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A Strategic Analysis of Narcoterrorism: Counterterrorism, Terrorist Extortion, and Illicit Drug Trafficking

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Abstract

The paper presents a novel strategic analysis of narcoterrorism where a developing country's terrorist group extorts home drug farmers to finance terror attacks. A developed country's counterterror actions are motivated by the harm its residents endure from those attacks. The developed country's counterterrorism involves efforts to destroy the drug crop abroad. The analysis begins with the drug price being exogenously fixed, followed by a "large-country case" with a market-determined drug price. The extension introduces a fourth participant, consisting of the developed country's consumers whose purchases determine the drug demand. A subsequent extension allows for two drug-exporting countries along with their resident terrorist groups. Now, the drug price depends on terrorist extortion rates and the developed country's counterterrorism associated with the two drug-exporting countries. With the last extension, novel drug-based counterterror transfers of terrorism occur between the drug-producing countries.

JEL codes: D74; H56; C72

Keywords: Narcoterrrorism; Transnational terrorism; Exploitation of drug producers; Counterterrorism; World drug prices

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1 Introduction

To conduct their campaigns of terrorism,[1] terrorist organizations must finance specific operations (e.g., the four hijackings on September 11, 2001 (henceforth, 9/11), the Madrid commuter train bombings on March 11, 2004, the London transport bombings on July 7, 2005, and Brussels and Brussels Airport bombings on March 27, 2016) and their organization and infrastructure (e.g., training camps, headquarters, intelligence gathering, and recruitment drives). Schneider (2025) characterized terrorist groups' operational expense as direct cost and their organizational and infrastructure expense as indirect cost. For terrorist groups, indirect cost dwarfs operational expense because a specific attack or operation is generally small scale involving few operatives, modest resources, and a small logistical support team. Additionally, individual attacks (e.g., bombings, kidnappings, assassinations, and armed attacks) limit their cost by drawing on economies of scale and scope associated with shared organizational resources that support the terrorist group. For instance, the 9/11 hijackings, the largest terrorist attack on record, is believed to have cost between $300,000 and $500,000, while al-Qaida's indirect annual cost was about $30 million at the time (National Commission on Terrorist Attacks upon the United States 2004; Schneider 2025). Other major terrorist incidents – e.g., Madrid commuter-train bombings and the London transport bombings – were estimated to cost about $10,000 apiece (Sands 2016).

The narcotic industry has been an important source for terrorist funding during the modern era of transnational terrorism[2] (Hoffman 2017; Kleiman 2004; Makarenko 2003; Peters 2009). Although not all terrorist groups gained some of their funding from illicit drugs, some

[1] Terrorism is the premeditated use or threat to employ violence by individuals or subnational groups to obtain a political or social objective through the intimidation of an audience beyond the immediate victims (Enders and Sandler 2012, 4; Hoffman 2017). Violence, audience intimidation, and political aims are the hallmark ingredients of terrorism (Gaibulloev and Sandler 2019).

[2] Transnational terrorist attacks involve two or more countries through its perpetrators, victims, or host-country venue. A kidnapping including a foreign victim or a bombing perpetrated by a foreign terrorist represent examples of transnational terrorist attacks (Enders and Sandler 2012; Kim et al. 2021).

influential groups derived a share of their support from drug production or transport. In a recent comprehensive overview of terrorist sources of funding, Schneider (2025) estimated illicit drugs as underwriting 30-35% of the direct and indirect cost of terrorist organizations. In particular, some large terrorist groups extorted their funds by protecting coca and poppy producers or by transporting drugs through South America and Central Asia to markets in North America and Europe.[3] Additional funding for terrorist organizations came from charitable donations (25-30%),[4] kidnappings and blackmail (10-15%), diamond trade (10-15%), and other legal and illegal activities (Schneider and Caruso 2011). For example, based on discussions with al-Qaida officials, Callimachi (2014) concluded that kidnappings covered half of al-Qaida's budget in 2013 (also see Brandt et al. 2016). After the era of state-sponsored terrorism during the 1980s, Hoffman (2017) indicated the need of terrorist groups to find new revenue sources, thus leading some groups to turn increasingly to illicit drug extortion and kidnappings. Those new revenue sources were further encouraged by heightened post-9/11 transnational security measures. During 2008–2015, high-profile terrorist groups whose annual revenues relied in part on drug protection and transport included the Revolutionary Armed Forces of Colombia (FARC), Hezbollah in Lebanon, the Taliban in Afghanistan and Pakistan, and al-Qaida in Afghanistan (Sands 2016, 26; Schneider 2025).

The primary purpose of the current paper is to specify a strategic analysis of narcoterrorism or the involvement of terrorist groups in drug trafficking as a means to finance their terrorist campaigns (Boyce 1987). This strategic analysis includes three key participants – a countering government, the resident terrorist group, and the drug-cultivating farmers. In the

[3] Abu Sayyaf, Hezbollah, Islamic Movement of Uzbekistan (IMU), Kurdish Workers Party (PKK), and Taliban facilitated the transfer of drugs from the producers to markets abroad (Hardouin and Weichhardt 2006; Hernández 2013; Peters 2009; Piazza 2011).

[4] On the use of charitable donations as a source of transnational terrorist groups' funding, see, e.g., Enders and Sandler (2012) and Meierrieks and Schneider (2019).

model, the countering government is from a developed country that is harmed by the associated transnational terror attacks emanating from the resident terrorist group in the drug-producing developing country. The host developing-country's government's weakness creates its reliance on the developed country's counterterror measures – e.g., Colombia's or Peru's post-9/11 reliance on the United States (Angrist and Kugler 2008; Brown 2023; Feickert 2006).

At the most basic level, the world drug price is fixed for the three participants who can, however, respond to exogenous changes in this price. A three-stage sequential game is initially formulated in which the developed country's government chooses its counterterrorism effort in stage 1 to limit the resulting net welfare losses while anticipating the drug-producing resident terrorist group's extortion rate of the farmers' surviving drug crop in stage 2. The atomistic representative farmer then chooses its labor to maximize net profit in stage 3 while accounting for the terrorists' extortion rate and the countering government's harvest-limiting actions. Although simple, our baseline representation indicates how the three participants (two strategic players and one atomistic) interact to determine counterterrorism efforts, the terrorist extortion rate, and drug output (terrorism). Exogenous changes in the world drug price are shown to affect the Nash equilibrium levels of counterterrorism, terrorist group's extortion rate, and terrorism. An extension includes a fourth participant – the drug-importing country's atomistic consumers and their drug demand – so that the market-clearing drug price is now endogenous. This large-country case results in interesting changes to equilibrium values when the developed country's preferences for the drug increase. A subsequent extension allows for two drug-exporting developing countries, each of which contains a resident terrorist group that extorts the local drug-producing farmers and launches terrorist attacks abroad. In this extension, the drug price is again endogenous with the drug supply being influenced by the developed country's counterterrorism, the terrorist groups' extortion of the farmers, and the production responses of the developing countries' farmers. A novel market-influenced transference of terrorist attacks characterizes the two drug-exporting countries (in a different transference context see Hausken 2008; Hausken and Bier 2011; Heal and Kunreuther 2007; Kunreuther and Heal 2003; Sandler and Siqueira 2006; Schneider et al. 2015).

Despite the importance of narcoterrorism, there have been few panel empirical studies linking the drug's price and production to the level of terrorism.[5] A noteworthy exception is Piazza (2011), which used myriad negative binomial cross-sectional, time-series regressions to gauge the effects of drug prices and eradication efforts on terrorism.[6] In particular, his study analyzed terrorist attacks for approximately 170 countries during 1986–2006. Generally, Piazza (2011) showed that higher drug prices and drug production augmented terrorist activities in the drug-producing country, whereas counterterrorism eradication efforts reduced these activities. Piazza's (2011) conceptual theoretical model is primarily based on consumers' response to higher drug prices, coupled with farmers' and terrorists' responses to eradication efforts. Unlike our current study, Piazza (2011) did not present a formal model for strategic and market interactions among key participants. In doing the latter, our current strategic analysis is complementary to his analysis by supplying an alternative theoretical foundation for his empirical findings.

The remainder of the paper has four additional sections. Section 2 contains the baseline three-participant model, where the world drug price is exogenously fixed. Section 3 extends the analysis to include the developed country's consumers whose drug demand equals the drug supply from the developing country at the market-clearing price, thus corresponding to the large-country case. In Section 4, a further extension is presented. Concluding remarks are contained

[5] Many empirical studies focused on a single country such as Colombia (Bibes 2007; Rangel 2023), Peru (Brown 2023), and Tajikistan (Paoli et al. 2007).

[6] Also see the interesting empirical study by Meierrieks and Schneider (2016) for 58 countries during 1984–2007. In the long run, the authors found that higher drug prices were associated with more terrorism; however, this positive association did not hold for the short run.

in Section 5.

2 The baseline model

The model here envisions a terrorist group that resides in a developing country with a weak state without capacity to fight the terrorists (see, e.g., Gaibulloev et al. 2024, 2025). Potential real-world examples, among others, include FARC in Colombia, Shining Path in Peru, and the Taliban in Afghanistan and Pakistan (Angrist and Kugler 2008; Brown 2023; Kleiman 2004; Organization for Security and Co-operation 2004; Piazza 2011; Rangel 1998; Schneider 2025). In those cases, the terrorist group finances its operations by extorting atomistic farmers who sell a cash crop X (e.g., coca or opium) on the world market at a given world price p. The group's extortion can arise from a unit tax of t that it places on the crop. Labor used in the farmers' production of X, namely, L^X, is associated with the production function, denoted by $f\left(L^X\right)$, with positive marginal product (MP_L^X), subject to diminishing returns such that $f' > 0$ and $f'' < 0$.[7] Another good, Y, is produced using a linear production function $Y = L^Y$, whose marginal product equals 1. Good Y serves as the numéraire good with price $p^Y = 1$, and is the importable good. In this economy, total labor, $\overline{L}$, equals its employment in the two industries, i.e., $L^X + L^Y = \overline{L}$. The wage rate corresponding to profit maximization in Y is $w = MP_L^Y = 1$, given Y's unitary price and unitary marginal product, $dY/dL^Y = 1$.

