Trade Agreements, Lobbying and Separation of Powers

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Abstract

This paper presents a model of international trade agreements in which the executive branches of each government negotiate agreements while the legislative branches, subject to political pressure, can disrupt them. Lobbying is in the style of Grossman and Helpman (1994) with a new feature: all actors face uncertainty arising from the complexity of the legislative process. I demonstrate that the lower the executives set trade agreement tariffs, the more effort lobbies put forth to induce the legislatures to disrupt the agreement. Thus trade agreements act as a domestic political commitment device: executives set relatively high tariffs to discourage lobbying and help the legislatures to withstand political pressure. This reconciles the result from tests of Grossman and Helpman's model that protection levels are high relative to contributions given estimates of governments' social-welfare weights. The need to balance conflicting repeated-game incentives of the legislature and lobby lead to new predictions for the optimal design of mechanisms for resolving the disputes that arise in the course of trade-agreement relationships.

1 Introduction

Empirical investigations of Grossman and Helpman's (1994) 'Protection for Sale' model (henceforth 'PFS') broadly support the predictions of the theory qualitatively, yet their quantitative estimates present several interesting puzzles.[1] These studies have consistently found the weight governments

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[1]cfr. Goldberg and Maggi 1999, Gawande and Bandyopadhyay 2000, Mitra, Thomakos and Ulubasoglu 2002, McCalman 2004.

place on social welfare to be many times that which they place on lobbying effort, while numerous estimates indicate that the deadweight losses caused by trade distortions are several orders of magnitude larger than lobbying expenditures.[2] This raises the question: how could governments value social welfare so highly, yet grant so much protection at such a low price?

Attempts to more fully model the lobbying process have been successful in reducing the parameter estimates for the government's welfare considerations somewhat, but the smallest estimates still indicate that the U.S. government, for instance, values social welfare about twenty times as much as contributions.[3] Taking a different approach, Gawande and Hoekman (2006) suggest that the PFS model can be reconciled with the empirical results by acknowledging the complexity of the policy-making process and the uncertainty that arises from it.

I demonstrate how political uncertainty can be incorporated with PFS-style lobbying into a model of trade agreements in which the executive branches of the governments set their tariff levels in anticipation of political pressure upon the legislatures. The structure is similar to that of Bagwell and Staiger (2005), with two main changes: political economy weights are endogenously determined and power over the policy-making process is modeled as shared between executive and legislative branches of the government.[4] Thus, in place of Bagwell and Staiger's unitary government with differing ex-ante and ex-post preferences, this model has two branches of government with differing and—in the case of the legislature—endogenous preferences.

This model generalizes the unitary government of the PFS setup in three ways. First, the legislature itself is assumed to be non-unitary, with the preferences of the median legislator modeled flexibly to take into account realistic lobbying strategies such as those that target committee chairs. At the very least, in legislatures with majority rules, it is clear that lobbies need win over no more than half the legislators. Since it appears that far fewer than half of legislators are actually lobbied by any given industry, this modification has the potential to provide an explanation for a significant portion of the puzzle.

Modeling power over trade policy as shared between the executive and legislative branches introduces a new dynamic and can resolve the puzzle altogether. Consider first the case of political certainty, and assume that the executive is more pro-social than the legislature, as has been the case

[2] Feenstra (1992) assembles estimates from the mid-1980s that place a floor of \$8 billion per year on the deadweight losses from protection, whereas Bombardini and Trebbi (2009) find that total annual lobbying expenditure on trade issues in 1999-2001 when this data first became available was about \$200 million.

[3] cfr. Gawande, Krishna and Robbins 2006, Mitra, Thomakos and Ulubasoglu 2006, Bombardini 2008, Gawande, Krishna and Olarreaga 2005, among others.

[4] Grossman and Helpman's (1995) model of trade agreements with endogenous lobbying considers "Trade Wars" and "Trade Talks" separately, whereas this approach allows the "Trade Talks" to be influenced by the desire to avoid a "Trade War." Thus here the "Trade War" can be viewed as a crucial subgame.

throughout the post-war period in the United States.[5] For any trade-agreement tariff set by the executives, the lobby knows the effort level required to induce a trade disruption: it must shift the preferences of the median legislator just far enough so that he will choose the trade-war tariffs instead of the trade agreement tariffs. Because the lobby will pay this price so long as its benefit outweighs the cost, a trade war will occur unless the executive sets the trade-agreement tariff so that lobbying is not worthwhile.

Thus, any trade agreement under political certainty involves a tariff high enough to disengage the lobby completely; that is, even welfare-maximizing executives set high tariffs and induce zero contributions in equilibrium. Careful modeling of the political process demonstrates that, while tariff-setting behavior is closely linked to deadweight-loss calculations, the parameter on welfare-mindedness does not necessarily figure into those calculations in the way previously assumed. In fact, when the government is non-unitary, we must think more carefully about *whose* welfare weight is being measured. What is clear is that the earlier-cited estimates and stylized facts are perfectly consistent in this model. The "case of the missing contributions," as Gawande and Hoekman (2006) refer to it, turns out to be an equilibrium phenomenon arising from the agenda-setting power of the executive branch.

The fact that *zero* contributions are predicted in equilibrium is not particularly satisfying. The addition of political uncertainty provides the missing realism, smooths the results and delivers additional intuition. I assume all actors are uncertain about the weight the median legislator places on the profits of the lobbying industry and that this is attributable to the complexity of the legislative process. Imagine, for instance, that the small number of lobbied legislators cannot deliver the votes of their non-lobbied colleagues with certainty. However, I show that the legislatures break trade agreements with a higher probability and set higher trade war tariffs when lobbying effort increases. Because the lobbies respond to higher trade agreement tariffs by decreasing effort (and therefore the probability the agreement will be broken), the executives must trade off the level of social welfare derived while a trade agreement is in force—since they prefer low tariffs—and the chances that the agreement will be broken.

The executives therefore set trade-agreement tariffs above their most-preferred levels in order to discourage lobbying activity and the accompanying probability of abrogation. Thus the executives use

[5]The commonly-made assumption that the executive is less protectionist than the legislature is a special case of the finding that susceptibility to special interests generally declines with the size of one's constituency. One simple illustration from the realm of trade policy is the following: a legislator whose district has a large concentration of a particular industry does not take into account the impact of tariffs on the welfare of consumers in other districts, while the executive, whose constituency encompasses the whole country, will internalize these diffuse consumption effects. For a detailed argument, see Lohmann and O'Halloran (1994).

trade agreements to change the incentives for lobbying activity and the legislatures' ability to withstand political pressure. One contribution of this model, therefore, is the idea that trade agreements can act as a kind of domestic political commitment device.

Although this is not the first paper to derive trade disruptions along the equilibrium path without asymmetric information, to the best of my knowledge it is the first to model lobbying specifically aimed at derailing trade agreements. Although this kind of politically-driven failure is commonplace, prior models have not allowed exploration of the endogenous dynamics behind them. Careful consideration of the political process seems to be important for understanding why governments so often fail to cooperate.

Another outcome of this setup is that trade-agreement tariffs, lobbying effort and the probability of trade disruptions vary in nuanced ways with the amount of political uncertainty present: they are influenced strongly by lobbying incentives, but not in the straightforward ways predicted by models with unitary governments. In particular, this model can explain the approximately 15% of sectors that receive protection in spite of apparently putting forth no lobbying effort.

Ultimately, it is the addition of a rich structure of government that resolves the main empirical puzzle surrounding the PFS model: in this framework, even a welfare-maximizing executive and lobbying effort at zero can be consistent with high tariff levels.

Removing the assumption of external enforcement and placing the model in a repeated-game framework where future punishments can be used to enforce cooperation reveals the presence of an additional incentive constraint due to endogenous lobbying that generates predictions for the optimal design of dispute settlement procedures. Here I utilize Klimenko, Ramey and Watson's (2008) notion of *recurrent agreement*, which takes into account the possibility of renegotiation and the need for a dispute settlement institution (DSI) that helps trading partners to credibly condition their negotiations on the state of their relationship.

In this context, I demonstrate that the dispute settlement mechanism that makes the optimal punishment incentive compatible must balance two, often-conflicting, objectives: longer punishments help to enforce cooperation by increasing the costs to the legislature of defecting from the agreement, but because the lobbies prefer the punishment outcome, this also incentivizes lobbying effort and with it the political pressure to break the agreement. Thus the model generates new predictions for the design of mechanisms for resolving the disputes that arise in the course of trade-agreement relationships, where the optimal length of punishments depends crucially upon the strength of lobbies in the domestic political process.

1.1 Related Literature

The foundations of this work rest on Grossman and Helpman's (1994) 'Protection for Sale' and their 1995 paper 'Trade Wars and Trade Talks.' The extensive literature that explores the empirical implications of the PFS model is well-summarized by Gawande and Magee (2011). After the first generation of work consistently found very high estimates for the government's welfare-mindedness (see footnote 1 above), a second generation has explored several modifications of the model and estimating techniques. Most of these have focused on an improved accounting of the lobbying process, such as including lobbying by up- and downstream firms (Gawande, Krishna and Olarreaga 2005, Paltseva 2011), better identifying which firms in an industry lobby (Bombardini 2008, Gawande and Magee 2011), taking into account lobbying by foreign interests (Gawande, Krishna and Robbins 2006) or changing the way in which organized sectors are determined (Mitra, Thomakos and Ulubasoglu 2006). Indeed, Imai, Katayama and Krishna (2008) argue that many of the classification schemes present serious challenges for the validity of results.

Another related literature considers the impact of exogenously-determined political uncertainty on the potential for trade cooperation. These studies (e.g. Feenstra and Lewis 1991, Milner and Rosendorff 2001, Bagwell and Staiger 2005, Beshkar 2010) derive various implications for the design of international trade agreements using a Baldwin (1987)-style government welfare function with exogenous shocks to the political-pressure parameter.

Several papers have studied the impact of executive/legislative interactions on international agreements in the case of exogenously-determined preferences. Mansfield, Milner and Rosendorff (2000) construct a model in which democracies trade more with each other because the domestic legislature's influence requires the foreign government to make deeper tariff cuts to ensure its cooperation. Dai (2006) typifies a second approach, which, in line with the Schelling conjecture, argues that a country's legislative constraint assists its own executive in maintaining higher barriers. The general approach I employ here will permit me to speak to outstanding questions such as these concerning the effects of domestic institutions on trade policy.

The above work is patterned on the model of Milner and Rosendorff (1997), which explores how uncertainty can affect trade policy and the probability of ratification failure when political preferences, and therefore uncertainty, are exogenous; Iida (1996) presents a similar model. Related is Le Breton and Salanie (2003), which studies lobbying when the lobby is uncertain about the preferences of a unitary decision maker. Le Breton and Zaporozhets (2007) go a step further and replace the unitary decision maker with a legislature with multiple actors. Song (2008) presents a model in which policy-making power is shared between an executive and a unitary legislature where lobbies are able to endogenously influence the political preferences of the legislature in a context of unilateral policy making with no uncertainty.

I begin by describing the model in detail. Section 3 then presents the main results. In Section 4, an extended example demonstrates these results as well as the impact of changing the institutional environment. Section 5 explores the connection between the model under consideration here and the 'Protection for Sale' theoretical framework and includes in-depth discussions of the roles of uncertainty and the separation-of-powers structure. The repeated-game version of the model and Dispute Settlement Institution is considered in Section 6 and Section 7 concludes.

2 The Model

I employ a partial-equilibrium model with two countries: home (no asterisk) and foreign (asterisk). The countries trade two goods, X and Y, where P_i denotes the home price of good $i \in \{X, Y\}$ and P_i^* denotes the foreign price of good i. In each country, the demand functions are taken to be identical for both goods, respectively $D(P_i)$ in home and $D(P_i^*)$ in foreign and are assumed strictly decreasing and twice continuously differentiable.

The supply functions for good X are $Q_X(P_X)$ and $Q_X^*(P_X^*)$ and are assumed strictly increasing and twice continuously differentiable for all prices that elicit positive supply. I also assume $Q_X^*(P_X) > Q_X(P_X)$ for any such P_X so that the home country is a net importer of good X. The production structure for good Y is taken to be symmetric, with both demand and supply such that the economy is separable in goods X and Y. It is assumed that the production of each good requires the possession of a sector-specific factor that is available in inelastic supply and is non-tradable so that the income of owners of the specific factors is tied to the price of the good in whose production their factor is used.

For simplicity, I assume each government's only trade policy instrument is a specific tariff on its import-competing good: the home country levies a tariff τ on good X while the foreign country applies a tariff τ^* to good Y. Local prices are then $P_X = P_X^W + \tau$, $P_X^* = P_X^W$, $P_Y = P_Y^W$ and $P_Y^* = P_Y^W + \tau^*$ where a W superscript indicates world prices and equilibrium prices are determined by the market clearing conditions

$$M_X(P_X) = D(P_X) - Q_X(P_X) = Q_X^*(P_X^*) - D(P_X^*) = E_X^*(P_X^*)$$

$$E_Y(P_Y) = Q_Y(P_Y) - D(P_Y) = D(P_Y^*) - Q_Y^*(P_Y) = M_Y^*(P_Y^*)$$

where M_X are home-county imports and E_X^* are foreign exports of good X and E_Y are home-county exports and M_Y^* are foreign imports of good Y.

It follows that P_X^W and P_Y^W are decreasing in τ and τ^* respectively, while P_X and P_Y^* are increasing in the respective domestic tariff. This gives rise to a standard terms-of-trade externality. As profits and producer surplus (identical in this model) in a sector are increasing in the price of its good, profits in the import-competing sector are also increasing in the domestic tariff. This economic fact, combined with the assumptions on specific factor ownership, is what motivates political activity.

