Audience Features and the Strategic Timing of Trade Disputes

Theoretical and Empirical Appendix

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Appendix 1: Theoretical Model

Proposition 1. *A CCE exists if and only if:*

(i) $Pr(H = B| \sim D)[u_A(t^*_{2b}) - u_A(t^*_{1b})] \leq m \leq Pr(H = B|D)[u_A(t^*_{2b}) - u_A(t^*_{1b})]$

(ii) $Pr(H = B|D) > Pr(H = B| \sim D) > 0$.

Proof of Proposition 1: Existence of Credible Commitments Equilibrium. Where necessary, I index the optimal initial and final policies chosen by bad governments with the subscript b: t^*_{1b} and t^*_{2b}. For good governments, I use the subscript g. Where there is no need to distinguish between government types, I omit the subscripts.

For the audience to choose $M|D$, it must be the case that $EU_A(M)|D \geq EU_A(\sim M)|D$. Rewriting the audience's expected utilities:

$$Pr(H = A|D)u_A(A) + Pr(H = B|D)u_A(t^*_{2b}) - m \geq Pr(H = A|D)u_A(A) + Pr(H = B|D)u_A(t^*_{1b})$$
$$m \leq Pr(H = B|D)[u_A(t^*_{2b}) - u_A(t^*_{1b})]$$

where $Pr(H = B|D) = \frac{\lambda F(t^*_{1b} - t^*_{2b})}{\lambda F(t^*_{1b} - t^*_{2b}) + (1-\lambda)F(0)}$.

For the audience to choose $\sim M| \sim D$, it must be the case that $EU_A(\sim M)| \sim D \geq EU_A(M)| \sim D$. As above, the audience's expected utilities are:

$$Pr(H = A| \sim D)u_A(A) + Pr(H = B| \sim D)u_A(t^*_{1b}) \geq Pr(H = A| \sim D)u_A(A) + Pr(H = B| \sim D)u_A(t^*_{2b}) - m$$
$$m \geq Pr(H = B| \sim D)[u_A(t^*_{2b}) - u_A(t^*_{1b})]$$

where $Pr(H = B| \sim D) = \frac{\lambda[1 - F(t^*_{1b} - t^*_{2b})]}{\lambda[1 - F(t^*_{1b} - t^*_{2b})] + (1-\lambda)[1 - F(0)]}$.

Derivations of t^*_{1b} and t^*_{2b}, as well as optimal policies chosen by good governments and dispute probabilities are shown in the proofs for subsequent propositions. □

Proposition 2. *The optimal post-mobilization policy, t_2^* satisfies:* $\frac{\alpha}{1-\alpha} = \frac{u'_H(t_2^*)}{-u'_A(t_2^*)}$.

Corrollary 1. *In equilibrium:*
(i) $\frac{\partial t_2^*}{\partial A} > 0$, *(ii)* $\frac{\partial t_2^*}{\partial \alpha} < 0$, *and (iii)* $\frac{\partial t_2^*}{\partial B} > 0$, *for bad home governments.*

Proof of Proposition 2: Optimal Post-mobilization policy. After mobilization, the home government faces the following optimization problem:

$$max_{t_2} \ \ \alpha u_A(t_2) + (1-\alpha)u_H(t_2)$$

The proof follows from rearranging the first order conditions of the post-mobilization maximization problem, $\alpha u'_A(t_2^*) + (1-\alpha)u'_H(t_2^*) = 0$.

The ratio of the audience and home government's marginal utilities matches the (inverse) ratio of their strength after mobilization. If the home government and audience's utility functions, u_H and u_A, were identical apart from their maximization points and were symmetrical, then the optimal policy would be an α-weighted combination of the two ideal points, $t_2^* = \alpha A + (1-\alpha)H$. For instance, this would be the case if both the home government and audience held preferences represented by the often-used quadratic loss function. If the audience and the home government share the same ideal point, $A = H$, as in the case of a "good" government, then $t_2^* = A$. □

Proposition 3. *For a fixed initial tariff, t_1, and, when $H > A$, the probability of a dispute, $\Pi(t_1)$, is: (i) decreasing in A, (ii) increasing in α, and (iii) decreasing in H.*

Proposition 4. *The home government's optimal initial policy, t_1^*, is: (i) increasing in A, (ii) decreasing in α, and (iii) increasing in H.*