The countering developed country's government applies counterterrorism effort E to contain terrorism by destroying the cash crop either at the farm or in transit. In the case of

[7] This stems from a concave production function $X = F\left(L^X, Z\right)$ with positive marginal products, where Z is land. For given Z, we can suppress it from the functional form and express the production function as $X = f\left(L^X\right)$, with $f' > 0$ and $f'' < 0$.

FARC, the Colombian government has been assisted by US efforts to destroy the coca crop or the processed cocaine (Brown 2023; Feickert 2006; Kleiman 2004; Piazza 2011; Pulid-Velásquez et al. 2025). Since these two governments' missions are complementary, we treat their collective efforts as coming from a single government entity, namely the developed country. In Afghanistan at times, the United States supported efforts to eradicate some poppy production to curb opium and heroin imports into the United States, thereby reducing important sources of financing for the Taliban's and al-Qaida's terrorism campaigns (Piazza 2011). In our model, the probability of crop detection in production or transit is $\theta(E)$, which increases with countering government's counterterrorism efforts, *E*, to eliminate the crop, but at a diminishing rate such that $\theta'(E) > 0$ and $\theta''(E) < 0$. Thus, the probability of success for the farmers in reaping their harvest equals $\phi(E) \equiv 1 - \theta(E)$, where $\phi' = -\theta' < 0$ and $\phi'' = -\theta'' > 0$. Consequently, the effective harvest for the farmers in sector *X* in the drug-exporting country is $X^S = \phi X = \phi f(L^X)$. Successfully harvested crop is then sold at a price *p* on the world market, out of which *t* per unit of output is extorted by the terrorist organization. Accordingly, the net revenue of the farmers is $(p-t)\phi f(L^X)$. We envisage a sequence of choices made in three stages, where the government chooses its counterterrorism effort *E* in stage 1, the terror organization then chooses *t* in stage 2, and the farmers lastly choose their labor L^X in stage 3. We proceed backward to describe the optimal choices, starting with the farmers' harvest choice in stage 3.

2.1 Stage 3

The net payoff of the farmers is π for which

$$\pi = (p-t)\phi f\left(L^X\right) - L^X , \tag{1}$$

because the effective net revenue of the farmers is $(p-t)\phi f\left(L^X\right)$ and the wage rate is unity. Farmers' net revenue is adversely affected by the terrorist group's extortion and the government's counterterrorism measures. In stage 3, the first-order condition (FOC) for the representative farmer's choice of L^X, given (t, p), is:[8]

$$(p-t)\phi f'\left(L^X\right) - 1 = 0 , \tag{2}$$

such that the net marginal revenue product of labor in sector X, which is $(p-t)\phi f'\left(L^X\right)$, is equated to the wage rate of unity. As such, the labor choices for both industry *X* and *Y* correspond to competitive labor and output markets equilibriums. Eq. (2) implicitly defines $L^X = L^X(t, E, p)$, capturing the terrorist group's extortion and the government's counterterrorist measures. Applying the implicit function rule, we get $L_t^X = \dfrac{f'}{(p-t) f''} < 0$, $L_E^X = -\dfrac{(p-t)\phi'}{\phi} L_t^X < 0$, and $L_p^X = -L_t^X > 0$, given that f'' and ϕ' are both strictly negative, and f' is strictly positive. The drug crop's gross output is $X = f\left(L^X\right)$, such that the aforementioned inequalities imply that a rise in the group's extortion rate t, or an increase in the government's counterterror effort *E*, will reduce *X*. In contrast, an increase in the drug price *p* will raise its supply.

2.2 Stage 2

[8] We have checked that the second-order condition (SOC) here and for the other optimization problems in this section are satisfied.

Terrorism is financed by the terrorist group's extortion revenue *R*, raised on the crop that survives the government's countermeasures. Hence, given that the terrorist group's extortion in stage 2 endogenizes the farmers' stage-3 choice of L^X, the group's extortion revenue equals

$$R = t\phi(E) f\left[L^X(t,E,p)\right] \equiv R(t,E,p). \tag{3}$$

For simplicity, we assume that the terror production function is $T = R$, where the objective of the terror group is to maximize its terrorism campaign, which is equivalent to maximizing *R*. The terrorist group takes *E*, chosen by the government in stage 1, as given when the group chooses its extortion rate *t*, such that the FOC associated with revenue maximization is

$$R_t(t,E,p) = \phi(E)\left[f(L^X) + tf'(L^X)L_t^X\right] = 0. \tag{4}$$

The optimal extortion rate balances the marginal revenue gains from a rate increase with the marginal revenue losses from the higher rate's disincentive effects on crop production (arising from $L_t^X < 0$). Eq. (4) implicitly defines the terrorist group's reaction function to the government's choice of *E* as

$$t = t(E,p), \tag{5}$$

where application of the implicit function rule and some substitutions from Eq. (2) give $t_E = \dfrac{\phi'(E)(p^2 - t^2)}{\phi(E)(2p+t)} < 0$, which corresponds to the negative slope of the terrorist organization's reaction function in (E,t) space. The shift in the reaction function in (E,t) space due to a change in *p* is captured by $t_p = \dfrac{p+2t}{2p+t} > 0$. In summary, the terrorist group reduces its extortion rate for a higher counterterror effort *E* (for a given *p*), while the group raises its extortion rate at a higher world *p* (for a given counterterror level *E*).

2.3 Stage 1

The countering country's government's objective is to minimize the loss from terrorism inclusive of its counterterrorism expenses. Recalling that the terror production function is $T = R$ and using Eqs. (3) and (5), we express the developed government's loss function as

$$V = R\left[t(E,p),E,p\right] + E \equiv V(E,p), \tag{6}$$

where the constant marginal counterterror cost is assumed to be unity. When the developed government moves in stage 1, it acts as a Stackelberg leader *vis à vis* the terrorist group, thereby taking the terrorist group's stage-2 reaction function [i.e., Eq. (5)] into account when choosing its optimal counterterrorism. Accordingly, applying $R_t = 0$, we represent the developed government's optimizing choice of *E* as

$$V_E(E,p) = R_{E|_{t,p}}\left[t(E,p),E,p\right] + 1 = 0. \tag{7a}$$

Utilizing Eqs. (2) and (3), we reduce Eq. (7a) to

$$pf\left\{L^X\left[t(E,p),E,p\right]\right\}\left|\phi'(E)\right| = 1, \tag{7b}$$

where the left-hand side (LHS) indicates the marginal reduction in the terrorist group's revenues from additional counterterrorism, while the right-hand side (RHS) denotes the unit marginal cost of additional counterterrorism. Eq. (7a) implicitly defines the optimal counterterror level $E = E(p)$ in terms of the world price of *X*.

This completes the description of the three-stage game where the Nash equilibrium counterterror level $E(p)$ can be substituted in Eqs. (5) and (2), respectively, to obtain the terrorist group's equilibrium extortion rate $t(p) \equiv t\left[E(p),p\right]$ and the farmers' equilibrium labor employment level $L^X(p) \equiv L^X\left\{t\left[E(p),p\right],E(p),p\right\}$.

2.4 Comparative Statics of change in the price of the drug/crop

We address now how an increase in the world drug price affects the counterterrorism level, the extortion rate, and terrorism. To begin, we consider the effect of higher *p* on the equilibrium counterterrorism level. Using Eqs. (2), (5), (7a), and (7b), we get (upon simplification) the following expression:

$$E'(p) = -\frac{V_{Ep}}{V_{EE}} = -\frac{\phi'(E)\left[f\left(L^X\right)(t+p) - p^2 f'\left(L^X\right)L_t^X\right]}{(2p+t)V_{EE}} > 0, \tag{8}$$

whose sign follows from $V_{EE} > 0$, $\phi'(E) < 0$, and $L_t^X < 0$. Eq. (8) establishes that an increase in the world drug price induces a larger counterterrorism effort. Despite the unambiguous rise in *E* in response to a higher *p*, the comparative static effects on the extortion rate *t* and the level of terrorism $T = R$ are not as clearcut. This is because of opposing influences with the rise in *p* bolstering the extortion rate, but the associated rise in counterterrorism, *E*, reducing the extortion rate. Similar opposing effects confound the direction of change of the terrorist group's revenues as the rise in *p* pushes up extorted revenues, while the rise in *E* pushes down the extorted revenues.

Fortunately, we can analyze the relative strengths of these opposing effects to arrive at clear qualitative conclusions regarding the net directions of these comparative-static effects. Proposition 1 summarizes the discussion thus far and provides a sufficient condition for an increase in both terrorism and the extortion rate in response to a higher world drug price.

Proposition 1

A rise in the drug price on the world market increases the counterterrorism level. A necessary and sufficient condition for the level of terrorism financing (and hence terrorism) to increase is that an elasticity ε^{ϕ} related to the convexity of the farmers' success probability function ϕ exceeds unity. This same elasticity condition is sufficient but not necessary to raise the extortion rate.

The proofs of the propositions are presented in the Appendix at the end of the paper with supporting material in the Online Appendix.

2.5 Discussion

At the outset, we must define the elasticity ε^{ϕ}, which is

$$\varepsilon^{\phi} = \frac{d \ln\left|\phi'(E)\right|}{d \ln \phi} = \frac{d \ln(-\phi') / d \ln E}{d \ln \phi / d \ln E} = \frac{\phi(E)\phi''(E)}{\left[\phi'(E)\right]^2}. \tag{9}$$

The elasticity ε^{ϕ} measures the rate at which the farmers' marginal success probability $|\phi'|$ falls relative to the rate at which the success probability ϕ falls as E is raised. We encourage a reader to visualize this elasticity by referring to a convex-to-the-origin, downward-sloping success probability function $\phi(E)$, where E is measured on the horizontal axis. As E is raised, the success probability falls but at a diminishing rate (because $\phi'' > 0 \Rightarrow \frac{d|\phi'|}{dE} < 0$, an assumption previously invoked owing to diminishing returns to counterterrorism).