I next describe the politically-relevant actors. In order to focus attention on protectionist political forces, I assume that only the import-competing industry in each country is politically-organized and able to lobby and that it is represented by a single lobbying organization. Each country's government is composed of two branches: an executive who can conclude trade agreements and a legislature that has final say on trade policy. In summary, the political process is modeled as involving three players in each country: the lobby, the executive, and the legislature.

The timing is as follows. First, the executives set trade policy cooperatively within the context of an international agreement. I assume that the agreement takes the form of tariff caps and that an external authority can ensure enforcement of the agreement in the one-shot game analyzed here.[6] After the trade agreement is concluded, the lobbies attempt to persuade the legislators in their respective countries to break the trade agreement. Next, the uncertainty about the the median legislator's identity is resolved and the legislatures decide whether to abide by the agreement or to provoke a trade war. In the event that the trade agreement does not remain in force, there is a final stage of lobbying and voting to set the trade-war tariffs. Once all political decisions are taken, producers and consumers make their decisions.

Although uncertainty is present, information about it is not asymmetric, so the appropriate solution concept is subgame perfect Nash equilibrium. As this game is solved by backward induction, it is intuitive to start by describing the incentives of the legislatures, whose decisions I model as being taken by a median legislator. As the economy is fully separable and the economic and political structures are symmetric, I focus here on the home country and the X-sector. The details are analogous for Y and foreign.

The welfare function of the home legislature is

$$W_{ML} = CS_X(\tau) + CS_Y(\tau^*) + \gamma(e,\theta) \cdot PS_X(\tau) + PS_Y(\tau^*) + TR(\tau) \tag{1}$$

where CS is consumer surplus, PS is producer surplus, $\gamma(e,\theta)$ is the weight placed on producer surplus (profits) in the import-competing industry, e is lobbying effort, and TR is tariff revenue. Here, the weight the median legislator places on the profits of the import-competing industry, $\gamma(e,\theta)$ is affected by the level of lobbying effort[7] and the random variable θ.

[6]Work in progress extends the analysis to a repeated-game context to remove this restriction.

[7]The standard PFS modeling would specify $W_{ML} = C + aW$, but as will be seen when we come to the preferences of the executive, this is not sufficiently general for the purposes of this model. Although complex, an isomorphism can be made between the two forms in a special case as discussed in Section 5.1.

I allow for the possibility of this uncertainty, which can be interpreted as uncertainty over the identity of the median legislator, in order to model the idea that the lobbying and voting "game" that goes on within legislatures is often complex enough that none of the actors know precisely what the outcome will be—that is, no one can predict exactly which legislator will be the median and therefore what weight will be placed on import-industry profits at the time of the vote. Thus one way we can think about θ is as an additional influence on the median legislator's preference about which all parties—executives, legislators and lobbies alike—are uncertain.

One can conceptualize this uncertainty as being a result of the lobby's strategic choice to engage with only some key members of the legislature who wield significant influence but who cannot deliver policy decisions without the cooperation of others within the legislature, which is in turn uncertain. Different assumptions on $\gamma(\cdot,\cdot)$ should correspond to different institutional features and will affect optimal lobbying- and tariff-setting behavior.

Given its expectations and the legislature's preferences, the home lobby chooses its lobbying effort (e_b to influence the break decision and e_n to influence the trade war tariff) to maximize the welfare function:

$$U_L = \Pr\left[\text{TradeWar}(\boldsymbol{\tau^a}, e_b, e_n)\right]\left[\pi(\tau^{tw}) - e_n\right] + \Pr\left[\text{TradeAgreement}(\boldsymbol{\tau^a}, e_b, e_n)\right]\pi(\tau^a) - e_b \quad (2)$$

where $\pi(\cdot)$ is the current-period profit and τ^a (τ^{tw}) is the home country's tariff on the import good under a trade agreement (war). I use the convention throughout of representing a vector of tariffs for both countries (τ, τ^*) as a single bold $\boldsymbol{\tau}$.

I assume the lobby's contribution is not observable to the foreign legislature. The implication is that the lobby can directly influence only the home legislature, and so the influence of one country's lobby on the other country's legislature occurs only through the tariffs selected.[8]

In the first stage, the executives choose the trade agreement tariffs $\boldsymbol{\tau^a} = (\tau^a, \tau^{*a})$ via a negotiating process that I assume to be efficient. It therefore maximizes the expected joint payoffs:

$$\begin{aligned} W_E(\boldsymbol{\tau^a}) + W_E^*(\boldsymbol{\tau^a}) = \Pr\left[\text{TradeWar}(\boldsymbol{\tau^a})\right]\left[W_E(\boldsymbol{\tau}^{tw}) + W_E^*(\boldsymbol{\tau}^{tw})\right] + \\ \Pr\left[\text{TradeAgreement}(\boldsymbol{\tau^a})\right]\left[W_E(\boldsymbol{\tau^a}) + W_E^*(\boldsymbol{\tau^a})\right] \quad (3) \end{aligned}$$

I model the executives' choice via the Nash bargaining solution where the disagreement point is the executives' welfare resulting from the Nash equilibrium in the non-cooperative game (i.e. in the absence of a trade agreement) between the legislatures.

The home executive's welfare is specified as follows:

$$W_E = CS_X(\tau) + CS_Y(\tau^*) + \gamma_E \cdot PS_X(\tau) + PS_Y(\tau^*) + TR(\tau)$$

[8] cfr. Grossman and Helpman 1995, page 685.

Note that this is identical to the welfare function for the legislature aside from the weight on the profits of the import industry, which is not a function of lobbying effort. This construction permits me to integrate the influence of the import-competing industry on negotiations prior to the formation of the trade agreement while also reflecting the idea that the mechanisms through which political considerations influence the executives' preferences appear to be quite different from those at the legislative level (the electoral college and primary/caucus systems for instance).

This assumption does *not* require that the executives are not lobbied; only that their preferences are not directly altered in a significant way by lobbying over trade—that they do not sell protection in order to finance their re-election campaigns. In the case of the post-war United States, where the Congress has consistently been significantly more protectionist than the President, this seems to reasonably reflect the political reality. For trade policy, where there are concentrated benefits but harm is diffuse, there are good reasons for this to be the case. Because the President has the largest constituency possible, delegating authority to the executive branch may simply be a mechanism for "concentrating" the benefits since consumers seem unable to overcome the free-riding problem. In fact, a strong argument can be made that power over trade policy has been delegated to the executive branch precisely *because* it is less susceptible to the influence of special interests (Destler 2005).

Therefore, in line with both the theoretical and empirical literature, I will assume that $\gamma_E \leq \gamma(e, \theta)$ for all realizations of θ.[9] That is, even for the least favorable outcome of the lobbying process, the legislature will be at least slightly more protectionist than the executive. This does not fully explain why the executive branch does not seem to be influenced toward protectionism in the same way that the legislature is, but one plausible rationale is that the President faces a more complex electoral calculus over a wider-range of policy areas.

Although the political process here matches most closely that of the United States in the post-war era, I believe the model or one of its extensions is applicable for a broad range of countries for which authority over the formation and maintenance of trade policy is diffuse and subject to political pressure either at home or in a trading partner.[10]

3 Main Results

To understand how the executives optimally structure trade agreements, we must first examine the incentives of the lobbies and how the legislatures make decisions regarding breach of the trade agree-

[9]Note that this includes in particular the special case of a welfare-maximizing executive ($\gamma_E = 1$).

[10]In particular, the binary decision by the legislature about whether to abide by or break the trade agreement is modeled on the "Fast Track Authority" that the U.S. Congress granted to the Executive branch almost continuously from 1974-1994 and then again as "Trade Promotion Authority" from 2002-2007.

ment, including how trade-war tariffs are set. The symmetric structure of the model permits restriction of attention to the home country.

3.1 Trade-War Tariffs

In the event that the trade agreement is broken, the legislature sets its tariff τ unilaterally by maximizing Equation 1 given τ^*. Because there are no interactions between the home and foreign tariffs, the home and foreign trade-war tariffs are independent and the home country's tariff in a trade war maximizes weighted home-country welfare in the X-sector only. The foreign legislature's decision problem is analogous, and unilateral optimization leads to what I refer to as the Nash tariffs as the solution to the following first order condition:

$$\frac{\partial CS_X(\tau)}{\partial \tau^n} + \gamma(e_n, \theta_n) \cdot \frac{\partial PS_X(\tau)}{\partial \tau^n} + \frac{\partial TR(\tau)}{\partial \tau^n} = 0$$

Conditions under which the second order condition is satisfied are contained in Lemma 8 in the Appendix.

In accordance with intuition, because profits are increasing in the tariff, trade war tariffs are increasing in the weight attached to the profits of the import-competing industry, as the following result shows:

Lemma 1. *If prices are linear in tariffs, $\tau^n(\gamma(e_n, \theta_n))$ is increasing in $\gamma(e_n, \theta_n)$.*

Proof: See the Appendix.

In the event of a trade war, the lobby chooses its effort e_n given this tariff-setting behavior by maximizing its profits net of effort: $\pi(\tau^n(\gamma(e_n, \theta_n))) - e_n$. (Note this is Equation 2 simplified by the resolution of uncertainty over the legislature's decision on the trade agreement). This implies a first order condition of

$$\frac{\partial \pi(\tau^n(\gamma(e_n, \theta_n)))}{\partial e_n} = 1 \tag{4}$$

That is, at this stage, the lobby chooses the level of effort that equates its expected marginal increase in profits with its marginal payment. Further details about the political weighting function γ and assumed structure of uncertainty are provided in the next section.

3.2 To Break or Not to Break?

With the trade-war behavior of both the lobby and the legislature specified, we can proceed to analyze their interaction regarding the legislature's decision to uphold or break the trade agreement. I assume that the form of the political weighting function is the same in both cases, but the model could be extended to allow the two to differ. What is in principle different are the lobbying efforts toward influencing the break decision, denoted e_b at this stage to distinguish them from those that are made to influence the Nash tariff, e_n. The realization of uncertainty about the median legislator's identity will similarly be denoted θ_b so as to distinguish it from θ_n at the later stage.

I also assume that each legislature will have the opportunity to break the agreement with probability less than one-half, and that the probability that both legislatures have the opportunity is vanishingly small. This allows me to focus on the interaction between the domestic actors at this stage; the case in which both legislatures could potentially vote to break the agreement at the same time is interesting and will be explored in future work.

The legislature will break the agreement and set the tariff at τ^n if the median legislator's utility from the Nash tariffs[11] is higher than his utility from the trade agreement tariffs, i.e. if

$$W_{ML}(\boldsymbol{\tau^n}, \gamma(e_b, \theta_b)) > W_{ML}\left(\boldsymbol{\tau^a}, \gamma(e_b, \theta_b)\right) \tag{5}$$

Recall that a bold $\boldsymbol{\tau}$ represents a vector of tariffs for both countries (τ, τ^*).

The legislature's decisions are stochastic, so the outcome of the vote on whether or not to break the trade agreement, as well as the level at which the tariff will be set in the case of a disruption, is not known to *any* player until the uncertainty over the identity of the median legislator is resolved at each stage—that is, until the moment the vote takes place.[12] I represent the probability that the home legislature breaks the trade agreement and sets the tariff at τ^n as:

$$\begin{aligned} b(e_b, \boldsymbol{\tau^a}, \boldsymbol{\tau^n}) &= \mathbb{E}_{\gamma|e_b}\mathbf{1}[W_{ML}(\boldsymbol{\tau^n}, \gamma(e_b, \theta_b)) > W_{ML}\left(\boldsymbol{\tau^a}, \gamma(e_b, \theta_b)\right)] \\ &= \Pr[W_{ML}(\boldsymbol{\tau^n}, \gamma(e_b, \theta_b)) > W_{ML}\left(\boldsymbol{\tau^a}, \gamma(e_b, \theta_b)\right) | e_b] \end{aligned} \tag{6}$$

Note that the legislature's best response functions (both for whether to break the agreement, and at what level to set the tariff if it does) will be affected by the shape of $\gamma(e, \theta)$. I make the following assumptions on the weight on import-industry profits:

Assumption 1. *$\gamma(e, \theta)$ is increasing and concave in e for every $\theta \in \Theta$.*

Assumption 2. *$\gamma(e, \theta) \geq \gamma_E \geq 1$ $\forall \theta$.*

[11] Note again the assumption of external enforcement: the countries can choose to abide by the terms of the agreement and take advantage of the external enforcement or can exit the agreement, but they cannot "cheat."

[12] Although we might think of the trade-war tariff as being set in the legislation before a vote takes place, the results of this slight simplification accord closely with intuition.

Assumption 1 formalizes the intuition that the legislature favors the import-competing industry more the higher is its lobbying effort, but that there are diminishing returns to lobbying activity. It allows the political uncertainty inherent in θ to be correlated in interesting ways with the level of e, ruling out only (i) that higher effort levels make lower γ-weights more likely and (ii) that effort and uncertainty are correlated in such a way that increasing lobbying effort changes the structure of uncertainty so that higher γ-weights become more likely at an accelerating pace.

Assumption 2 ensures that $\tau^a < \tau^n$, and more generally, that the legislature's incentives are more closely aligned with the lobby's than are those of the executive. This is not essential but simplifies the analysis and matches well the empirical findings that politicians with larger constituencies are less sensitive to special interests (See Destler 2005 and footnote 5 above).

We are now in a position to examine the legislature's decision more closely. Of central concern is how the probability that the legislature will break the trade agreement varies with lobbying effort:

Result 1. *The probability that the legislature breaks a trade agreement is increasing and concave in* e_b.