Proof of Proposition 4 and 3: Probability of a Dispute and Optimal Initial Policy. Before describing optimal initial policy, I describe the probability of a dispute. The utility to the foreign government of initiating a dispute is $-t_2^* - k$, and the utility of not doing so is $-t_1$. In a CCE, the foreign government initiates a dispute if and only if their costs are lower than their expected gains:

$$k \leq t_1 - t_2^*$$

Recall, for a good home government, $t_{2g}^* = A$, and for a bad home government, $t_{2b}^* > A$. For a good home government, therefore, the foreign government only initiates a dispute if it draws a negative litigation costs, i.e. it has some extraneous benefit to initiating a dispute, apart from the potential effects on home's policies. Facing a bad home government, the benefit of a dispute comes from the effect that any subsequent audience mobilization will have on changing the initial tariff policy to a new, lower final policy. If the foreign government draws a litigation cost that is higher than the benefits from changing the home government's policy, then it will not initiate a dispute. The probability of a dispute for a particular initial policy, which I call $\Pi(t_1)$, is the probability that the foreign government draws a low enough litigation cost that it will choose to initiate a dispute.

$$\Pi(t_1) = Pr(k \leq t_1 - t_2^*) = F(t_1 - t_2^*)$$

The home government's initial optimization problem and related first order condition are:

$$max_{t_1} \quad \Pi(t_1)u_H(t_2^*) + (1 - \Pi(t_1))u_H(t_1)$$

$$max_{t_1} \quad F(t_1 - t_2^*)u_H(t_2^*) + (1 - F(t_1 - t_2^*))u_H(t_1)$$

$$[1 - F(t_1^* - t_2^*)]u'_H(t_1^*) = f(t_1^* - t_2^*)[u_H(t_1^*) - u_H(t_2^*)]$$

For a good home government, their optimal policy choice is $t_{1g}^* = A$. Good home governments can do no better by choosing a different initial policy. If the foreign government draws a negative litigation cost and initiates a dispute, then the good home government will still choose $t^*_{2g} = A$. If the foreign government draws a higher litigation cost, they will not initiate a dispute and the audience will not mobilize, leaving the home government's ideal policy in place.

Observe that for bad governments, $t^*_{1b} \in [t^*_{2b}, B]$. The home government can do no better by choosing an initial policy higher than B, such that $t_{1b} > B$. Lowering the policy to B decreases the probability of a dispute and leaves the home government better off if they avoid a dispute. Similarly, the home government can do no better by choosing a policy lower than t^*_{2b}, such that $t_{1b} < t^*_{2b}$. Raising the policy to t^*_{2b} lowers the probability of a dispute by decreasing the distance between t^*_1 and t^*_2 and leaves the home government better off if they avoid a dispute.

Rewriting the FOC for the home government's maximization problem associated with t^*_1 yields:

$$f(t^*_1 - t^*_2)[u_H(t^*_2) - u_H(t^*_1)] + [1 - F(t^*_1 - t^*_2)]u'_H(t^*_1) = 0$$

Since t^*_2 is uninfluenced by t^*_1, we can rewrite the FOC as:

$$h(t^*_1)\frac{\partial t^*_1}{\partial t^*_2} + g(t^*_2) = 0$$

where $h(t^*_1)$ is the total derivative of the FOC with respect to t^*_1 and $g(t^*_2)$ is the total derivative of the FOC with respect to t^*_2.

Rearranging yields:

$$\frac{\partial t^*_1}{\partial t^*_2} = \frac{-g(t^*_2)}{h(t^*_1)}$$

Substituting in the total derivatives, $h(t^*_1)$ and $g(t^*_2)$ yields:

$$\frac{\partial t^*_1}{\partial t^*_2} = \frac{f'(t^*_1 - t^*_2)[u_H(t^*_2) - u_H(t^*_1)] - f(t^*_1 - t^*_2)[u'_H(t^*_2) + u'_H(t^*_1)]}{f'(t^*_1 - t^*_2)[u_H(t^*_2) - u_H(t^*_1)] - 2f(t^*_1 - t^*_2)u'(t^*_1) + [1 - F(t^*_1 - t^*_2)]u''_H(t^*_1)}$$