Now, consider any point Z on the $\phi(E)$ curve with coordinates $\left[E^Z, \phi\left(E^Z\right)\right]$ and slope $\phi'\left(E^Z\right)$. Various convex curves corresponding to different functional forms of ϕ'' can pass through this point while maintaining the same slope $\phi'\left(E^Z\right)$. For functions corresponding to higher ϕ'', we have more convex-to-the-origin ϕ functions and larger values of ε^{ϕ}. For very convex curves, there is minimal fall in the success probability ϕ in response to a small rise in E starting from $E = E^{Z}$. Accordingly, counterterrorism is relatively ineffective in curbing drug supply at *Z*. In such a situation, the countering developed country's government is not as aggressive in responding to the drug price increases when raising E. The muted counterterror response at $\varepsilon^{\phi} > 1$ is sufficient to allow both a greater extortion rate *t* and greater revenues *R* from extortion, thus raising terrorism in response to a higher world drug price. By contrast, for weak diminishing returns represented by $\varepsilon^{\phi} < 1,$ counterterrorism is effective and also sufficiently large to more than offset the terrorists' revenue gains, leading to a reduction in terrorism.

Turning to the extortion rate, we have that the rate can be shown to increase in response to a larger *p* if and only if $\varepsilon^{\phi} > \dfrac{t(p-t)}{p(p+2t)} < 1$, which follows because $p > t$. Although $\varepsilon^{\phi} > 1$ is sufficient for *t* to rise, the extortion rate will rise (with *p*) even for values of ε^{ϕ} that are less than unity but sufficiently close to it. If, however, ε^{ϕ} is smaller than $\dfrac{t(p-t)}{p(p+2t)}$, the extortion rate will fall with an increase in *p*. Overall, we can conclude that the extent of diminishing returns to counterterrorism effort is critical in determining the direction of changes in terrorism and the terrorist group's extortion rate in response to a rise in the world drug price.

Our three-stage game provides a formal model for hypotheses put forward by Piazza (2011) in his important study of the illicit drug trade, counternarcotic tactics, and terrorism. In particular, Piazza (2011) hypothesized that that higher (lower) drug prices would cause terrorism to increase (decrease). For Colombia, Peru, and Bolivia, Piazza's hypothesis was foreshadowed by Angrist and Kugler (2008). Proposition 1 supports such a hypothesis based on the elasticity of farmers' success to increases in counterterrorism effort. Generally, the literature did not specify how higher world drug prices would affect the level of terrorism in a framework accounting for the strategic interactions of the key agents – namely, the countering government, the terrorist group, and the drug farmers. For example, Meierrieks and Schneider (2016) argued that higher drug prices could reduce terrorism as terrorist groups divert some of their effort from terrorism to criminal drug activities without considering the countering government's or farmers' response. Proposition 1 also indicates a foundation for Piazza's (2011) hypothesis that greater drug eradication reduces terrorism. Our foundation is again based on the elasticity of farmers' success in light of greater counterterrorism effort.

2.6 Defense and proaction

Thus far, we considered proactive counterterror measures while abstracting from defensive counterterror measures that protect against damage from terrorist attacks. In our framework, defense can be incorporated by using a terror production function, $T = \theta(a)T^e$, where a is the level of defense deployed by the government, T^e is the effort level expended by the terrorist organization, and $0 \leq \theta(a) \leq 1$ is a measure of the terrorists' attack success probability. Defense reduces this success probability but at a diminishing rate, such that $\theta'(a) < 0$ and $\theta''(a) > 0$.[9] Terror effort T^e is financed by extortion revenues R for which $T^e = R$, with the level of terror equaling $T = \theta(a)T^e = \theta(a)R$.

Given this new terror production function, we note that the FOCs of stages 2 and 3 are

[9] On defensive measures, see Bandyopadhyay et al. (2025), Bier et al. (2007), Hausken and Bier (2011); Heal and Kunreuther (2007), Kunreuther and Heal (2003), Sandler and Siqueira (2006), and Schneider et al. (2015).

unchanged for the terrorist group and the drug farmers, respectively. Stage-1 counterterrorism choice will change because defense *a* and proaction *E* enter the government's modified loss function, $V = \theta(a)R\left[t(E,p),E,p\right]+E+a$, where both types of counterterror marginal costs are assumed to be unity. The proaction FOC is minimally altered compared to Eq. (7a) and takes the form $\theta(a)R_{E_{|t,p}}\left[t(E,p),E,p\right]+1=0$, while the defense FOC is $R\left|\theta'(a)\right|=1$. The LHS of the latter equality corresponds to the marginal terror reduction from defense, and the RHS indicates the marginal unit cost of defense. We can check that $V_{Ea}>0$, so that a marginal increase in defense raises the marginal loss of proaction and reduces proaction. In other words, defense and proaction are substitutes, as is well understood in the literature (e.g.. Bandyopadhyay et al. 2025).

In the current context, a rise in the drug price will have direct effects tending to increase both defense and proaction. However, cross effects due to substitutability between defense and proaction oppose the direct effects, potentially increasing only one of the two counterterror measures in response to a rise in *p*. For example, if at the initial equilibrium $\theta''(a)$ is very large relative to $\phi''(E)$, the marginal loss of employing defense, $R\theta'(a)+1$, will increase more rapidly than the marginal loss of employing proaction. In this situation, the countering government will rely more on proaction to counter the increased terror from the higher drug price, where the comparative statics of a rise in *p* will follow more closely the patterns highlighted in Proposition 1.

3 Large-country analysis

This section extends the previous analysis to the "large-country" case, where the market-clearing price of the drug/crop is determined by equating the consumers' demand from the importing developed country to the supply from the drug-exporting, terrorist-hosting developing country. As before the game possesses three stages but now has four participants – two non-atomistic strategic players (the developed country's government and the developing country's terrorist group) and two atomistic participants (the developed country's drug consumers and the developing country's farmers). In stage 1, the developed country's government chooses counterterrorism in light of the drug price being determined by market-clearing forces of the representative drug-supplying farmers and the representative drug consumers. The terror group determines the extortion rate imposed on farmers in stage 2, while the representative farmers choose labor (and drug production) in stage 3. The large-country case may apply to examples involving the United States, which contains a sizable share of coke or poppy consumption. For simplicity of exposition, we assume that there is no domestic consumption of the drug in the developing exporting country, and no domestic production of the drug in the developed importing country. These are reasonable assumptions for most drug scenarios.

In the developed country, the utility function, U, of a representative drug consumer is assumed to be quasi-linear in the two goods, *X* and *Y*, as follows:

$$U = u\left(X,\alpha\right) + Y\,, \tag{10}$$

where $u_X > 0$, $u_{XX} < 0$, and $\alpha > 0$. The latter denotes a taste parameter that enhances the marginal utility of *X*, such that $u_{X\alpha} > 0$. Given quasi-linear preferences, the demand for good *X* is obtained by inverting the price-equaling marginal utility equation,

$$u_X\left(X,\alpha\right) = p \Rightarrow X^d = X^d\left(p,\alpha\right), \tag{11}$$

where $X^d\left(p,\alpha\right)$ represents the demand for drugs from the developed country. Applying the implicit function rule in Eq. (11), we have the slope of the drug demand curve,

$X_p^d(p,\alpha) = 1/u_{XX} = m < 0$. Similarly, the effect of an increase in the preference for drugs is given by $X_\alpha^d(p,\alpha) = u_{X\alpha}/(-u_{XX}) > 0$.

3.1 Stage 3

In regard to the representative farmer's production decision, stage 3 of the baseline model applies here without any changes because perfectly competitive farmers take the price *p* as given when choosing L^X, as in Eq. (2). The export supply of *X*, say X^S, is $X^S = \phi(E) f\left[L^X(t,E,p)\right]$, so that the market-clearing equation for *X* is:

$$X^S = X^d \Leftrightarrow \phi(E) f\left[L^X(t,E,p)\right] - X^d(p,\alpha) = 0. \tag{12}$$

In Eq. (12), the equilibrium price is implicitly defined as $p = p(t,E;\alpha)$, where, after substituting $L_p^X = -L_t^X$, we get $p_t = \phi f' L_t^X / \left(m + \phi f' L_t^X\right) > 0$, $p_E = \left(f\phi' + \phi f' L_E^X\right) / \left(m + \phi f' L_t^X\right) > 0$, and $p_\alpha = -X_\alpha^d / \left(m + \phi f' L_t^X\right) > 0$. These three positive partials reflect the supply-reducing effect of the extortion rate *t*, supply-reducing effect of counterterror effort E, and the demand-enhancing effect of the taste parameter α, respectively, all leading to an increase in the excess demand for *X*, and hence a rise in its market-clearing price.

3.2 Stage 2

The terror group exercises market power by recognizing the dependence of the market-clearing drug price on the group's extortion rate. Based on the market-clearing price in Eq. (12), we get

$$R = t\phi(E) f\left\{L^X\left[t,E,p(t,E;\alpha)\right]\right\} \equiv R(t,E;\alpha), \tag{13}$$

where this terrorist revenue function differs from that in Eq. (3) because revenue now incorporates the market-clearing price $p = p(t, E; \alpha)$. As in Section 2.2, the terrorist group takes *E*, chosen by the countering government in stage 1, as given when the group chooses its extortion rate, *t*, such that the FOC associated with revenue maximization is

$$R_t(t, E, p) = \phi(E)\left[f(L^X) + tf'(L^X)L_t^X(1 - p_t)\right] = 0. \tag{14}$$

When contrasting the large- and small-country cases, we see that the critical difference between Eq. (14) and Eq. (4) is captured by the last term inside the square bracket in Eq. (14). The terror organization recognizes that the rise in its extortion rate also augments the drug price by magnitude p_t, such that the net impact on the price received by the farmers is $\frac{\partial(p-t)}{\partial t} = -(1 - p_t)$. The latter decline is smaller than the net price drop for the farmers in Section 2 where $p_t \cong 0$. The smaller disincentive effect on crop production prompts the terror group to choose a higher extortion rate compared to the small-country case. This can be clearly seen by evaluating the terrorist group's marginal revenue at the optimum extortion rate for the small-country case,

$$R_t(t, E, p)\big|_{f + tf'L_t^X = 0} = -\phi t f'(\cdot) L_t^X p_t > 0, \tag{15}$$

indicating that at the small-country extortion rate there are positive marginal gains for the terror group from further raising its extortion rate.

