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**Why Suicide-Terrorists Get Educated,  
and What to Do About It.**

by

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**Abstract:** This paper tries to reconcile the observed fact that suicide-terrorists have a relatively high education level with rationality. It brings out the conditions under which potential students choose to acquire some education in a rational-choice model where this yields a non-zero probability of blowing up the resulting human capital in a terrorist attack. The comparative-statics of the rational expectations equilibrium of this model demonstrate how economic development, on the one hand, and repression, on the other hand, might reduce terrorism under some parameter restrictions.

**Key Words:** Terrorism – Education – Development

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## 1. Introduction

The “quality of terror” has recently emerged as an empirical puzzle (Bueno de Mesquita, 2005). Krueger and Maleckova (2003) show that terrorists, especially from Hezbollah, have on average a higher level of education than the rest of their population of origin, and come from a relatively wealthy family background. A similar pattern has been found among the Leftist terrorists in Europe in the 1970s, among other groups. Paz (2000) documents the simultaneous increase in higher education and militancy among Palestinian youths. The biographies of Al-Qaeda’s activists analyzed by Sageman (2004) show that they generally have a high level of education, mostly in scientific or technical disciplines. His data suggest that education is a key characteristic of these activists, while their religious background plays no significant role. Hassan (2001) describes Hamas volunteers with a similar background and she shows that they are given some intensive religious training *after* enrolling for a suicide mission. More recently, Berrebi (2007) has analyzed the biographies of about 300 *Shahids* (martyrs) from Hamas and the Palestinian Islamic Jihad confirming that a relatively high level of education is a key characteristic of terrorists. Similarly, Reuter (2004) provides a lot of journalistic information on suicide bombers, suggesting that militancy is often acquired through education. Stern (2003) presents examples of terrorists from various religious backgrounds including Omar Sheikh, the mastermind behind Daniel Pearl’s murder and a former student of the London School of Economics (see also Lévy, 2003). Some other insights on the profiles of terrorists can be gleaned from Bloom (2005) and Pape (2006). The emerging picture is that terrorists are in general men and women in their twenties with some secondary or post-secondary training, mostly in technical or engineering education. This rules out the widespread view that poverty or ignorance breed terrorism, although these people come mostly from developing countries. Instead, we observe young adults with fairly good prospects of a rewarding future career who chose to sacrifice their own life for the sake of a

cause. Pape (2006) emphasizes that these volunteers are free from psychological problems and make their decision like good soldiers, out of “a sense of duty”.

These findings put out a challenge to the rational-choice theorist, as they entail that despite their higher opportunity cost of destroying their lives than most people in their society, suicide killers are not deterred by this<sup>1</sup>. The analytical literature has offered three main hypotheses for handling this puzzle. Bueno de Mesquita (2005) suggests that what we observe is not the supply of terrorist volunteers, but the demand for them by the terrorist organizations. In his model, poor and uneducated people have as strong an incentive as richer and more educated ones for supplying their lives for terrorist missions. However, the terrorist organizations recruit the most educated ones, because they are probably more reliable for performing their mission. Azam (2005) assumes that educated people have a stronger concern for the welfare of the future generations. This stronger altruistic feeling leads them to engage more decisively in terrorist activities for increasing the probability of the next generation benefiting from some public good like freedom or national independence. Then, an equilibrium may prevail where the most educated people, i.e. who care the most for the next generation, will systematically engage in suicide bombing in order to enhance this probability. Berman and Laitin (2005), Ferrero (2006) and Wintrobe (2006) provide a third line of argument based on the impact of social pressure on the decision to opt for suicide terrorism. More educated people would be more sensitive to social pressure, especially students living far away from their families who tend to create a closed circle with other students. Sageman (2004) illustrates this by examples from Al-Qaeda activists. Bloom (2005) and Pape (2006) discuss the special features of the social pressure on female terrorists in traditional societies.

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<sup>1</sup> Suicide terrorism has become the dominant kind of terrorism since the early 1980s, especially if one defines it broadly (see Pape, 2006). One can include such borderline cases as the Sikh bodyguards who assassinated Indira Gandhi and did not try to defend themselves against the other guards who shot them dead, or the Tamil Tigers who carry a capsule of cyanide around their neck and kill themselves rather than being captured by the Sinhalese police. The biographies of Palestinian terrorists analyzed by Berrebi (2007) suggest that most of them have been tested first in non suicidal actions before becoming *Shahids*, so that suicide terrorism might be viewed in some cases as the final stage of a successful terrorist cursus. We neglect the other types of terrorism in this paper.

These two dimensions of altruism and social pressure are present in Durkheim's classic analysis of suicide that Pape (2006) uses for explaining suicide terrorism (Durkheim, 1897). He mainly uses education as a signal of a highly pro-social attitude. In these models, education is taken as an exogenous characteristic that influences the educated person's probability of becoming a terrorist.

However, an additional challenge is put out to the rational-choice theorist by the fact that the prospect of engaging in suicide terrorism is liable to affect the expected rate of return to education, and hence the decision to invest in it in the first place. This is the issue analyzed in this paper using a simple model where the decision to invest in education is endogenous. Workers have to decide up front whether they want to acquire some education or not, and then whether they want to work or go for a terrorist mission instead, in a second stage. Education has two effects on those who acquire it: (i) it gives them access to a better-paid segment of the labor market, and (ii) it changes their worldview. The "worldview" effect (ii) is directly related to Akerlof's "loyalty filter" theory well captured by the following quote: "When people go through experiences, frequently their loyalties, or their values, change. I call these value-changing experiences "loyalty filters"" (Akerlof, 1983, p.54). Here, changing their worldview means that the value that they attach to terrorist activity might be strongly increased (or reduced) as a response to education, with some probability. This approach is fairly agnostic about the precise channel of impact of education on the decision to become a terrorist, and can accommodate either the altruistic or the social pressure hypotheses, or any combination of the two. Hence, this analysis takes as given the political setting in the society under study. In a more open society, the altruistic motive for terrorism might be absent, as more peaceful methods might be used to reach the same outcome. Similarly, there might be no social pressure to engage in terrorism, if other means exist for enhancing the welfare of the group. This worldview effect may in fact increase the expected rate of return on education, as

it creates an additional outlet for skilled labor, in terrorism, beside high-paying jobs, for some parameter values. The model presented below captures this phenomenon by looking at the joint determination of the supply of educated workers and of suicide terrorists in a rational expectations framework. The interaction between these two processes suggests some mechanisms to reduce the terrorist threat, beside the obvious counter-measures based on repression and deterrence. Moreover, it provides a framework for discussing the ambiguous impact of economic development on the supply of high-quality terrorism.

