Transnational Terrorism, U.S. Military Aid, and the Incentive to Misrepresent

Mathematical Appendix

Proposition 1. The following set of strategies constitute a stationary Markov Perfect Equilibrium (*MPE*):

1. T : If H plays *Defensive*, *~Attack Center* if $c_T \geq 1 - \frac{p^{\lambda t}}{1-x}$ and *Attack Center* otherwise. *If* H plays *Negotiate* and US plays *~Sustain Aid*, play *Accept; Attack Center* if $c_T < \frac{p^{\lambda t} x^*}{1-x^*}$ and *Accept, ~Attack Center* otherwise.
2. H: If $x > 0$, play *Defensive.* If $x = 0$, play *Negotiate* if $p^{\lambda t} < c_H$ and *Defensive* otherwise.
3. US: If $p^{\lambda t} < c_H$, set $x = x^*$, where $x^* = \frac{1}{18}[18 - \frac{12 * 3^{\frac{1}{3}} p^{\lambda t}(1+\alpha)}{(-9p^{2\lambda t}(1+\alpha)+\sqrt{3}\sqrt{-8+27p^{\lambda t}-8\alpha})(1+\alpha)^{\frac{1}{3}}} - 6 * 3^{\frac{1}{3}}(-9p^{2\lambda t}(1+\alpha) + \sqrt{3}\sqrt{-8+27p^{\lambda t}-8\alpha})(1+\alpha)^{\frac{1}{3}})]$ if $x^* < 1 - p^{\lambda t}$, and set $x = 1 - p^{\lambda t}$ otherwise. If $p^{\lambda t} > c_H$, set $x = x^*$ iff $x^* < 1 - p^{\lambda t}$ and $\alpha > \frac{p^{2\lambda t}(2-x^*) - 2p^{\lambda t}(1-x^*) - (1-x^*)^2}{p^{\lambda t}(2 - p^{\lambda t}(2-x^*) - 2x^*)}$, and set $x = 0$ otherwise. If $x^* > 1 - p^{\lambda t}$, set $x = 1 - p^{\lambda t}$ iff $\alpha > \frac{p^{\lambda t}}{1-p^{\lambda t}}$ and $x = 0$ otherwise.

Proof. The game divides into three subgames: one in which H plays *Negotiate*, one where H plays *Defensive*, and one where H plays *Offensive.*

Lemma 1. H strictly prefers *Defensive* to *Negotiate* if $x > 0$.

Proof. From the text, we know that if H plays *Negotiate*, US plays *~Sustain Aid*, T plays *Attack Center* if $c_T < \frac{p^{\lambda t}x}{1-x}$ and *~Attack Center* otherwise. Since $c_T \sim U[0,1]$, define H's belief that T plays *Attack Center* if H plays *Negotiate* as $\frac{p^{\lambda t}x}{1-x}$. Since it is common knowledge that US has a dominant strategy to *~Sustain Aid*, the expected utility to H for playing *Negotiate* is: $\frac{p^{\lambda t}x}{1-x}(p - c_H) + (1 - \frac{p^{\lambda t}x}{1-x})(\frac{p^{\lambda t}}{1-x})$. Alternatively, if H plays *Defensive*, T plays *Attack Center* if $1 - \frac{p^{\lambda t}}{1-x} - c_T > 0$, or $1 - \frac{p^{\lambda t}}{1-x} > c_T$. Define H's belief that T plays *Attack Center* if H plays *Defensive* as $(1 - \frac{p^{\lambda t}}{1-x})$ since $c_T \sim U[0,1]$. H's utility for this strategy is therefore equal to $(1 - \frac{p^{\lambda t}}{1-x})(\frac{p^{\lambda t}}{1-x} - c_H) + (\frac{p^{\lambda t}}{1-x})(1)$. Comparing expected utilities, we see that the payoffs for playing *Defensive* weakly dominate those for playing *Negotiate*. If T plays *Attack Center*, the payoff to H for *Negotiate* is equal to $p^{\lambda t} - c_H$, whereas the payoff to H for *Defensive* if T plays *Attack Center* is equal to $(\frac{p^{\lambda t}}{1-x} - c_H)$. If $x > 0$, it must be true that $\frac{p^{\lambda t}}{1-x} > p^{\lambda t}$. Therefore, H improves his welfare by playing *Defensive* versus *Negotiate* if T plays *Attack Center*. On the other hand, if T ~*Attack Center*, H's payoff if he plays *Negotiate* is equal to $\frac{p^{\lambda t}}{1-x}$, whereas if he plays *Defensive*, his payoff is equal to 1. Since by assumption $1 \geq \frac{p^{\lambda t}}{1-x}$, the payoff to H for playing *Defensive* if T plays ~*Attack Center* weakly dominates the payoff to H for playing *Negotiate* if T plays ~*Attack Center*. ■

Corollary 1. If $x = 0$, H prefers *Defensive* iff $p^{\lambda t} > c_H$ and prefers *Negotiate* otherwise.

