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# The Origins of Terrorism

## Cross-Country Estimates on Socio-Economic Determinants of Terrorism\*

February 16, 2010

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### Abstract:

As a prerequisite of an appropriate anti-terror strategy, it is indispensable to assess the underlying causes of terror. We examine social and economic conditions in the country of origin of terrorist attacks, claiming that low opportunity costs of terror, e.g., approximated by slow growth and poor institutions raise the likelihood of terror and the willingness in the population to support terror. Using a negative binomial regression model, we are able to show that unfortunate socio-economic conditions in a country are likely to reduce the opportunity costs of potential terrorists and increase the number of terrorist attacks originating from a specific country. Interestingly, this effect is particularly relevant after a certain level of development has been reached. We therefore distinguish between several broad country groups, namely the OECD, Europe and Islamic countries.

JEL classification: P16, F15, C25

Keywords: terror attacks, openness, discrete choice analysis, institutions

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## I. INTRODUCTION

The prevailing strategy to fight terrorism, or, more dramatic, to win *the war on terrorism* is to isolate the terrorists and their supporters, so as to minimize the (substantial) costs of terrorism.<sup>1</sup> This strategy is successful in that it helps reducing immediate terror threats. However, it also has cost in fiscal terms as well as with respect to declining civil liberties (The Economist 2008). In the economic literature this policy approach is implicitly backed by a number of empirical analyses (e.g., Abadie 2006; Krueger and Laitin 2008; Krueger and Malecková 2003; Kurrild-Klitgaard, Justensen and Klemmensen 2006; Krueger 2008) which show that terrorism is not rooted in poor socio-economic conditions (e.g., low levels of educational attainment, low income); rather, these studies claim that terrorists are typically well-educated and have a good economic status. The authors of these studies argue that terrorism is a political creature, i.e., that it is rooted in political repression. We argue that this view is overly simplistic as it misses some decisive aspects of terror and its foundations. In particular, it seems necessary to consider the environment of terrorist and their socio-economic (and political) circumstances. In order to develop their strategies, terrorists need retreats and backing in the population. This backing may depend on a set of variables documenting these very socio-economic aspects. Given the widespread socio-economic underdevelopment of many Middle Eastern and other countries from which terror originates, hawkish counterterrorist strategies may backfire if they worsen socio-economic conditions further. For the development of sustainable anti-terror strategies, a deeper knowledge of the origins and causes of terrorism is required. In this study, we want to contribute some theoretical and empirical results that may be part of such a foundation.

Our contribution contains a systematic analysis of the origins of terrorism by offering a theoretical analysis of the socio-economic background of terrorists, where we show how this background may translate into violence. Subsequently, we investigate some of our model's implications empirically. Here, we put a special emphasis on the socio-economic and institutional situation in those countries from which terrorists originate. The focus is laid upon active terrorists and their background rather than on leaders of terrorist groups, as the latter

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<sup>1</sup> Terrorism may damage economic activity, e.g., by reducing trade (Nitsch and Schmacher 2004), FDI flows (Enders and Sandler 1996; Abadie and Gardeazabal 2003) and economic activity in certain industries, e.g., the tourism sector (Enders, Sandler and Parise 1992). Such negative effects may feed through to a reduction of overall economic growth (Crain and Crain 2006; Gaibulloev and Sandler 2008). It may also produce political costs, e.g., by affecting government stability (Gassebner, Jong-A-Pin and Mierau 2008) or voter behavior (Berrebi and Klor 2008).

regularly use terror as a means to meet other objectives. The main hypothesis is that terror is more easily generated in those parts of the world where poor socio-economic conditions and institutions prevail. While an empirical analysis of the determinants of the genesis of terrorism is associated with methodological problems (e.g., finding reliable data, cautious interpretation of the data etc.), we nevertheless think that it is worthwhile to conduct this study, given the enormous importance to learn about the motivation of terrorists and their environment against the background of the need for effective and efficient anti-terror strategies. As our main results, we challenge the widespread believe that poverty and poor socio-economic conditions are not determinants of terror. Opportunity costs of all stakeholders do not only depend on political variables.

The remainder of this paper is organized as follows. After a theoretical analysis of the behavior of terrorists and their environment in Section 3, we provide empirical evidence on the driving forces of terrorism in Sections 4 (method and data), 5 (results) and 6 (discussion). For our empirical estimates, we use a set of negative binomial regression models to take into account the special nature of our dependent variable. These core parts of the paper are surrounded by the following Section 2 which is dedicated to an overview about the related literature and the conclusions in Section 7.

