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Immigration and Terrorism

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Abstract

This paper presents a general equilibrium analysis of immigration and counterterrorism policy. An international terrorist organization based in a developing nation draws unskilled and skilled labor from the productive sector to hit its targets. Labor units choose to join terrorism if their return from volunteering for the terrorist organization exceeds their return from productive activity. The terrorist organization chooses to allocate the limited supply of these factors to attack its host nation and also to attack the developed nation. The developing nation chooses a proactive counterterrorism policy, while the developed nation chooses an optimal mix of skilled and unskilled immigration policies and a defensive counterterrorism policy. We analyze the Nash policy equilibrium as well as the Stackelberg equilibrium where the developed nation is the Stackelberg leader.

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Abstract

This paper presents a general equilibrium analysis of immigration and counterterrorism policy. An international terrorist organization based in a developing nation draws unskilled and skilled labor from the productive sector to hit its targets. Labor units choose to join terrorism if their return from volunteering for the terrorist organization exceeds their return from productive activity. The terrorist organization chooses to allocate the limited supply of these factors to attack its host nation and to attack the developed nation. The developing nation chooses proactive counterterrorism policies taking into account the behavior of the terrorist organization. The developed nation chooses an optimal mix of skilled and unskilled immigration policies and a defensive counterterrorism policy. Our main findings are the following: (i). Defense by the developed nation reduces terror against it, while raising terror in the developing nation; (ii). Proaction may or may not reduce terror in the developed nation; (iii). Even if proaction raises terror in the developing nation it may still be rational for it to use the policy; (iv). The developing nation's proaction rises when the developed nation raises its defense; (v). An increase in the unskilled immigration quota raises terrorism against the developed nation; (vi). If the developed nation chooses its policy at an earlier stage compared to the developing nation, it will defend more aggressively, but reduce its unskilled immigration quota, because of a strategic effect which helps spur proaction.

Keywords: Transnational terrorism, Immigration, Counterterrorism Policy.

JEL codes: D74, F22, H40.

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1. Introduction

In recent years, terrorism and its economic implications have increasingly interested economists. While contributions such as Sandler and Siqueira (2006), and Siqueira and Sandler (2007), have focused on the demand side of the problem; Krueger and Maleckova (2003), and Abadie (2006), among others, have focused on the supply side. Krueger and Laitin (2007) focus on both the supply and demand sides of transnational terrorism to analyze what determines whether a nation is a source or a target of international terrorism. Another strand of the literature relates trade to terrorism. The findings of this literature are nicely summarized in Mirza and Verdier (2008). In spite of these contributions, to my knowledge, there is no paper that formally connects immigration policy to the supply of terrorism in a general equilibrium context. This is an important omission because an exclusive focus on the standard terms of trade effects of immigration may lead us to wrong policy conclusions. We show that in general equilibrium, terrorism related costs (or benefits) along with the terms of trade effects are critical in determining optimal immigration policy.

We focus on terrorism that is produced by a transnational organization that is based in a developing nation. This organization uses potentially productive factors to create terrorism. It hits targets in its host nation, as well as in the developed nation. The technologies to produce these two kinds of terrorism are different, because hitting a target in a developed nation like the US may perhaps require a different kind of skill level compared to hitting a target close to the terrorist base in a developing nation. Assuming that international terrorism is more skill intensive compared to domestic terrorism, we analyze the effects of counterterrorism policy as well as immigration policy on the supply of terrorism.

The remainder of the paper contains four sections. Section 2 presents the analysis of the terrorists' decision problem. Section 3 considers the developing nation's government's decision problem. Section 4 considers the policy choices of the developed nation. Section 5 concludes.

2. The Terrorist Organization

The terrorist organization derives benefit from attacking targets in both the host developing nation (say *F*) and the developed (say *H*) nation. Along the lines of Mirza and Verdier (2008) and Bandyopadhyay et al (2011) we propose that the terrorist utility function is:

$$V = \phi^H \left(p^H T^H + p^F \tilde{T}^H \right) + \phi^F p^F T^F , \qquad (1)$$

where ϕ^j is the terrorists' preference for attacking nation *j* (=*H*,*F*), p^j is the probability of success of a planned attack in nation-*j*, while T^j is the level of terror damage for nation-*j* from a successful attack in nation-*j*.[1] $\tilde{T}^H$ is the terror damage for *H* from an attack in *F*. As in Bandyopadhyay et al (2011) we assume that terror damage for *H* in *F* is:[2]

$$\tilde{T}^H = \delta^H T^F , \qquad (2)$$

where δ^H is a parameter measuring the extent of *H*'s foreign interests in *F*. Eqs. (1) and (2) imply that:

$$V = \gamma^H T^H + \gamma^F T^F \text{, where, } \gamma^H = \phi^H p^H \left(e \right) \text{, and } \gamma^F = \left(\phi^H \delta^H + \phi^F \right) p^F . \qquad (3)$$

The probability of success of a planned attack against *H* is lowered by its defensive actions (although at a diminishing rate). Thus:

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[1] We assume both economies produce the same single good, which serves as the numeraire in this model. Also, the developed nation is assumed to have superior technology, which contributes to its factor returns being strictly larger than the corresponding factor returns in the developing nation. This international factor price difference is possible (in equilibrium) because factor mobility is controlled by immigration quotas imposed by the developed nation.