Proof: See the Appendix.

Lobbying affects only the weight the legislature places on the profits of the import-competing industry. These profits are higher in a trade war than under a trade agreement, so given Assumption 1, the expectation of γ is increasing in lobbying effort, implying that the legislature becomes more favorably inclined toward the high trade-war tariff and associated profits as lobbying increases and therefore more likely to break the trade agreement.

The probability of a trade war, just like the trade-war tariffs, is increasing in γ, so it's the natural assumption that γ is increasing in lobbying effort that implies that the lobby can increase both its trade war tariff and the probability of a trade war by raising its lobbying effort.

Turning to the effects of the trade-agreement tariffs on the probability that the agreement will be abrogated, it is straightforward that the legislature always prefers lower levels of the foreign tariff:

Lemma 2. *The probability the legislature breaks a trade agreement is increasing in* τ^{*a}.

Proof: See the Appendix.

Because the home country is an exporter of good Y, the lower world price for Y has a negative effect on producer surplus that is larger than the positive effect on consumer surplus. Thus the net effect of an increase in foreign trade-agreement tariffs on legislative (and home country) welfare is negative, leading to an increased probability that the trade agreement will be broken.

The relationship between the home country's trade-agreement tariff τ^a and the legislature's probability of breaking the agreement is slightly more complex because τ^a interacts directly with $\gamma(e_b, \theta_b)$.

The intuition is as follows. For any given level of e_b, we can think of the expected median legislator as having a preferred tariff that can be found in the same way as τ^n. Call this tariff $\mathbb{E}\left[\tau^{e_b}\right]$, and notice that, in expectation, the median legislator's welfare under the trade agreement increases in τ to the left of $\mathbb{E}\left[\tau^{e_b}\right]$ and decreases in τ to the right of it. The break probability therefore decreases up to $\mathbb{E}\left[\tau^{e_b}\right]$ because the trade agreement tariff is coming ever closer to the expected median legislator's preferred level. However, it continues to decrease thereafter because, as the tariff rises further, progressively more protectionist median legislators will also prefer the trade agreement—that is, fewer and fewer realizations of $\gamma(e_b, \theta_b)$ will lead to abrogation. Even very high tariffs, although not pleasing to the median legislators that result from low realizations of $\gamma(e_b, \theta_b)$, are preferable to a trade war, so the probability of breaking either becomes zero or continues to decrease.

Lemma 3. *Holding lobbying effort constant, the probability the legislature breaks a trade agreement is weakly decreasing in τ^a.*

Proof: See the Appendix.

The intuition for the above results is quite straightforward. When the lobby increases effort, the median legislator will have a higher weight on the import-competing industry's profits and prefer a higher tariff, making it more likely to break the trade agreement. On the other hand, a higher tariff for the import-competing industry (at least for those below the expected median legislator's most-preferred level) increases the legislature's payoffs under the trade agreements and makes it less likely to break that agreement, while a higher tariff on home country exports in the trading partner reduces the legislature's payoffs from the agreement and makes it more likely to break the agreement.

3.2.1 Lobby

The lobby chooses its level of effort e_b as a function of $\boldsymbol{\tau^a}$, given the implications of that choice on the legislature's probability of breaking the agreement, $b(e_b, \boldsymbol{\tau^a}, \boldsymbol{\tau^n})$. I will henceforth suppress the Nash tariffs in the expression of the break probability to simplify notation.[13] Recalling that if the lobby has the chance to act, there is no chance for the foreign legislature to break the agreement, the lobby's decision is

$$\max_{e_b} b(e_b, \boldsymbol{\tau^a}) \left[\pi(\tau^n) - e_n\right] + \left[1 - b(e_b, \boldsymbol{\tau^a})\right]\pi(\tau^a) - e_b$$

The lobby simply maximizes probability-weighted profits net of effort. From its first order condition, we can see that the lobby balances the cost of an extra dollar of lobbying expenditure with the higher

[13]Since the decisions over the Nash tariffs are taken in the final period, they are constants from the point of view of earlier stages. Similarly, because the lobbying effort made in that period does not interact with other decision variables in earlier periods, I will suppress the dependence of the Nash tariffs on e_n.

profits from a trade war weighted by the increase in the probability of receiving the higher profit level that expenditure induces:

$$\frac{\partial b(e_b, \boldsymbol{\tau^a})}{\partial e_b}\left[\pi(\tau^n) - e_n - \pi(\tau^a)\right] = 1 \tag{7}$$

The second order condition is satisfied given Assumption 2 and Result 1. However, the solution is not guaranteed to be interior, for which we need

$$\frac{\partial b(0, \boldsymbol{\tau^a})}{\partial e_b}\left[\pi(\tau^n) - e_n - \pi(\tau^a)\right] > 1. \tag{8}$$

For instance, if the executives were to set $\tau^a = \tau^n$, there would be no incentive for the lobby to make a positive contribution. We will see that there are some cases in which it may be in the executives' joint interest to set trade agreement tariffs so as to completely disengage the lobby. The following results thus only hold when Condition 8 is satisfied, that is, when the marginal impact of the first lobbying dollar on the break probability is sufficiently high to make engaging in the political process worthwhile for the lobby.[14]

We can now proceed to the central result concerning the lobby's behavior.

Result 2. *When the trade agreement remains in force with positive probability, lobbying effort is decreasing in the home-country trade agreement tariff.*

Proof: See the Appendix.[15]

Raising the trade agreement tariff decreases the benefit of inducing a break in the trade agreement by raising profits under the trade agreement. This is in many ways the key result of this paper: the executives can reduce lobbying effort by setting higher tariffs in their trade agreement. We will see in the next section how this shapes the executives' joint decision.

Note that, because the foreign tariff does not impact profits in the import-competing industry, changing τ^{*a} does not change the optimal choice of lobbying expenditure.

Corollary 1. *Lobbying effort does not respond to the foreign-country trade agreement tariff.*

Proof: See the Appendix.

3.3 The Trade Agreement

The executives choose trade agreement tariffs $\boldsymbol{\tau^a} = (\tau^a, \tau^{*a})$ to maximize Equation 3. I call the maximized joint value $MV(\boldsymbol{\tau^a})$ and write the division of surplus according to the Nash bargaining

[14]This is primarily a condition on the curvature of the political weighting function but also involves the production and demand structure.

[15]See Section 5.3 for a detailed account of behavior when the lobby is able to induce a trade war with probability 1.

solution as

$$V_E(\boldsymbol{\tau^a}) + t = W_E(\boldsymbol{\tau^n}) + \frac{1}{2}\left(MV(\boldsymbol{\tau^a}) - W_E(\boldsymbol{\tau^n}) - W_E^*(\boldsymbol{\tau^n})\right)$$
$$V_E^*(\boldsymbol{\tau^a}) - t = W_E^*(\boldsymbol{\tau^n}) + \frac{1}{2}\left(MV(\boldsymbol{\tau^a}) - W_E(\boldsymbol{\tau^n}) - W_E^*(\boldsymbol{\tau^n})\right)$$

where expectation operators have been dropped for convenience and t is an intergovernmental transfer.[16] The solution to this system of equations determines the tariffs $\boldsymbol{\tau^a}$ that will be set in the trade agreement.

I simplify the problem by assuming that political constraints prevent the executives from choosing asymmetric tariffs. This restricts attention to symmetric solutions in the fully symmetric environment under consideration, which means that the trade agreement tariffs for which we're looking are simply those that maximize the joint welfare of the executives.[17] In order to solve for them, I represent the probability that the trade agreement will be broken as $B(\boldsymbol{\tau^a}) = b(e(\boldsymbol{\tau^a}), \boldsymbol{\tau^a})$ where $e(\boldsymbol{\tau^a})$ is the best response function implicit in Equation 7, the lobby's first order condition.

The problem then becomes to maximize the following modified version of Equation 3:

$$\{o \cdot B(\boldsymbol{\tau^a}) + o^* \cdot B^*(\boldsymbol{\tau^a})\} \boldsymbol{W_E}(\boldsymbol{\tau^n}) + \{1 - o \cdot B(\boldsymbol{\tau^a}) - o^* \cdot B^*(\boldsymbol{\tau^a})\} \boldsymbol{W_E}(\boldsymbol{\tau^a}) \tag{9}$$

where I have written the sum of the home and foreign executives' utilities as $\boldsymbol{W_E}(\cdot)$. Here o and o^* are the probabilities that the home and foreign legislatures, respectively, will have the opportunity to break the trade agreement; these are assumed to be mutually exclusive events that are realized after the conclusion of the trade agreement. One can think of o and o^* as being determined by events beyond the executives' or legislatures' control that determine whether or not the legislatures will be willing to consider the lobby's request; for example, they would be affected by the occurrence of an economic crisis that diverts the legislature's attention from less-pressing matters.

Of central concern is how the break probabilities behave as a function of the trade agreement tariffs given the lobby's optimal response. Begin by examining the impact of $\boldsymbol{\tau^a}$ on $B(\boldsymbol{\tau^a})$. Two effects are present: the indirect effect through the impact on the lobby's choice of e_b, which is negative by Results 1 and 2 and Corollary 1, and the direct effect on the legislature's break decision. Lemma 3 tells us that the latter is also negative. However, because we've assumed that τ^a must equal τ^{*a}, any

[16]While direct monetary transfers have to date rarely been used in practice, it seems appropriate to interpret linked concessions on non-trade issues as indirect transfers (Klimenko, Ramey and Watson 2008, Maggi and Staiger 2011). Here, transfers do not occur as long as the full set of symmetry assumptions are maintained.

[17]I have assumed that $W_E(\tau) = W_E^*(\tau)\ \forall \tau$; further in a symmetric equilibrium, $\tau^n = \tau^{*n}$ and $\tau^a = \tau^{*a}$, so

$$V_E(\boldsymbol{\tau^a}) + t = W_E(\boldsymbol{\tau^n}) + \frac{1}{2}\left(MV(\boldsymbol{\tau^a}) - W_E(\boldsymbol{\tau^n}) - W_E^*(\boldsymbol{\tau^n})\right) = W_E(\boldsymbol{\tau^n}) + \frac{1}{2}\left(MV(\boldsymbol{\tau^a}) - 2W_E(\boldsymbol{\tau^n})\right) = \frac{1}{2}\mathbb{E}MV(\boldsymbol{\tau^a})$$

increase in τ^a will be accompanied by an equal increase in τ^{*a}. This does not affect the lobby's effort, but Lemma 2 shows that τ^{*a} has a positive direct impact on the legislature's probability of breaking the trade agreement. The following result addresses the combined impact of τ^a and τ^{*a} on $b(e, \boldsymbol{\tau^a})$ when the two are constrained to be equal:

Lemma 4. *Holding lobbying effort constant, the probability the legislature breaks a trade agreement is weakly decreasing in $\boldsymbol{\tau^a}$ (i.e. $\frac{\partial b(e,\boldsymbol{\tau^a})}{\partial \tau^a} + \frac{\partial b(e,\boldsymbol{\tau^a})}{\partial \tau^{*a}} \leq 0$).*

Proof: See the Appendix.

When any change in one of the trade agreement tariffs must be met with an equal change in the other (as in a symmetric agreement), the negative impact on the legislature's propensity to break the trade agreement of raising the home tariff always outweighs the positive impact of raising the foreign tariff. This fully describes the direct effect of the trade agreement tariffs on the total break probability. Recalling the definition of the total break probability, $B(\boldsymbol{\tau^a}) = b(e_b(\boldsymbol{\tau^a}), \boldsymbol{\tau^a})$, we must combine this direct effect with the indirect effect through the lobbying decision. The fact that the indirect effect of raising tariffs is a reduction in lobbying (see Result 2) and therefore a reduction in the propensity of the legislature to break the agreement (Result 1) leads to the following key result: the overall probability that the trade agreement will be broken is decreasing in the trade agreement tariffs.

Result 3. *The total probability that the trade agreement will be broken is decreasing in $\boldsymbol{\tau^a}$ (i.e. $\frac{\partial B(\boldsymbol{\tau^a})}{\partial \tau^a} + \frac{\partial B(\boldsymbol{\tau^a})}{\partial \tau^{*a}} \leq 0$).*

Proof: See the Appendix.

That is, when the executives raise the trade agreement tariffs the legislature becomes less likely to abrogate the agreement, for three reasons. First, the legislature prefers a higher domestic tariff; second, the higher tariff discourages lobbying; finally, the lower lobbying effort reduces the legislature's preferred tariff further. Thus, beyond promising a lower tariff from the trading partner, we can think of the trade agreement as a sort of political commitment device that can be used to relieve political pressure and allow the legislature to maintain a lower tariff than it otherwise would.

We are now prepared to examine the executives' optimal choice of trade agreement tariffs. Because joint executive welfare is decreasing in trade agreement tariffs for $\boldsymbol{\tau^a}$ above the executives' preferred tariffs, we have the following fundamental feature of the executives' problem:

Lemma 5. *The executives face the following trade off when choosing $\boldsymbol{\tau^a}$: higher tariffs decrease the probability that the trade agreement will be broken, but they also decrease welfare when the agreement is in force.*

I define the tariff the executives prefer in the absence of legislative constraints as $\boldsymbol{\tau^E}$ and show in the Appendix that it is never optimal in a symmetric equilibrium for the executives to choose $\boldsymbol{\tau^a} < \boldsymbol{\tau^E}$ if there is a positive probability that the legislatures will have an opportunity to break the trade agreement. This is the result of an envelope-like result: there are only second-order losses from raising tariffs slightly from the most-preferred level yet there are first-order gains in reducing the probability that the agreement will be broken.