## II. LITERATURE REVIEW

A common definition characterizes terrorism as the “premeditated use, or threat of use, of extreme violence to obtain a political objective through intimidation or fear directed at a large audience.” (Tavares 2004, p. 1041). An economic analysis of terrorism (as the one we will provide in Section 3) assumes that terrorists are rational individuals (Caplan 2006). That is, the costs, benefits and opportunity cost of terrorism determine the level of terrorist activity carried out by individuals.<sup>2</sup> Costs from terror result, e.g., from the exhaustion of resources or the possibility of punishment by the government. Benefits from terror arise when terrorists are

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<sup>2</sup> One may argue that conducting terrorism (e.g., killing other people arbitrarily to meet certain objectives) also requires strong emotions. Wintrobe (2003) develops a model where individual terrorists choose between two (emotional) goods, namely intellectual independence and group solidarity. The potential terrorist trades independence against solidarity – and identity, as Harrison (2006) stresses – and strong leadership. Wintrobe’s model shows that terrorist activity may depend on individual desires and emotions, where the demand for solidarity again makes terrorism (including suicide terrorism) rational. That is, this theoretical approach also implicitly argues with the opportunity costs of terrorism.

successful in approaching their short-run or long-run goals, where the short-run goals are a destabilization of attacked economies and polities as well as publicity (e.g., Tavares 2004) and the long-run goal is a redistribution of power and wealth not enforceable in the ordinary political process (Frey and Luechinger 2003). Ultimately, terror is chosen as a tool to reach abstract political objectives as long as terrorists' marginal benefits exceed marginal costs (Frey and Luechinger 2003; Harrison 2006). Following this economic perspective on the generation of terrorism, the theoretical and empirical literature has focused on those (country-specific) factors influencing the costs, benefits and opportunity cost of terrorism, i.e., on the *determinants of terrorism*. Clearly, these factors matter to the terrorists. Also, they matter to the terrorists' environment, i.e., to their families and supporters.<sup>3</sup>

From a theoretical point of view, earlier studies have argued that poor (country-specific) socio-economic conditions (e.g., poverty, slow growth, poor investment, trade disadvantages) is reflected in the cost-benefit considerations of terrorists and their environments, consequently providing incentives for violence. For instance, Gurr (1970) argues economic disparity makes it more likely that individuals feel economically disadvantaged and resort to violence to enforce economic change, so that that poverty morphs into violence. Similarly, slow growth may feed into violent behavior because there are relatively fewer prospects of economic advancement and participation (e.g., employment) in poor economic times (Blomberg, Hess and Weerapana 2004). Also, economic integration may curtail economic opportunities of globalization 'losers' and trigger grievances against the existing economic order, thus potentially increasing the risk of terror (Harrison 2006). Generally, poor socio-economic conditions may translate into terrorism by making violence more beneficial as the pay-offs from terrorist success are comparatively high (e.g., a redistribution of wealth in favor of the terrorists). Also, poor socio-economic conditions may make violence more likely because its direct costs (e.g., from recruiting) and opportunity costs are comparatively low. For instance, terrorist organizations may capitalize on a comparatively large pool of recruits and supporters when poverty abounds, growth is poor or economic integration is perceived as 'unfair'. From a theoretical point of view, it is thus possible that poor socio-economic

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<sup>3</sup> Harrison (2006) argues that the terrorists' environment also takes into account the (opportunity) costs and benefits of violence. For instance, terrorist supporters weigh off the identity created by terrorism against the benefits from non-support, basing their actual decision on the opportunity costs of terror. As another example, parents may support the decision of their children to become (suicide) terrorists, if the children's future is unpromising (e.g., as unemployment is high) and if (as an alternative to non-violence) the children's actions as a terrorist guarantee a martyr status in the society or financial support from terrorist organizations.

conditions result into terrorism by swaying the cost-benefit considerations of (potential) terrorists and their environment in ways that make violence more likely.

Empirically, answering the question whether socio-economic factors indeed matter to the genesis of terrorism means to analyze the circumstances from which terrorists originate, regardless of their eventual targets.<sup>4</sup> Several studies provide support for the notion that terrorism is (partly) rooted in poor socio-economic conditions. In Lai (2007) and Blomberg and Hess (2008), high levels of income and low levels of income inequality are associated with lower levels of terrorism production. Burgoon (2006) finds that welfare policies (government activities) reduce the generation of terrorism by their leveling effect on unfavorable socio-economic conditions. That is, as social policies lower poverty and inequality in a society they make terrorism a less attractive option. Basuchoudhary and Shughart (2010) detect a negative link between the quality of economic institutions and the generation of terrorism. When the quality of economic institutions is poor (e.g., when property rights are not well protected), terrorism becomes more likely, suggesting a trade-off between institutional opportunities and terrorist violence. While institutional quality is often named as a source of economic success (e.g., Heckelman and Stroup 2000; Gwartney, Holcombe and Lawson 2006), the findings of Basuchoudhary and Shughart (2010) may thus suggest that poor institutional quality feeds through to terrorism by its adverse effects on economic performance and development. Finally, Blomberg and Hess (2008) and Kurrild-Klitgaard, Justensen and Klemmensen (2006) find a negative correlation between trade openness and terrorism production. This indicates that economic integration is not recognized as a threat (Wintrobe 2006). Rather, it seems to be seen as an opportunity for economic gains, so that economic integration indirectly reduces the propensity for violence by fostering economic development (e.g., through trade gains).