[2] We should note a few things here. First, we assume that *F* has no foreign interests in *H*. Therefore attacks in *H* are attacks against *H* alone. However, *H* has foreign interests in *F* that may be subject to attacks. In principle, attacks in *F* against *H*'s or *F*'s interests may be separate. Also, these attack technologies may be distinct, with different skill intensities. If this is the case, then there are three skill intensities, a high skill intensity for attacks in *H*, an intermediate intensity for attacks against *H* in *F*, and a low skill intensity for attacks against *F*. Although this structure is reasonable, it is analytically intractable in this general equilibrium setup. The compromise that we use is that an attack against *F* has a collateral damage component for *H*, which is weighted by its foreign interests in *F*. For example, if the US has extensive foreign interests in Pakistan, then in an *ex ante* sense, it will more likely suffer from a terrorist attack in Pakistan.

$$p^H = p^H(e), \; p^{H\prime}(\bullet) < 0, \text{ and } p^{H\prime\prime}(\bullet) > 0. \tag{4}$$

Terror attacks targeted at a developed nation from foreign bases require a higher degree of sophistication and are produced using a more skill intensive technology. However, both types of terror require a mix of unskilled and skilled labor and exhibit constant returns to scale (CRS). The terror production functions are:[3]

$$T^H = T^H\left(L^{tH}, S^{tH}\right), \text{ and,} \tag{5a}$$

$$T^F = T^F\left(L^{tF}, S^{tF}\right), \tag{5b}$$

where L^{tj} (S^{tj}) is unskilled (skilled) labor used by the terrorists to attack targets in nation-*j*. Unskilled (skilled) labor supply is inelastically given for *F* at $\bar{L}^F$ ($\bar{S}^F$). We assume that *H*'s immigration quotas are α and ρ, for unskilled and skilled labor, respectively. Thus, the unskilled and skilled labor force available in *F* are $\bar{L}^F - \alpha$, and $\bar{S}^F - \rho$, respectively.

Each unit of unskilled labor has a certain level of radical beliefs parameterized by θ^u, which means that if they succeed in working for the terrorist organization they get an utility equivalent to θ^u units of the numeraire good. While units of unskilled labor are homogeneous as inputs in terrorism or in producing goods, they differ in their radical beliefs. The distribution of such beliefs is given by the following probability density function and distribution function, respectively:

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[3] These are standard CRS production functions with positive marginal products T_i^j, negative second partials ($T_{ii}^J < 0$), and positive cross partials ($T_{ix}^j < 0$, $i \neq x$). We also assume without loss of generality that producing terror directed against *H* is more skill intensive (i.e., $l^{tH} < l^{tF}$, where $l^{tj} = \dfrac{L^{tj}}{S^{tj}}$, $j = H, F$). Unless specified otherwise, we wll use the convention that for any function $f\left(x_1, x_2, ..x_n\right)$, f_i is the partial of f with respect to its *i*-th argument, and f_{ij} the partial of f_i with respect to the *j*-th. Argument.

$$\theta^u \sim x\left(\theta^u\right),\ X\left(\bar{\theta}\right) = \int_{-\infty}^{\bar{\theta}} x\left(\theta^u\right) d\theta^u . \tag{6}$$

All unskilled labor units in *F* earn w^{uF} from the productive sector, which equals the marginal product of unskilled labor in production of goods. When they volunteer for the terrorist organization, they know that there is a chance that they may not be able to effectively serve for the organization. For example, they may be killed or incarcerated before they have been able to take part in an attack. We assume that they succeed in providing their services to the terrorist organization with a probability β, which is a declining function of proactive effort *m* undertaken by the host government. Assuming diminishing returns in the use of proaction, we have:

$$\beta = \beta\left(m\right),\ \beta'\left(\bullet\right) < 0 \text{, and } \beta''\left(\bullet\right) > 0 . \tag{7}$$

An unskilled labor unit stays in the productive sector if:

$$\theta^u \beta\left(m\right) < w^{uF} \Rightarrow \theta^u < \frac{w^{uF}}{\beta\left(m\right)} . \tag{8}$$

Using (6) and (8), the fraction of unskilled labor force which stays in the productive sector is $X\left(\frac{w^{uF}}{\beta\left(m\right)}\right)$. Thus $\left(1 - X\right)\left(\bar{L}^F - \alpha\right)$ labor units volunteer for the terrorist organization, of which a fraction β succeeds in providing its services to the terrorist organization. Thus, the unskilled labor pool L^T for the terrorist organization is:

$$L^T = \beta\left(m\right)\left[1 - X\left(\frac{w^{uF}}{\beta\left(m\right)}\right)\right]\left(\bar{L}^F - \alpha\right) = L^T\left(\alpha, w^{uF}, m, \bar{L}^F\right) \tag{9}$$