The empirical literature has brought out some variables that affect significantly the level of terrorist activity and helps us establish the stylized facts that must be taken on board. For nearly two decades, Todd Sandler has been the most active in this line of research with various co-authors, and he has published recently a synthesis of his findings (Enders and Sandler, 2006). These results have shown the effectiveness of various countermeasures used by the West. They raise the issue of deflection, whereby self-protection by some countries diverts the flow of terrorist attacks to other countries. A lot of attention has been devoted to evaluating empirically the relative importance of economic and political factors in determining the flow of terrorist attacks originating from different countries. Krueger and Laitin (2003) and Krueger and Maleckova (2003) have found that the key determinant is the presence of a repressive state in the source country, while they underplay the role of economic variables. These results have been reinforced in Krueger (2007). Similarly, Testas (2004) focuses on political repression rather than on income per capita, which he finds marginally significant or insignificant in a sample of Muslim countries. He finds a non-monotonic impact of political repression on the supply of terrorist events, as both low and high levels of repression have a positive impact, as does Abadie (2006). The analytical literature on repression, or “crackdown”, offers a potential explanation for this result. Bueno de Mesquita’s “quality of terror” model discusses both the effects of repression and of improved economic

conditions as means to fight terrorism (Bueno de Mesquita, 2005), the latter working mainly through the incentives of the terrorist organization. It brings out that “crackdown” might be counter-productive by increasing mobilization and thus boosting the supply of volunteers to the terrorist organizations. In Rosendorff and Sandler (2004), crackdown can become a counter-productive policy, as too harsh an attack on terrorism might increase grievances, because of its negative fallout on the general public, which backfires by increasing terrorist activity. The model below allows us also to discuss such a response to repressive measures. However, Azam and Thelen (2008, 2010) suggest that political repression and the supply of terrorist attacks are jointly determined, both responding positively to the unobserved level of “militancy” prevailing in the source country. Hence, the positive impact of repression on the supply of terrorist attacks described above might be spurious.

Moreover, although terrorists are found in the upper tail of the income distribution, as mentioned above, some empirical studies suggest that the occurrence of terrorist attacks is negatively correlated with shifts of that distribution. Several papers have shown that economic downturns are significant for explaining upsurges of terrorist attacks (Blomberg *et al.* 2004, Li, 2005). Hence, the macroeconomic evidence seems to contradict the findings from individual data. Moreover, Basuchoudhary and Shughart (2007) find that it is economic freedom and secure property rights that reduce the number of terrorist attacks by source countries rather than political rights. Lastly, Azam and Thelen (2008, 2010) find that foreign aid and education have a negative impact on the supply of terrorist attacks by country of origin. They suggest that this works through the recipient government’s incentives, rather than through the much debated impact of aid on poverty reduction. The analytical model presented below produces some comparative-static predictions that can be compared with these findings. It allows us to simulate the impacts of both economic variables and repressive policy tools, and thus discussing the “carrot *vs.* stick” tradeoff, introduced by Frey (2004).

The next section discusses the microeconomic foundations of the worker's choice, first between investing in education or not, and second between working and turning to terrorism instead. Section 3 describes the equilibrium of the model and derives the comparative-static predictions. This sketches the design of the counter-terrorist strategies that this model brings out. The conclusions are drawn in section 4.

## 2. Betting on Education

In this model, a potential worker must first choose whether to get a fixed amount of education or not, at the first date, and then what to do with it at a second date. There is a large number  $N$  of workers, indexed by  $i$ , who incur an individual-specific cost  $\delta(i, \varepsilon)$  for acquiring this fixed amount of education. Workers are indexed by increasing order so that  $\partial \delta(i, \varepsilon) / \partial i \geq 0$ . This cost function may be viewed as a portmanteau variable capturing the prospective student's innate ability, his or her family background, as well as the level of education expenditures by the government or the civil society, here captured by the shift parameter  $\varepsilon$ . This function can be used for capturing some social polarization, reflected in a differential access to education among social groups. In the present model, social heterogeneity may be captured by assuming that the cost function is very steep with respect to  $i$  in some neighborhood of the equilibrium point, so that extending the benefit of education to a significant number of workers would involve people facing a significantly higher cost of education. The additional beneficiaries could then be deemed to come from a socially different group. Azam (2005) discusses also how social heterogeneity might affect the supply of terrorists. A more egalitarian society would have a much flatter  $\delta(i, \varepsilon)$  function, so that quite a lot of additional students with a similar cost characteristic could be enrolled. In several Middle-Eastern countries, terrorist organizations like Al-Qaeda, Hamas or Hezbollah have a social arm that provides or helps financing education services. This undoubtedly reduces the

cost of education for the beneficiaries, and can be captured by an increase in  $\varepsilon$ . Ly (2007) discusses why some of these terrorist organizations have both a charitable branch and a terrorist one. He suggests that vertical integration, whereby charity and terror are produced by the same organization, has a dampening effect on terrorist activity, by internalizing the latter's negative externalities. By contrast, Berman (2009) suggests that terrorist organizations with a charitable or self-help branch are more effective killers than the others. A related result is discussed below. However, many more students go through these educational institutions than the ones who turn eventually to the *Jihad*, including terrorism (See Paz, 2000, Reuter, 2004, and Stern, 2003). Hence, it is safe to assume that the *ex ante* cost of education does not depend on whether the educated worker chooses *ex post* to work or to go for a terrorist mission instead.

In the present model, this level of education is acquired at the first date by those who choose to do so, while its effects are felt at the second date. In the real world, of course, acquiring education takes some time, so that the equilibrium described below should be viewed as involving a fairly long planning horizon for the potential students. Then, the decision to invest in education must be based on its expected rate of return, which depends in turn on the skilled-labor wage rate expected to prevail at the second date and on the decision to work or to become a terrorist. The prospective student is assumed to form the relevant expectations on the basis of her analysis of the rational expectations equilibrium of the model. Hence, for determining the number of educated workers and the expected fraction of them that choose to become terrorists, we need to work out the expected value of the equilibrium skilled-labor wage rate, as seen from the first date. This is done in the next section.

### ***The Worldview Effect of Education***

Education is doing two things to the people who acquire it. It affects their worldview, as described below, and gives them access to the high-paying segment of the labor market.