If US sets $x = 0$,the payoff to H for *Negotiate* is:

$$\frac{p^{\lambda t}(0)}{1-(0)}(p - c_H) + (1 - \frac{p^{\lambda t}(0)}{1-0})(\frac{p^{\lambda t}}{1-0})$$

This expression simplifies to $p^{\lambda t}$, which indicates that H's payoff for *Negotiate* if $x = 0$ is equal to $p^{\lambda t}$. On the other hand, if US sets $x = 0$, the payoff to H for *Defensive* simplifies to:

$$(1 - p^{\lambda t})(p - c_H) + (p^{\lambda t})(1)$$

H therefore prefers to play *Defensive* over playing *Negotiate* when $x = 0$ if:

$$p^{\lambda t} < (1 - p^{\lambda t})(p^{\lambda t} - c_H) + (p^{\lambda t})(1)$$

Simplifying this expression further by subtracting $p^{\lambda t}$ from both sides:

$$0 < (1 - p^{\lambda t})(p^{\lambda t} - c_H)$$

Since $p^{\lambda t} \in [0,1]$, it must be true that $(1 - p^{\lambda t}) \geq 0$. This expression is therefore true unless $c_H > p^{\lambda t}$. ■

Lemma 2. H strictly prefers to play *Defensive* over *Offensive*.

Proof. If $x > 0$, H's payoff for *Defensive* is equal to:

$$(1 - \frac{p^{\lambda t}}{1-x})(\frac{p^{\lambda t}}{1-x} - c_H) + (\frac{p^{\lambda t}}{1-x})(1)$$

H's payoff for *Offensive* is:

$$\frac{p^{\lambda t}}{1-x} - c_H - \rho$$

If H plays *Defensive*, both possible outcomes yield greater utility than H's payoff for *Offensive*. If T plays *Attack Center*, H prefers *Defensive* if $\frac{p^{\lambda t}}{1-x} - c_H > \frac{p^{\lambda t}}{1-x} - c_H - \rho$, which is true since $\rho \in [0,1]$. If T

plays ~*Attack Center*, H prefers *Defensive* if $1 > \frac{p^{\lambda t}}{1-x} - c_H - \rho$, which is always true. If, on the other hand, US sets $x = 0$, H prefers *Defensive* to *Offensive* if $\frac{p^{\lambda t}}{1-0} - c_H > \frac{p^{\lambda t}}{1-0} - c_H - \rho$, which simplifies to $0 > -\rho$. Again, since $\rho \in [0,1]$, this statement is also true, which indicates that H strictly prefers *Defensive* to *Offensive*. ■

Lemma 3. If $p^{\lambda t} < c_H$, & $x^* > 1 - p^{\lambda t}$, US sets $x = 1 - p^{\lambda t}$.

Proof. If $p^{\lambda t} < c_H$, and US sets $x = 0$, H plays *Negotiate*, which produces a payoff to US of $-\alpha$. On the other hand, if US provides H with military aid, H plays *Defensive*, which produces a payoff to US of:

$$(1 - \frac{p^{\lambda t}}{1-x})(\frac{p^{\lambda t}}{1-x} + (1 - \frac{p^{\lambda t}}{1-x})(-\alpha)) + (\frac{p^{\lambda t}}{1-x})(1) - x$$

Since $\frac{p^{\lambda t}}{1-x} \leq 1$, max(x)= $(1 - p^{\lambda t})$, which results in $\frac{p^{\lambda t}}{1-(1-p^{\lambda t})} = 1$. US payoff is therefore simplifies to $1 - (1 - p^{\lambda t}) = p^{\lambda t}$. Since $p^{\lambda t} > -\alpha$, it is true that US prefers to set $x = 1 - p^{\lambda t}$ to setting $x = 0$. ■

Corollary 2. If $p^{\lambda t} < c_H$, & $x^* < 1 - p^{\lambda t}$, US sets $x = x^*$.

If $x^* < 1 - p^{\lambda t}$, US prefers setting $x = x^*$ over setting $x = 1 - p^{\lambda t}$. US optimizes her utility by maximizing the above function:

$$\frac{\partial (1 - \frac{p^{\lambda t}}{1-x})(\frac{p^{\lambda t}}{1-x} + (1 - \frac{p^{\lambda t}}{1-x})(-\alpha)) + (\frac{p^{\lambda t} x}{1-x})(1) - x}{\partial x} = \frac{(1-x)^3 + 2p^{2\lambda t}(1+\alpha) - 2p^{\lambda t}(1-x)(1+\alpha)}{(-1+x)^3}$$

We can then define x^* as the value of x such that $\frac{(1-x)^3 + 2p^{2\lambda t}(1+\alpha) - 2p^{\lambda t}(1-x)(1+\alpha)}{(-1+x)^3} = 0$:

$$x^* = \frac{1}{18}[18 - \frac{12 * 3^{\frac{1}{3}} p^{\lambda t}(1+\alpha)}{(-9p^{2\lambda t}(1+\alpha) + \sqrt{3}\sqrt{-8 + 27p^{\lambda t} - 8\alpha})(1+\alpha)^{\frac{1}{3}}} - 6 * 3^{\frac{1}{3}}(-9p^{2\lambda t}(1+\alpha) + \sqrt{3}\sqrt{-8 + 27p^{\lambda t} - 8\alpha})(1+\alpha)^{\frac{1}{3}})]$$