Similarly, let θ^s, $g\left(\theta^s\right)$, and $G\left(\theta^s\right)$, the radicalization parameter, the probability density function, and the distribution function for skilled labor, respectively. Then, assuming that the economy's endowment of skilled labor is $\bar{S}^F - \rho$, the skilled labor volunteers for the terrorist organization are:

$$S^T = \beta(m)\left[1-G\left(\frac{w^{sF}}{\beta(m)}\right)\right]\left(\bar{S}^F-\rho\right) = S^T\left(\rho, w^{sF}, m, \bar{S}^F\right). \tag{10}$$

The terrorist organization maximizes its utility [Eq. (3)], given its supply of skilled and unskilled labor [Eqs. (9) and (10)]. The constrained optimization problem for the terrorist organization is:

$$Max\, V = \gamma^H T^H\left(L^{tH}, S^{tH}\right) + \gamma^F T^F\left(L^{tF}, S^{tF}\right) + \lambda_L\left[L^T\left(\alpha, w^{uF}, m, \bar{L}^F\right) - L^{tH} - L^{tF}\right]$$

$$+\lambda_S\left[S^T\left(\rho, w^{sF}, m, \bar{S}^F\right) - S^{tH} - S^{tF}\right]. \tag{11}$$

The first order conditions (presented in an appendix at the end) yield the unskilled and skilled labor used by the terrorist organization, and also yields the shadow prices λ_L and λ_S. Denoting the vector of parameters faced by the terrorist organization by μ, we have:

$L^{tj} = L^{tj}(\mu),\ S^{tj} = S^{tj}(\mu),\ j = H, F;\ \lambda_i = \lambda_i(\mu),\ i = L, S$; where,

$$\mu = \mu\left(\gamma^H, \gamma^F, w^{uF}, \alpha, \rho, w^{sF}, m, \bar{L}^F, \bar{S}^F\right). \tag{12}$$

Substituting (12) in (11) we have the envelope function V^*, where:

$$V^* = V^*\left(\gamma^H, \gamma^F; \alpha, \rho, w^{uF}, w^{sF}, m, \bar{L}^F, \bar{S}^F\right). \tag{13}$$

V^* is similar to the revenue function used in dual models of trade (see Dixit and Norman, 1980, for a comprehensive treatment). Using the envelope theorem, the supply of terrorism aimed at *H* and *F* are obtained as:

$$V_1^* = T^H\left[L^{tH}(\mu), S^{tH}(\mu)\right], \text{ and,} \tag{14a}$$

$$V_2^* = T^F\left[L^{tF}(\mu), S^{tF}(\mu)\right]. \tag{14b}$$

It is easy to show that V^* is convex and homogeneous of degree one in γ^H and γ^F.[4]

[4] Proof is standard and is available from the authors on request.

Proposition 1

A rise in the defense effort (e) by H reduces terror against it while raising the terror directed at F.

Proof

Using the first order conditions of the optimization problem it is easy to show that:[5]

$$\frac{\partial T^H}{\partial \gamma^H} = V_{11}^* > 0 . \tag{15}$$

Noting that $\gamma^H = \phi^H p^H(e)$,

$$\frac{\partial T^H}{\partial e^H} = \left(\frac{\partial T^H}{\partial \gamma^H}\right)\phi^H p^{H\prime} < 0 . \tag{16}$$

From homogeneity of degree one of V^*, we know that the first order partial V_1^* is homogeneous of degree zero in γ^H and γ^F. Using Euler's theorem and (15):

$$0 = V_{11}^*\gamma^H + V_{12}^*\gamma^F \Rightarrow V_{12}^* = -V_{11}^*\frac{\gamma^H}{\gamma^F} < 0 \Rightarrow V_{12}^* = V_{21}^* = \frac{\partial T^F}{\partial \gamma^H} < 0 . \tag{17a}$$

(17a) implies that:

$$\frac{\partial T^F}{\partial e} = \left(\frac{\partial T^F}{\partial \gamma^H}\right)\phi^H p^{H\prime} > 0 . \tag{17b}$$

Equations (16) and (17b) establish the proposition. ■

The proposition confirms the terror reduction versus the terror deflection role of defensive actions that have been discussed by Enders and Sandler (2006), Sandler and Siquera (2006), Intriligator (2010), Bandyopadhyay and Sandler (2011) among others. When defense is raised by one nation, it reduces the attacks on that nation but raises it on other potential target nations.