Denote  $w$  the market wage rate for unskilled labor, which is assumed to be fixed exogenously by a given level of unskilled-labor productivity, for example in a subsistence sector as in Lewis (1954). Then, the educated ones will have an opportunity to work for a skilled-labor wage rate  $w_s \geq w$ , which is endogenously determined by the skilled-labor market equilibrium at the second date. At that point in time, the worker can choose whether to accept the job offered, or go for a terrorist mission instead. The value attached to the latter depends on the person's worldview.

The worker can choose to become a terrorist if she attaches a high enough value to performing a terrorist mission, denoted  $v$ . This value is expressed in monetary units that can be directly compared to the wage rate. As argued in Azam (2005), the latter is likely to be affected by the educational status of the person who is facing this choice. It seems natural to assume that people who are facing the choice of investing in education do not know precisely what impact this would have on their worldview, and hence on the value  $v$  that they attach to performing a terrorist mission. Assume instead that they form expectations about this, based on a probability distribution. Its cumulative density distribution<sup>2</sup>  $F(v, \theta)$  is defined on a continuous support  $[v_L, v_H]$ , where  $\theta$  is a shift parameter. The latter is used below in the comparative-static analysis for capturing the policies that reduce the probability of the high values of  $v$ . This may describe the effect of either “crackdown” or that of some social policies that reduce the popular support for terrorism, the “carrots” in Frey's theoretical framework. Azam and Thelen (2010) have found empirically that an index of Law and Order has a significant impact on the supply of terrorist attacks by source countries. This would also be captured by a higher  $\theta$  in the present framework. This way of modeling the “worldview” effect is flexible enough to accommodate various interpretations. My favorite one is that education reveals her own type to the person who invests in it. Those who remain uneducated

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<sup>2</sup> This c.d.d. is assumed continuous, increasing between 0 and 1, and differentiable.

are content with an uncertain worldview, given the cost of education that they are facing, and the value that they attach to a terrorist attack is then equal to the mean value of  $v$ , denoted  $\bar{v}$ . This fairly Socratic view is consistent with the discussion by Victoroff, a psychiatrist, suggesting that terrorists belong to well-defined psychological and moral types, activated by the individual's cultural and cognitive experience (Victoroff, 2005). The analysis below is restricted to the case where  $w > \bar{v}$  so that no uneducated worker is ever tempted to engage in terrorism. In the real world, one finds a few examples of uneducated people who became terrorists, but this is a minority phenomenon, which is disregarded in this model.

In Azam (2005), the value of the terrorist attack for the potential bomber depends also on the total number of attacks performed by all the terrorists, and on the value of some future public good for the next generation. These additional effects can be neglected as a first approximation in the present model, given the labor-market focus of the present analysis. Nevertheless, various subjective characteristics of the potential students can be taken on board by combining the  $v$  and  $\delta(i, \varepsilon)$  types. For example, the latter portmanteau variable can be used for capturing some risk aversion, which could affect the choice of investing in education made by some people. Hence, a high value of  $\delta(i, \varepsilon)$  could be used to capture the attitude of some potential students who are afraid to discover their true  $v$  type. Instead of just risk aversion, this parameter could also capture the effect of a strong moral commitment not to become a terrorist. Hence, some people might simply eschew the opportunity of acquiring education because they are not prepared to run the risk of becoming a terrorist. Moreover, this variable can also be used for capturing the effect of decisions made by the parents of potential terrorists at an early stage. Most terrorists are about 20 years of age or more, and have certainly had a say in the decision to pursue a course of study to that age. However, the parents have various means for influencing this decision. For example, some parents might not let their children complete primary education or might take them out of high school at an

early stage in order to pre-empt their decisions to be made at a later age to go for further education and thus run the risk of becoming terrorists. Then, these parents are strategically imposing a high  $\delta(i, \varepsilon)$  on their children for affecting their choice.

Having completed her course of study, the potential terrorist discovers her  $v$  type and has to choose between getting a skilled job and becoming a terrorist. This decision is simply made by comparing the ruling wage rate on this segment of the market  $w_S$  to the value of  $v$  just revealed. Hence, all the students who drew  $v \leq w_S$  get a job, while the others become terrorists. This entails immediately that the supply of terrorists dries up when the skilled-labor wage rate reaches a level such that  $w_S \geq v_H$ . We thus focus in the following on cases where the skilled-labor wage rate falls within the range  $w < w_S < v_H$ .

The decision rule just described allows for some additional interpretations of the motives for becoming a terrorist that have been offered in the literature, beside altruism and social pressure discussed above. For example, Reuter (2004) describes the choice of becoming a terrorist as a way to enhance one's self esteem. Here, one could say that the educated worker has two possible ways of enhancing her self esteem, by either getting a high-paying job, or by going for a terrorist mission instead of accepting a low-paying job. Then, the worldview effect of education is working through an "aspiration" effect. The  $v$  type drawn through studying describes a self-imposed norm, such that an educated worker of type  $v$  will accept any job offer that she gets, rather than going for a terrorist mission, provided the wage level is such that  $v \leq w_S$ . Otherwise, her self esteem will be enhanced by opting for a terrorist mission instead, enjoying then the benefit of serving the cause or the prospect of being recognized as a "martyr". Similarly, the so-called "Herostratos syndrome" (Borowitz, 2005) can be accommodated within this framework. This describes the case of people who perpetrate infamous crimes for the sake of self-glorification. It is named after a Greek citizen

who started purposefully the fire that burnt the temple of Artemis to ashes in the city of Ephesus in 356 BC. He did not try to escape afterwards, and admitted that he did it for the sake of making a name for himself before being put to death. Within the framework of the present model, this would be accommodated by the draw of a high  $v > w_S$ .