As already stressed in the introduction, the notion that terrorism is caused by poor socio-economic conditions has been challenged by some scholars on theoretical and empirical

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<sup>4</sup> The empirical literature on terrorism determinants has mainly analyzed the origins and targets of transnational terrorism, recognizing the dyadic nature of this kind of terrorism. *Transnational terrorism* is terrorism involving citizens, groups or the territory of more than one country. In this study we focus on the source countries of terrorism, so we also center this review on this issue. Investigating the targets of terrorism means to scrutinize the traits of countries targeted by terror, irrespective of the country of origin of the terrorists. Studies taking the target perspective are, e.g., Blomberg, Hess and Weerapana (2004), Tavares (2004) and Krueger and Laitin (2008). These studies suggest that economically successful countries are more often targeted by terrorism than poor economies. See Krieger and Meierrieks (2010) for an overview of the literature.

grounds. Theoretically, some authors have stressed the role of the political and institutional order (e.g., Ross 1993) or of identity conflicts (e.g., Huntington 1996) in influencing terrorist activity. Empirically, some studies find political and institutional factors (e.g., Krueger and Malečková 2003; Kurrild-Klitgaard, Justensen and Klemmensen 2006), political instability (Piazza 2008) and ethnic tensions (Basuchoudhary and Shughart 2010) also matter to terrorism, potentially even trumping economic factors.<sup>5</sup>

The result of this literature review is thus that terrorism can be analyzed economically, assuming that terrorists and their support are influenced by the costs, benefits and opportunity costs of their behavior. Theoretically, socio-economic factors may influence this calculus, where poor socio-economic conditions are generally expected to foster terrorist activity. Empirically, it is by now unclear whether this transmission effect is indeed valid, or whether other mechanisms are more important. With this contribution, we want to provide a theoretical channel from poor socio-economic conditions (via the opportunity costs of violence) to terrorism and an empirical investigation of the implications of our model. If we indeed find that an improvement in the (country-specific) socio-economic environment makes terrorism less likely, this should have some important policy implications. Given that terrorism may be fought by hard or soft measures, i.e., by the use of ‘the stick’ or ‘the carrot’ (Frey 2004), corresponding results would suggest that an increase in the opportunity costs of terrorism (e.g., by means of economic success) feeds through to less terrorism, indicating that using the carrot is a valid option in the war on terror.

### III. THEORETICAL MOTIVATION: OPPORTUNITY COSTS OF TERROR

If terrorism is rational, it seems to be intuitive to model it as one of several choices driven by economic constraints. The concept of opportunity costs is suitable for the theoretical analysis of the origin of terrorism, as it indicates what terrorists need to sacrifice when choosing to use violence. The opportunity costs are driven by different socio-economic and political circumstances and actors. We distinguish between different actors influencing the decision to commit terrorist attacks. Several groups are relevant. The first is the top-level of the terrorist

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(2008). These studies suggest that economically successful countries are more often targeted by terrorism than poor economies. See Krieger and Meierrieks (2010) for an overview of the literature.

<sup>5</sup> See Krieger and Meierrieks (2010) for an overview on the theoretical and empirical literature on the determinants of terrorism.



organization. Their members can be characterized by a goal, which they want to meet, thereby using different instruments. One instrument is extremism, in our case terrorism. It is a means not an end. The decision to use a certain instrument itself is driven by rational calculus (Wintrobe 2006). Following to this reasoning, the top-level terrorists use an incentive structure to attract active terrorists.

The incentives of these recruited persons – and their environment – are different in comparison to the ones of their leaders. Thus, the second relevant group is the environment of the terrorists, e.g. friends, parents or a sympathetic public. The more support the terrorists get from the environment the lower are the opportunity costs of terrorism for individuals. The third group are the terrorists themselves, whose characteristics and motivations have been extensively been discussed in the literature (see Section 2). The predisposition of an individual to become or support a terrorist is assumed to depend on the opportunity costs of terror. The fourth group that influences the opportunity costs of terrorism contains the local, domestic and foreign governments, trying to combat terrorism. They want to prevent individuals to become terrorists. Needless to say, that their influence is dependent on the local, intellectual and mental distance to the second and third group.