We now turn our attention to the effects of proactive policies. The effect of a rise in

[5] Proof is in the appendix.

proaction m on home terror is:

$$\frac{\partial T^H}{\partial m} = \frac{\partial V_1^*}{\partial m} = \frac{\partial V_m^*}{\partial \gamma^H}. \tag{18}$$

Using the envelope property of V^*, we can use (11) to get:

$$V_m^* = \lambda_L \frac{\partial L^T}{\partial m} + \lambda_S \frac{\partial S^T}{\partial m}. \tag{19}$$

Differentiating (9) and (10), respectively, we get:

$$\frac{\partial L^T}{\partial m} = L_m^T = \left(\bar{L}^F - \alpha\right)\beta'(m)\left(1 - X + \frac{xw^{uF}}{\beta}\right) < 0;$$

$$\text{and } \frac{\partial S^T}{\partial m} = S_m^T = \left(\bar{S}^F - \rho\right)\beta'(m)\left(1 - G + \frac{gw^{sF}}{\beta}\right) < 0. \tag{20}$$

Substituting (20) in (19) and differentiating (19), we get:

$$\frac{\partial V_m^*}{\partial \gamma^H} = L_m^T\left(\frac{\partial \lambda_L}{\partial \gamma^H}\right) + S_m^T\left(\frac{\partial \lambda_S}{\partial \gamma^H}\right). \tag{21}$$

We show in the appendix that:

$$\frac{\partial \lambda_L}{\partial \gamma^H} = \gamma^F T_{11}^F\left(\frac{\partial l^{tF}}{\partial \gamma^H}\right) < 0; \text{ and, } \frac{\partial \lambda_S}{\partial \gamma^H} = \gamma^F T_{21}^F\left(\frac{\partial l^{tF}}{\partial \gamma^H}\right) > 0. \tag{22}$$

Using (18), (21) and (22) we find that the sign of $\frac{\partial T^H}{\partial m}$ is ambiguous. Proposition 2 throws more light on this issue.

Proposition 2

A small rise in *F*'s proactive effort will reduce terror against *H* if and only if l^{tF} exceeds a critical level l^0. This critical level depends on the initial proaction level, *F*'s factor endowments and factor prices, and the probability density functions *f* and *g*. Terror against *F* will fall if and only if l^{tH} exceeds this critical value l^0. It is not possible for terror to rise against both nations.

Proof

Using (18) through (22):

$$\frac{\partial T^H}{\partial m} < 0 \text{ if and only if } l^{tF} > l^0,$$

$$\text{where, } l^0 = \frac{L_m^T}{S_m^T} = \left(\frac{\bar{L}^F - \alpha}{\bar{S}^F - \rho}\right)\left[\frac{(1-X)\beta + xw^{uF}}{(1-G)\beta + gw^{sF}}\right] = l^0\left(\alpha, \rho, w^{uF}, w^{sF}, m, \bar{L}^F, \bar{S}^F\right). \quad (23)$$

Analogously, we can show that:

$$\frac{\partial T^F}{\partial m} < 0 \text{ if and only if } l^{tH} < l^0. \quad (24)$$

Note from the terrorist organization's first order conditions that the terror labor intensities are entirely determined by γ^H and γ^F and independent of any parameter that determines l^0 above. Therefore, depending on values of γ^H and γ^F, we can have different possibilities. We can rule out the possibility that both $\frac{\partial T^H}{\partial m}$ and $\frac{\partial T^F}{\partial m}$ are positive, because it requires that $l^{tF} < l^0$, and $l^{tH} > l^0$. This case violates the assume factor intensity ranking $l^{tH} < l^{tF}$. Based on (23) and (24), three cases are possible:

Case 1: $\frac{\partial T^H}{\partial m} > 0$, $\frac{\partial T^F}{\partial m} < 0$, if $l^{tF} < l^0$, $l^{tH} < l^0$.

Case 2: $\frac{\partial T^H}{\partial m} < 0$, $\frac{\partial T^F}{\partial m} > 0$, if $l^{tF} > l^0$, $l^{tH} > l^0$, and,.

Case 3: $\frac{\partial T^H}{\partial m} < 0$, $\frac{\partial T^F}{\partial m} < 0$, if $l^{tF} > l^0 > l^{tH}$.

Cases 1 through 3 establish that proaction will reduce terror against both the home and the foreign nations only in the third case, where the critical value l^0 lies in between the factor intensities of the two types of terrorism. If l^0 is low relative to the two factor intensities then preemption raises terror against the home nation while it reduces terror against the foreign nation. This result is reversed if l^0 is high relative to the two factor intensities. ■

The envelope properties of V^* can be used to unravel the effects of changes in the wage rates, factor endowments, probability distributions and targeting preferences. Proposition 3 summarizes these results.

Proposition 3

A rise in the target preference for *H* raises T^H and lowers T^F. A rise in unskilled (skilled) emigration raises (reduces) T^H and reduces (raises) T^F. A rise in *F*'s unskilled (skilled) wage raises (reduces) T^H and reduces (raises) T^F.

