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:

\[
Pr(H = A | \sim D)u_A(A) + Pr(H = B | \sim D)u_A(t^*_1b) \geq Pr(H = A | \sim D)u_A(A) + Pr(H = B | \sim D)u_A(t^*_2b) - m \\
m \geq Pr(H = B | \sim D) [u_A(t^*_1b) - u_A(t^*_2b)]
\]

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. \( \square \)
Proposition 2. The optimal post-mobilization policy, \( t^*_2 \) satisfies:
\[
\alpha \frac{\alpha}{1-\alpha} = \frac{u'_H(t^*_2)}{u'_A(t^*_2)}.
\]

Corollary 1. In equilibrium:
(i) \( \frac{\partial t^*_2}{\partial \alpha} > 0 \), (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 \( \alpha \)-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 \( \alpha \), and (iii) decreasing in \( H \).

Proposition 4. The home government’s optimal initial policy, \( t^*_1 \), is: (i) increasing in \( A \), (ii) decreasing in \( \alpha \), 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:

\[
\begin{align*}
\max_{t_1} \quad & \Pi(t_1)u_H(t_2^*) + (1 - \Pi(t_1))u_H(t_1) \\
\max_{t_1} \quad & F(t_1 - t_2^*)u_H(t_2^*) + (1 - F(t_1 - t_2^*))u_H(t_1) \\
& [1 - F(t_1^* - t_2^*)]u_H'(t_1^*) = f(t_1^* - t_2^*)[u_H(t_1^*) - u_H(t_2^*)]
\end{align*}
\]

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.

\[ \text{Proposition 5.} \] If \( f(t^*_1 - t^*_2)u'_H(t^*_2) + u'_H(t^*_1) \leq 1 - F(t^*_1 - t^*_2)u''_H(t^*_1) \)

\[ \frac{\partial^2 \Pi(t^*_1)}{\partial t^*_1 \partial t^*_2} \geq 0 \quad \text{and} \quad \frac{\partial^2 \Pi(t^*_1)}{\partial t^*_1 \partial \alpha} \leq 0 \]

\[ \text{Proof of Proposition 5: Audience Effects on Optimal Initial Policy.} \] 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.

\[ \square \]

\section*{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, \textit{WTO Dispute, Unilateral Removal, In Effect}. Call \( j = 3, \text{In Effect} \), 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 $\beta$ is a $k \times 1$ vector of coefficients. $\Sigma = (\sigma_{lm})$ is a positive definite $2 \times 2$ 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 $\beta$ and $\Sigma$, based on particular prior distributions. I use very agnostic priors, where each element of $\beta$ 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.\(^2\)

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\(^1\) 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.