Eq. (14) implicitly defines the terrorist group's reaction function to the government's choice of *E* as

$$t = t(E; \alpha). \tag{16}$$

Using Eqs. (1), (2), and (12)-(14), we can show that

$$t_E = \frac{\phi'(E)\left\{p^2 - t^2 - tp_t\left[2(p-t) + 3(1-p_t)(p - tp_t)\right]\right\}}{\phi(E)\left[2p + t - 3tp_t(2 - p_t)\right]}, \tag{17a}$$

where $t_E < 0$ if and only if $p^2 - t^2 > tp_t\left[2(p-t)+3(1-p_t)(p-tp_t)\right]$. Also, we have

$$t_\alpha = \frac{\left[p+2t-3tp_t(2-p_t)\right]p_\alpha}{\left[2p+t-3tp_t(2-p_t)\right](1-p_t)} = \frac{\left[p-t+3t(1-p_t)^2\right]p_\alpha}{\left[2(p-t)+3t(1-p_t)^2\right](1-p_t)} > 0 . \tag{17b}$$

By setting $p_t = 0$, we reduce the expressions for t_E and t_α effectively to the corresponding small-country expressions for t_E and t_p in Section 2. The positive price effect $p_t > 0$ captures the departure of the extortion rate function $t = t(E;\alpha)$ in Eq. (16) compared to Eq. (5) of the small-country case. Unlike Section 2, Eq. (17a) suggests that the terrorist group's reaction function is not necessarily downward sloping because the increase in *E* raises the market-clearing price, thus opposing the crop-destruction effect of counterterrorism. If the price effect is small, then as in Section 2 the terrorist group's marginal revenue falls, lowering the optimal extortion rate. For large price effects, however, the extortion rate may rise, yielding a positively sloped stage-2 terrorists' reaction function (i.e., strategic complementarity). Focusing on Eq. (17b), we find that a positive demand shift captured by an increase in the taste parameter α must raise the extortion rate by amplifying crop production and extortion revenues.

3.3 Stage 1

The government's loss function, where the government anticipates the effect of its counterterror effort on the drug price, the group's extortion rate, and the farmers' output choice, is

$$V = R\left[t(E;\alpha), E;\alpha\right] + E \equiv V(E;\alpha), \tag{18}$$

where, as in Section 2, the constant marginal counterterror cost is unity. Applying Eqs. (2), (13), (14), and $R_t = 0$, we get the developed government's FOC for its counterterrorism choice, namely,

$$V_E = \left(p - tp_t\right) f\left(L^X\right)\phi'\left(E\right) + 1 = 0 \Leftrightarrow \left(p - tp_t\right) f\left(L^X\right)\left|\phi'\left(E\right)\right| = 1 . \tag{19}$$

The LHS of the last equality in Eq. (19) is similar to Eq. (7b) except that the marginal benefit from counterterror is now moderated by the presence of a price effect p_t – i.e., $\left(p - tp_t\right)$. This moderation stems from the government's realization that its counterterror effort reduces drug supply and drives up the equilibrium drug price, thereby creating an incentive for further drug production. To counter that perverse incentive, the government restricts its counterterror level compared to the small-country case. This is evident by evaluating the government's FOC, corresponding to the first equation in Eq. (19), at the small-country level:

$$V_{E_{|pf\phi'+1=0}} = tp_t f\left|\phi'\left(E\right)\right| > 0 , \tag{20}$$

which indicates that the price effect induces the government to reduce its loss by reducing E below the small-country level. Finally, based on Eqs. (12) and (16), we can express Eq. (19) as $\left\{p\left[t\left(E,\alpha\right),E;\alpha\right] - t\left(E,\alpha\right)p_t\left(\cdot\right)\right\} f\left\{L^X\left[t\left(E,\alpha\right),E;\alpha\right]\right\}\left|\phi'\left(E\right)\right| = 1$, which implicitly defines the optimal counterterror level as $E = E\left(\alpha\right)$.

This completes the characterization of the large-country outcome, where α determines the equilibrium level of *E*, which when substituted in Eq. (16) gives the optimal extortion rate. The crop output and the price level are then obtained from Eqs. (2) and (12), respectively.

3.4 Effects of an increased taste for drugs

An increase in the taste parameter α reflects a larger demand for drugs from the developed importing country's consumers. How does such a demand shift affect the optimal counterterror and terror levels, among other endogenous variables? For analytical tractability, we assume that the drug demand function is linear (i.e., the slope *m* is a negative constant). Proposition 2 summarizes the findings.

Proposition 2

Assuming linear demand, an increase in the taste for drugs increases the counterterrorism level. A necessary and sufficient condition for the level of terrorism financing (and hence terrorism) to increase is that elasticity ε^{ϕ} exceeds a critical value $\overline{\varepsilon}$, where $\overline{\varepsilon}$ strictly exceeds one. This same elasticity condition is sufficient but not necessary to raise the extortion rate.

3.5 Discussion

In small-country Proposition 1, terror rose with an increase in the world price of drugs if and only if ε^{ϕ} exceeded unity. Since $\overline{\varepsilon}$ exceeds unity in the current large-country case, diminishing returns must be stronger to surpass a higher threshold for terror to rise with an increase in drug demand. This stems from the following reasons. First, notice that the level of terror is given by the function $R(t, E; \alpha)$ in Eq. (13), where the FOC of the terror organization $(R_t = 0)$ ensures that there is no first-order effect of *t* on terror. Second, inspection of Eqs. (2), (12), and (13) reveals that, at given *E* (and *t*), a rise in α must increase the extortion revenue by raising crop output. Thus, the direct effect of enhanced demand is a rise in the terror group's revenue level and hence its terrorism. However, as in the small-country case, *E* will rise in response to an increase in drug demand. Third, when this counterterror response overwhelms the direct effect, then terror can actually fall.

We can show that the price effect p_t becomes smaller in the face of an increase in α, amplifying the marginal benefit of *E* in Eq. (19), thereby incentivizing a large counterterrorism response. For the direct effect of α on terror to dominate the effect of the amplified counterterror response, the magnitude of the diminishing returns to E (characterized by ε^{ϕ}) has to be correspondingly larger than in the small-country case. Thus, increase in demand raises terror in the large country only when ε^{ϕ} exceeds a critical value $\overline{\varepsilon}$ which exceeds unity.

The extortion rate must rise when demand increases if $\varepsilon^{\phi} \geq \overline{\varepsilon}$. An increase in α raises the extortion rate at a given E, while the demand-induced rise in E raises or lowers the extortion rate depending on the sign of t_E in Eq. (17a). If $t_E > 0$, then the rise in E complements the direct effect of demand on the extortion rate, such that the extortion rate must rise.[10] If $t_E < 0$, then the indirect effect opposes the direct effect. Even in this scenario, if diminishing returns are sufficiently strong such that $\varepsilon^{\phi} \geq \overline{\varepsilon}$, the counterterror response is limited so that the direct effect of α dominates the indirect effect. Thus, $\varepsilon^{\phi} \geq \overline{\varepsilon}$ is a sufficient but not a necessary condition for the extortion rate to rise in response to an increase in demand.

Compared to the small-country case, the large-country case endogenizes or ties the drug price to the terrorist group's extortion rate choice in stage 2 where the group internalizes that a higher extortion rate results in a price rise in the drug, so that the farmers suffer a smaller net drug price drop than for the small-country scenario. Thus, the terrorist group extorts to a greater extent compared to the fixed-price, small-country case. In the large-country case, the developed-country's government must balance opposing marginal influences on its counterterrorism choice, which can result in counterterrorism increasing in cases identified above. Unlike the small-country scenario, counterterror and the extortion rate can be strategic complements when the drug price is endogenous, resulting in interesting interactions between the two adversaries – the

[10] This is easy to see using Eq. (16), which yields $dt/d\alpha = t_\alpha + t_E E'(\alpha)$. The first RHS term is the direct effect of the demand increase on t, while the second RHS term is the indirect effect through the counterterror response. Since $t_\alpha > 0$ from Eq. (17b) and $E'(\alpha) > 0$ from the Appendix, we have that $dt/d\alpha > 0$ when $t_E > 0$.

developed country's government and the developing country's terror group.

4 Two drug-exporting countries

The preceding sections assume that there is a single terror organization in a lone drug-exporting country. Here, we consider the possibility of two drug-exporting countries, each hosting its own terror organization, which targets the developed country that employs optimal counterterror operations. To simplify notation, we use an asterisk for all variables corresponding to the second drug-exporting country and drop the superscript for good *X*'s labor input L^X.

4.1 Stage 3

Compared to earlier, the representative farmer's problem in the first exporting country is unchanged. In the second drug-exporting country, the farmer's labor choice satisfies FOC,

$$\left(p-t^*\right)\phi^*\left(E^*\right)f^{*\prime}\left(L^*\right)-1=0, \tag{21}$$

which defines $L^*=L^*\left(t^*,E^*,p\right)$, where t^* and E^* are the terrorist group's extortion rate and the developed government's counterterrorist measure, respectively. From Eq. (21), we have

$$L^*_{t^*}=\frac{f^{*\prime}}{\left(p-t^*\right)f^{*\prime\prime}}<0,\ L^*_{E^*}=-\frac{\left(p-t^*\right)\phi^{*\prime}}{\phi^*}L^*_{t^*}<0, \text{ and } L^*_p=-L^*_{t^*}>0.$$

Accounting for the drug supply from the two exporting countries and dropping the demand-shift parameter α, we amend the drug market-clearing equation [previously Eq. (12)] to

$$\phi(E)f\left[L(t,E,p)\right]+\phi^*\left(E^*\right)f^*\left[L^*\left(t^*,E^*,p\right)\right]-X^d(p)=0, \tag{22}$$

which implicitly defines the equilibrium drug price $p=p\left(t,t^*,E,E^*\right)$. Applying the implicit function rule to Eq. (22) and defining the slope of the excess drug demand function as

$M = m + \phi f' L_t + \phi^* f^{*\prime} L^*_{t^*} < 0$, we get $p_t = \phi f' L_t / M > 0$, $p_{t^*} = \phi^* f^{*\prime} L^*_{t^*} \big/ M > 0$,

$p_E = \left(f\phi' + \phi f' L_E \right) / M > 0$, and $p_{E^*} = \left(f^* \phi^{*\prime} + \phi^* f^{*\prime} L^*_{E^*} \right) \Big/ M > 0$. These positive partials indicate that enhanced supply restrictions in either drug-exporting country from a larger extortion rate or greater counterterror effort (crop destruction) will raise the drug price.