The executives will also always choose $\boldsymbol{\tau^a} < \boldsymbol{\tau^n}$ unless the legislature breaks even agreements with tariffs very close to the Nash level with certainty, in which case the problem is not interesting so I will ignore this case. Thus there is an interior solution in all cases of interest, but this solution may be of two different forms. First, it could be at the point that maximizes the concave portion of the executives' welfare function (Equation 9). Here, the optimal tariffs are chosen to balance concerns for trade-agreement welfare against those for discouraging lobbying activity aimed at breaking the agreement.

But there is an alternative. For some specifications, high enough tariffs can disengage the lobby sufficiently so that the probability that the trade agreement will be broken is reduced to zero. Interestingly, if this occurs at a low enough tariff level, executive welfare can be maximized at this point.

Result 4. *The executives maximize their welfare by either (a) raising tariffs sufficiently high to ensure that the trade agreement will remain in force or (b) trading off reductions in the probability that the agreement will be broken with reductions in welfare under the agreement.*

This seems to accord well with observations of trade policy politics, in that some lobbies appear to exert significant effort toward disrupting trade agreements (often in the form of some kind of individual administrative remedy such as anti-dumping duties) whereas others apparently do not contest the levels of protection granted them. The current model points to differences across industries in production and demand structure, as well as political weighting (γ), to help explain these variations.

4 An Example

It is instructive to examine a simple parameterization of the model economy. The fundamentals here are chosen to match those of Bagwell and Staiger (2005). Home country demand, supply and profits are given by $D(P_i) = 1 - P_i$, $Q_X(P_X) = \frac{P_X}{2}$, $Q_Y(P_Y) = P_Y$, $\Pi_X(P_X) = \frac{(P_X)^2}{4}$, and $\Pi_Y(P_Y) = \frac{(P_Y)^2}{2}$ where P_i is the price of good i in the home country market. Foreign is taken to be symmetric.

This implies Home-country imports of X and exports of Y of $M_X(P_X) = 1 - \frac{3}{2}P_X$ and $E_Y(P_Y) = 2P_Y - 1$, with foreign imports of Y and exports of X given by $M_Y^*(P_Y^*) = 1 - \frac{3}{2}P_Y^*$ and $E_X(P_X^*) =$

$2P_X^* - 1$. With the only trade policy instruments being tariffs on import competing goods, world prices are $P_X = P_X^W + \tau$, $P_X^* = P_X^W$, $P_Y^* = P_Y^W + \tau^*$, and $P_Y = P_Y^W$. Market clearing implies that world and home prices of X are $P_X^W = \frac{4-3\tau}{7}$ and $P_X = \frac{4+4\tau}{7}$, symmetric for Y.

4.1 Trade War Tariffs

The median legislator's welfare can be written as the sum of

$$W_{ML}^X(\tau, \gamma(e,\theta)) = \frac{9}{98} - \frac{5}{49}\tau - \frac{34}{49}\tau^2 + \frac{1}{98}\gamma(e,\theta)\left[8 + 16\tau + 8\tau^2\right]$$

$$W_{ML}^Y(\tau^*) = \frac{25}{98} - \frac{3}{49}\tau^* + \frac{9}{49}(\tau^*)^2$$

where $W_{ML}^X(\tau, \gamma(e,\theta))$ is the utility derived from consumer surplus, producer surplus and tariff revenues in the import-competing industry and $W_{ML}^Y(\tau^*)$ is the utility derived from consumer and producer surplus in the exporting industry.

When setting the trade-war tariff, the legislature simply maximizes $W_{ML}(\tau, \tau^*) = W_{ML}^X(\tau) + W_{ML}^Y(\tau^*)$ by choice of τ given τ^*. As there are no interactions between τ and τ^*, the legislature simply maximizes $W_{ML}^X(\tau)$ and sets the trade war tariff

$$\tau^n = \frac{8\gamma(e,\theta) - 5}{68 - 8\gamma(e,\theta)}$$

I refer to this as the Nash tariff because it is the result of Nash equilibrium in the non-cooperative game between the legislatures. τ^n is increasing in e and the second order condition is satisfied for all realizations of $\gamma < 17/2$. Because $\gamma = 7/4$ is enough to achieve the prohibitive tariff of $1/6$ it seems reasonable to assume that this condition is satisfied.

In the event of a trade war and facing this tariff-setting behavior by the legislature, the lobby maximizes $\pi\left(\tau^n\left(\gamma\left(e_n, \theta_n\right)\right)\right) - e_n$. In order to predict the Nash tariff, the political weighting function and form of political uncertainty must be specified. Take for instance $\gamma(e,\theta) = 1.25 + C^{.2}$ with θ distributed uniformly on $[-0.25, 0.25]$. Facing this specification of the political process, the lobby maximizes its objective function at $e_n = 0.00166$, which produces a Nash tariff of 0.129.

4.2 Break Decision

Next we move to the legislature's decision on whether or not to break the trade agreement. Figure 1 depicts the probability that the legislature will vote to break the trade agreement as a function of the

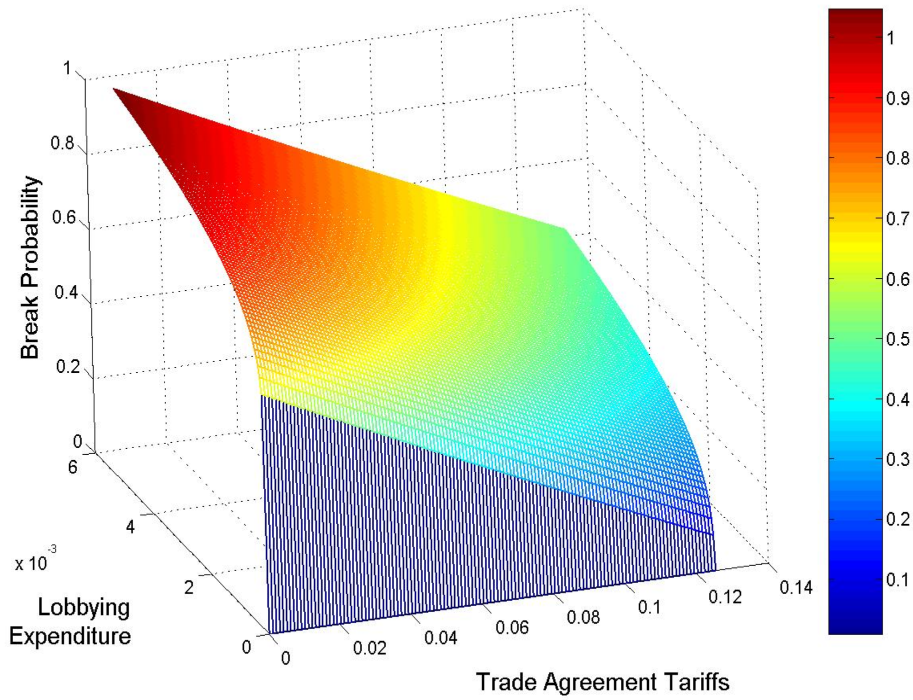

Figure 1: Probability Trade Agreement will be Broken

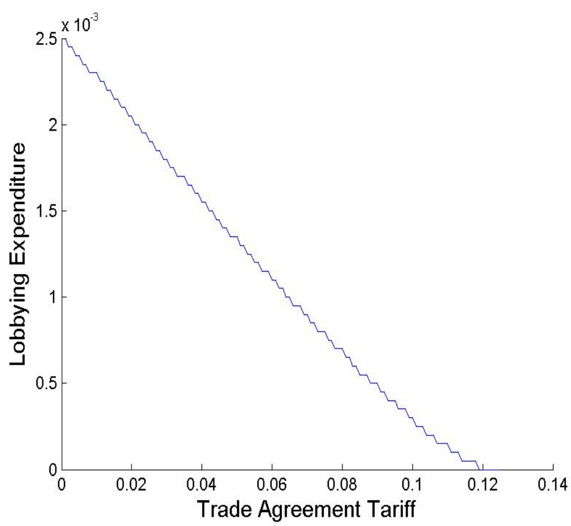

Figure 2: Lobbying Effort

tariff levels set in the trade agreement (with the restriction that $\tau^a = \tau^{*a}$) and the lobby's effort. It is strongly increasing in lobbying effort and decreasing in the level of tariffs set in the trade agreements.

Given the impact of lobbying on the legislature's break decision, the lobby's optimal contribution level turns out to be strongly decreasing in the trade agreement tariffs, as shown in Figure 2.

4.3 Trade Agreement

Because the probability of legislative break never reaches zero for this parameterization, the executives' welfare function is concave everywhere. Assuming that each legislature has the opportunity to vote to break the agreement with probability $\frac{1}{2}$ and that the executives are social-welfare maximizers (i.e. $\gamma_E = \gamma_E^* = 1$), they will set trade agreements tariffs of $\tau^a = \tau^{*a} = 0.078$, with lobbying expenditures of 0.0007 and a total break probability of 0.505. The expected tariff is then 0.103.

We can compare this against several different benchmarks. The most stark is the trade-war outcome itself, which can also be interpreted as the outcome that would prevail in the absence of executive involvement in trade policy *and* the absence of any effort to make a trade agreement. The tariff in the executive-formed trade agreement is about 60% of the Nash tariff of 0.129, and the expected level given the probability that the agreement will be broken is 80% of the Nash level. Lobbying expenditures in the agreement-maintenance phase are about 40% of the those in the Nash game, while expected expenditures in the executive-led trade-agreement scenario are 90% of what they would be if the legislatures set tariffs unilaterally.

Although the welfare-maximizing governments here are not able to set and maintain tariffs at zero as they would like, they are able to achieve significant reductions in tariff levels through the use of the trade agreement.

Another interesting benchmark is a scenario in which no executives are involved in trade policy, but in which the politically-susceptible legislatures can make use of a trade agreement. As in Bagwell and Staiger (2005), I find when maximizing their joint welfare in a legislature-led trade agreement ($W_{ML}(\tau, \tau^*) = W_{ML}^X(\tau) + W_{ML}^Y(\tau^*)$), the cooperative tariff levels will be set at

$$\tau^L = \frac{4\gamma(e,\theta) - 4}{25 - 4\gamma(e,\theta)}, \quad \tau^{*L} = \frac{4\gamma(e^*,\theta) - 4}{25 - 4\gamma(e^*,\theta)}$$

The legislatures are able to use the agreement to internalize the terms of trade externality, making political influence more expensive for the lobbies. Indeed, I find that lobbying expenditures rise to 0.0027—60% higher than in the Nash case—while the agreement tariffs are set at 0.118, only slightly lower than the Nash tariffs of 0.129 and still higher than even the expected tariffs from the trade agreement scenario in which the executives choose the tariffs.

If one interprets the addition of a second policy-making actor as consistent with a move from autocracy to democracy, this result helps to explain the extensive empirical evidence that democracies trade more with each other than autocracies.[18]

5 Discussion

5.1 Relation to Grossman and Helpman's 'Protection for Sale'

The legislative welfare function employed in this paper allows significant flexibility to model a wide range of political processes within a non-unitary legislature. This is a departure from the 'Protection for Sale' welfare function, which assumes that a unitary government maximizes the sum of contributions and some fraction, a, of social welfare. The $\gamma(e,\theta)$-weighting procedure does not rule out that any given politician behaves according to the PFS specification, but it does allow for legislators to have different a-weights and for the aggregation of their preferences to follow more realistic patterns.

To see the relationship between the two forms, we can write the PFS welfare function (replacing their C with e) as

$$e + aW = e + a\left[CS_X(\tau) + CS_Y(\tau^*) + PS_X(\tau) + PS_Y(\tau^*) + TR(\tau)\right]$$

Here, just as in Equation 1, the relationship between e and the weight the legislature places on profits is endogenous. However, in Equation 1, the weight placed on profits is determined by the reduced form $\gamma(e,\theta)$, whereas in the PFS model, we must first solve for equilibrium behavior to retrieve the relationship between e and the weight the legislature places on profits.

Thus the isomorphism to the model presented in this paper can only be made once equilibrium lobbying behavior has been determined—that is, after specifying how the game will be played and so how lobbying effort will be related to the weight on profits in equilibrium. Although $\gamma(e,\theta)$ is a reduced-form of this relationship, in a model with only one lobby who makes a take-it-or-leave-it offer, the lobby's behavior in this regard is very easy to describe and so nothing is lost.

Take the case of no uncertainty and assume that the legislature chooses $\tau = 0$ in the absence of lobbying and that $\gamma(0) = 1$. In the PFS model, for any τ that the lobby desires, it must pay according to the indifference condition

$$e(\tau) = a\left[W(0) - W(\tau)\right]$$

[18] cfr. Laver and Shepsle 1999; Morrow, Siverson and Tabares 1999; Milner and Kubota 2005; Henisz and Mansfield 2006; Kono 2006; Ward and Hoff 2007; Aidt and Gassebner 2010.

That is, the lobby must pay for the welfare loss caused by the tariff it requests, weighted by a. In the model of this paper, the indifference condition is

$$CS_X(\tau)+CS_Y(\tau^*)+\gamma(e)\cdot\pi_X(\tau)+\pi_Y(\tau^*)+TR(\tau) = CS_X(0)+CS_Y(0)+\gamma(0)\cdot\pi_X(0)+\pi_Y(0)+TR(0)$$

or

$$\gamma(e) = \frac{CS_X(0) + CS_Y(0) + \pi_X(0) + \pi_Y(0) + TR(0) - CS_X(\tau) - CS_Y(\tau^*) - \pi_Y(\tau^*) - TR(\tau)}{\pi_X(\tau)}$$

In order to match the form of the simple PFS framework above, we must have

$$\gamma(e) = 1 + \frac{e}{a\pi_X(\tau)} \tag{10}$$

Choosing the political weighting function identified in Equation 10 aligns the political objective function used in the current model with the PFS framework. Although using the γ-weighted government welfare function is a reduced-form approach in one sense, the above calculations demonstrate that the PFS welfare function embodies a very specific restriction on the political weights: a lobby must pay exactly a-weighted welfare cost of the policy it receives.