### ***The Expected Return to Education***

The decision rule described above allows us to compute the expected return to education. Define  $\tilde{w}_S$  as the expected value of the skilled-labor wage, as formed at date 1. Then the expected (gross) return to education formed at date 1 may be computed as:

$$R(\tilde{w}_S, \theta) = F(\tilde{w}_S, \theta) \tilde{w}_S + \int_{\tilde{w}_S}^{v_H} v \frac{\partial F(v, \theta)}{\partial v} dv. \quad (1)$$

This expression says that the educated worker is expecting to enjoy the benefit of the wage rate if she draws a  $v$  that falls below the skilled labor wage that she expects, while she will value above that the terrorist attack that she will perform otherwise. The return to education thus includes a “political premium<sup>3</sup>” over and above the skilled labor wage, which can be defined as:

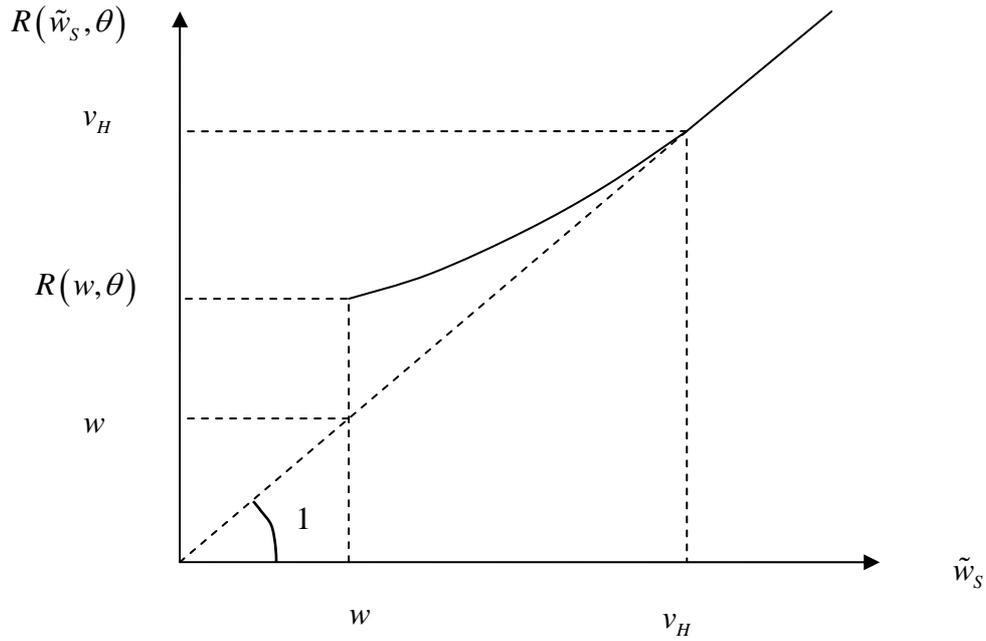
$$\pi(\tilde{w}_S, \theta) = R(\tilde{w}_S, \theta) - \tilde{w}_S = \int_{\tilde{w}_S}^{v_H} (v - \tilde{w}_S) \frac{\partial F(v, \theta)}{\partial v} dv. \quad (2)$$

Figure 1 depicts  $R(\tilde{w}_S, \theta)$  as a function of  $\tilde{w}_S$ . Because educated workers can always accept an unskilled job,  $\tilde{w}_S$  is bounded from below by  $w$ . For  $\tilde{w}_S \geq v_H$ , the expected return to education reduces to  $R(\tilde{w}_S, \theta) = \tilde{w}_S$ . Lastly, in the range where  $w \leq \tilde{w}_S \leq v_H$ ,  $R(\tilde{w}_S, \theta)$  is an increasing and convex function because:

$$\frac{\partial R(\tilde{w}_S, \theta)}{\partial \tilde{w}_S} = F(\tilde{w}_S, \theta). \quad (3)$$

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<sup>3</sup> This fairly neutral label can accommodate either the self-rewarding impact of altruistic motivation for perpetrating a suicide attack, as analyzed by Azam (2005), or the more socially mediated sense of becoming a martyr, as analyzed among others by Ferrero (2006) or Pape (2006). It seems less appropriate for describing more dubious motivations, like the Herostratos syndrome mentioned above, after Borowitz (2005).



**Figure 1: The Expected Return to Education**

The political premium can be read off figure 1 as the vertical distance between the curve and the 45° line. It is immediately apparent that it decreases with increasing values of  $\tilde{w}_s$ , until it reaches 0 as the latter reaches  $v_H$ . It is natural to assume that an expected increase in repression, or “crackdown”, here captured by an increase in  $\theta$ , reduces the political premium, given the expected skilled-labor wage, as it reduces the probability of high values of  $v$  while  $\tilde{w}_s$  is likely to be located in the upper part of the distribution<sup>4</sup>. This entails that the expected crackdown reduces the rate of return on education, given  $\tilde{w}_s$ .

The next section shows how this political premium provides some workers with an incentive to “studying to die”, i.e., to invest in education despite the resulting non-zero probability of dying as a suicide terrorist afterwards.

<sup>4</sup> This assumes a monotonic impact, resulting in stochastic dominance of the resulting distribution over the initial one. One might imagine more complicated effects. For example, increased repression might entail an increase in the probability of very high values of terrorism, by triggering a sense of increased grievances, while it could reduce the value of terrorism in a lower part of the distribution. We neglect these complicated cases in what follows.

### 3. The Equilibrium Number of Terrorists

Assume now that the demand for skilled labor is expected at date 1 to be governed at date 2 by the following function:

$$L(K, w_s, w), \quad (4)$$

which is increasing in  $K$ . The latter measures the capital stock, or any other variable affecting positively the demand for skilled labor, for any given wage rates. For example, the level of technology is subsumed in this variable. In particular, we assume below that it depends positively on foreign aid, provided the latter is targeted explicitly at boosting the demand for skilled labor. This is a key policy issue in this context because terrorists mainly come from developing countries. In other words,  $K$  is a shorthand notation for any variable that affects positively the demand for skilled labor, including for example any employment subsidy granted by the government for supporting the demand for educated labor, which might be funded by foreign aid. Naturally, the skilled-labor demand function in (4) is decreasing in both  $w_s$  and  $w$ , assuming that skilled and unskilled labor are cooperating in production<sup>5</sup>.

#### *The Rational Expectations Equilibrium*

Let  $n_s$  denote the number of educated workers, which is determined at date 1 by the potential students by comparing the expected return to education to its cost. As seen above, the former can be derived from the expected value of the skilled-labor wage rate  $\tilde{w}_s$  using (1). However, the actual value of  $w_s$  will be determined at date 2 by the market equilibrium, of which the supply side will depend on  $\tilde{w}_s$ , via  $n_s$ . Hence, these two variables must be determined simultaneously in the rational expectations equilibrium of the model. The latter is characterized by definition 1.

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<sup>5</sup> i.e., the cross second derivative of the underlying production function with respect to the two kinds of labor is positive.