4.2 Stage 2

The terror groups in the two drug-supplying countries recognize the dependence of the market-clearing drug price on their extortion rates and the developed government's counterterror effort levels. In the two exporting nations, the terrorist groups' revenues are

$$R = t\phi(E) f\left\{ L\left[t, E, p\left(t, t^*, E, E^*\right)\right]\right\} \equiv R\left(t, t^*, E, E^*\right) \text{ and} \tag{23a}$$

$$R^* = t^* \phi^*\left(E^*\right) f^*\left\{ L^*\left[t^*, E^*, p\left(t, t^*, E, E^*\right)\right]\right\} \equiv R^*\left(t, t^*, E, E^*\right). \tag{23b}$$

Given simultaneous moves, each terror group takes the other's extortion rate as given along with stage-1 variables $\left(E, E^*\right)$ when choosing its revenue-maximizing extortion rate. Corresponding FOCs for the two extortion rates are

$$R_t\left(t, t^*, E, E^*\right) = \phi(E)\left[f(L) + tf'(L) L_t \left(1 - p_t\right)\right] = 0 \text{ and} \tag{24a}$$

$$R^*_{t^*}\left(t, t^*, E, E^*\right) = \phi^*\left(E^*\right)\left[f^*\left(L^*\right) + t^* f^{*\prime}\left(L^*\right) L^*_{t^*}\left(1 - p_{t^*}\right)\right] = 0. \tag{24b}$$

Eq. (24a) implicitly defines the first terror organization's reaction function as $t = t\left(t^*; E, E^*\right)$. At a given $\left(E, E^*\right)$, the slope of this reaction function in $\left(t, t^*\right)$ space is

$$\frac{\partial t}{\partial t^*} = -\frac{R_{tt^*}}{R_{tt}}, \tag{25a}$$

where $R_{tt} < 0$ (by the SOC). Similarly, Eq. (24b) defines the second terror organization's reaction function $t^* = t^*\left(t; E, E^*\right)$ with slope,

$$\frac{\partial t^*}{\partial t} = -\frac{R^*_{t^*t}}{R^*_{t^*t^*}}, \tag{25b}$$

where $R^*_{t^*t^*} < 0$. At a symmetric reaction-function equilibrium, we have $R_{tt^*} = R^*_{t^*t} > 0$, such that the reaction functions are positively sloped (strategic complementarity) around the symmetric second-stage Nash equilibrium. Simultaneous solutions of Eqs. (24a) and (24b) for given $\left(E, E^*\right)$ yield the second-stage extortion rates,

$$t = t\left(E, E^*\right), \text{ and } t^* = t^*\left(E, E^*\right). \tag{26}$$

Recall from the earlier section that terms-of-trade effects can lead to the extortion rate in a drug-supplying country to be positively related to the counterterror effort employed at home. Strategic complementarity between the two extortion rates can bolster the possibility of a positive relationship between *E* and the extortion rate *t* [i.e., $t_E\left(E, E^*\right) > 0$]. The positive boost between *E* and *t* works as follows. Counterterror drug-supply restriction raises *p*, which then spurs drug production in the other exporting country. The latter effect raises the marginal revenue of the terror organization abroad, which increases t^*. As t^* rises, strategic complementarity in $\left(t, t^*\right)$ space drives up *t*. If, therefore, the effect of *E* on *t*, at a given t^*, is positive, then strategic complementarity ensures that the total effect of *E* on *t* (allowing for change in t^*) must be positive.

If the effect of E^* on t^* is positive for a given *t*, then the resulting rise in t^* will also increase t through strategic complementarity. Also, at given $\left(t, t^*\right)$, a rise in E^* will reduce drug supply from the second exporting country, thereby driving up the drug price and prompting the first exporting country's terror organization to raise its extortion rate *t*. Thus, the total effect of E^* on *t* [i.e., $t_{E^*}\left(E,E^*\right)$] is positive.

4.3 Stage 1

The developed country's government loss involves terror coming from both drug-supplying countries and the associated counterterror expenses. Assuming constant marginal cost of *c* and c^* for the respective two-country counterterror efforts, we get the total loss for the developed country's government to be

$$Z\left(E,E^*;c,c^*\right)=V\left(E,E^*;c\right)+V^*\left(E,E^*;c^*\right), \tag{27}$$

where $V\left(E,E^*,c\right)\equiv R\left[t\left(E,E^*\right),t^*\left(E,E^*\right),E,E^*\right]+cE$ and $V^*\left(E,E^*,c^*\right)\equiv R^*\left[t\left(E,E^*\right),t^*\left(E,E^*\right),E,E^*\right]+c^*E^*$ are the respective terror damage and counterterror expense. The FOCs for the choice of the respective counterterror levels correspond to

$$Z_E=V_E+V_E^*=0 \text{ and } Z_{E^*}=V_{E^*}+V_{E^*}^*=0, \tag{28}$$

which reduce to

$$R_{t^*}t_E^*\left(E,E^*\right)+R_t^*t_E\left(E,E^*\right)+R_E+R_E^*+c=0 \text{ and} \tag{29a}$$

$$R_t^*t_{E^*}\left(E,E^*\right)+R_{t^*}t_{E^*}^*\left(E,E^*\right)+R_{E^*}+R_{E^*}^*+c^*=0. \tag{29b}$$

From Section 4.2, we have $t_E^*\left(E,E^*\right)>0$, $t_E\left(E,E^*\right)>0$, $t_{E^*}\left(E,E^*\right)>0$, and

$t^*_{E^*}\left(E,E^*\right)>0$.[11] Also, the cross-revenue effects R_{t^*} and R^*_t are strictly positive. With strong drug price effects, the first two terms on the LHS of Eqs. (29a) and (29b) add to the marginal loss of counterterror provision. Consider the first term on the LHS of Eq. (29a), as E drives up the extortion rate t^* [because $t^*_E\left(E,E^*\right)>0$], the drug price rises because of reduced supply from the second exporting country. The higher drug price augments the revenue of the terror organization in the first exporting country leading to greater terror supply there. Similarly, as t rises in response to an increase in E [because $t_E\left(E,E^*\right)>0$], supply restriction from the first exporting country raises the overall drug price along with terrorist revenues and terrorism from the second exporting country.

The interpretations of the first two terms on the LHS of Eq. (29b) are analogous. The third term on the LHS of Eq. (29a) is $R_E = f\phi'\left(p-tp_t\right)<0$, which represents marginal gains (i.e., reduced losses) from terror reduction due to greater counterterror effort E. The fourth term R^*_E is positive because as the supply-reducing effect of E pushes up the drug price, revenues of the terror organization hosted by the other drug-producing country increases. Finally, the fifth term on the LHS of Eq. (29a) is simply the marginal counterterror provision cost. With symmetry, we can show that $p_t<1/2$, such that $R_E+R^*_E=\dfrac{f\phi'\left(p-tp_t\right)\left(1-2p_t\right)}{1-p_t}<0$, which ensures that the own effect of terror reduction R_E dominates the positive cross-effect R^*_E, leading to an overall terror reduction from an increase in E. Essentially, the optimal counterterror level E balances the gains from direct terror reduction with the marginal losses from extortion rate adjustments and the marginal counterterror cost. Similar considerations determine the optimal

[11] If any of these partials are negative, they would add to the marginal benefit of counterterrorism and bolster the case for more aggressive counterterror effort. This point is clear given the logic of the rest of this paragraph.

level of E^*.

4.4 Effects of an increase in counterterror efficiency in the first drug-exporting country

Now, we consider the comparative statics of a fall in the counterterror provision marginal cost *c*, starting from a symmetric equilibrium where $c = c^*$. Differentiating the two FOCs in Eq. (28) and solving, we have

$$\frac{dE}{dc} = -\frac{Z_{E^*E^*}}{D^E} < 0, \tag{30}$$

because the SOCs of the minimization of $Z\left(E, E^*; c, c^*\right)$ require that $Z_{EE} > 0$, $Z_{E^*E^*} > 0$, and $D^E = Z_{EE}Z_{E^*E^*} - \left(Z_{EE^*}\right)^2 > 0$. Thus, a fall in *c* must raise *E*.

The effect of a fall in *c* on E^* is given by

$$\frac{dE^*}{dc} = \frac{Z_{EE^*}}{D^E} > 0 \Leftrightarrow Z_{EE^*} > 0. \tag{31}$$

Eq. (31) shows that if and only if the cross effect of *E* on the marginal loss Z_{E^*} is positive, then a fall in *c* will reduce E^* in the second drug-exporting country. By Eqs. (30) and (31), when a fall in *c* raises *E*, Z_{E^*} will rise if and only if $Z_{E^*E} > 0$. An increase in the marginal loss Z_{E^*} requires the developed country's government to reduce its optimal level of E^* in the second drug-exporting country. Therefore, when $Z_{EE^*} = Z_{E^*E} > 0$, a fall in *c* raises *E* and *reduces* E^*. We note that under symmetry $Z_{EE^*} = 2V_{EE^*}$, such that the condition for E^* to fall along with *c* is $V_{EE^*} > 0$. Using Eq. (27) and $R_t = 0$, we get $V_E = R_{t^*}t_E^* + R_E + c$. Differentiating the RHS of the latter equality indicates that the sign of V_{EE^*} is generally ambiguous. These changes result in the following proposition:

Proposition 3

A fall in counterterror marginal provision cost in the first drug-exporting country will raise counterterror effort there but may or may not reduce counterterror effort in the second-exporting country. If the direct effect of the fall in marginal provision cost of counterterror effort in the first exporting country dominates the influences working through the two extortion rates and the developed country's counterterror efforts in the second exporting country, then terror falls in the first exporting country and rises in the second exporting country, resulting in terror transference among countries.