Since $f'(k) = 0$ for the uniform distribution, this equation can be signed by observing that $u'_H > 0$ and $u''_H < 0$ for all $t \in [A, B]$. It follows that $\frac{\partial t_1^*}{\partial t_2^*} \geq 0$. This implies that t_1^* "inherits" the properties of t_2^* that are described in Corollary 1. □

Proposition 5. *If* $f(t_1^* - t_2^*)u'_H(t_2^*) \leq -[1 - F(t_1^* - t_2^*)]u''_H(t_1^*)$ *then* $\frac{\partial \Pi(t_1^*)}{\partial A} \geq 0$ *and* $\frac{\partial \Pi(t_1^*)}{\partial \alpha} \leq 0$

Proof of Proposition 5: Audience Effects on Optimal Initial Policy. This proof builds off of the proof for Proposition 4 which showed that $\frac{\partial t_1^*}{\partial t_2^*} \geq 0$. Now, we consider whether $\frac{\partial t_1^*}{\partial t_2^*} \leq 1$. If $\frac{\partial t_1^*}{\partial t_2^*} \leq 1$, then equilibrium increases in t_2^* result in *smaller* accompanying increases in t_1^*. Since k is distributed uniformly, this would imply that the post-dispute effect dominates.

Recall the expression for $\frac{\partial t_1^*}{\partial t_2^*}$ with the uniform distribution simplifies to:

$$\frac{\partial t_1^*}{\partial t_2^*} = \frac{f(t_1^* - t_2^*)[u'_H(t_2^*) + u'_H(t_1^*)]}{2f(t_1^* - t_2^*)u'(t_1^*) - [1 - F(t_1^* - t_2^*)]u''_H(t_1^*)}$$

Since Proposition 4 implies that the numerator and denominator have the same sign, for $\frac{\partial t_1^*}{\partial t_2^*} \leq 1$ it must be the case that:

$$f(t_1^* - t_2^*)[u'_H(t_2^*) + u'_H(t_1^*)] \leq 2f(t_1^* - t_2^*)u'(t_1^*) - [1 - F(t_1^* - t_2^*)]u''_H(t_1^*)$$

$$f(t_1^* - t_2^*)u'(t_2^*) \leq -[1 - F(t_1^* - t_2^*)u''(t_2^*)$$

yielding the condition stated in Proposition 5.

□

Appendix 2: Empirical Model

Following Imai and VanDyk (2005), I let the observed multinomial variable, Y_{it}, take on a distinct value depending on the status of tariff i at time t. Let $j = 1, 2, 3$ index the 3 statuses, *WTO Dispute*, *Unilateral Removal*, *In Effect*. Call $j = 3$, *In Effect*, the base category. Let $W_{it} = (W_{it1}, W_{it2})$ be a vector of 2 latent variables, associated with *WTO Dispute* and *Unilateral Removal*, for tariff i at time t. The observed variable, Y_{it} is modeled in terms of W_{itj} via:

$$Y_{it}(W_{itj}) = \begin{cases} 0 & \text{if } max(W_{it}) < 0 \\ j & \text{if } max(W_{it}) = W_{itj} > 0 \end{cases}$$

where $max(W_{it})$ represents the largest value in the vector W_{it}. The latent variables are modeled as a function of the k observed covariates.

$$W_{it} = X_{it}\beta + e_{it}, e_{it} \sim N(0, \Sigma)$$

X_{it} is a $2 \times k$ matrix of observed covariates and β is a $k \times 1$ vector of coefficients. $\Sigma = (\sigma_{lm})$ is a positive definite 2×2 matrix. For identification, the model assumes that $\sigma_{11} = 1$. The Bayesian approach implemented here uses the MCMC procedure developed by Imai and VanDyk (2005) to sample to sample from posterior distributions of β and Σ, based on particular prior distributions. I use very agnostic priors, where each element of β is distributed normally with mean 0 and variance 100.[1] For the main MNP model, I used a burn-in of 20,000 draws and kept every fourth draw from 70,000 subsequent draws.[2]

[1]Setting the prior variance to 100 means that the prior distribution is very diffuse and unlikely to influence results.

[2]For the models with calendar month and age polynomials included as covariates (described below), I set the prior variance to 80, used a 15,000 draw burn-in, and kept every fourth draw from 60,000 subsequent draws.