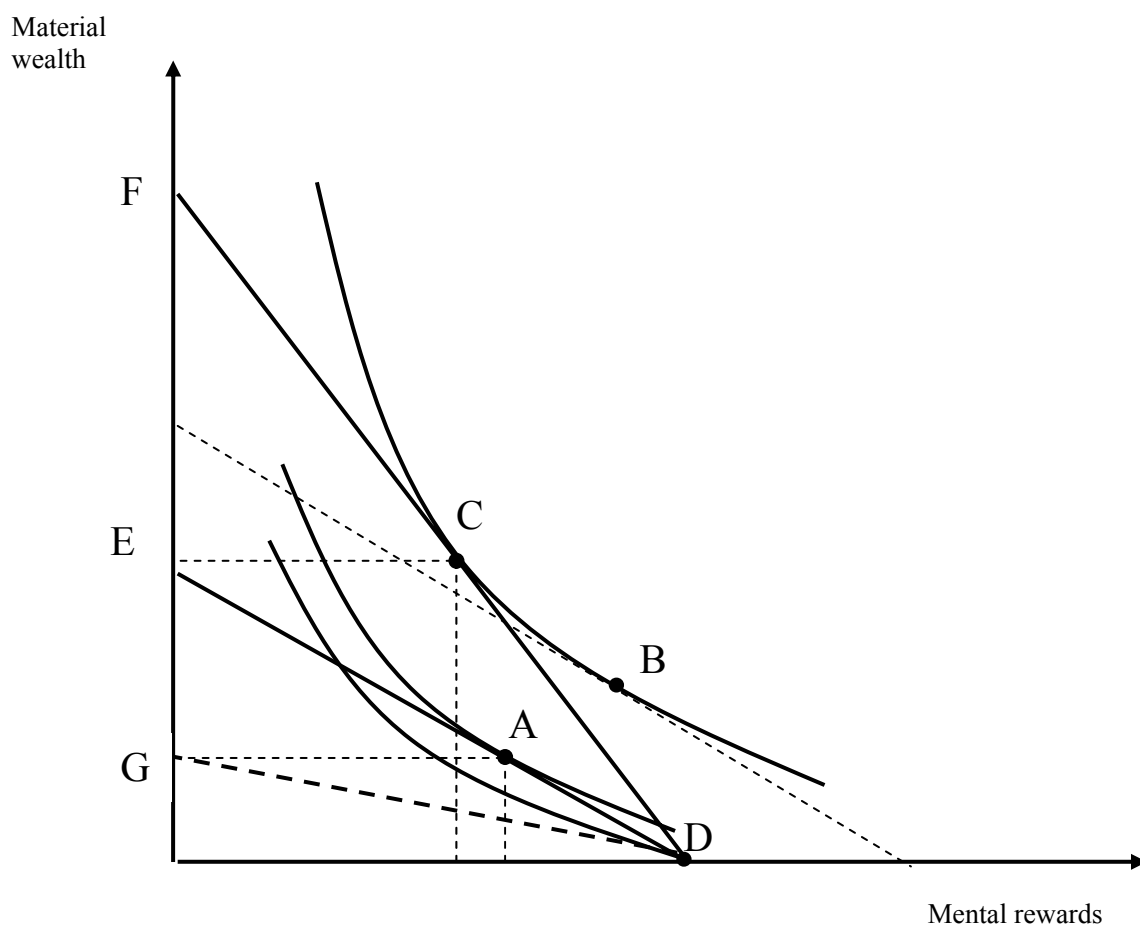
Before we discuss the drivers of opportunity cost of terrorism, we first consider the terrorists' deliberations leading to the idea of opportunity costs. The terrorist leaders try to attract terrorists by the help of the trade-off between two goods. In particular, Wintrobe's (2003) idea of analyzing the trade-off between independence and solidarity is convincing. Solidarity includes the support of the environment. Within this framework, the opportunity costs of terrorism can be illustrated quite easily. The two goods we consider are individual wealth on earth and mental rewards for the terrorist. Mental rewards can include the promise of a happy life after death, the status and honor of a martyr, support for the family of a suicide bomber or even the restoration of individual forgone honor.<sup>6</sup> The terrorist is assumed to perceive life on earth as less desirable than the mental rewards, support and group solidarity, even including the promise to move into paradise after a successful suicide strike.

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<sup>6</sup> It is reported that groups force group members to suicide bombing by, e.g., threatening to do harm to the members' relatives. This mechanism seems to function with young women who have been subject to sexual harassment in Islamic countries. To restore their self-appreciation, suicide bombing seems to be the last option (Harrison 2006).