4.5 Discussion

The fall in counterterror provision cost in the first drug-exporting country has a direct and unambiguous counterterror-augmenting effect at home. For the other exporting country, there are several potentially opposing effects of E on the marginal benefit of E^* to consider with the sign of the final outcome depending on the associated functional forms and parameters. For example, the higher price of the drug from an enhanced level of drug-reducing counterterrorism in the first exporting country may raise or lower drug-production employment, L^*, in the second exporting country. This ambiguity follows because the increased drug price incentivizes the farmers in the second exporting country to produce more, but the concomitant rise in the resident terrorist group's extortion rate motivates those same farmers to produce less. If, however, L^* rises and the effect of this increase swamps other induced effects from changes in the two extortion rates, then terrorist revenues will rise in the second exporting country, prompting an increase in E^*. The final effect could, in general, go either way.

We turn next to the effect of a fall in c on terror originating in the two drug-supplying countries. The direct effect of a fall in c and the associated rise in E is to reduce returns for the farmers in the first exporting nation. The reduced crop output curbs the extortion revenues, R, for the resident terror organization, and if this direct effect dominates the cross-effects arising out of induced changes in t^* and E^*, then terror from the first exporting nation falls. Next, consider the effect of the fall in c on terrorist group's revenues, R^*, in the second exporting country. The direct effect here works through the increase in the price of the drug at given levels of t and E^*. As the supply restriction from increased E raises the drug price, farmers in the other drug-exporting country produce more, thereby raising their extortion revenues R^*. If this direct effect dominates the effects arising out of changes in t and E^*, then terror from the second drug-exporting country rises.

The extant literature has noted that counterterror measures against one source country of terror can transfer terrorism to another source country (Enders and Sandler 2012; Gaibulloev and Sandler 2019). Proposition 3 reveals a novel transference mechanism between terrorist-hosting countries through counterterror efforts to reduce terrorism-supporting drug production. A prime real-world example involved US cocaine interdiction efforts in Bolivia and Peru in the 1990s, during which time those two countries were major cocaine providers to North America and Europe (Pulid-Velásquez et al. 2025). The US crackdown caused cocaine prices to soar and coca production to shift from Peru and Bolivia to Colombia, which had primarily been a processor but not a grower of coca before the shift. Narcoterrorism characterized these three supply countries so that the drug production shifts caused a transference of terrorist activities by indigenous groups, such as Shining Path in Peru and FARC in Colombia (Angrist and Kugler 2008). Such transference also applied to poppy-supported terrorism in Asian countries (Afghanistan, Myanmar, and Pakistan) that confronted counterterror activities from abroad.

5 Concluding remarks

The paper presents a game-theoretical analysis of narcoterrorism in which a developed country (e.g., the United States) sustains terrorist attacks from a terrorist group residing in a weak developed country (e.g., Colombia). By extorting the developing country's drug farmers, the resident terrorist group gains financing for its organization, infrastructure, and terror campaign. The developed country is motivated to take counterterrorism measures by destroying the drug farmers' crop abroad that supports the terrorist campaign. In the baseline model where the world drug price is initially fixed, there are three key participants – a countering developed country's government, the resident terrorist group, and the drug-cultivating farmers. A three-stage game is depicted where the developed country's government chooses its counterterrorism action to minimize its loss from terrorism in stage 1. The terrorist organization then determines its extortion rate of the indigenous drug farmers in stage 2 to maximize its net extortion revenue. In stage 3, the representative drug farmers determine their labor to maximize net profit and, in so doing, fix the terrorist extortion revenue and terrorist campaign. An initial proposition shows that a rise in the price of drugs increases the counterterrorism level while relating a key elasticity to changes in the level of terrorism and the extortion rate. The elasticity in question captures the relative effectiveness of counterterrorism in eliminating the farmers' crops. In cases where this effectiveness is weak, terrorism and extortion rates are anticipated to increase.

Extensions generalize the model in two ways: (1) allowing endogeneity of the drug price and (2) allowing two drug-exporting developing countries. The first extension permits the developed country's consumers (a fourth participant) to generate the drug demand so that an endogenous market-clearing price equates drug supply and demand. The drug supply hinges, in part, on counterterrorism level and the terrorist group's extortion rate. In the second extension, the drug price is influenced by the counterterrorism levels and the terrorist groups' extortion rates in both drug-exporting countries. The latter extension can be associated with counterterror cost changes in the two drug exporters that cause a novel terror transference between the two source countries, unlike transnational terrorism transference in the literature (e.g., Heal and Kunreuther 2007; Sandler and Siqueira 2006; Schneider et al. 2015).

The analysis here involves a mix of strategic and atomistic participants in multiple countries that are linked through narcoterrorism. Our analysis identifies key considerations that can relate drug prices to terrorist extortion rates and government counterterrorism crop-destroying actions. As such, the theoretical study can serve as a foundation to panel studies involving drug trade, counterterrorism, and terrorism (e.g., Meierrieks and Schneider 2016; Piazza 2011).

There are multiple potential extensions to the analysis. For instance, two or more counterterrorism-deploying developed countries can be introduced so that a targeted developed country can free ride on another's counterterror response (Bier et al. 2007; Hausken 2012; Rossi de Oliveira et al. 2018). Currently, the models presented have the developed country assume a leadership position over the foreign terrorist group(s). This sequence can be changed to permit those participants to move simultaneously (see, e.g., Sandler and Siqueira 2006). Another extension can involve the developed country imposing penalties on its drug-consuming citizens as a means for limiting drug demand to lower the drug's price. For the large-country case, the introduction of the market-clearing drug price allows for a host of market-influencing actions.

Appendix

(1) Proof of Proposition 1

The first sentence of the proposition derives from Eq. (8). Differentiating Eq. (3) and using $R_t = 0$ yield

$$\frac{dT}{dp} = \frac{dR}{dp} = R_{E_{|t,p}} E'(p) + R_{p_{|t,E}}, \tag{A1}$$

where $E'(p)$ is defined in Eq. (8). From Eq. (7a), we have $R_{E_{|t,p}} = -1$, such that Eq. (A1) reduces to

$$\frac{dT}{dp} = R_{p_{|t,E}} - E'(p). \tag{A2}$$

From Eq. (3), we have that $R(t,E,p) \equiv t\phi(E) f\left[L^X(t,E,p)\right]$, so that

$$R_{p_{|t,E}} = t\phi(E) f'(L^X) L_p^X = -t\phi(E) f'(L^X) L_t^X > 0. \tag{A3}$$

The Online Appendix shows

$$V_{EE} = pf\phi'' - \frac{p^2 (\phi')^2 fL_t^X (p-t)}{\phi(E)(2p+t)} > 0, \tag{A4}$$

because $\phi'' > 0$ and $L_t^X < 0$. We note that Eq. (A4) establishes that the SOC of the government's loss-minimization problem is satisfied. Substituting for V_{EE} into Eq. (8), we get

$$-E'(p) = \frac{\phi\phi'\left[(t+p)f - p^2 fL_t^X\right]}{pf\phi\phi''(2p+t) - p^2(\phi')^2 fL_t^X(p-t)}. \tag{A5}$$

Based on Eqs. (A3) and (A5), we substitute for $R_{p_{|t,E}}$ and $-E'(p)$ in Eq. (A2) and simplify terms to obtain:

$$\frac{dT}{dp} > 0 \Leftrightarrow \varepsilon^{\phi} \equiv \frac{\phi\phi''}{(\phi')^2} > 1, \tag{A6}$$

as claimed in the second sentence of Proposition 1.

To consider the extortion rate, we use Eq. (5) to yield

$$\frac{dt}{dp} = t_E E'(p) + t_p . \tag{A7}$$

Substituting the expressions for t_E and t_p given in the paragraph following Eq. (5) and the expression for $E'(p)$ shown in Eq. (A5), we get

$$\frac{dt}{dp} > 0 \Leftrightarrow \varepsilon^{\phi} > \frac{t(p-t)}{p(p+2t)}, \tag{A8}$$

upon simplification. We note that $\frac{t(p-t)}{p(p+2t)} < 1$. Thus, when $\varepsilon^{\phi} > 1$, it must be that $\frac{dt}{dp} > 0$. However, since $\frac{t(p-t)}{p(p+2t)} < 1$, for $\varepsilon^{\phi} \to 1$ but $\varepsilon^{\phi} < 1$, we still have $\frac{dt}{dp} > 0$. In other words, $\varepsilon^{\phi} > 1$ is a sufficient but not a necessary condition for the extortion rate to rise in response to an increase in *p*. This completes the proof of Proposition 1.

(2) Proof of Proposition 2

The government's FOC, $V_E(E,\alpha) = 0$, implicitly defines $E(\alpha)$. Applying the implicit function rule, we get $E'(\alpha) = -\frac{V_{E\alpha}}{V_{EE}} > 0 \Leftrightarrow V_{E\alpha} < 0$, given that $V_{EE} > 0$ by the SOC. The Online Appendix shows that $V_{E\alpha} < 0$. Thus, $E'(\alpha) > 0$, as claimed in Proposition 2.

Differentiating Eq. (13) and using $R_t = 0$, we get

$$\frac{dT}{d\alpha} = \frac{dR}{d\alpha} = R_{E_{|t,\alpha}} E'(\alpha) + R_{\alpha_{|t,E}} . \tag{A9}$$

The government's FOC implies that $R_{E_{|t,\alpha}} = -1$, such that Eq. (A9) reduces to $\frac{dT}{d\alpha} = R_{\alpha_{|t,E}} - E'(\alpha)$. Substituting the expressions for $R_{\alpha_{|t,E}}$ and $E'(\alpha)$, available in the Online

Appendix, we can show that $\frac{dT}{d\alpha} > 0 \Leftrightarrow \varepsilon^{\phi} > \overline{\varepsilon}$, where $\overline{\varepsilon} = 1 + z$ and $z > 0$. Thus,

$\frac{dT}{d\alpha} > 0 \Leftrightarrow \varepsilon^{\phi} > \overline{\varepsilon}$, where $\overline{\varepsilon} > 1$.