Proof

The proof is provided in the appendix. The explanation is the following. A greater target preference for *H* makes the terrorists devote more of its resources to attacking *H*. This leaves fewer resources for attacks on *F*. Thus, when terrorists fixate on *H*, T^H rises and T^F falls. The rest of the proposition can be traced back to the well known Rybczynski theorem. When *F*'s unskilled emigration rises, the terrorist organization's unskilled resources L^T falls [see Eq. (9)]. Along the lines of the Rybczynski theorem, this suggests that unskilled labor intensive terror (T^F) should fall, while skill intensive terror (T^H) must rise. A rise in *F*'s unskilled wage has exactly the opposite effect, because it makes the productive sector more attractive for the unskilled laborers, thereby reducing the relative abundance of unskilled labor for the terrorist organization. ■

3. The Foreign Government

We assume that *F* produces a single good Q^F using the following CRS production function:

$$Q^F = \eta^F\left(L^F, S^F\right), \tag{25}$$

where L^F and S^F are unskilled and skilled labor used in the production of this good. Recalling that *X* is the share of unskilled labor engaging in productive activity in *F*, we have:[6]

$$L^F = \left(\overline{L}^F - \alpha\right)X\ , \tag{26a}$$

and, similarly,

$$S^F = \left(\overline{S}^F - \rho\right)G\ . \tag{26b}$$

F's national income including the earnings of its emigrants and net of terror damage and counterterrorism spending is:

$$Y^F = \eta^F\left[\left(\overline{L}^F - \alpha\right)X, \left(\overline{S}^F - \rho\right)G\right] + w^{uH}\alpha + w^{sH}\rho - T^F - m, \tag{27}$$

where w^{uH} and w^{sH} are the unskilled and skilled wage rates, respectively, in *H*.

We assume that *H*'s CRS production function is:

$$Q^H = \eta^H\left(L^H, S^H\right). \tag{28}$$

Accounting for the immigrants in *H*'s labor pool, we get:

$$L^H = \overline{L}^H + \alpha\text{, and, } S^H = \overline{S}^H + \rho\,. \tag{29}$$

The wage rates in the two nations reflect their respective marginal products. Therefore, we have (suppressing the factor endowments in the functional forms):

$$w^{uH} = \eta_1^H\left(i^H, 1\right) \equiv w^{uH}\left(i^H\right),\ w^{sH} = \eta_2^H\left(i^H, 1\right) \equiv w^{sH}\left(i^H\right),\ w^{uF} = \eta_1^F\left(i^F, 1\right) \equiv w^{uF}\left(i^F\right)\text{, and,}$$

$$w^{sF} = \eta_2^F\left(i^F, 1\right) \equiv w^{sF}\left(i^F\right)\text{, where,}$$

[6] We assume that emigration is neutral in terms of affecting the probability distributions of radicalization in *F*'s population of skilled and unskilled labor. Thus a reduction of the unskilled (skilled) labor pool through emigration does not affect the fraction *X (G).*

$$i^H = \frac{\overline{L}^H + \alpha}{\overline{S}^H + \rho} = i^H(\alpha, \rho) \text{, and,}$$

$$i^F = \frac{\left(\overline{L}^F - \alpha\right) X\left(\dfrac{w^{uF}}{\beta(m)}\right)}{\left(\overline{S}^F - \rho\right) G\left(\dfrac{w^{sF}}{\beta(m)}\right)} = i^F(m, \alpha, \rho). \tag{30}$$

F takes *H*'s immigration quotas (α and ρ) as given when choosing its national income maximizing proaction level.[7] In the light of Eq. (30), this fixes i^H and therefore the skilled and unskilled wages in *H* in terms of *F*'s decision making. The first order condition for the national income maximizing choice of proaction is:

$$\frac{\partial Y^F}{\partial m} = Y_m^F = \eta_1^F\left(\overline{L}^F - \alpha\right)\left(\frac{\partial X}{\partial m}\right) + \eta_2^F\left(\overline{S}^F - \rho\right)\left(\frac{\partial G}{\partial m}\right) - \frac{\partial T^F}{\partial m} - 1 = 0. \tag{31}$$

Notice that:

$$\frac{\partial X}{\partial m} = \frac{x}{\beta^2}\left[\beta\left(\frac{\partial w^{uF}}{\partial i^F}\right)\left(\frac{\partial i^F}{\partial m}\right) - w^{uF}\beta'\right]. \tag{32}$$

We show in the appendix that:

$$\frac{\partial i^F}{\partial m} \geq 0 \text{ if and only if } \varepsilon^X \geq \varepsilon^G, \tag{33}$$

Where ε^X and ε^G are the elasticity of the distribution functions *X* and *G*, respectively. For simplicity, let us assume for the rest of this analysis that the probability density functions *x* and *g* are independently, identically and uniformly distributed with support zero and $\overline{\theta}$, such that:[8]

$$x(\theta) = g(\theta) = \frac{1}{\overline{\theta}} \text{, and } X(\theta) = G(\theta) = \frac{\theta}{\overline{\theta}}. \tag{34}$$

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[7] This is consistent with two scenarios: (i). *F* moves simultaneously with *H* in terms of choosing their respective policies; and (ii). *H* makes its policy choice at an earlier stage compared to *F*. We analyze both.

