alpha)]\left[u'\left(l;\underline{\theta}\right)+v'(l)\right]+\lambda_1\left[u'\left(l;\underline{\theta}\right)+\alpha v'(l)\right]=0, \tag{21}$$

$$\frac{\delta L}{\delta s} = \rho\left[u'\left(s;\overline{\theta}\right)+v'(s)\right]+\alpha\rho\left[u'\left(s;\underline{\theta}\right)+v'(s)\right]-\lambda_1\left[u'\left(s;\underline{\theta}\right)+\alpha v'(s)\right]=0, \tag{22}$$

$$\frac{\delta L}{\delta \alpha} = -\rho\left[u\left(l;\underline{\theta}\right)+v(l)\right]+\rho\left[u\left(s;\underline{\theta}\right)+v(s)\right]-\lambda_1\left[v(s)-v(l)\right]=0, \tag{23}$$

$$\frac{\delta L}{\delta \lambda_1} = u\left(s;\underline{\theta}\right)+\alpha v(s)-u\left(l;\underline{\theta}\right)-\alpha v(l)=0. \tag{24}$$

Condition (24) implies

$$\alpha = \frac{u\left(s;\underline{\theta}\right)-u\left(l;\underline{\theta}\right)}{v(l)-v(s)}.$$

Condition (23) implies

$$\begin{aligned} \lambda_1 &= \rho\frac{\left[u\left(l;\underline{\theta}\right)+v(l)\right]-\left[u\left(s;\underline{\theta}\right)+v(s)\right]}{v(l)-v(s)} \\ &= \rho\left(1-\frac{u\left(s;\underline{\theta}\right)-u\left(l;\underline{\theta}\right)}{v(l)-v(s)}\right) \\ &= \rho(1-\alpha) \end{aligned}$$

Substituting α and λ_1 into (21) yields:

$$\frac{\delta L}{\delta l} = [2-\rho(1+\alpha)]\left[u'\left(l;\underline{\theta}\right)+v'(l)\right]+\rho(1-\alpha)\left[u'\left(l;\underline{\theta}\right)+\alpha v'(l)\right]=0$$

or, equivalently,

$$\frac{1}{2(1-\alpha\rho)}\frac{\delta L}{\delta l} = u'(l;\underline{\theta}) + \frac{\left(2-(1+\alpha)^2\rho\right)}{2(1-\alpha\rho)}v'(l) = 0 \tag{25}$$

Since $0 < \frac{2-(1+\alpha)^2\rho}{2(1-\alpha\rho)} < 1$, we have $l > \tau^{PE}(\underline{\theta})$.

As was shown above, in optimum we have $s \geq l$. Here, I show that in optimum s is strictly greater than l. On the contrary, suppose that $l = s$. Since $l > \tau^{PE}(\underline{\theta})$, the derivative of the objective function with respect to l is negative. Moreover, when $l = s$, by reducing l marginally, both incentive compatibility constraints will be still satisfied. Therefore, the optimal solution must involve $l < s$.

Since $s > l > \tau^{PE}(\underline{\theta})$, we have

$$u(l;\underline{\theta}) + v(l) > u(s;\underline{\theta}) + v(s)$$

which implies that

$$\alpha = \frac{u(s;\underline{\theta}) - u(l;\underline{\theta})}{v(l) - v(s)} < 1.$$

Case 2: $\lambda_1 = 0, \lambda_2 > 0$

First-order conditions:

$$\frac{\partial L}{\partial l} = [2-\rho(1+\alpha)]\left[u'(l;\underline{\theta}) + v'(l)\right] - \lambda_2\left[u'\left(l;\overline{\theta}\right) + \alpha v'(l)\right] = 0 \tag{26}$$

$$\frac{\partial L}{\partial s} = \rho\left[u'\left(s;\overline{\theta}\right) + v'(s)\right] + \alpha\rho\left[u'(s;\underline{\theta}) + v'(s)\right] + \lambda_2\left[u'\left(s;\overline{\theta}\right) + \alpha v'(s)\right] = 0 \tag{27}$$

$$\frac{\partial L}{\partial \lambda_2} = -\left[u\left(l;\overline{\theta}\right) + \alpha v(l) - u\left(s;\overline{\theta}\right) - \alpha v(s)\right] = 0 \tag{28}$$

$$\frac{\partial L}{\partial \alpha} = -\rho\left[u(l;\underline{\theta}) + v(l)\right] + \rho\left[u(s;\underline{\theta}) + v(s)\right] - \lambda_2\left[v(l) - v(s)\right] = 0 \tag{29}$$

Condition (28) implies

$$\alpha = \frac{u(s;\underline{\theta}) - u(l;\underline{\theta})}{v(l) - v(s)}$$

Condition (29) implies

$$\lambda_2 = -\rho\left(1 - \frac{u(s;\underline{\theta}) - u(l;\underline{\theta})}{v(l) - v(s)}\right)$$

Therefore, we either have $\lambda_2 < 0$ or $\alpha \geq 1$. If $\alpha \geq 1$, we have a corner solution in which $\alpha = 1$ and $\lambda_2 = 0$, and the relevant conditions for optimality are

$$\frac{\partial L}{\partial l} = 2(1-\rho)\left[u'(l;\underline{\theta}) + v'(l)\right] = 0 \tag{30}$$

$$\frac{\partial L}{\partial s} = \rho\left[u'\left(s;\overline{\theta}\right) + v'(s)\right] + \rho\left[u'(s;\underline{\theta}) + v'(s)\right] = 0 \tag{31}$$

$$\frac{\partial L}{\partial \lambda_2} = -\left[u\left(l;\overline{\theta}\right) + v(l) - u\left(s;\overline{\theta}\right) - v(s)\right] = 0 \tag{32}$$

$$\frac{1}{\rho}\frac{\partial L}{\partial \alpha} = \left[u(s;\underline{\theta}) + v(s)\right] - \left[u(l;\underline{\theta}) + v(l)\right] \geq 0 \tag{33}$$

Condition (30) implies $l = \tau^{PE}(\underline{\theta})$. If $l = \tau^{PE}(\underline{\theta})$, then the condition (33) implies that $s = l = \tau^{PE}(\underline{\theta})$. However, when $s = \tau^{PE}(\underline{\theta})$, condition (31) is not satisfied. Thus, $\lambda_2 < 0$, and this solution is not optimal. ■

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