Finally, differentiating Eq. (16) gives

$$\frac{dt}{d\alpha} = t_E E'(\alpha) + t_\alpha. \tag{A10}$$

From Eq. (17b), we know that $t_\alpha > 0$. Given that $E'(\alpha) > 0$, if $t_E \geq 0$, then Eq. (A10) yields $\frac{dt}{d\alpha} > 0$. However, if $t_E < 0$, the two terms on the RHS of Eq. (A10) have opposing signs. Even then, we show in the Online Appendix that if $\varepsilon^{\phi} > \overline{\varepsilon}$, then $\frac{dt}{d\alpha} > 0$. In other words, $\varepsilon^{\phi} > \overline{\varepsilon}$ is a sufficient but not a necessary condition for $\frac{dt}{d\alpha} > 0$, which completes the proof of Proposition 2.

(3) Proof of Proposition 3

The first sentence of the proposition follows directly from Eqs. (30) and (31) and the discussion following Eq. (31). Using Eq. (23a) and noting that $R_t = 0$, we have

$$\frac{dT}{dc} = \frac{dR}{dc} = R_{t^*}\Big|_{t,E,E^*} \frac{dt^*}{dc} + R_E\Big|_{t,t^*,E^*} \frac{dE}{dc} + R_{E^*}\Big|_{t,t^*,E} \frac{dE^*}{dc}. \tag{A11}$$

The direct effect through E of changes in c on R is given by the second RHS term of the last equality in Eq. (A11). We show in the Online Appendix that $R_E\Big|_{t,t^*,E^*} = f\phi'(p - tp_t) < 0$, such that applying $\frac{dE}{dc} < 0$ [from Eq. (30)] makes the second term strictly positive. Thus, if the second term (the direct effect) dominates the other two RHS terms of Eq. (A11), then $\frac{dT}{dc} > 0$, implying that a fall in c must reduce T as claimed in Proposition 3.

Turning to the effect of c on T^*, we use Eq. (23b) and $R^*_{t^*} = 0$ to get

$$\frac{dT^*}{dc} = \frac{dR^*}{dc} = R^*_{t_{|t^*,E,E^*}} \frac{dt}{dc} + R^*_{E_{|t,t^*,E^*}} \frac{dE}{dc} + R^*_{E^*_{|t,t^*,E}} \frac{dE^*}{dc}. \tag{A12}$$

In Eq. (A12), the direct effect of c on R^* through E is given by the second RHS term of the last equality. Differentiating Eq. (23b) with respect to E while holding $\left(t, t^*, E^*\right)$ constant, we have

$R^*_{E_{|t,t^*,E^*}} = t^*\phi^* f^{*\prime} L^*_p p_E = -t^*\phi^* f^{*\prime} L^*_{t^*} p_E > 0$. Given that $\frac{dE}{dc} < 0$, the second RHS term of Eq. (A12) must be negative. If this second term of Eq. (A12) dominates the other two RHS, then $\frac{dT^*}{dc} < 0$, which implies that a fall in c raises T^*, thereby completing the proof of Proposition 3.

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Online Appendix

1. Deriving t_E and t_p corresponding to Eqs.(4) and (5)

Using the implicit function rule in Eq. (4), we get

$$t_E = -\frac{R_{tE}}{R_{tt}}. \tag{M1}$$

Differentiating Eq. (4), using the expressions for L_t^X, L_E^X, and $L_p^X = -L_t^X$ [below Eq. (2)], and evaluating the partials at the optimal extortion rate (where $R_t = 0$) yield

$$R_{tt} = \frac{\phi L_t^X f'\left(L^X\right)\left(2p+t\right)}{p-t} < 0 \text{ and} \tag{M2a}$$

$$R_{tE} = \frac{\phi L_E^X f'\left(L^X\right)\left(p+t\right)}{p-t} < 0, \tag{M2b}$$

because L_t^X and L_E^X are negative. Substituting Eqs. (M2a) and (M2b) in Eq. (M1) gives

$$t_E = -\frac{L_E^X\left(p+t\right)}{L_t^X\left(2p+t\right)}. \tag{M3}$$

Based on the expression for L_E^X [below Eq. (2)], we have $-\frac{L_E^X}{L_t^X} = \frac{\left(p-t\right)\phi'}{\phi}$, such that Eq. (M3) reduces to

$$t_E = \frac{\phi'\left(E\right)\left(p-t\right)\left(p+t\right)}{\phi\left(E\right)\left(2p+t\right)} = \frac{\phi'\left(E\right)\left(p^2-t^2\right)}{\phi\left(E\right)\left(2p+t\right)} < 0, \tag{M4}$$

because $p > t$, and $\phi' < 0$.

Similarly, we note that $t_p = -\frac{R_{tp}}{R_{tt}}$. Applying substitutions analogous to those above, we have $R_{tp} = -\frac{\phi L_t^X f'\left(L^X\right)\left(p+2t\right)}{p-t} < 0$. Using this expression for R_{tp} and Eq. (M2a), we get

$$t_p = -\frac{R_{tp}}{R_{tt}} = \frac{p+2t}{2p+t}.$$

2. Deriving Eq. (7b)

Differentiating Eq. (3) with respect to E at a given (t, p), we derive

$$R_{E_{|t,p}} = t\left(f\phi' + \phi f' L_E^X\right). \tag{M5}$$

Recall from Eq. (2) that $\phi L_E^X = -(p-t)\phi' L_t^X$. Substituting $-(p-t)\phi' L_t^X$ for ϕL_E^X yields

$f\phi' + \phi f' L_E^X = \phi'(E)\left(f + tf' L_t^X - pf' L_t^X\right) = -\phi'(E)\, pf' L_t^X$, since [by Eq. (4)] $f + tf' L_t^X = 0$. Thus,

Eq. (M5) reduces to $R_{E_{|t,p}} = -t\phi'(E)\, pf' L_t^X$. Applying Eq. (4) again, we know that $tf' L_t^X = -f$.

Therefore, substituting $-f$ for $tf' L_t^X$, we get $R_{E_{|t,p}} = \phi'(E)\, pf < 0$, given $\phi' < 0$. Using

$R_{E_{|t,p}} = \phi'(E)\, pf$ in Eq. (7a) gives $V_E(E,p) = \phi'(E)\, pf + 1 = 0 \Leftrightarrow \left|\phi'(E)\right| pf = 1$.

3. Deriving Eq. (8)

From Eq. (7a) and its preceding paragraph, we note that

$$V_E(E,p) \equiv \phi'(E)\, pf + 1 \equiv \phi'(E)\, pf\left\{L^X\left[t(E,p), E, p\right]\right\} + 1, \tag{M6}$$

where partial differentiation with respect to E yields

$$V_{EE}(E,p) = p\left[f\phi'' + \left(L_t^X t_E + L_E^X\right)\phi' f'\right]. \tag{M7}$$

Substituting the expressions for L_t^X, L_E^X, and t_E in the RHS of Eq. (M7), we can rewrite Eq.

(M7) as

$$V_{EE}(E,p) = pf\phi'' - \frac{(p\phi')^2 f' L_t^X (p-t)}{\phi(2p+t)} > 0, \tag{M8}$$

because $\phi'' > 0$ and $L_t^X < 0$. Eq. (M8) indicates that the SOC of the government's loss-minimization problem is satisfied.

Partially differentiating Eq. (M6) with respect to *p* and using $t_p = \frac{p+2t}{2p+t}$, we get

$$V_{Ep}(E,p) = \frac{\phi'(E)\left[f\left(L^X\right)(p+t) - p^2 f'\left(L^X\right)L_t^X\right]}{2p+t} < 0, \tag{M9}$$

after simplification, because $\phi' < 0$ and $L_t^X < 0$. Substituting the RHS expression of Eq. (M9) for V_{Ep} gives the last RHS expression of Eq. (8).

4. Deriving Eq. (14)

Partial differentiation of Eq. (13) with respect to *t* yields

$$R_t = \phi\left[f + tf'\left(L^X\right)\left(L_t^X + L_p^X p_t\right)\right], \tag{M10}$$

where substituting $-L_t^X$ for L_p^X on the RHS produces Eq. (14).

5. Deriving Eqs. (17a) and (17b)

In the large-country case, t_E is different from what is shown in Eq. (M3) because $R = R(t,E;\alpha)$, where the latter is defined by Eq. (13). Given Eq. (14), we know that $t_E = -\frac{R_{tE}(t,E;\alpha)}{R_{tt}(t,E;\alpha)}$.

Define $\chi(t,E;\alpha) \equiv f + tf'(\cdot)L_t^X(\cdot)(1-p_t)$, so that $R_t = \phi(E)\chi(t,E;\alpha)$ by Eq. (14). Partially differentiating the latter expression with respect to *t*, we get $R_{tt} = \phi\chi_t$. Similarly, $R_{tE} = \chi\phi'(E) + \phi\chi_E$. The optimal extortion rate $R_t = 0$ implies $\chi = 0$, so that $R_{tE} = \phi\chi_E$. Thus,

$t_E = -\frac{\chi_E}{\chi_t}$. For the current section, we note that $L^X = L^X\left[t, E, p(t,E;\alpha)\right] \Rightarrow \frac{\partial L^X}{\partial t} = (1-p_t)L_t^X$

and $L_t^X = \frac{f'(L^X)}{\left[p(t,E;\alpha)-t\right]f''(L^X)}$. Considering these relationships, using the expressions for the partials of p [noted after Eq. (12)], and assuming linear demand (i.e., m is constant), we differentiate $\chi(t,E;\alpha) = f(L^X) + tf'(L^X)L_t^X(1-p_t)$ with respect to t to obtain

$$\chi_t = \frac{f'L_t^X(1-p_t)\left[2(p-t)+3t(1-p_t)^2\right]}{p-t} < 0, \tag{M11}$$

upon simplification. Eq. (M11) establishes that the terror organization's SOC is satisfied because $R_{tt} = \phi\chi_t < 0$. Turning to $R_{tE} = \phi\chi_E$, we similarly differentiate χ with respect to E to get

$$\chi_E = -\frac{f'L_t^X(1-p_t)\phi'\left\{p^2 - t^2 - tp_t\left[2(p-t)+3(1-p_t)(p-tp_t)\right]\right\}}{(p-t)\phi}. \tag{M12}$$

Using Eqs. (M11) and (M12) in $t_E = -\frac{\chi_E}{\chi_t}$, we derive Eq. (17a).