This helps to address the questions that have been raised by empirical investigations of the PFS model about the relationship of the magnitude of welfare losses relative to the weight placed on social welfare by governments. Most studies have predicted the pattern of protection quite well but produce parameter estimates for a that seem to be up to several orders of magnitude too large for the deadweight losses produced by the protection provided.

While the empirical work is well-placed to test the cross-industry implications of the PFS model, it is unable to test the political assumption that the government is a unitary actor. In fact, it is quite clear that trade policy is shaped in a very complicated process (see, for instance, Destler 2005) involving multiple actors. This paper has presented one attempt to more fully model the political process—both by adding a second branch of government and by acknowledging the complexity of the decision-making process within the legislature.

Even without the involvement of the executive branch, the most natural extension of the PFS assumption to a non-unitary legislature would have the industry lobbying all legislators in exactly the same way, similar in spirit to Le Breton and Zaporozhets (2007). Actual behavior by lobbies tends to follow a very different pattern in which a subset of legislators receive contributions and lobbying activity in varying amounts and then participate in a complicated process involving committees and log-rolling (Ansolabehere, Figueiredo and Snyder 2003). So while the amounts of protection granted may conform quite well to the cross-industry PFS predictions, the issue of the magnitudes of contributions and lobbying expenditures being too low compared to the deadweight losses inflicted by the protection provided may be explained in part by the mismatch between the unitary government assumption and the reality of the political process. One of the simplest hypotheses that emerges from the non-unitary government framework is that lobbies may only have to pay a small number of legislators for their districts' a-weighted welfare loss.

The current model demonstrates that the solution to the empirical puzzle is most likely more complex. Examining a more realistic political process and the concomitant political uncertainty reveals a nuanced relationship between the preferences of governmental actors, lobbying and tariffs. The executives' incentive to set higher tariffs than they would otherwise prefer in order to discourage lobbying activity and trade disruptions introduces a wedge between lobbying expenditures and the associated political weights on one hand and tariff levels on the other. The next section explores the effects of the separation of powers between the executive and legislative branches of the government on lobbying expenditures and the associated provision of tariffs in more detail, while Section 5.3 addresses the additional impact of political uncertainty.

5.2 Separation of Powers

Consider the model of Section 3 for the case of $\theta_b = 0$—that is, no uncertainty at the break stage (as will be discussed in the next section, in the case of mean-zero uncertainty, strategic behavior at the trade-war stage is not altered by uncertainty). This allows the isolation of the results that derive from the assumption that power over trade policy is shared between the executive and legislative branches from those which derive from uncertainty over the identity of the median legislator. Again, let us focus on the home lobby.

Now $\gamma(e_b)$ is deterministic, so the lobby knows the precise contribution it must make for any given trade agreement tariffs $\boldsymbol{\tau^a}$ to induce the legislature to break the agreement (see Inequality 5). Here, the lobby's contribution *increases* in $\boldsymbol{\tau^a}$ since the higher are the trade agreement tariffs, the larger is the political weight that is required to induce the legislature to find them unsatisfactorily low. As long as trade war profits net of the required contribution are greater than trade agreement profits, the lobby will induce a trade war; otherwise, it is not in the lobby's interest to make any contribution. Facing this behavior, the executives prefer to set the lowest trade agreement tariffs that make it prohibitively expensive for the lobby to have the agreement broken.

I return to the example of Section 4 to illustrate the effects of changing the environment to one without political uncertainty. Recall that, under the specification $\gamma(e,\theta) = 1.25 + e_b^2$ with θ_b distributed uniformly on $[-0.25, 0.25]$, the Nash tariff is 0.129 and the executive-led trade agreement tariff is 0.078, while if the legislatures form a trade agreement directly, they would set tariffs of 0.118 while the lobbies would spend 0.0027.

In this example, under an executive-led trade agreement with no uncertainty, the tariff level will be set at 0.106, the lobby will exert zero effort, and the agreement will remain in force with probability 1. If instead the executives were to set trade-agreement tariffs of 0.105, the lobby would contribute 0.0025 and the legislature would break the agreement with probability 1. This demonstrates both the agenda-setting power of the executives and the stark discontinuities induced when political uncertainty is not an issue.

Moreover, this case highlights the manipulation of the tariff level to discourage lobbying and therefore the disconnect that can arise between the tariffs that are chosen and the preferences of the governmental actors. In the example, the executive is a social welfare maximizer and so prefers zero tariffs, while the legislators with $\gamma(e,\theta) = 1.25 + e_b^2$ with $e_b = 0$ prefer 0.05. However, the trade agreement tariffs are set at 0.106 precisely to ensure that $e_b = 0$ so that we have a relatively free-trading legislature that upholds the trade agreement.

5.3 The Role of Political Uncertainty

In this model, if there were no political uncertainty, there would be no lobbying in equilibrium. Thus, if nothing else, adding the realism of political uncertainty allows for positive lobbying on the equilibrium path. If we examine more closely the assumption that there is significant uncertainty surrounding the legislative lobbying process, additional insights come to light. It is most clear in the case of mean-zero uncertainty, so I will assume this throughout this section unless otherwise noted.

In the event of a trade war, the lobbies' behavior, and therefore the expected trade-war tariffs, are not altered by mean-zero uncertainty (see Equation 4): the lobbies will equate the marginal increase in profits to the marginal cost, whether this increase is certain or in expected terms. As this stage is analogous to previous models with a single governmental actor and endogenous political pressure, we can see that the only impact of introducing political uncertainty would be on the legislatures' decision after the realization of θ_n.

However, at the earlier stage of lobbying, uncertainty alters optimizing behavior by both the lobby and the executives. In contrast to the example in the previous section with no uncertainty, consider the case of a very small amount: take θ distributed uniformly on $[-0.01, 0.01]$. Here, the executives find it optimal to set the tariffs once again to completely disengage the lobby and ensure the agreement remains in force. However, the tariff level will be different because instead of making the decision to lobby according to the certainty condition

$$\pi(\tau^n) - e_n - \pi(\tau^a) > e_b,$$

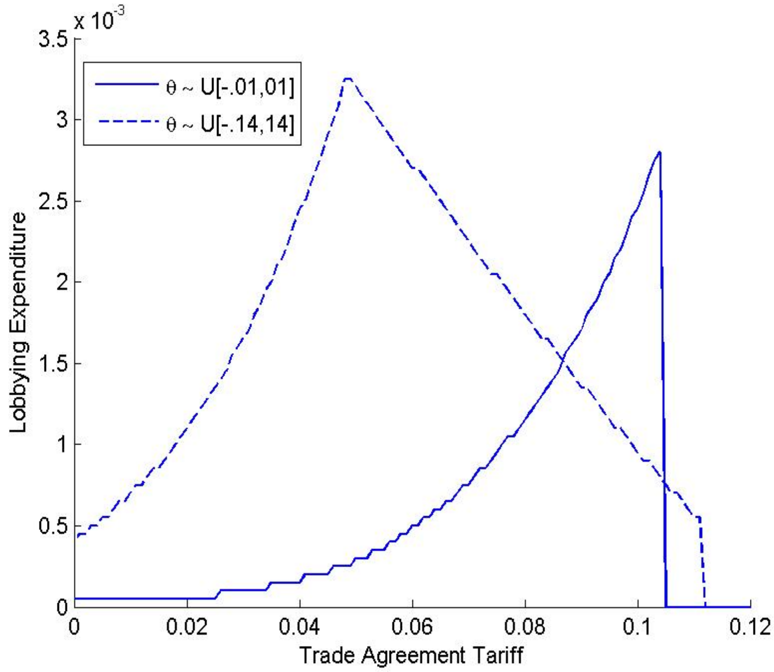

Figure 3: Lobby's Optimal Expenditure Function (Low and Intermediate Uncertainty)

the lobby makes this decision according to Condition 8, which can be re-written as

$$\pi(\tau^n) - e_n - \pi(\tau^a) > \left[\frac{\partial b(0, \boldsymbol{\tau^a}, \boldsymbol{\tau^n}(e_n, e_n^*))}{\partial e_b}\right]^{-1}.$$

Although the relationship between the tariff under certainty and a small amount of uncertainty will depend on the structure of the economy and the legislative process, in this case, the tariff can be reduced slightly to 0.105. As we have seen above, with significant uncertainty, the tariff in this example is reduced to 0.078. Interestingly, the optimal tariff does not decrease monotonically between these two values as uncertainty increases.

It is particularly instructive to examine the lobby's reaction function at this very low level of uncertainty as well as the intermediate level when θ is distributed uniformly on $[-0.14, 0.14]$ because it is at the latter that the executives set the highest tariff level of 0.107. For the former, when facing very little uncertainty, the lobby finds it optimal to contribute at a level high enough to ensure the legislature will break the agreement up until $\boldsymbol{\tau^a} = 0.103$ and disengages completely at $\boldsymbol{\tau^a} = 0.105$ (see Figure 3). When there is so little uncertainty, the range of tariff levels to which the lobby responds with an intermediate contribution that leaves open the possibility of a break is very small: only those between 0.103 and 0.104.

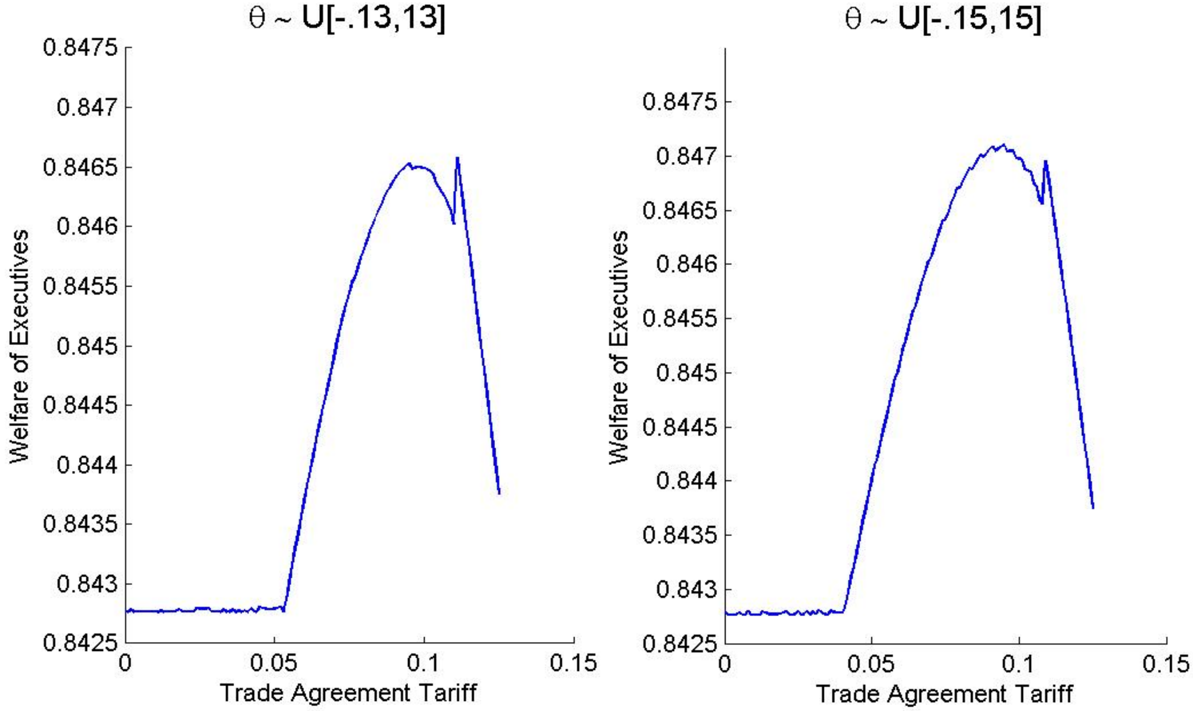

Figure 4: Differences in Executive Welfare when Uncertainty Increases

In contrast, when uncertainty is increased to the interval $[-0.14, 0.14]$, we see that the increasing portion of the reaction function only extends to $\boldsymbol{\tau}^{\boldsymbol{a}} = 0.048$. After this point, the lobby begins to leave open the possibility of a break and the reaction function begins to decrease in $\boldsymbol{\tau}^{\boldsymbol{a}}$ as predicted in Result 2. It chooses to disengage completely at 0.107 and this is the tariff level that the executives find optimal. Interestingly, at intermediate uncertainly levels, both portions of the best response curve are steeper and it turns out that the lobby disengages at slightly lower tariff levels—as low as 0.099 when $\theta \sim U[-0.06, 0.06]$.

The preceding discussion illustrates Part (a) of Result 4: here the executives maximize their welfare by raising tariffs to the point where the import-competing industry ceases to lobby and thus the agreement remains in force for sure. Note, however, that although lobbying expenditures are zero, the potential for lobbying behavior is essential in shaping the trade agreement.