**Definition 1:** The rational expectations equilibrium (REE) of the model is a pair  $\{\tilde{w}_s, n_s\}$  that fulfills the following two consistency conditions:

(i) arbitrage:

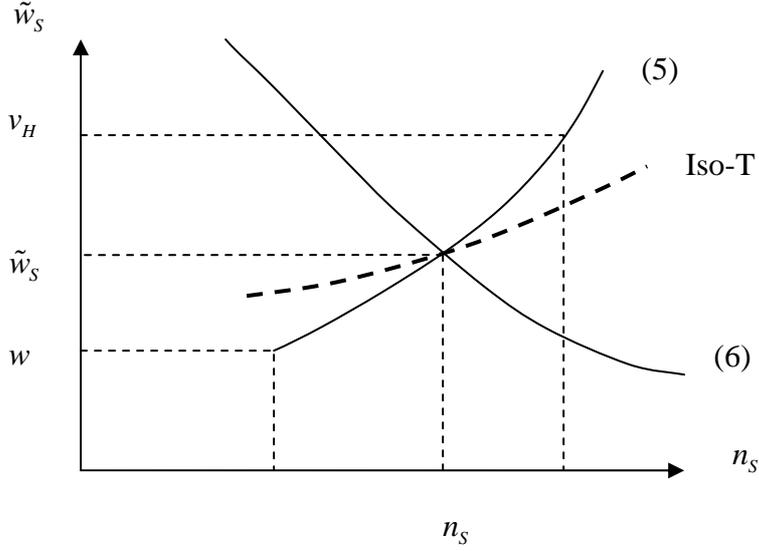
$$R(\tilde{w}_s, \theta) - \delta(n_s, \varepsilon) = w; \quad (5)$$

(ii) market clearing:

$$n_s F(\tilde{w}_s, \theta) = L(K, \tilde{w}_s, w). \quad (6)$$

The arbitrage condition says that the marginal student must be indifferent between enrolling or not in education. This entails that the return to education, net of the cost of acquiring it for the marginal student, must be equal to the unskilled wage rate. All the prospective students with a lower cost of education will choose to get educated, while all those with a higher cost will refrain from doing so. Hence, this condition is sufficient to determine the equilibrium number of educated people at date 2 as a function of the expected wage  $\tilde{w}_s$ . The market-clearing condition says that the expected skilled-labor wage must be such that the expected supply of educated labor is absorbed exactly by the demand for it. The expected supply of educated labor is equal to the expected fraction of educated people that chooses to work, rather than to engage in terrorism.

Figure 2 depicts the determination of the REE, assuming that the set of parameter values for  $\{\varepsilon, \theta, w, K\}$  is such that the equilibrium  $\tilde{w}_s$  falls within the  $[w, v_H]$  range. The downward sloping curve represents the locus of  $\{\tilde{w}_s, n_s\}$  such that (6) holds, while the upward sloping curve is the locus corresponding to (5). For such a set of parameter values, this diagram shows evidently that the REE is unique because of the opposite slopes of (5) and (6). The rest of the section is devoted to deriving its comparative statics.



**Figure 2: Determination of the Rational Expectations Equilibrium**

Beyond the REE, the aim of this whole modelling exercise is to determine the impact of the various parameters or policy tools on the expected number of terrorist attacks coming out of the education process. This can also be done using figure 2. All the educated workers who do not choose to get a job engage in terrorism instead. Their expected number is that of the students who are expected to draw a value  $v > \tilde{w}_s$  from their education. Hence, the expected number of terrorists is given by:

$$\tilde{n}_T = (1 - F(\tilde{w}_s, \theta))n_s. \quad (7)$$

This may be interpreted as the relevant loss function to evaluate the implications of the changes in the REE predicted by the comparative-static exercises. Let us define the iso-T locus, which serves as our social indifference curve, as all the combinations of  $\tilde{w}_s$  and  $n_s$  yielding the same level of  $\tilde{n}_T$ . Its slope is positive, as long as  $\tilde{w}_s < v_H$ :

$$\frac{\partial \tilde{w}_s}{\partial n_s} = \frac{1 - F(\tilde{w}_s, \theta)}{n_s \partial F(-)/\partial \tilde{w}_s} > 0. \quad (8)$$

The iso-T locus going through the initial REE is represented in figure 2 by the upward-sloping dotted curve. All the points located above the iso-T locus produce a lower

expected number of terrorists than those on the locus itself, as they imply a lower  $n_s$  for any given  $\tilde{w}_s$ . This entails that an increase in the number of educated people must be accompanied by a large enough increase in the expected skilled-labor wage rate to prevent an increase in the expected number of terrorists. We focus on the case represented in figure 2, where the iso-T locus is flatter than the arbitrage locus (5). This describes a society where there is some degree of social polarization, embedded in a steeply rising cost of education. The case of an egalitarian society would be captured by inverting the relative slopes of these two loci, i.e. by assuming locus (5) to be flatter than the iso-T locus. This is done below in appendix 2

### *Comparative Statics*

Figure 2 can now be used for generating the comparative-static predictions presented at table 1. Each cell represents the impact of a change in the column variable on the row one.

**Table 1: Comparative-Static Predictions**

	$K$	$w$	$\theta$	$\varepsilon$
$\tilde{w}_s$	+	?+	?+	-
$n_s$	+	-	-	+
$\tilde{n}_T$	-	?-	?-	+

**Note:** Appendix 1 presents the algebraic calculations supporting these predictions.  
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An increase in  $K$  entails a shift to the right of locus (6), as the resulting increase in demand for skilled labor would need to be matched by an increased supply, if the wage rates were to remain unchanged. This implies unambiguously a simultaneous increase in  $\tilde{w}_s$  and  $n_s$ , as common sense would suggest. In the case of figure 2, this also entails a fall in the expected number of terrorists, as the resulting equilibrium point lies above the initial iso-T

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<sup>6</sup> This c.d.d. is assumed continuous, increasing between 0 and 1, and differentiable.

locus. Hence, economic development in general, insofar as it boosts the demand for skilled labor, is predicted here to reduce the terrorist threat. Other policies, like an increase in foreign aid, targeted at boosting the demand for skilled labor, or an employment subsidy for educated labor, would yield the same result. This prediction is in agreement with the empirical finding by Azam and Thelen (2008) that per capita GDP and foreign aid have a negative impact on the supply of terrorist attacks by country of origin. Notice that this prediction would be reversed in the case of an egalitarian society, with a very flat  $\delta(i, \varepsilon)$  curve. In that case, the rise in  $\tilde{w}_s$  would not be large enough to attract the increased supply of educated people into the labor force.