Define x^* as the offer that maximizes US utility. US therefore sets $x = x^*$ unless $x^* > 1 - p^{\lambda t}$, which is the upper limit on x. We know from Lemma 1 that US strictly prefers providing $x = 1 - p^{\lambda t}$ to setting $x = 0$ if when $p^{\lambda t} < c_H$ and H plays *Negotiate*. Therefore, if $EU_{US}(x = x^*) > EU_{US}(x = 1 - p^{\lambda t})$, it must be also be true that $EU_{US}(x = x^*) > EU_{US}(x = 0)$ when $p^{\lambda t} < c_H$. ■

Lemma 4. If $p^{\lambda t} > c_H$ & $x^* > 1 - p^{\lambda t}$, US sets $x = 1 - p^{\lambda t}$ iff $\alpha > \frac{p^{\lambda t}}{1-p^{\lambda t}}$.

Proof. If $p^{\lambda t} > c_H$, H plays *Defensive* regardless of whether or not US provides military aid. However, without the military aid from US, the probability that T successfully destabilizes H is equal to

$(1-p^{\lambda t})$, whereas the probability that T destabilizes H with military aid is $(1-\frac{p^{\lambda t}}{1-x})$, which must be lower than $1-p^{\lambda t}$ if $x>0$. We therefore see that while US does not need to provide military aid to prevent H from playing *Negotiate*, US may prefer to provide aid to increase H's ability to resist destabilization, and deter T from playing *Attack Center*. If $p^{\lambda t}>c_H$, US sets $x=1-p^{\lambda t}$ if $(1-\frac{p^{\lambda t}}{1-(1-p^{\lambda t})})(\frac{p^{\lambda t}}{1-(1-p^{\lambda t})}+(1-\frac{p^{\lambda t}}{1-(1-p^{\lambda t})})(-\alpha))+(\frac{p^{\lambda t}}{1-(1-p^{\lambda t})})(1)-(1-p^{\lambda t})>(1-p^{\lambda t})(p^{\lambda t}+(1-p^{\lambda t})(-\alpha))+p^{\lambda t}$, which simplifies to:

$$0>(1-p^{\lambda t})(p^{\lambda t}-\alpha+p^{\lambda t}\alpha)$$

This expression is true if:

$$\alpha>\frac{p^{\lambda t}}{1-p^{\lambda t}}$$

We therefore see that if $p^{\lambda t}>c_H$ and $\alpha>\frac{p^{\lambda t}}{1-p^{\lambda t}}$, US will set $x=1-p^{\lambda t}$ to avoid the potentially harmful political cost α. If, however, $p^{\lambda t}>c_H$ and $\alpha<\frac{p^{\lambda t}}{1-p^{\lambda t}}$, US is willing to risk the political cost associated with H's destabilization, and sets $x=0$. ■

Corollary 3. If $p^{\lambda t}>c_H$ & $x^*<1-p^{\lambda t}$, US sets $x=x^*$ iff $\alpha>\frac{p^{2\lambda t}(2-x^*)-2p^{\lambda t}(1-x^*)=(1-x^*)^2}{p^{\lambda t}(2-p^{\lambda t}(2-x^*)-2x^*}$.

Proof. If $x=x^*$ and $p^{\lambda t}>c_H$, US sets $x=x^*$ if:

$$(1-\frac{p^{\lambda t}}{1-x^*})(\frac{p^{\lambda t}}{1-x^*}+(1-\frac{p^{\lambda t}}{1-x^*})(-\alpha))+(\frac{p^{\lambda t}}{1-x^*})(1)-x^*$$
$$>(1-p^{\lambda t})(p^{\lambda t}+(1-p^{\lambda t})(-\alpha))+p^{\lambda t}$$

Simplifying, we see that US sets $x=x^*$ if:

$$\alpha>\frac{p^{2\lambda t}(2-x^*)-2p^{\lambda t}(1-x^*)-(1-x^*)^2}{p^{\lambda t}(2-p^{\lambda t}(2-x^*)-2x^*)}$$

■

Supplement 1. Cox Model Estimates of the Effect of U.S. Military Aid on the Duration until Host Government Disarms Terrorist Groups

Cox	US Military Aid (0,1)	Logged Max Military Aid	Instrument
Variable	β (s.e.)	β (s.e.)	β (s.e.)
Military Aid	-1.3 (.33)***	-.43 (.11)***	-1.5 (.74)**
LN US Affinity	-.45 (.21)**	-1.1 (.38)***	-.54 (.3)*
LN Per Capita GDP	-.04 (.17)	-.69 (.33)**	.07 (.16)
LN Population	-.34 (.14)**	.76 (.25)***	-.39 (.14)***
LN Armed Force	.60 (.18)***	.9 (.34)***	.74 (.18)***
N	174	103	174
Log Likelihood	-.268.69	-84.97	-276.4
Pr. $>\text{chi}^2$	.00	.00	.00

$^{*}p < .1$; $^{**}p < .05$; $^{***}p < .01$