When uncertainty rises above this threshold of $\theta \sim U[-0.14, 0.14]$, the executives' choices are made according to Part (b) of Result 4: that is, they trade off reductions in welfare under the agreement with reductions in the probability that the agreement will be abrogated by the legislature. In terms of the lobby's best response function, the executives now choose the optimal point on the downward-sloping portion of the curve instead of the point where it reaches zero. In terms of the welfare function for the executives, shown in Figure 4, they are now choosing the point that maximizes the concave portion of the curve instead of the "spike" that is created when the lobbies disengage and the chance that the agreement will be abrogated is removed altogether.[19]

As uncertainty increases further, the general pattern is that tariffs, and therefore lobbying effort, are reduced, while the break probability increases. However, this pattern is not smooth or absolute, in contrast to the welfare level achieved by the executives, which increases monotonically in the amount of uncertainty present. It is not clear how general a result this is, but it is particularly interesting in contrast to the non-monotone pattern over the lower-range of uncertainty where executive welfare is minimized at the edges of the range that lead to disengagement of the lobby and maximized in the middle of that range.

Several salient points emerge from this example. First, different amounts of uncertainty lead to very different outcomes—both in terms of the tariffs that are set in the trade agreement and the probability of disruption. Second, these outcomes vary in nuanced ways with the underlying behavior of the lobbies and the executives. The provided tariff levels are strongly influenced by lobbying incentives, but not in the straightforward ways predicted by unitary models. Finally, the empirical puzzle surrounding the PFS model can be resolved: in particular, with small enough levels of political uncertainty, this example shows that a welfare-maximizing executive and lobbying effort at zero (and therefore legislature with no endogenous protectionist bias) are consistent with very high tariff levels.

6 Repeated Game

In the absence of strong external enforcement mechanisms for international trade agreements, we generally assume that cooperation is enforced by promises of future cooperation, or, alternatively, promises of future punishments for exploitative behavior. Here I remove the assumption of perfect external enforcement and replace it with repeated-game incentives, taking account of the potential problems that can be caused by renegotiation. I will assume throughout that the political process is certain—that is, all actors know precisely how lobbying effort affects the identity of the median legislator through $\gamma(e)$.

[19] Note that the initial, flat portion of the curve is where the tariff is low enough that the lobby buys a trade war with certainty; we then enter the concave portion where the main results of Section 3 are applicable; finally, we see the upward spike where the probability of a trade war is reduced to zero and the executives' welfare declines after that because there is no further reduction in break probability as the tariff increases.

6.1 Dispute Settlement Institution

Klimenko, Ramey and Watson 2008 (hereafter KRW) show that typical grim trigger punishments are not useful for supporting cooperation when renegotiation is possible. They propose a notion of *recurrent agreement* that takes into account the possibility of renegotiation via one appealing solution: a dispute settlement institution (DSI) loosely patterned on the Dispute Settlement Body of the World Trade Organization that helps trading partners to credibly condition their negotiations on the state of their relationship.

Following KRW, I assume that the countries submit themselves to such a DSI for the purposes of overcoming the renegotiation problem: that is, the incentive to renegotiate out of punishment phases that destroys the ability of the punishments to enforce cooperation. One way to (informally) make adherence to the DSI incentive compatible is to imagine that many trading partners use the DSI and that all will punish a country who deviates in any bilateral agreement.

The DSI is assumed to keep records of the negotiated agreements, complaints, and violations, and to settle disputes when agreements are violated. The simple DSI employed here conditions the interaction of the countries in the following manner.[20] The DSI keeps records in terms of two possible states of the trade relationship, "cooperative" and "dispute." At the start of any period, it is assumed that either there is no dispute pending, or else the DSI is in the process of resolving a dispute triggered by a violation in some prior period. I refer to the former situation as the "cooperative state," or state C. If a dispute is pending, then the period begins in the "dispute state," or state D. When a tariff agreement is violated, the DSI switches the state from C to D, and a dispute settlement process (DSP) begins, as described below. When settlement is achieved, the DSI switches the state from D back to C.

Importantly, the DSI cannot be directly manipulated by the countries involved in a dispute, so countries continue to negotiate agreements and choose tariffs as before, except their negotiation can be conditioned on the DSI's state. Therefore, the negotiation problem that countries face following a dispute history may be different than the negotiation problem they face following a cooperative history.

Rather than developing a detailed model of the DSP, KRW treat the DSP as a "black box," where the key feature is that settlement occurs with delay. For a period that begins in the D state, the dispute is resolved, and the state is switched to C, with probability p where p is exogenous and is meant to capture the idea that dispute resolution may entail costs including delay. I will follow an alternative and equivalent convention by assuming that the state is switched back to the "cooperative state" T periods after a dispute is initiated.

[20] See KRW Section 5.1 for more details.

Thus the timing of actions is the following. If the countries are in state C at the start of period t, they choose any agreement that is supportable in state C and communicate the agreement to the DSI. As long as their tariff choices adhere to the agreement, they remain in state C at the start of period $t + 1$. If one or both countries defect from the agreement, however, a dispute arises, and the state is switched to D at the start of period $t + 1$.

If the countries are in state D at the start of period t, the state will only be switched back to C if $t - 1$ was the Tth period since the beginning of the dispute. In this case, the countries immediately negotiate an agreement supportable in the cooperative state and communicate it to the DSI. If the dispute is unresolved, the state remains D through the start of period $t + 1$, irrespective of what tariffs the countries select in the current period. In this event, the countries choose an agreement from among those that are supportable in the dispute state.

KRW define a recurrent agreement to be a subgame perfect equilibrium in which, in each period, the continuation value is consistent with this theory of negotiation. This requires, first, that countries agree to do as well as possible in each state; and second, that agreement is recurrent, in that continuation payoffs are always drawn from those that are supportable in the current state, but the countries are unable to alter the state as part of their agreement. The solution concept I employ here is that of the maximal recurrent agreement; that is, the recurrent agreement that maximizes the welfare of the executives, who I assume for simplicity are social welfare maximizers.

6.2 Trade Agreements with External Enforcement

Standard repeated-game models have one player in each country; here there are three, each with distinctive roles that mirror those laid out in the stage game. To review, in each period, the executives can re-negotiate the trade agreement, the legislature can break the trade agreement and set trade-war tariffs, and the lobby can choose whether or not to exert lobbying effort and how much effort to exert.

Given that each trading partner submits to the DSI, we can determine the repeated-game incentives in each state. The executives will jointly maximize social welfare given the state, but have no opportunity to affect the state other than to choose tariffs that are supportable. Thus the executives maximize joint welfare subject to the incentive constraints of the other players. Again, because of symmetry and separability, it suffices to restrict attention to the home country.

In state D, no action of either the lobby or the legislature will change the state; that is, the continuation payoffs will be the same regardless of their actions. Since future payoffs will not be impacted by current actions, the legislature has no incentive to choose anything other than its static best response. Thus the only tariffs that can be supported in state D are the static best responses to the lobby's choice e_b.

The lobby faces an analogous problem. Because nothing the lobby does can impact the disposition of the DSP, it will choose the effort level that maximizes static profits. Thus the unique tariffs that are supportable in state D are the $\boldsymbol{\tau^n}$ that are derived in Section 3.1.

The supportability conditions in state C are quite different. As before, I assume that one legislature is randomly assigned the opportunity to break the agreement in any given period. This implies the following constraint on the trade agreement tariffs $\boldsymbol{\tau^a}$:

$$W(\gamma(e_b), \boldsymbol{\tau^a}) + \delta V_{ML}^C \geq W(\gamma(e_b), \tau^R(\tau^{*a})), \tau^{*a}) + \delta V_{ML}^D$$

where V_{ML}^C is the continuation value of the median legislator in the cooperative state and τ^R is the unilateral best response. If the punishment is T periods in the dispute state (where only trade-war tariffs can be chosen), then the only part of the continuation values that need be considered are the next T periods because after T periods, the relationship will revert back to cooperation in either state and so the continuation value will be the same from period $T+1$ on. When in state C in the future, the executives will choose the same trade-agreement tariffs because they will maximize welfare subject to the same supportability conditions; in state D, the argument above shows that $\boldsymbol{\tau^n}$ must be chosen. Therefore we have[21]

$$W(\gamma(e_b), \boldsymbol{\tau^a}) + \frac{\delta - \delta^{T+1}}{1-\delta} W(\gamma(e_b), \boldsymbol{\tau^a}) \geq W(\gamma(e_b), \tau^R(\tau^{*a})), \tau^{*a}) + \frac{\delta - \delta^{T+1}}{1-\delta} W(\gamma(e_b), \boldsymbol{\tau^n}) \quad (11)$$

and

$$\pi(\tau^a) + \frac{\delta - \delta^{T+1}}{1-\delta} \pi(\tau^a) \geq \pi(\tau^R(\tau^{*a})) + \frac{\delta - \delta^{T+1}}{1-\delta} \left[\pi(\tau^n) - e_n\right] - e_b \quad (12)$$

Because the countries will not be able to do anything to change the disposition of the DSI after a dispute has been triggered, it is only these constraints for T-length punishments that must be checked; once a punishment has been triggered, the dispute-state incentive conditions are the relevant ones.

6.3 Trade Agreement Structure

We can write the executives' joint problem as

$$\max_{\boldsymbol{\tau^a}} \frac{\boldsymbol{W_E(\tau^a)}}{1-\delta} \quad \text{subject to (14) and (15)} \quad (13)$$

$$\frac{\delta - \delta^{T+1}}{1-\delta} \left[W(\gamma(e_b), \boldsymbol{\tau^a}) - W(\gamma(e_b), \boldsymbol{\tau^n})\right] \geq W(\gamma(e_b), \tau^R(\tau^{*a})), \tau^{*a}) - W(\gamma(e_b), \boldsymbol{\tau^a}) \quad (14)$$

[21] Note that $\delta + \delta^2 + \ldots + \delta^i = \sum_{t=1}^{i} = \sum_{t=1}^{\infty} - \sum_{t=i+1}^{\infty} = \frac{\delta}{1-\delta} - \frac{\delta^{i+1}}{1-\delta} = \frac{\delta - \delta^{i+1}}{1-\delta}$.

$$e_b \geq \pi(\tau^R(\tau^{*a})) - \pi(\tau^a) + \frac{\delta - \delta^{T+1}}{1-\delta}\left[\pi(\tau^n) - e_n - \pi(\tau^a)\right] \tag{15}$$

Where Inequalities 14 and 15 are simple rearrangements of 11 and 12.

To understand how the executives optimally structure trade agreements, we must first examine the incentives of the lobbies and how the legislatures make decisions regarding breach of the trade agreement. The symmetric structure of the model permits restriction of attention to the home country.

I will consider the economically interesting case in which, for a given δ and T, there exists a non-trivial trade agreement in the absence of lobbying, that is, one in which the lowest supportable cooperative tariffs are strictly lower than the trade-war (i.e. non-cooperative) level. When this condition holds, we will see that the logic is strikingly similar to that of the one-shot model under uncertainty discussed in Section 5.2. If this is not the case, the lobby has no incentive to be active and the extra constraint implied by the presence of the lobby does not bind.

In state C, the lobby has a two-stage problem. First, for the given $\boldsymbol{\tau^a}$, δ and T, it calculates the minimum e_b required to induce the legislature to break the trade agreement. Call this minimum effort level $\overline{e}_b(\boldsymbol{\tau^a})$. Again, this calculation of precise indifference is possible because I have assumed here that the political process is certain.

The e_b required to break the agreement will produce a "cheater's payoff" of $\pi(\tau^R(\overline{e}_b))$. The lobby will then compare its current and future payoffs from inducing a dispute net of lobbying effort (that is, $\pi(\tau^R(\overline{e}_b)) + \delta V_L^D - \overline{e}_b$) to the profit stream from the trade agreement with no lobbying effort ($\pi(\tau^a) + \delta V_L^C$). With the appropriate substitutions and rearrangements, this is Condition (15) evaluated at $\overline{e}_b$. If the former is larger, it induces the cheapest possible break; if the latter is larger, the lobby chooses to be inactive and the agreement remains in force.

The executives maximize social welfare by choosing the lowest tariffs such that the trade agreement they negotiate remains in force. Thus they must raise tariffs to the point that makes the lobby indifferent between exerting effort $\overline{e}_b(\boldsymbol{\tau^a})$ and disengaging completely,[22] provided that this also satisfies the legislative constraint. By construction, the legislative constraint will always be satisfied. Because $\overline{e}_b(\boldsymbol{\tau^a})$ is calculated to make the median legislator indifferent between cooperating and initiating a dispute, when the lobby is disengaged ($e_b = 0$) the median legislator cannot prefer to break the agreement since her preferred tariff is lower than at $\overline{e}_b(\boldsymbol{\tau^a})$.

Thus I have shown the following result.

Result 5. *In the case of political certainty, the equilibrium trade agreement will induce zero lobbying effort and will never be subject to dispute. The executives will choose the minimum tariff level that*

[22]Here I assume that the lobby does not exert effort when indifferent; if one were to assume the opposite, tariffs would have to be raised an extra ε.

induces the lobby to choose $e_b = 0$.

At the equilibrium tariffs, the lobby's constraint will bind, while the legislature's will not. The cost of provoking a dispute, however, is derived from the legislature's constraint, which is then made slack when the lobby is disengaged.

For a given δ and T, the presence of political pressure from the lobby can remove the possibility of trade-policy cooperation. That is, it is possible that in a case where the lowest supportable tariffs in an environment with no lobbying are strictly smaller than the trade-war tariffs, a lobby would find it profitable to exert effort to provoke disputes for any trade agreement short of the trade-war level. The key intuition is that what is a sufficient "punishment" in terms of T to prevent the legislature from defecting from the trade agreement may very well make provoking that dispute very attractive to the lobby, even relative to what it must pay to provoke that dispute. This idea will be made precise in what follows.