An expected increase in the unskilled-labor wage rate  $w$ , which can be regarded as well as a usual fallout of the development process, has a more complicated impact, combining two effects. There is first an increase in the opportunity cost of getting educated, requiring an increase in the return to education for keeping the arbitrage condition binding, so that locus (5) shifts upwards. There is next a fall in the demand for skilled labor, insofar as the two kinds of labor are cooperating in production. Locus (6) thus shifts to the left, as less educated labor would be needed to keep the market clearing, for any given  $\tilde{w}_s$ . Hence, the equilibrium impact on  $n_s$  is undoubtedly negative. The impact on  $\tilde{w}_s$  is uncertain, depending on the relative amplitude of the two shifts, and on the slopes of the curves. A slightly positive effect seems likely, if the arbitrage effect dominates the negative demand effect. This would be the case for example if the two types of labor were quite substitutable in production. Nevertheless, the REE skilled-labor wage effect is likely to be of a secondary importance. In that case, the impact of an increased  $w$  on the expected number of terrorists is negative, as the new equilibrium point is located above the iso-T locus. This prediction would be reversed, were the impact on the skilled-labor wage strongly negative. Notice that this prediction of a

favorable impact against expected terrorism of an increase in the expected unskilled-labor wage rate would be vindicated unambiguously in the case of the egalitarian society.

Now, the key alternative to economic development as a tool for reducing terrorism is undoubtedly repression. It is captured in the present model by the shift parameter  $\theta$ , which is assumed to shift the cumulative probability distribution upwards, i.e., to increase the probability of low values of  $v$  and reduce correlatively the probability of high values of this variable. However, as mentioned above, this parameter can as well describe other counter-terrorism measures working through the social support that the terrorist organization can get, that Frey (2004) would put under the “carrot” heading, like food subsidies or public expenditures in health or social infrastructure. However, this should not include policies that reduce directly the cost of education, because the model has a separate parameter  $\varepsilon$  for capturing the latter type of action. The impact of  $\theta$  is quite complicated to analyse in the present setting. The first effect concerns the reduction in the political premium, and thus in the return to education. This entails an upward shift of the arbitrage locus (5), as a higher wage rate is required to compensate for that, *ceteris paribus*. There is next a leftward shift in the market-clearing locus, as a fall in the number of educated workers would be needed to accommodate an increase in the fraction of the labor force going for a job. Hence, the impact on the REE is somewhat similar to that of the increase in  $w$ . Moreover, the iso-T locus itself shifts to the right, as a lower fraction of the educated labor force chooses to engage in terrorism, so that a larger number of educated people would be needed to leave the initial number of terrorists unchanged. This makes a fall in the expected number of terrorists resulting from this move more likely than in the case of an increase in  $w$ . Hence, this model predicts that in the case of a fairly polarized society, an expected repressive policy is likely to

be effective in fighting terrorism<sup>7</sup>. Notice, however, that there is some uncertainty regarding the impact of repression, which could be reversed if the impact on the skilled-labor wage was strongly negative. Hence, this model opens the possibility of a counter-productive effect of repression, which could in fact lead for some parameter values to an increase in the expected number of terrorist, as in the models presented by Bueno de Mesquita (2005) and Rosendorff and Sandler (2004). This uncertain impact would not arise in the case of an egalitarian society, where the effectiveness of repression would be predicted unambiguously.

The last parameter that the model allows us to change for comparative-static purposes is  $\varepsilon$ . The latter may capture various policy tools that help to reduce the cost of education for the marginal worker. This may be achieved through a public policy of popular education, or by the involvement of civil society. As mentioned in the introduction, many terrorist organizations are involved in supporting popular education through their charitable arm. This is the case of Hamas and Hezbollah in the Middle East. The present model helps to understand better why these organizations might be involved in these activities, as it predicts unambiguously a positive response of the expected number of terrorists<sup>8</sup>. This is due to a simultaneous fall in  $\tilde{w}_s$  and increase in  $n_s$ , resulting from the downward shift in the arbitrage locus (5). Then, more people get educated as the cost of education has fallen, while a lower fraction of them chooses to work, as the level of compensation has fallen too. This result is consistent with the analytical framework presented by Azam and Thelen (2008), which predicts that expanded education should be matched by increased repression, for some parameter values, in order to dampen the resulting increase in terrorism. Here as well, a policy of expanded education would need to be accompanied in the short run either by an additional

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<sup>7</sup> Changing this parameter can also be used for simulating a cross-country comparison between two societies differing only by their level of “militancy”. A higher  $\theta$  would then describe a less militant society. Azam and Thelen (2008) have illustrated how important are these kind of differences across countries. The present model implies that a more militant society could have the same REE as a less militant one if its level of repression was adjusted accordingly.

<sup>8</sup> Berman (2009) gets a similar prediction, but from an entirely different mechanism. His emphasizes the incentives created by mutual help organizations.

repressive effort or by a boost in the demand for skilled labor, e.g. by means of an employment subsidy, while in the longer run, the favorable effects of economic development would make repression less needed.

### *The Impacts of Unexpected Shocks*

The foregoing comparative-static analysis of the REE only predicts the impact of some expected changes on the actual supply of educated people and on the expected number of terrorists. The model can also be used for predicting the impact of some *unexpected* changes that occur after the students have completed their course of study and before they choose between working and going for a terrorist mission. Then,  $n_s$  is given, or more precisely predetermined, but the actual number of skilled workers and of terrorists can still be affected. At that point, a policy move aimed at reducing the cost of education is irrelevant, and a change in the unskilled wage  $w$  is only relevant in the borderline case where  $w_s = w$ , as far as its direct impact on the decision of the educated person to take a job or not is concerned. However, it is liable to work indirectly through the demand for skilled labor, where it has a negative impact. Therefore, an unexpected increase in the unskilled labor wage rate will entail a fall in the skilled-labor wage rate, and thus lead to an increase in the actual number of terrorists. Arguably, this could be seen as a perverse effect of poverty reduction, insofar as the level of the unskilled labor wage rate is a major determinant of the incomes of the poor. Nevertheless, the demand for skilled labor could be shielded from such an effect by a wage subsidy for either the unskilled or the skilled labor. An unexpected increase in  $K$  works in the opposite direction. Thus, an unexpected boost of the demand for educated labor would lead to an increase in the actual skilled-labor wage rate, and would thus lower the actual number of terrorists. Conversely, this might explain why a downturn in economic activity was found empirically to give rise to an upsurge in terrorist activity by Blomberg *et al.* (2004) and Li (2005), if this downturn implies an unexpected fall in the demand for educated labor. Hence,