[8] We show in Eq. (35) below that this assumption allows us to focus on the simplest of the three possible cases that Eq. (33) yields. Most of the tradeoffs faced by the governments come out cleanly in this case. While it is possible to analyze the other two cases, we choose not to do so in this paper, both for clarity and for space considerations.

(34) implies that:

$$\varepsilon^{X} = \varepsilon^{G} = 1 \Rightarrow \frac{\partial i^{F}}{\partial m} = 0\,. \tag{35}$$

Using (35) in (32):

$$\frac{\partial X}{\partial m} = -\frac{\beta' w^{uF} x}{\beta^{2}} > 0\,. \tag{36a}$$

Similarly,

$$\frac{\partial G}{\partial m} = -\frac{\beta' w^{sF} g}{\beta^{2}} > 0\,. \tag{36b}$$

Proposition 4

Proaction is chosen to reduce terror damages and also to benefit from bringing more of *F*'s resources from the terrorist sector into productive activity. Thus, even if proaction raises terrorism in *F*, the nation may choose to engage in it.

Proof

Using (30) we can write (31) as:

$$w^{uF}\left(\overline{L}^{F} - \alpha\right)\left(\frac{\partial X}{\partial m}\right) + w^{sF}\left(\overline{S}^{F} - \rho\right)\left(\frac{\partial G}{\partial m}\right) - \frac{\partial T^{F}}{\partial m} = 1\,. \tag{37}$$

Using (36a) we know that $\frac{\partial X}{\partial m}$ is positive. It reflects the rise in the proportion of productive unskilled labor in *F*. This happens because greater proaction drives some potential terrorist volunteers into the productive sector by reducing the *ex ante* returns from terrorism. The first term on the left-hand-side of (37) measures the rise in output in *F* from this migration of unskilled labor from terrorism to productive activity. Similarly, the second term in (37) reflects the corresponding rise in output from the migration of skilled labor into productive activity. The third term represents *F*'s potential terror reduction. The right-hand-side of (37) reflects the direct cost of proaction.

Recall from proposition 2 that it is possible that proaction may raise T^F. Notice, however, that even in this case proaction will be positive as long as the first two terms in (37) dominate, starting from $m = 0$. This is a general equilibrium result, which, as far as we are aware, is novel to this literature. It suggests that the deterrence effect, which keeps more of the population away from terrorism, may be an objective of counterterrorism policy. It can rationalize why some governments may continue to engage in counterterrorism activity, even if one may observe a rise in terrorist attacks. ■

Lemma

Nation-*F*'s income maximizing proaction level is increasing in *H*'s defense choice. It is negatively related to *H*'s choice of unskilled immigration quota. The proaction level may either rise or fall in response to an increase in the skilled immigration quota.

Proof:

The proof is in the appendix. First notice that for a given *m*, and for given immigration quotas (α and ρ), Eq. (30) suggests that skilled and unskilled wages in both nations are fixed. Thus, greater defense by *H* cannot affect the migration choice between the terrorist sector and the productive sector in *F* [Recall Eqs. (8) through (10)]. The marginal effect of proaction on T^F (i.e. $\dfrac{\partial T^F}{\partial m}$) can be shown to be stronger for a higher e. Thus, defense raises the net marginal benefit of proaction, raising the level chosen by *F*. On the other hand, quotas on skilled or unskilled immigration reduce the size of the respective labor pools in *F* [i.e., $\left(\overline{L}^H - \alpha\right)$ and $\left(\overline{S}^H - \rho\right)$ in Eq. (37) are reduced, respectively]. As a result, the marginal benefit from raising the fraction of laborers entering the productive pool is reduced. There are other effects working through the change in wages, and through the effects of the immigration quotas on $\frac{\partial T^F}{\partial m}$. We show in the appendix that under the assumed uniform probability distributions, the marginal benefit of proaction is reduced by a relaxation of the unskilled immigration quota, but this marginal benefit may either rise or fall in response to an increase in the skilled immigration quota. ■

4. The Home Government

Using Eqs. (28) through (30) , *H*'s national income net of immigrant earnings, terrorism damages and counterterrorism expenditure, is:[9]

$$Y^H = \eta^H\left[\bar{L}^H + \alpha, \bar{S}^H + \rho\right] - w^{uH}\alpha - w^{sH}\rho - p^H(e)T^H - \tilde{T}^H - e. \qquad (38a)$$

Using (2):

$$Y^H = \eta^H\left[\bar{L}^H + \alpha, \bar{S}^H + \rho\right] - w^{uH}\alpha - w^{sH}\rho - p^H(e)T^H - \delta^H T^F - e. \qquad (38b)$$

We consider two scenarios for *H*'s choice of its national income maximizing combination of defense and immigration policy. First, we analyze the (Nash) case where *H* moves simultaneously with *F*. Next, we analyze a Stackelberg game where *H* chooses its policy one stage earlier compared to *F*.