6.4 Optimal Dispute Resolution

In an environment without lobbying, KRW show that social welfare increases (that is, trade-agreement tariffs can be reduced) as punishments are made stronger. This can be seen here if we restrict attention to the legislature's constraint:

$$\frac{\delta - \delta^{T+1}}{1-\delta}\left[W(\gamma(e_b), \boldsymbol{\tau^a}) - W(\gamma(e_b), \boldsymbol{\tau^n})\right] \geq W(\gamma(e_b), \tau^R(\tau^{*a})), \tau^{*a}) - W(\gamma(e_b), \boldsymbol{\tau^a})$$

This constraint is made less binding as T increases—that is, as we raise the number of periods of punishment. The intuition is straightforward and in line with standard repeated-game models of the prisoner's dilemma: the per-period punishment is felt for more periods as the one period of gain from defecting remains the same. Thus larger deviation payoffs can be supported as T increases.

Lemma 6. *The slackness of the legislative constraint is increasing in T.*

Thus the model with no lobby gave no model-based prediction about the optimal length of punishment. Longer is better, but there are renegotiation constraints that must be taken into account that are outside of the model as well as other concerns.

The logic of the lobby's constraint works in the opposite direction in relation to T:

$$e_b \geq \pi(\tau^R(\tau^{*a})) - \pi(\tau^a) + \frac{\delta - \delta^{T+1}}{1-\delta}\left[\pi(\tau^n) - e_n - \pi(\tau^a)\right]$$

Here, the lobby benefits in each dispute period, and so the total profit from a dispute is increasing in T. Thus we have

Lemma 7. *The slackness of the lobbying constraint is decreasing in T.*

The interaction of the impact of the length of the punishment on these two constraints is quite nuanced, and in many cases, adding the lobbying constraint provides a prediction for the optimal T.

As the executives choose the smallest $\boldsymbol{\tau^a}$ that makes the lobby indifferent at $\overline{e}_b(\boldsymbol{\tau^a})$, we must analyze the lobby's constraint (Expression 15) evaluated at $\overline{e}_b(\boldsymbol{\tau^a})$ to determine the optimal T. The derivative of this constraint with respect to T is

$$\frac{-\frac{\delta^{T+1}ln\delta}{1-\delta}\left[W(\gamma(\overline{e}_b),\boldsymbol{\tau^a})-W(\gamma(\overline{e}_b),\boldsymbol{\tau^n})\right]}{\frac{\partial\gamma}{\partial e}\left[\pi(\tau^R(\gamma(\overline{e}_b)))-\pi(\tau^a)\right]+\frac{\delta-\delta^{T+1}}{1-\delta}\frac{\partial\gamma}{\partial e}\left[\pi(\tau^n)-\pi(\tau^a)\right]}+\frac{\delta^{T+1}ln\delta}{1-\delta}\left[\pi(\tau^n)-e_n-\pi(\tau^a)\right] \tag{16}$$

The first term is the change in the required payment to break the trade agreement. All of its bracketed terms are positive, so by Assumption 1, it is positive; however, it is also decreasing in T. The second term, the change in the lobby's net profit from breaking the agreement, is negative for all values of τ^a except those that are very close to the trade-war level. The optimal punishment length trades off the effects of T on these two key objects.

If Expression 16 is negative for all T, the constraint is most slack at $T = 0$, which might seem to be at odds with incentivizing cooperation by the legislature; however, unless the legislature is so biased toward the lobbying industry that its most-preferred tariff at $e_b = 0$ is above the trade-agreement level that is required to disengage the lobby, the legislature will have no incentive to defect from the agreement.

On the other hand, if this expression is positive for all T, the constraint is most slack as T approaches infinity and so we are in a case similar to that of the model without lobbying where an ad-hoc renegotiation constraint determines the upper bound on the punishment length. Here, the legislative constraint outweighs concerns about provoking lobbying effort. Perhaps most interesting are intermediate cases where the optimal T is interior—that is, the punishment length optimally balances the need to punish legislators for deviating with that of not rewarding lobbies too much for provoking a dispute.

The key intuition for distinguishing between the above situations comes from examining the properties of the political process. If $\frac{\partial\gamma}{\partial e}$ is very small, Expression 16 may be positive for all T, indicating that the lobby is so weak that concerns about its incentives are completely overshadowed by those concerning the legislature's incentives as in repeated games with just one player in each country. For intermediate values of $\frac{\partial\gamma}{\partial e}$, the positive term is more likely to dominate in the beginning and lead to an interior value for the optimal T. Very large values for $\frac{\partial\gamma}{\partial e}$ make it more likely that the derivative is negative everywhere, leading to a prescription of $T = 0$—i.e. the lobby is so strong that demotivating it by removing the punishment altogether is the most important consideration.

For a given effort level, this derivative will be smaller when the lobby is less influential; that is, when a marginal increase in e_b creates a smaller increase in the legislature's preferences. Thus when the lobby is less powerful ($\frac{\partial \gamma}{\partial e}$ is smaller), longer punishments are desirable. If the lobby is very influential, the same length of punishment will have a larger impact on the legislature's decisions (the impact on the gain accruing to the lobby does not change). This tips the balance in favor of shorter punishments.

Result 6. *In the case of political certainty, if non-trivial cooperation is possible in the presence of a lobby, the optimal punishment scheme is finite when the influence of lobbying on legislative preferences is sufficiently strong (*$\frac{\partial \gamma}{\partial e}$ *is sufficiently high).*

This helps to complete the comparison to the standard repeated-game model without lobbying. There, grim-trigger (i.e. infinite-period) punishments are most helpful for enforcing cooperation (cfr. KRW's Proposition 4). I have shown here that shorter punishments are more likely to be optimal in the presence of lobbying. This is because long punishments incentivize the lobby to exert more effort to break trade agreements.

However, the model with no lobbies and one with very strong lobbies can be seen as two ends of a spectrum parameterized by the strength of the lobby. The optimal punishment will lengthen as the political influence of the lobby wanes and the desire to discipline the legislature becomes more important relative to the need to de-motivate the lobby.

7 Conclusion

I have shown that the legislature both breaks trade agreements with a higher probability and sets higher trade war tariffs when lobbying activity increases, while the probability with which it breaks agreements decreases in the domestic trade agreement tariff. Because the lobby decreases its effort in response to higher trade agreement tariffs, the executives face a trade-off between the welfare derived while a trade agreement is in force and the probability with which the agreement is broken.

I have also shown that in a government in which power is separated between branches of government, a less politically-motivated executive can utilize an international trade agreement to reduce the political pressure on the legislative branch and therefore increase the probability that the agreement will remain in force. Thus, in a model with a richer description of government structure, a political-commitment role for trade agreements can arise.

The executives' incentive to raise tariffs in order to reduce lobbying effort, as well as a more realistic legislative structure, helps to explain the empirical finding in the Protection for Sale literature that levels of protection and associated deadweight losses are too high relative to lobbying expenditure given the high estimates for governments' weighting of social welfare. I have shown that both serve to mediate the relationship between preferences for contributions relative to social welfare and the tariffs that are provided. The former has a particularly intuitive facet: the observed lobbying expenditure levels may in fact be low *because* tariffs have been raised sufficiently high to prevent political pressure and the increased risk of a costly trade disruption it engenders.

That lobbying and tariff levels are related in systematic ways to the amount of political uncertainty present suggests interesting avenues for future empirical work. Several directions for future theoretical work also seem potentially fruitful, including removing the assumption of perfect enforceability and supporting cooperation through repeated interaction and generalizing the model to the case of multiple lobbies.

I have also demonstrated that integrating the separation-of-powers policy-making structure with lobbying into a theory of recurrent trade agreements adds an extra constraint to the standard problem. While the constraint on the key repeated-game player, which here is the legislature, is loosened by increasing the punishment length, this new constraint due to the presence of lobbying becomes tighter as the punishment becomes more severe since the lobby *prefers* punishment periods in which tariffs, and thus its profits, are higher. It thus has increased incentive to exert effort as the punishment lengthens.

In a model with only the legislature, welfare increases with the punishment length. Here, this result only occurs if the lobby is sufficiently weak. As the lobby's political influence grows, the optimal punishment length becomes shorter—in the race between incentivizing the legislature and the lobby, the need to de-motivate the lobby begins to win. This suggests that a key consideration when designing the length of dispute settlement procedures is how to optimally balance the incentives of those capable of breaking trade agreements with the political forces who influence them, *given* the strength of that influence.

8 Appendix

Lemma 8. *When prices are linear in tariffs, the second-order condition for the legislature's problem when setting trade-war tariffs holds for all non-prohibitive tariffs given that the tariff elasticity of supply is less than unity.*

Proof: The first order condition can be rewritten as

$$-D(P_X)\frac{\partial P_X}{\partial \tau} + \gamma(e_n,\theta_n)Q_X(P_X)\frac{\partial P_X}{\partial \tau} + [D(P_X) - Q_X(P_X)] + \tau\left(\frac{\partial D(P_X)}{\partial \tau} - \frac{\partial Q_X(P_X)}{\partial \tau}\right) = 0$$

The required second order condition is that the following is negative:

$$-D(P_X)\frac{\partial^2 P_X}{\partial \tau^2} - \frac{\partial D(P_X)}{\partial \tau}\frac{\partial P_X}{\partial \tau} + \gamma(e_n,\theta_n)Q_X(P_X)\frac{\partial^2 P_X}{\partial \tau^2} + \gamma(e_n,\theta_n)\frac{\partial Q_X(P_X)}{\partial \tau}\frac{\partial P_X}{\partial \tau}$$
$$+2\left[\frac{\partial D(P_X)}{\partial \tau} - \frac{\partial Q_X(P_X)}{\partial \tau}\right] + \tau\left(\frac{\partial^2 D(P_X)}{\partial \tau^2} - \frac{\partial^2 Q_X(P_X)}{\partial \tau^2}\right)$$

$\gamma(e_n,\theta_n)$ is endogenous, so we must find a way to bound it. Because the lobby receives no gains if the tariff is raised beyond its prohibitive level (that is when $D(P_X) = Q_X(P_X)$), it has no incentive to exert effort above the level that induces the $\gamma(e_n,\theta_n)$ that leads to the prohibitive tariff. Setting $D(P_X) = Q_X(P_X)$ in the first order condition, this is

$$\gamma(e_n,\theta_n) = 1 - \frac{\tau\left(\frac{\partial D(P_X)}{\partial \tau} - \frac{\partial Q_X(P_X)}{\partial \tau}\right)}{Q_X(P_X)\frac{\partial P_X}{\partial \tau}}$$

If prices are linear in tariffs, the second order terms are zero, and substituting the above expression for $\gamma(e_n,\theta_n)$, we arrive at

$$-\frac{\partial D(P_X)}{\partial \tau}\frac{\partial P_X}{\partial \tau} + \frac{\partial Q_X(P_X)}{\partial \tau}\frac{\partial P_X}{\partial \tau} - \tau\left(\frac{\partial D(P_X)}{\partial \tau} - \frac{\partial Q_X(P_X)}{\partial \tau}\right)\frac{\frac{\partial Q_X(P_X)}{\partial \tau}}{Q_X(P_X)} + 2\left[\frac{\partial D(P_X)}{\partial \tau} - \frac{\partial Q_X(P_X)}{\partial \tau}\right]$$

Because $P_X = P_X^W + \tau$, $\frac{\partial P_X}{\partial \tau} = \frac{\partial P_X^W}{\partial \tau} + 1$; together with $\frac{\partial P_X^W}{\partial \tau} < 0$, this implies $\frac{\partial P_X}{\partial \tau} < 1$. Therefore the previous expression is bounded above by

$$-\tau\left(\frac{\partial D(P_X)}{\partial \tau} - \frac{\partial Q_X(P_X)}{\partial \tau}\right)\frac{\frac{\partial Q_X(P_X)}{\partial \tau}}{Q_X(P_X)} + \left[\frac{\partial D(P_X)}{\partial \tau} - \frac{\partial Q_X(P_X)}{\partial \tau}\right]$$

Since $\frac{\partial D(P_X)}{\partial \tau} - \frac{\partial Q_X(P_X)}{\partial \tau} < 0$, the second order condition is negative as long as $\frac{\tau}{Q_X(P_X)}\frac{\partial Q_X(P_X)}{\partial \tau} < 1$. If prices are not linear in the tariff, additional conditions are required. ■

Proof of Lemma 1:
By the implicit function theorem, $\frac{\partial \tau^n}{\partial \gamma} = -\frac{\frac{\partial FOC}{\partial \gamma}}{\frac{\partial FOC}{\partial \tau^n}}$. We have $\frac{\partial FOC}{\partial \gamma} = Q_X(P_X)\frac{\partial P_X}{\partial \tau}$ from the proof of Lemma 8. This is always positive. Lemma 8 also shows that $\frac{\partial FOC}{\partial \tau^n}$ is negative everywhere. ■

Proof of Result 1:
Substituting from Equation 1, Equation 6 can be re-written as

$$b(e_b,\boldsymbol{\tau^a},\boldsymbol{\tau^n}) = \Pr[CS_X(\tau^n) + CS_Y(\tau^{*n}) + \gamma(e_b,\theta_b)\cdot PS_X(\tau^n) + PS_Y(\tau^{*n}) + TR(\tau^n) >$$
$$CS_X(\tau^a) + CS_Y(\tau^{*a}) + \gamma(e_b,\theta_b)\cdot PS_X(\tau^a) + PS_Y(\tau^{*a}) + TR(\tau^a)|e_b] \quad (17)$$