while the impact of the increase in the unskilled wage rate must be qualified depending on whether it is expected or unexpected, in addition to the qualifications expressed above, this is not necessary for the impact of any variable that affects positively the demand for skilled labor, in the case described in figure 2. In the case of the egalitarian society (flat  $\delta(i, \varepsilon)$ ), only unexpected boosts of skilled-labor demand would work in the right direction. This implies that an aid policy aimed at reducing terrorism should focus on boosting the demand for skilled labor in the terrorists' countries of origin, provided they are not "too egalitarian", and not on fighting poverty. Poverty alleviation, here captured by a rise in the unskilled labor wage rate, would have a favorable impact against terrorism in the long run, in the most likely case, after a possible unfavorable short-run impact, if it was unexpected at first. Lastly, an unexpected "crackdown" policy, or any other policy that reduces the value of terrorist attacks *ex post* would also reduce the actual number of terrorists.

#### 4. Conclusion

This short paper has offered a rational-choice explanation for the so-called "quality of terror" puzzle. A well-documented fact is that terrorists are usually more educated than the rest of their society of origin. At first sight, this seems to challenge the rationality hypothesis, as more educated people are facing a higher opportunity cost of destroying their lives than less educated ones. This would suggest instead that less educated people would turn out to become terrorist, what is contradicted by most available data. This is even more challenging when one takes into account that suicide terrorism has become the dominant mode of operation of terrorists, so that these educated activists destroy their own human capital as they kill their victims. This observation seems to challenge even further the rationality hypothesis, as one may wonder why these people get educated in the first place, knowing that they have a non negligible probability of blowing up the resulting human capital in the end.

In fact, the model presented here suggests that the prospect of dying while perpetrating a terrorist attack is far from discouraging prospective students, in the rational expectations equilibrium. The prospect of performing a valued political act with some probability is enhancing instead the expected return to education for some parameter values. In this model, the potential terrorists choose first to acquire some education and then whether they want to become terrorists or skilled workers. Education is described here as doing two things to the people who acquire it. First, of course, it gives them access to the higher paying segment of the labor market, as skilled worker. Additionally, it affects their worldview, in such a way that they may acquire a high value for engaging in terrorism, with some probability. This is the source of the “political premium”, which enhances the expected return to education. There is thus a two-way causation between education and terrorism, as the latter influences the expected rate of return on education, while the supply of educated labor is affecting the expected skilled-labor wage rate, and through it, the expected rate of return on education. The rational expectations equilibrium of the model has thus been analyzed for describing the simultaneous determination of these two variables. Its comparative statics allows us to make some predictions about the impact of some parameters or policy tools on the expected number of terrorists. It turns out that under some parameter restrictions, the model predicts that both economic development and repression (“crackdown”) may be effective for reducing the terrorist threat, while some social policy, in the form of a contribution to reduce the cost of education would be counter-productive. Nevertheless, the model points out that some policies for boosting the demand for skilled labor might also have a desirable impact on the supply of terrorists. Hence, under some caveat, this exercise provides some support to the “carrot” approach to counterterrorism advocated by Frey (2004) or Berman (2009). However, as pointed out by an anonymous referee, some cost-benefit analysis may be required before jumping to the conclusion that the effective counter-terrorism measures brought out here are

desirable. It might be the case that their social cost is very high while their impact on terrorist activity is small. Evaluating these costs and benefits falls outside the scope of this paper and would require some specific new empirical research. Finally, the present model predicts that general economic development is the most attractive solution for abating terrorism, in the long run, by offering high-paying jobs to an expanding number of educated workers. This prediction seems vindicated by Azam and Thelen (2008) who find that the number of terrorist attacks by country of origin decreases with a higher GDP per capita. However, this is not confirmed by Azam and Thelen (2010), under a different specification that emphasizes Law and Order instead as a favorable influence on the supply of terrorist attacks.

### Appendix 1: Calculations for Table 1.

The REE of the model determines the triplet  $\{\tilde{w}_s, n_s, \tilde{n}_T\}$  as a function of the set of parameter values for  $\{K, w, \theta, \varepsilon\}$ . The comparative-static predictions are generated by working out the impact of changes in the latter on the former. Let us first focus on the determinants of the REE value of  $\tilde{w}_s$ , whose impacts are found by jointly solving (5) and (6), by calculating their total differentials, and eliminating  $n_s$  between them. For the sake of simplifying the notation, define first:

$$\Delta = (F(-))^2 + n_s \frac{\partial \delta(-)}{\partial n_s} \left( \frac{\partial F(-)}{\partial \tilde{w}_s} - \frac{\partial L}{\partial \tilde{w}_s} \right) > 0$$

The following derivatives can then be derived for describing the impact of the four parameters on  $\tilde{w}_s$ :

$$\frac{\partial \tilde{w}_s}{\partial K} = \frac{1}{\Delta} \frac{\partial \delta(-)}{\partial n_s} \frac{\partial L(-)}{\partial K} > 0,$$

$$\frac{\partial \tilde{w}_s}{\partial w} = \frac{1}{\Delta} \left( F(-) + \frac{\partial \delta(-)}{\partial n_s} \frac{\partial L}{\partial w} \right) \quad (?+)$$

$$\frac{\partial \tilde{w}_s}{\partial \theta} = \frac{-1}{\Delta} \left( F(-) \frac{\partial R(-)}{\partial \theta} + \frac{\partial \delta(-)}{\partial n_s} \frac{\partial F(-)}{\partial \theta} \right) \quad (?+)$$

$$\frac{\partial \tilde{w}_s}{\partial K} = \frac{1}{\Delta} \frac{\partial \delta(-)}{\partial \varepsilon} < 0.$$

The two ambiguous results have been marked here (?+), as in table 1. The present algebraic formulation helps the interested reader to evaluate the validity of the guesswork discussed in the main text above. It can thus be checked that the outcomes of these comparative static exercises depends crucially on the relative amplitude of the shifts of the two curves (5) and (6), as well as on their slopes.