Case 1 (Nash Equilibrium):

In this case, *H* takes *m* as given while choosing its optimal policy. Thus, the first order conditions are:

$$\left(\frac{\partial Y^H}{\partial e}\right)_{|m} = -T^H p^{H\prime} - p^H\left(\frac{\partial T^H}{\partial e}\right) - \delta^H\left(\frac{\partial T^F}{\partial e}\right) - 1 = 0, \qquad (39a)$$

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[9] Taking out immigrant incomes from the host nation's objective function is a debatable issue. However, for the lack of an unambiguously superior alternative, this approach is standard, and is used widely in the trade-immigration literature (for example, see Ethier, 1986).

$$\left(\frac{\partial Y^H}{\partial \alpha}\right)_{|m} = \left(i^H \rho - \alpha\right)\frac{\partial w^{uH}}{\partial \alpha} - p^H\left(\frac{\partial T^H}{\partial \alpha}\right) - \delta^H\left(\frac{\partial T^F}{\partial \alpha}\right) = 0\,, \tag{39b}$$

$$\left(\frac{\partial Y^H}{\partial \rho}\right)_{|m} = \left(i^H \rho - \alpha\right)\frac{\partial w^{uH}}{\partial \rho} - p^H\left(\frac{\partial T^H}{\partial \rho}\right) - \delta^H\left(\frac{\partial T^F}{\partial \rho}\right) = 0\,. \tag{39c}$$

Defense:

Using proposition 1 ($\frac{\partial T^H}{\partial e} < 0$, and $\frac{\partial T^F}{\partial e} > 0$), Eq. (39a) suggests that *H*'s optimal defense choice has to balance the benefits from domestic terror reduction with the direct costs, as well as the terror costs arising from damages to its foreign interests.

Unskilled Immigration:

Using Eq. (30) above, it is easy to see that $\frac{\partial w^{uH}}{\partial \alpha} = \eta_{11}^H\left(\frac{\partial i^H}{\partial \alpha}\right) < 0$. This fall in unskilled wage benefits (hurts) *H* depending on whether $\left(i^H \rho - \alpha\right)$ is negative (positive). The reason is a standard terms-of-trade effect of immigration. Consider the case where there are no skilled immigrants in *H* (i.e., $\rho = 0$). In this case, the first term on the right-hand-side of Eq. (39b) equals $-\alpha\left(\frac{\partial w^{uH}}{\partial \alpha}\right) > 0$. This is simply the gain in *H*'s national income from having to pay less to the inframarginal units of unskilled immigrants when the marginal immigrant reduces the wages for all. However, the fall in unskilled wage drives up the skilled wage $\left[i.e., \frac{\partial w^{sH}}{\partial \alpha} = -i^H\left(\frac{\partial w^{uH}}{\partial \alpha}\right) > 0\right]$. If $\rho > 0$, then more has to be paid to the existing stock of skilled immigrants to the tune of $\rho\frac{\partial w^{sH}}{\partial \alpha} = -i^H \rho\left(\frac{\partial w^{uH}}{\partial \alpha}\right)$. This is a loss for *H*. These two opposing effects are summarized by the first right-hand-side term in Eq. (39b). If, the unskilled labor intensity of the immigrant pool (i.e., α / ρ) is larger than the corresponding intensity in production i^H, then this effect raises *H*'s national income. It can be shown that a relaxation of the unskilled immigration quota raises the terror directed at home (i.e., $\frac{\partial T^H}{\partial \alpha} > 0$). This occurs because greater emigration of unskilled labor from *F* reduces its relative supply of unskilled labor, thereby raising the skilled labor intensity in *F*'s production. The result is a higher unskilled wage and a lower skilled wage in *F*. This draws unskilled labor out of terrorism and skilled labor into terrorism, raising the relative supply of skilled resources for the terrorist organization. Using proposition 3, we know that this results in T^H. This effect [i.e., the second term on the right-hand-side of Eq. (39b)] tends to reduce *H*'s incentive to allow unskilled immigration. For the same reasons, the unskilled-labor intensive T^F will fall, which benefits *H* if it has extensive foreign interests. Thus, Eq. (39b) suggests that in the presence of terrorism, even if the terms-of-trade reasons suggest that we should allow greater unskilled immigration, terrorism related costs may suggest an opposite policy. At an optimum, these different costs and benefits have to be properly weighed.