We distinguish between two choices, namely the decision to support and/or become a terrorist or not, i.e., to consume mental rewards or to consume goods and services on earth. Analogous to the analysis of income and substitution effects in microeconomics, this decision can be analyzed in terms of the different utilities derived from either living in peace – and making a living on earth – or engaging in and/or supporting activities that lead to a terror assault, thereby qualifying for mental rewards. In Figure 1, consider an original budget constraint, represented by the line DE, together with indifference curves. The individual's utility is maximized in A.

Figure 1  
Choice between the Consumption of Goods and Mental Rewards



If life on earth becomes more attractive, e.g., as per capita GDP increases with more economic opportunities, then the budget constraint moves to DF. In the case of given preferences, utility is maximized now in C. The move to B shows the income effect. This cannot be the new optimum, which is represented in C. The interesting part of the story is the

move from B to C showing the substitution effect of the change in the budget restriction. The relative price of material wealth decreases in comparison to mental rewards increases and the individual prefers more consumption and fewer activities related to terror. Thus, the opportunity costs of terrorist activities have increased. If, however, the opportunity costs decrease by a sufficiently large degree, e.g., because there is an economic downturn, the budget constraint moves to DG, and terror becomes increasingly attractive. In an extreme case, a corner solution is reached and utility is maximized in D. As D is located both on the new (DG) and on the original budget constraint (DE), the only relevant effect here is the substitution effect. This corner solution may be interpreted as the choice of an individual to commit a suicide attack.

Now we consider the drivers of opportunity costs. As already stressed by our literature review in Section 2, a core group of factors driving the opportunity costs of terrorism are macroeconomic conditions. From the review and the theory outlined before, we state several hypotheses that link socio-economic conditions to the emergence of terrorism. Among such socio-economic variables, openness to foreign trade is assumed to have positive effect on the propensity to terror (Wintrobe 2006). With high trade, the threats from trade for some individuals become obvious; trade then may be positively related to terror. A second influential variable is income. We expect an ambiguous effect: In rich countries, GDP per capita or its growth may be positively correlated with terrorism, since as an empirical phenomenon in rich countries an increasing number of young people may become unsatisfied with the economic and political system. In poor countries, we would rather expect increasing opportunity costs – and less terror – with higher GDP per capita and likewise with GDP growth. Another proxy for opportunity costs is investment: the higher investment, the better future prospects and the lower the willingness of individuals to become terrorists. Finally, a high share of government consumption in GDP can be interpreted in two ways: on the one hand it can be expressed as a proxy for misallocation, as the government demands a huge share of income for consumption purposes. Thus, it reduces opportunity costs of terror. On the other hand, it can be an input – education, health, infrastructure, social welfare policies (e.g., Burgoon 2006) – for economic improvement and therefore increase opportunity costs. We follow the second interpretation. Higher education (human capital) should also increase opportunity costs of terror. However, it has been argued in the literature that higher levels of

are sometimes positively linked to terrorism production (e.g., Krueger and Malečková 2003). Our hypotheses are thus:

- Hypothesis 1: Globalization is perceived as a threat. The higher trade relative to GDP, the higher is the probability of terrorist activities originating from this country.
- Hypothesis 2: In rich countries, high GDP spurs terrorist activities; in poor countries, high GDP deters terrorist activities.
- Hypothesis 3: Higher public spending increases the opportunity costs of terrorism.
- Hypothesis 4: A higher degree of education diminishes terrorism.

In the following empirical analysis, we test these core hypotheses. Given that terrorism may also be rooted in non-economic conditions (Krieger and Meierrieks 2010), we include several control variables which have a rather indirect link to the concept of opportunity costs. First, we control for properties of the citizens, namely the size of population.<sup>7</sup> Some other variables can also give information on the opportunity costs of terror resulting from country-specific effects. The opportunity costs are higher the higher the institutional quality in a country is, e.g., measured by the Fraser Index for Economic Freedom (Gwartney et al. 2007). One would expect that this relation is stronger in countries with less economic freedom than in countries with more economic freedom, as smaller differences on a high level are less relevant. In addition, the number of patents granted in the US originating from a country is expected to be negatively related to terrorism, as this number shows the technological strength of the country. The higher the number of patents is, the higher are the opportunity costs of terror. However, it again can be interpreted differently for different country groups. If there is no technological base, this variable may be less relevant than for countries with a broader base. Finally, the number of past terror attacks is included.

We argue that we can apply the theoretical thoughts both to the active terrorist and to his environment. Although the latter does not commit the terrorist acts, the propensity of individuals to be sympathetic to terrorists is a function of the opportunity costs. The better the socio-economic conditions today and prospects for the future, the less sympathy these

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<sup>7</sup> It would be superior to use the share of young persons – under 15 years of age – adding to potential violence (e.g., Krieger and Meierrieks 2010). However, data are not available over a longer time span.

individuals have for terrorists – they simply have more to lose.<sup>8</sup> In other words, an outward shift of the budget constraint in Figure 1 reduces the public support for terror and thereby indirectly the level of actual terrorist activities. Therefore, the basic hypothesis is that terror is rooted in countries in which the opportunity costs of terrorism are low. Thus, it is not the individual terrorist whose characteristics are important as the individual often may be mentally ill and disguised. Rather, the atmosphere of the environment of terrorists and their background matter.