Likewise, we now eliminate  $\tilde{w}_s$  between (5) and (6) in order to calculate the comparative statics of  $n_s$ . For the sake of simplifying notation, let us define:

$$\Phi = n_s \left( \frac{\partial F(-)}{\partial \tilde{w}_s} - \frac{\partial L(-)}{\partial \tilde{w}_s} \right) > 0 \text{ and } \Gamma = \Phi + (F(-))^2 > 0.$$

We thus find the following derivatives:

$$\frac{\partial n_s}{\partial K} = \frac{F(-)}{\Gamma} \frac{\partial L(-)}{\partial K} > 0,$$

$$\frac{\partial n_s}{\partial w} = \frac{-1}{\Gamma} \left( \Phi - F(-) \frac{\partial L(-)}{\partial w} \right) < 0,$$

$$\frac{\partial n_s}{\partial \theta} = \frac{1}{\Gamma} \left( \Phi \frac{\partial R(-)}{\partial \theta} - n_s F(-) \frac{\partial F(-)}{\partial \theta} \right) < 0,$$

$$\frac{\partial n_s}{\partial \varepsilon} = \frac{-\Phi}{\Gamma} \frac{\partial \delta(-)}{\partial \varepsilon} > 0.$$

None of them is ambiguous, confirming the findings of the graphical analysis performed above.

Lastly, these derivatives can be used in turn for determining the impacts of the four shift parameters on the expected number of terrorists at date 2 which is governed by (7). Most

of these derivatives are ambiguous, and depend on the slope assumptions spelt out in the text above. They read:

$$\frac{\partial \tilde{n}_T}{\partial K} = \left( (1 - F(-)) \frac{F(-)}{\Gamma} - \frac{n_s}{\Delta} \frac{\partial F(-)}{\partial \tilde{w}_s} \frac{\partial \delta(-)}{\partial (n_s)} \right) \frac{\partial L(-)}{\partial K} \quad (?-),$$

$$\frac{\partial \tilde{n}_T}{\partial w} = -\frac{1 - F(-)}{\Gamma} \left( \Phi - F(-) \frac{\partial L(-)}{\partial w} \right) - \frac{n_s}{\Delta} \frac{\partial F(-)}{\partial \tilde{w}_s} \left( F(-) + \frac{\partial \delta(-)}{\partial n_s} \frac{\partial L(-)}{\partial w} \right) \quad (?-),$$

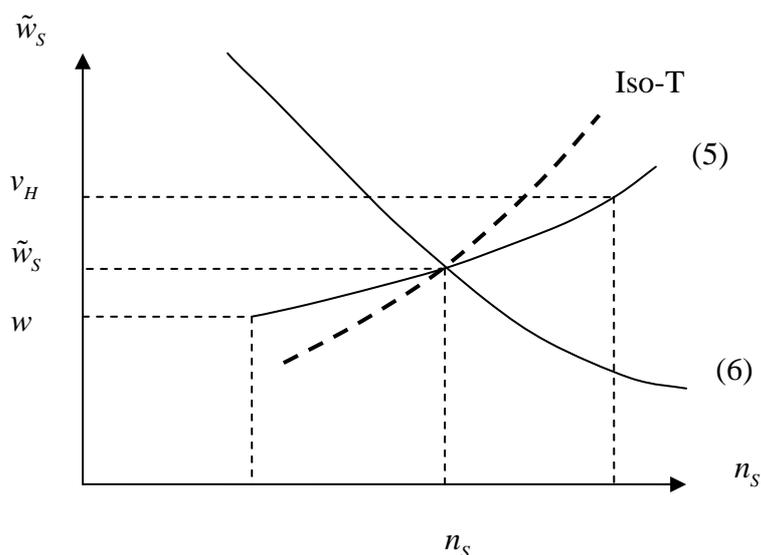
$$\begin{aligned} \frac{\partial \tilde{n}_T}{\partial \theta} = & -\frac{1 - F(-)}{\Gamma} \left( \Phi \frac{\partial R(-)}{\partial \theta} - n_s F(-) \frac{\partial F(-)}{\partial \theta} \right) \\ & + \frac{n_s}{\Delta} \frac{\partial F(-)}{\partial \tilde{w}_s} \left( F(-) \frac{\partial R(-)}{\partial \theta} + n_s \frac{\partial \delta(-)}{\partial n_s} \frac{\partial F(-)}{\partial \theta} \right) - n_s \frac{\partial F(-)}{\partial \theta}, \quad (?-) \end{aligned}$$

$$\frac{\partial \tilde{n}_T}{\partial \varepsilon} = -(1 - F(-)) \frac{\Phi}{\Gamma} - \frac{n_s}{\Delta} \frac{\partial F(-)}{\partial \tilde{w}_s} \frac{\partial \delta(-)}{\partial \varepsilon} > 0.$$

The latter result is the only unambiguous one in this set, making the expansion of education a policy that is only desirable if it is accompanied by some additional measures that compensate for its terrorism-enhancing effect. In particular, when repression is assumed to work, this finding makes it desirable as a companion to education policy. However, the algebraic expression just presented for the impact of repression on the supply of terrorists confirms that repression might not work in a highly polarized society, where the cost of education is rising “too” steeply in the neighborhood of the equilibrium point. In that case, it has a perverse effect, akin to the predictions of the Bueno de Mesquita (2005) and Rosendorff and Sandler (2004) models. By contrast, the algebraic expression for the impact of an increased demand for skilled labor engineered by an increase in  $K$  shows a perverse response in the case where the society is not polarized enough, as discussed in the graphical analysis above. It also shows that for some sets of parameter values, the two strategies might be effective while, unfortunately, one could construct some configurations of parameter values

where neither economic development nor repression would work for absorbing an increased educated youth without creating an increased supply of terrorists.

## Appendix 2: The Egalitarian Case



**Figure A.1: Determination of the Rational Expectations Equilibrium  
in the Egalitarian Case**

**Table A.1: Comparative-Static Predictions in the Egalitarian Case**

	$K$	$w$	$\theta$	$\varepsilon$
$\tilde{w}_S$	+	?+	?+	-
$n_S$	+	-	-	+
$\tilde{n}_T$	+*	-*	-*	+

Figure A.1 describes the case of the egalitarian society, where the locus corresponding to equilibrium condition (5) is flatter than the iso-T locus. It can be used to generate the comparative-static predictions presented at table A.1, whose differences with table 1 are mentioned in section 3 of the paper, and are marked here with a “\*”. The bottom line of this exercise is that this case provides some support for a “pro-poor” and repressive policy to

counter terrorism, while it predicts that boosting education and the demand for skilled labor would be counter-productive.

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