<u>Skilled Immigration</u>:

Note that Eq. (39c) is very similar in structure to (39b). Therefore, in the light of the above discussion it is easy to see that a rise in the skilled immigration quota will reduce w^{sH}, raise w^{uH}, reduce T^H and raise T^F. Notice, however, that unlike the case discussed above, if α / ρ exceeds i^H, then *H*'s national income falls, due to the terms-of-trade effect. This is because *H* loses more from paying higher wages to unskilled immigrants than it gains from reduced payments to the relatively small group of skilled immigrants. The remaining terrorism related effects suggest that if *H* has limited foreign interests then it will gain from encouraging skilled immigration because $\frac{\partial T^H}{\partial \rho} < 0$.

Case 2 (Stackelberg Equilibrium):

We can write Eq. (38b) as:

$$Y^H = Y^H\left(e, \alpha, \rho, m\right). \tag{40a}$$

Using Eq. (31):

$$Y^{HL} = Y^H\left[e, \alpha, \rho, m\left(e, \alpha, \rho\right)\right], \tag{40b}$$

where Y^{HL} is *H*'s payoff function from being a Stackelberg leader. The first-order conditions in this case are:

$$\frac{\partial Y^{HL}}{\partial e} = \left(\frac{\partial Y^H}{\partial e}\right)_{|m} + \left(\frac{\partial Y^H}{\partial m}\right)\left(\frac{\partial m}{\partial e}\right) = 0, \tag{41a}$$

$$\frac{\partial Y^{HL}}{\partial \alpha} = \left(\frac{\partial Y^H}{\partial \alpha}\right)_{|m} + \left(\frac{\partial Y^H}{\partial m}\right)\left(\frac{\partial m}{\partial \alpha}\right) = 0, \tag{41b}$$

$$\frac{\partial Y^{HL}}{\partial \rho} = \left(\frac{\partial Y^H}{\partial \rho}\right)_{|m} + \left(\frac{\partial Y^H}{\partial m}\right)\left(\frac{\partial m}{\partial \rho}\right) = 0. \tag{41c}$$

If we evaluate the marginal leadership payoffs at Nash, the first term on the right-hand-side, respectively, of (41a) through (41c) is zero. Using the Lemma on page 13, we have:

$$\left(\frac{\partial Y^{HL}}{\partial e}\right)_{|N} = \left(\frac{\partial Y^H}{\partial m}\right)\left(\frac{\partial m}{\partial e}\right)_{|N} > 0, \text{ if and only if } \frac{\partial Y^H}{\partial m} > 0\ , \tag{42a}$$

$$\left(\frac{\partial Y^{HL}}{\partial \alpha}\right)_{|N} = \left(\frac{\partial Y^H}{\partial m}\right)\left(\frac{\partial m}{\partial \alpha}\right)_{|N} < 0 \text{ if and only if } \frac{\partial Y^H}{\partial m} > 0\ , \tag{42b}$$

$$\left(\frac{\partial Y^{HL}}{\partial \rho}\right)_{|N} = \left(\frac{\partial Y^H}{\partial m}\right)\left(\frac{\partial m}{\partial \rho}\right)_{|N} < 0 \text{ if and only if } \frac{\partial Y^H}{\partial m} > 0. \tag{42c}$$

Using proposition 2, if $l^H < l^0 < l^F$, then T^H and T^F both decline with proaction, thus:

$$\frac{\partial Y^H}{\partial m} = -p^H\left(\frac{\partial T^H}{\partial m}\right) - \delta^H\left(\frac{\partial T^F}{\partial m}\right) > 0 \text{, if } l^H < l^0 < l^F . \tag{43}$$

This leads us to proposition 5.

Proposition 5

If $l^H < l^0 < l^F$, *H*'s leadership choice of defense exceeds the Nash level, while its choice of the unskilled immigration quota must be lower than the Nash level. *H*'s choice of the skilled immigration quota cannot be unambiguously compared to the Nash level.

Proof

After substituting Eq. (43) in (42a), we notice that the net marginal gains from defense when *H* is a Stackelberg leader is positive, when evaluated at the Nash equilibrium. Therefore, starting from Nash, *H* will have an incentive to raise its defense. The intuition is the following. At Nash, *H* assumes that *F*'s proaction is not affected by *H*'s policies. However, under leadership, in the light of the Lemma, *H* knows that a rise in defense will induce *F* to engage in greater proaction. If $l^H < l^0 < l^F$, this greater proaction reduces terrorist attacks against *H* both at home and in *F*. These benefits prompt *H* to raise its defense level. The argument for reducing the unskilled immigration quota at Stackelberg is similar. Because the direction of the effect of ρ on proaction is ambiguous, we cannot compare its Stackelberg level to its Nash level.

5. Conclusion

Immigration policy and counterterrorism policy are both central issues facing the US and many other nations of the world. This paper looks into the interrelationships between these two issues in the context of a competitive general equilibrium model. Some of the findings, like the effect of defensive policies, confirm and extend existing results. Others, like the effects of proactive policies and immigration quotas yield novel and sometimes counterintuitive results. We show that the interaction between terrorism and immigration policies suggests that optimal immigration (or counterterrorism) policies cannot be looked at in isolation. This paper should serve as a useful benchmark to think about their interrelationship.

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