Noting that $t_\alpha = -\frac{\chi_\alpha}{\chi_t}$, we use a similar procedure to derive Eq. (17b).

6. Deriving Eq. (19)

Using Eq. (18) and noting that $R_t(t,E;\alpha) = 0$, we get

$$V_E(E,\alpha) = R_{E_{|t,\alpha}} + 1. \tag{M13}$$

Partial differentiation of Eq. (13) with respect to E produces

$$R_{E_{|t,\alpha}} = t\left[f\phi' + \phi f'(\cdot)\left(L_E^X + L_p^X p_E\right)\right] = t\left[f\phi' + \phi f'(\cdot)L_t^X\left(\frac{L_E^X}{L_t^X} - p_E\right)\right]. \tag{M14}$$

From the price partials below Eq. (12), we note that

$$\frac{p_E}{p_t} = \frac{f\phi'}{\phi f' L_t^X} + \frac{L_E^X}{L_t^X} \Rightarrow p_E = \left(\frac{f\phi'}{\phi f' L_t^X} + \frac{L_E^X}{L_t^X}\right) p_t \ . \tag{M15}$$

Noting that $\frac{L_E^X}{L_t^X} = -\frac{(p-t)\phi'}{\phi}$ [from Eq. (2)] and substituting the last RHS term in Eq. (M15) for p_E, we have

$$\frac{L_E^X}{L_t^X} - p_E = \frac{\phi'(1-p_t)\left[t(1+p_t)-p\right]}{\phi}. \tag{M16}$$

Substituting the RHS of Eq. (M16) for $\frac{L_E^X}{L_t^X} - p_E$ on the RHS of Eq. (M14), we obtain

$$R_{E_{|t,\alpha}} = t\phi'(\cdot)\left\{f + f'(\cdot)L_t^X(1-p_t)\left[t(1+p_t)-p\right]\right\}. \tag{M17}$$

Given Eq. (14), we have $f'(\cdot)L_t^X(1-p_t) = -f/t$. Substituting the latter expression for $f'(\cdot)L_t^X(1-p_t)$ on the RHS of Eq. (M17) and simplifying, we get $R_{E_{|t,\alpha}} = f\phi'(E)(p - tp_t)$, which when substituted for $R_{E_{|t,\alpha}}$ in Eq. (M13) yields Eq. (19).

7. Deriving V_{EE}, $V_{E\alpha}$, and $E'(\alpha)$

From Eq. (19), we have $V_E = \phi'(E) f(L^X)(p - tp_t) + 1$, where $p \equiv p\left[t(E,\alpha), E; \alpha\right]$,

$L^X = L^X\left\{t(E,\alpha), E, p\left[t(E,\alpha), E; \alpha\right]\right\}$, $L_t^X \equiv \frac{f'(L^X)}{\left[p(\cdot) - t(\cdot)\right]f''}$, constant $m < 0$, and $f''' = 0$.

Based on these relationships, we differentiate V_E with respect to E and simplify to get

$$V_{EE} = -\frac{\phi''}{\phi'} + \frac{t_E}{t} + \frac{f' L_t^X(\cdot)\left(p_E - \frac{L_E^X}{L_t^X}\right)}{f} + f\phi'(E)\left[p_E - t\left(\frac{dp_t}{dE}\right)_{|\alpha}\right], \tag{M18}$$

where $\phi''(E)$ is assumed sufficiently large to ensure that $V_{EE} > 0$ (i.e., the government's SOC is satisfied). Similarly, differentiating V_E with respect to α and simplifying give

$$V_{E\alpha} = \phi' p_\alpha \left[f - \frac{(p-t)(p-tp_t) f' L_t^X - 3tfp_t(1-p_t)}{2(p-t)+3t(1-p_t)^2} \right] < 0, \tag{M19}$$

because $\phi' < 0$, $L_t^X < 0$, $0 < p_t < 1$, and $p_\alpha > 0$. The last inequality is established following Eq. (12). Applying Eqs. (M18) and (M19) gives $E'(\alpha) = -\frac{V_{E\alpha}}{V_{EE}} > 0$, as claimed in Proposition 2.

8. Deriving the condition for $\frac{dT}{d\alpha} > 0$

Differentiating Eq. (13) with respect to α for a given (t, E), we have

$$R_{\alpha_{|t,E}} = -t\phi f' L_t^X p_\alpha. \tag{M20}$$

Using Eqs. (M18)-(M20) in Eq. (A9) and recalling that $R_{E_{|t,\alpha}} = -1$, Eq. (A9) reduces to

$$\frac{dT}{d\alpha} = \frac{dR}{d\alpha} = R_{\alpha_{|t,E}} - E'(\alpha) = \frac{V_{E\alpha}}{V_{EE}} - t\phi f' L_t^X p_\alpha. \tag{M21}$$

Substituting the respective expressions for V_{EE} and $V_{E\alpha}$ from Eqs. (M18) and (M19) in Eq. (M21), we have $\frac{dT}{d\alpha} > 0 \Leftrightarrow \varepsilon > 1 + Z$, where

$$Z = -f\phi' p_t \left\{ p - t + \frac{3t(1-p_t)\left[2p_t(p-tp_t) + (1-p_t)(p+t-2tp_t)\right]}{2(p-t)+3t(1-p_t)^2} \right\} > 0, \tag{M22}$$

because $p + t - 2tp_t = p - t + 2t - 2tp_t = p - t + 2t(1-p_t) > 0$ and $\phi' < 0$. Thus,

$\frac{dT}{d\alpha} > 0 \Leftrightarrow \varepsilon > 1 + Z = \bar{\varepsilon}$, where $\bar{\varepsilon} > 1$ because $Z > 0$.

9. Showing that $\frac{dt}{d\alpha} > 0$ *if* $\varepsilon > \bar{\varepsilon}$

Recall Eq. (A10) where $\frac{dt}{d\alpha} = t_E E'(\alpha) + t_\alpha$. Given that $E'(\alpha) > 0$ and $t_\alpha > 0$, if $t_E \geq 0$, then

$\frac{dt}{d\alpha} > 0$ for any value of ε. Next, we consider $t_E < 0$. We note that if $\varepsilon > \bar{\varepsilon}$, then

$\frac{dT}{d\alpha} = R_{\alpha_{|t,E}} - E'(\alpha) > 0 \Rightarrow R_{\alpha_{|t,E}} > E'(\alpha)$. Since $t_E < 0$, $R_{\alpha_{|t,E}} > E'(\alpha)$ implies that

$t_E R_{\alpha_{|t,E}} < t_E E'(\alpha)$. Adding t_α to both sides of the last inequality, we get

$\frac{dt}{d\alpha} = t_E E'(\alpha) + t_\alpha > t_E R_{\alpha_{|t,E}} + t_\alpha$. Thus, $\frac{dt}{d\alpha} > t_\alpha \left(\frac{t_E R_{\alpha_{|t,E}}}{t_\alpha} + 1 \right) > 0 \Leftrightarrow \frac{t_E R_{\alpha_{|t,E}}}{t_\alpha} + 1 > 0$ because

$t_\alpha > 0$. Using the expressions for t_E and t_α from Eq. (17a) and (17b) , as well as the expression for $R_{\alpha_{|t,E}}$ [from Eq. (M20)], we get

$$1 + \frac{t_E R_{\alpha_{|t,E}}}{t_\alpha} = \frac{t(1-p_t)\left[2(p-t) + 3t(1-p_t)\right]}{(p - tp_t)\left[p - t + 3t(1-p_t)^2\right]} > 0. \tag{M23}$$

Therefore, if $\varepsilon > \bar{\varepsilon}$, then $\frac{dt}{d\alpha} > 0$.

10. Strategic complementarity between t *and* t^*

Partial differentiation of R_t with respect to *t* [in Eq. (24a)], simplification of resulting terms, and assumed symmetry yield

$$R_{tt} = \phi(1-p_t) L_t f'(L) \left\{ 2 + \frac{3t(1-2p_t)\left[1 - p_t(1-p_t)\right]}{(p-t)(1-p_t)} \right\} < 0. \tag{M24}$$

This follows because symmetry yields $1 - \left(p_t + p_{t^*}\right) = 1 - 2p_t = \frac{m}{M} > 0$ and $p_t(1-p_t) < 1$ with

$0 < p_t < 1$. Symmetry ensures satisfaction of the SOC of the terrorist organization.

Partially differentiating R_t with respect to t^* and applying symmetry, we get

$$R_{tt^*} = -\phi L_t p_t f'(L)\left[1 + \frac{3t(1-p_t)(1-2p_t)}{p-t}\right] > 0, \tag{M25}$$

because $1-2p_t > 0$ and $L_t < 0$. Under symmetry, Eqs. (M24) and (M25) yield $R_{tt} = R^*_{t^*t^*} < 0$

and $R_{tt^*} = R^*_{t^*t} > 0$, such that $\frac{\partial t}{\partial t^*} > 0$ and $\frac{\partial t^*}{\partial t} > 0$, given Eqs. (25a)-(25b).

11. Deriving the expression for R_E in the two exporting-country case

Differentiating $R(t, t^*, E, E^*) \equiv t\phi(E) f\left\{L\left[t, E, p(t, t^*, E, E^*)\right]\right\}$ with respect to *E* for given

(t, t^*, E^*) yields

$$R_{E|_{t,t^*,E^*}} = t\left[f\phi' + \phi f'(L_E + L_p p_E)\right]. \tag{M26}$$

Following similar steps to the derivation of Eq. (19) in #6 above, we can reduce Eq. (M26) to

$R_{E|_{t,t^*,E^*}} = f\phi'(E)(p - tp_t)$.