#### IV. METHOD AND DATA

Unfortunately, the individual decision to become a terrorist and its dependence on socio-economic characteristics in the country of origin of terrorism are not observable to us. What we can observe, however, are country aggregates with respect to terrorist activities. This implies that our dependent variable is a count variable (non-negative integers), namely the numbers of attacks by individuals originating from a certain country during a given time span.<sup>9</sup> Specifically, for our analysis we use an estimation model for which we can use panel data to explain the number of terrorist attacks by a set of country characteristics (e.g., trade openness, GDP, population size) intended to approximate opportunity costs. This requires the application of regression methods specifically designed to cope with count data. In particular, the overdispersion phenomenon leads to the application of a panel regression model for count data (in our case, the number of terror incidents) which is based on the negative binomial distribution. In contrast to the Poisson distribution where the mean is restricted to equal the variance, the negative binomial distribution is able to account for a variance that is larger than the mean (overdispersion). Specifically, we apply the negative binomial regression with fixed effects as proposed by Hausman et al. (1984) and implemented in Stata. See also Cameron and Trivedi (1998) for a more detailed account of count data regression.

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<sup>8</sup> One may argue that the declining violence in Northern Ireland or in the Basque country is supporting this line of reasoning. Similarly, the declining success of the RAF in Germany follows this pattern.

<sup>9</sup> We do not distinguish between attacks with and without casualties as well as not take the number of victims into account, as this is often a matter of (bad) “luck” for the terrorist or the victims respectively. Further, the country of origin of the terrorist is the home country of that organization claiming responsibility or proven as responsible.

Letting  $y_{it} \in \{0,1,2,\dots\}$  denote the number of terror incidents in country  $i \in \{1,\dots,N\}$  at time  $t \in \{1,\dots,T_i\}$ , indicating the five-year periods we use. Thus we are in the situation of an unbalanced panel. This variable acts as our dependent variable in all subsequent regressions and evidently is a non-negative integer magnitude. The expected number of terror incidents depends on a vector of explanatory variables  $\mathbf{x}_{it}$  and a country specific fixed effect  $\alpha_i$ , i.e.  $E(y_{it} | \mathbf{x}_{it}) = \exp(\alpha_i + \mathbf{x}_{it}'\boldsymbol{\beta})$  with  $\boldsymbol{\beta}$  as the vector of regression parameters to be estimated. This expected value is assumed to be associated with the negative binomial distribution.

The data for the number of terror assaults during 1971 to 2005 originating from a country are from the Terrorist Knowledge Base of the MIPT (2006), a US governmental funded think tank. From these data a variable  $Y_{it}$  is constructed, representing the number of terror incidents originating from a country  $i$  during a five year span  $t$  (1971-1975, ..., 2001-2005). We have five different samples: all countries available, OECD countries (OECD), European countries (Europe), Islamic countries (Islam), and Islamic countries excluding oil producers (Islam2).<sup>10</sup> Note that while past empirical studies have mostly focused on transnational terrorism, we focus on all terrorist activity originating from a country, so that we also take into account ‘purely’ domestic terrorism.<sup>11</sup> While a focus on transnational terrorism only may lead to biased results (Sanchez-Cuenca and Calle 2009), our definition of the dependent variable circumvents such problems and gives a broader look on the phenomenon of terrorism.

The data for the explanatory variables are assembled from various data sets that are frequently used in the literature on cross-country growth regressions. These consist of updates of the Penn World Table (PWT 6.1), with an earlier version being described in Summers and Heston (1991) and various other sources.<sup>12</sup> In particular, the explanatory variables used in the regressions are:

- Openness to international trade from the PWT 6.1 (exports plus imports divided by GDP, constant prices, in percent);
- Material wealth in the economy, quantified by the variable real GDP per capita from the PWT 6.1 (real GDP per capita, constant prices, chain index);

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<sup>10</sup> An overview of the different country samples is given in the appendix.