Rearranging, we have

$$b(e_b, \boldsymbol{\tau^a}, \boldsymbol{\tau^n}) = \Pr\Big[\frac{CS_X(\tau^n)+CS_Y(\tau^{*n})+PS_X(\tau^n)+PS_Y(\tau^{*n})+TR(\tau^n)-CS_X(\tau^a)-CS_Y(\tau^{*a})-PS_X(\tau^a)-PS_Y(\tau^{*a})-TR(\tau^a)}{PS_X(\tau^a)-PS_X(\tau^n)} + 1 < \gamma(e_b, \theta_b) | e_b \Big] \quad (18)$$

The left side of the inequality in Expression 18 does not depend on e_b. But Assumption 1, the right side of the inequality is increasing and concave in e_b. Thus $b(e_b, \boldsymbol{\tau^a}, \boldsymbol{\tau^n})$ is increasing and concave in e_b. ■

Proof of Lemma 2:

It must be shown that the left hand side of the inequality in Expression 18 is decreasing in τ^{*a}. The derivative of this quantity with respect to τ^{*a} is

$$\frac{-\left(PS_X(\tau^a) - PS_X(\tau^n)\right)\left(\frac{\partial CS_Y(\tau^{*a})}{\partial \tau^{*a}} + \frac{\partial PS_Y(\tau^{*a})}{\partial \tau^{*a}}\right)}{\left(PS_X(\tau^a) - PS_X(\tau^n)\right)^2} = \frac{\frac{\partial CS_Y(\tau^{*a})}{\partial \tau^{*a}} + \frac{\partial PS_Y(\tau^{*a})}{\partial \tau^{*a}}}{PS_X(\tau^n) - PS_X(\tau^a)}. \quad (19)$$

The reduction in price under the agreement causes a decrease in producer surplus and an increase in consumer surplus. Because Y is the export good, the decrease in producer surplus is larger than the increase in consumer surplus, making the numerator, and thus the entire quantity (since producer surplus is increasing in τ), negative. ■

Proof of Lemma 3:

Using the logic of the proof of Lemma 2, the effect on the break probability is determined by the sign of the derivative of the left hand side of the inequality in Expression 18 with respect to τ^a; to show that the break probability is decreasing in τ^a, I must demonstrate that this derivative is positive. Labeling the numerator of that expression $[W(\boldsymbol{\tau^n}) - W(\boldsymbol{\tau^a})]$ (for the change in social welfare), this derivative can be written

$$\frac{\left(PS_X(\tau^n) - PS_X(\tau^a)\right)\left(\frac{\partial CS_X(\tau^a)}{\partial \tau^a} + \frac{\partial PS_X(\tau^a)}{\partial \tau^a} + \frac{\partial TR(\tau^a)}{\partial \tau^a}\right) - [W(\boldsymbol{\tau^n}) - W(\boldsymbol{\tau^a})]\frac{\partial PS_X(\tau^a)}{\partial \tau^a}}{\left(PS_X(\tau^a) - PS_X(\tau^n)\right)^2}. \quad (20)$$

$(PS_X(\tau^n) - PS_X(\tau^a))$ is always positive by Assumption 2. Because the optimal unilateral tariff for large welfare-maximizing governments is positive (call it τ^O), $\left(\frac{\partial CS_X(\tau^a)}{\partial \tau^a} + \frac{\partial PS_X(\tau^a)}{\partial \tau^a} + \frac{\partial TR(\tau^a)}{\partial \tau^a}\right)$ is increasing up to τ^O and decreasing above it. Thus the first summand is increasing up until τ^O and decreasing thereafter.

Because total social welfare is maximized at $\tau^a = \tau^{*a} = 0$, $W(\boldsymbol{\tau^n}) - W(\boldsymbol{\tau^a})$ is always negative, whereas producer surplus is increasing in τ^a, so the second summand is positive everywhere. With a positive denominator, we thus have that the derivative is positive on $[0, \tau^O]$.

It is also positive over the remaining (τ^O, τ^n). To see this, notice that one can add

$$\left(\tilde{\Gamma} - 1\right) \frac{\partial PS_X(\tau^a)}{\partial \tau^a} \left(PS_X(\tau^n) - PS_X(\tau^a)\right)$$

to the first summand and subtract it from the second. For any particular value of $\tilde{\tau}^a$, one can choose the $\tilde{\Gamma}$ weight that would make $\tilde{\tau}^a$ the preferred unilateral tariff; this makes the derivative in the first summand zero. Having subtracted the same quantity from the second summand modifies the welfare difference in the second summand to be maximized at $\tilde{\tau}^a$ so that this term is always negative, thus ensuring the result. ■

Proof of Result 2:

Proof is via the Implicit Function Theorem using the lobby's first order condition, Equation 7, referred to here as FOC_L.

$$\frac{\partial e_b}{\partial \tau^a} = -\frac{\frac{\partial FOC_L}{\partial \tau^a}}{\frac{\partial FOC_L}{\partial e_b}} = \frac{\frac{\partial b}{\partial e_b}\frac{\partial \pi(\boldsymbol{\tau^a})}{\partial \tau^a} - \frac{\partial^2 b}{\partial e_b \partial \tau^a}\left[\pi(\tau^n) - \pi(\tau^a)\right]}{\frac{\partial^2 b}{\partial {e_b}^2}\left[\pi(\tau^n) - \pi(\tau^a)\right]}$$

From the conclusion of the Proof of Result 1, we can easily take the cross-derivative to see that $\frac{\partial^2 b}{\partial e_b \partial \tau^a}$ is zero since $\gamma(e_b, \theta_b)$ does not depend on τ^a. $\frac{\partial b}{\partial e_b}$ is positive and $\frac{\partial^2 b}{\partial {e_b}^2}$ negative by Result 1 while $\frac{\partial \pi(\boldsymbol{\tau^a})}{\partial \tau^a}$ is positive by construction.

Because $\pi(\tau)$ is increasing everywhere, $[\pi(\tau^n) - e_n - \pi(\tau^a)]$ is positive for all but very large values of τ^a, that is for all τ^a such that $\pi(\tau^n) - e_n > \pi(\tau^a)$. For these values, $\frac{\partial e_b}{\partial \tau^a} < 0$. When τ^a rises above this level, it is no longer in the lobby's interest to ask to have the agreement broken so $e_b = 0$ and $\frac{\partial e_b}{\partial \tau^a} = 0$ Thus $\frac{\partial e_b}{\partial \tau^a} \leq 0$. ■

Proof of Corollary 1:

As in the proof of Result 2, I employ the Implicit Function Theorem on the lobby's first order condition, Equation 7, denoted FOC_L.

$$\frac{\partial e_b}{\partial \tau^{*a}} = -\frac{\frac{\partial FOC_L}{\partial \tau^{*a}}}{\frac{\partial FOC_L}{\partial e_b}} = \frac{\frac{\partial b}{\partial e_b}\frac{\partial \pi(\boldsymbol{\tau^a})}{\partial \tau^{*a}} - \frac{\partial^2 b}{\partial e_b \partial \tau^{*a}}\left[\pi(\tau^n) - e_n - \pi(\tau^a)\right]}{\frac{\partial^2 b}{\partial {e_b}^2}\left[\pi(\tau^n) - e_n - \pi(\tau^a)\right]}$$

From the conclusion of the Proof of Result 1, we can take the cross-derivative to see that $\frac{\partial^2 b}{\partial e_b \partial \tau^{*a}}$ is zero since $\gamma(e_b, \theta_b)$ does not depend on τ^{*a}. $\frac{\partial \pi(\boldsymbol{\tau^a})}{\partial \tau^{*a}}$ is also zero: because of the separability between the sectors, profits in the import-competing sector do not depend on τ^{*a}. Thus $\frac{\partial e_b}{\partial \tau^{*a}} = 0$. ■

Proof of Lemma 4:

Again, I want to show how the inequality in Expression 18 changes, now with respect to both τ^a and τ^{*a}, so I add the derivatives in Expressions 19 and 20 to get

$$\frac{\left(PS_X(\tau^n) - PS_X(\tau^a)\right)\left(\frac{\partial W_X(\boldsymbol{\tau^a})}{\partial \tau^a} + \frac{\partial W_X(\boldsymbol{\tau^a})}{\partial \tau^{*a}}\right) - \left[W(\boldsymbol{\tau^n}) - W(\boldsymbol{\tau^a})\right]\frac{\partial PS_X(\tau^a)}{\partial \tau^a}}{\left(PS_X(\tau^n) - PS_X(\tau^a)\right)^2}.$$

where $\frac{\partial W_X(\boldsymbol{\tau^a})}{\partial \tau^a} + \frac{\partial W_X(\boldsymbol{\tau^a})}{\partial \tau^{*a}} = \frac{\partial CS_X(\tau^a)}{\partial \tau^a} + \frac{\partial PS_X(\tau^a)}{\partial \tau^a} + \frac{\partial TR(\tau^a)}{\partial \tau^a} + \frac{\partial CS_Y(\tau^{*a})}{\partial \tau^{*a}} + \frac{\partial PS_Y(\tau^{*a})}{\partial \tau^{*a}}$ is the total derivative of social welfare. Since social welfare is maximized at $\boldsymbol{\tau^a} = (0,0)$,[23] this is negative $\forall \boldsymbol{\tau} \in (\mathbf{0}, \boldsymbol{\tau^n}]$; note that it is 0 at $\mathbf{0}$ and vanishingly small for very small tariffs.

Thus the first summand in the numerator is zero at $\boldsymbol{\tau^a} = \mathbf{0}$ and increasingly negative as $\boldsymbol{\tau^a}$ increases. The second summand is positive everywhere because social welfare, W, is lowest at $\boldsymbol{\tau^n}$ and producer surplus is increasing everywhere. Thus the numerator is positive at $\mathbf{0}$ and at least for very small $\boldsymbol{\tau^a}$

It is also positive for all other values of $\boldsymbol{\tau^a}$ strictly below $\boldsymbol{\tau^n}$. Just as in the proof of Lemma 3, one one can add

$$\left(\tilde{\Gamma} - 1\right)\frac{\partial PS_X(\tau^a)}{\partial \tau^a}\left(PS_X(\tau^n) - PS_X(\tau^a)\right)$$

to the first summand and subtract it from the second. For any particular value of $\tilde{\boldsymbol{\tau^a}}$, one can choose the $\tilde{\Gamma}$ weight that would make $\tilde{\boldsymbol{\tau^a}}$ the politically optimal tariff; this makes the derivative in the first summand zero. Having subtracted the same quantity from the second summand modifies the welfare difference in the second summand to be maximized at $\tilde{\boldsymbol{\tau^a}}$ so that this term is always negative, thus ensuring the result.

Because the denominator is positive, the entire expression is positive for all $\boldsymbol{\tau^a} < \boldsymbol{\tau^n}$. ■

Proof of Result 3:

$$\frac{\partial B(\boldsymbol{\tau^a})}{\partial \tau^a} + \frac{\partial B(\boldsymbol{\tau^a})}{\partial \tau^{*a}} = \frac{\partial b}{\partial e_b}\frac{\partial e_b}{\partial \tau^a} + \frac{\partial b}{\partial e_b}\frac{\partial e_b}{\partial \tau^{*a}} + \frac{\partial b}{\partial \tau^a} + \frac{\partial b}{\partial \tau^{*a}}$$

The first summand is negative by Results 1 and 2. As shown in Corollary 1, the second summand is zero because $\frac{\partial e_b}{\partial \tau^{*a}}$ is zero. Taken together, the final two summands are negative by Lemma 4. Thus the entire expression is negative. ■

Conditions for Interior Solution to Executives' Problem

The first order condition for maximizing joint surplus with respect to τ^a and τ^{*a} when the two are

[23]Note, this is identical to the result that joint social welfare is maximized at zero tariffs because of symmetry.

constrained to be equal is

$$\{1 - o \cdot B(\boldsymbol{\tau^a}) - o^* \cdot B^*(\boldsymbol{\tau^a})\} \left\{ \frac{\partial \boldsymbol{W_E}(\boldsymbol{\tau^a})}{\partial \tau^a} + \frac{\partial \boldsymbol{W_E}(\boldsymbol{\tau^a})}{\partial \tau^{*a}} \right\}$$
$$+ \left\{ o \cdot \left[\frac{\partial B(\boldsymbol{\tau^a})}{\partial \tau^a} + \frac{\partial B(\boldsymbol{\tau^a})}{\partial \tau^{*a}} \right] + o^* \cdot \left[\frac{\partial B^*(\boldsymbol{\tau^a})}{\partial \tau^a} + \frac{\partial B^*(\boldsymbol{\tau^a})}{\partial \tau^{*a}} \right] \right\} [\boldsymbol{W_E}(\boldsymbol{\tau^n}) - \boldsymbol{W_E}(\boldsymbol{\tau^a})] = 0$$

Because there is no benefit to setting $\boldsymbol{\tau^a}$ below the executives' preferred level, which I will denote $\boldsymbol{\tau^E}$, I will take the choice space to be $[\boldsymbol{\tau^E}, \boldsymbol{\tau^n}]$. Note that for $\gamma_E = 1$, $\boldsymbol{\tau^E} = 0$.

To demonstrate that the executives do not choose $\boldsymbol{\tau^a} = \boldsymbol{\tau^E}$, I must show that the left side of the above equation is positive at $\boldsymbol{\tau^a} = \boldsymbol{\tau^E}$. Assumption 2 and Result 3 combined with symmetry ensure that the first term of the second summand is negative. That executive welfare is maximized at $\boldsymbol{\tau^E}$ ensures that the term multiplying it is also negative as well as that $\frac{\partial \boldsymbol{W_E}(\tau^E)}{\partial \tau^a} + \frac{\partial \boldsymbol{W_E}(\tau^E)}{\partial \tau^{*a}}$ is zero. Therefore the derivative of joint executive welfare is positive at $\boldsymbol{\tau^E}$. ■

9 References

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