- Alternatively, the growth rate of real GDP per capita (PWT 6.1);
- Capital accumulation in the economy from the PWT 6.1 (investment share of GDP, constant prices, in percent);
- Consumptive governmental expenditures in the economy, quantified by the variable government ratio, from the PWT 6.1 (government share of GDP, constant prices, in percent);
- Human capital, measured by the average schooling years in the total population older than 15 years, taken from an updated version of the data set of Barro and Lee (1993, 1996);
- Population size, quantified by the variable POP from the PWT 6.1 (population in 1000);
- Patents, denoted as the number of patents granted in the USA during 1980 to 1990 using data from the US Patent and Trademark Office (USPTO). The number of patents is transformed by the natural logarithm to limit the differences between countries with a relatively low number of patents and countries with a relatively high number of patents. The case of countries with a zero number of patents is allowed for by the addition of unity;
- The quality of institutions in a country, quantified by the Index of Economic Freedom from Fraser Institute (Gwartney et al. 2007).

## V. EMPIRICAL RESULTS

Using the data as described above, we run several specifications of our regression model in order to assess the influence of socio-economic conditions on the emergence of terrorism. First, we run a baseline model specification using only those variables closely linked to a country's socio-economic environment and thus terrorism's opportunity costs. The results are reported in Table 1.

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<sup>11</sup> Although domestic terrorism is a more common phenomenon (e.g., Abadie 2006), past analyses have focused on the determining factors of transnational terrorism due to data constraints.

<sup>12</sup> Table 4 in the appendix shows the descriptive statistics.

Table 1 clearly shows that we have for the full sample and the European countries the most statistically significant coefficients.<sup>13</sup> In the full sample, trade openness, the size of government and the population are statistically significant and have the expected signs. In the sample for Europe we have a statistically significant influence of real GDP per capita, of the size of government (negative as expected) and of the population (negative as expected). Population size in all specification has a statistically significant negative influence.<sup>14</sup> We find that GDP per capita, size of government and the population are important independent variables.

Table 1  
Baseline Specification with Core Explanatory Variables  
(Negative Binomial Estimates with Fixed Effects)

	full sample	OECD	Europe	Islam	Islam2
intercept	1.378* (1.693)	-3.856** (1.991)	-5.195* (1.731)	1.442 (0.674)	4.033 (1.524)
log(openness)	0.371*** (4.862)	0.294 (1.224)	0.075 (0.202)	0.254* (1.670)	0.275 (1.493)
log(real GDP per capita)	0.058 (1.028)	0.642*** (2.615)	1.323*** (3.064)	0.074 (0.431)	-0.290 (1.144)
log(government ratio)	-0.470*** (4.051)	-0.760* (1.781)	-1.195** (2.179)	-0.247 (1.085)	-0.159 (0.496)
log(population)	-0.168*** (3.860)	-0.062 (0.525)	-0.392** (2.210)	-0.238** (2.313)	-0.255** (2.169)
likelihood-ratio index	0.157	0.056	0.081	0.237	0.232
number of countries	123	28	18	28	21
total sample size	891	218	142	181	137

Note: dependent variable is the number of terror incidents within a five-year interval; absolute *t*-statistics are given in parentheses below the coefficient estimates; goodness-of-fit is measured by the likelihood ratio index (Mc-Fadden's- $R^2$ ); significance at the 1%, 5% and 10% levels is indicated by \*\*\*, \*\* and \*, respectively.

Next, we amend the baseline model with a quadratic effect of the GDP to investigate whether terrorism and per capita GDP are related in a nonlinear way. The results are reported in Table 2. If we extend our baseline specification by a quadratic effect of the GDP, we clearly detect a U-shaped pattern of the effect of real GDP per capita on terror for the full sample, for the Islamic countries (weakly significant) and the Islamic countries when excluding the Gulf

<sup>13</sup> Diagnostics for multicollinearity (e.g. the condition number and variance inflation factors) indicate that multicollinearity may be a problem for the lacking significance in the regressions.

<sup>14</sup> This result is surprising as the literature rather predicts a positive relationship. The difference might be explained by methodical differences; we use a panel, whereas most of the literature refers to cross-country studies. We also concentrate on the origins of terror and not the targets: bigger countries may attract relatively more attacks. There may also be a bias in data collecting towards bigger countries.



States. Only for the OECD countries we do not find this U-shaped effect, however for the European countries we have an inverse U-shaped effect of the GDP per capita on terror for the European countries. This indicates that we have a rather heterogeneous sample. Generally, a strengthening of the significance of several effects occurs, but also losses of significance can be observed after the inclusion of squared log GDP.

Table 2  
Baseline Specification Extended by a Quadratic Effect of GDP  
(Negative Binomial Estimates with Fixed Effects)

	full sample	OECD	Europe	Islam	Islam2
intercept	15.150*** (4.436)	-3.781 (0.235)	-139.73*** (3.263)	14.368** (2.060)	69.693*** (3.790)
log(openness)	0.300*** (3.873)	0.294 (1.180)	0.286 (0.729)	0.246 (1.633)	0.315* (1.659)
log(real GDP per capita)	-3.150*** (4.084)	0.626 (0.178)	30.017*** (3.312)	-3.255* (1.889)	-17.796*** (3.681)
log(real GDP per capita) squared	0.192*** (4.176)	0.001 (0.005)	-1.508*** (3.178)	0.201* (1.936)	1.159*** (3.636)
log(government ratio)	-0.449*** (3.847)	-0.759* (1.670)	-1.861*** (3.466)	-0.111 (0.466)	-0.349 (1.036)
log(population)	-0.204*** (4.594)	-0.062 (0.517)	-0.439** (2.267)	-0.206* (1.956)	-0.199 (1.642)
likelihood-ratio index	0.162	0.056	0.101	0.241	0.250
number of countries	123	28	18	28	21
total sample size	891	218	142	181	137

Note: dependent variable is the number of terror incidents within a five-year interval; absolute  $t$ -statistics are given in parentheses below the coefficient estimates; goodness-of-fit is measured by the likelihood ratio index (Mc-Fadden's- $R^2$ ); significance at the 1%, 5% and 10% levels is indicated by \*\*\*, \*\* and \*, respectively.

Table 3 reports the results of a substantial augmentation of the regression specification by adding several explanatory variables (labeled extended specification). First, considering the additional variables for economic freedom and patents, we clearly find that they have a statistically significant influence in none of the regressions. If we consider the independent factor human capital it has a statistically significant influence in the OECD countries and in European countries, both positive and statistically significant. The investment ratio has a negative statistically significance in the full sample but in none of the sub-samples. To summarize the findings, these additional variables contribute something to the overall explanation but especially the Fraser index and the patents have no statistically significant influence. The loss of significance in the case of the variables included in the extended

regressions can be explained by multicollinearity which is naturally more pronounced in this extended set of variables.

Table 3  
Extended Specification  
(Negative Binomial Estimates with Fixed Effects)

	full sample	OECD	Europe	Islam	Islam2
intercept	1.483 (0.849)	0.091 (0.018)	4.357 (0.586)	12.366* (1.687)	5.835 (0.482)
lagged terror dummy	0.239** (2.434)	0.307* (1.706)	0.212 (0.851)	0.115 (0.391)	0.163 (0.482)
log(openness)	0.637*** (4.993)	0.225 (0.764)	-0.036 (0.076)	0.164 (0.451)	0.284 (0.513)
log(real GDP per capita)	0.064 (0.406)	0.296 (0.601)	0.673 (0.907)	-0.374 (0.729)	0.143 (0.158)
log(investment ratio)	-0.506*** (3.491)	-0.369 (0.852)	-0.953 (1.286)	0.394 (0.871)	0.087 (0.122)
log(government ratio)	-0.540*** (2.973)	-1.820*** (3.012)	-2.311*** (3.129)	-0.183 (0.356)	-0.298 (0.291)
log(human capital)	0.015 (0.0844)	1.909*** (2.928)	2.082* (1.785)	1.017 (1.589)	0.221 (0.179)
log(population)	-0.169** (2.387)	-0.012 (0.060)	-0.384 (0.997)	-1.222*** (2.587)	-0.889 (1.062)
log(Fraser index)	0.231 (0.854)	0.088 (0.121)	-0.491 (0.512)	1.062 (1.338)	1.235 (1.38)
log(1+patents)	0.035 (0.670)	-0.129 (1.090)	0.041 (0.216)	-0.011 (0.041)	0.119 (0.335)
likelihood-ratio index	0.450	0.240	0.273	0.622	0.576
number of countries	94	26	16	16	13
total sample size	573	177	112	96	79

Note: dependent variable is the number of terror incidents within a five-year interval; absolute *t*-statistics are given in parentheses below the coefficient estimates; goodness-of-fit is measured by the likelihood ratio index (Mc-Fadden's- $R^2$ ); significance at the 1%, 5% and 10% levels is indicated by \*\*\*, \*\* and \*, respectively.

## VI. DISCUSSION AND INTERPRETATION

After having a first look at the results, we now want to discuss the findings in more detail and with respect to our hypothesis that the opportunity costs (reflected in socio-economic conditions) sway terrorist activity markedly. As the Tables 1 to 3 show, the results are somewhat mixed, but in general give support to our hypothesis, namely that opportunity costs

of terror drive the number of attacks originating from a country, where this number positively depends on macroeconomic performance and negatively depends on population.

Considering trade openness as a proxy for the degree of globalization, for the full sample we find that openness has a positive impact on terror, which implies that in general it is seen as a threat. Considered from the perspective of different country groups, the effect of globalization is as suggested by theory. In rich countries, the threat seems to be bigger than in poorer countries. That is, our findings to some extent confirm earlier results by Wintrobe (2006) and somewhat contradict Blomberg and Hess (2008) and Kurrild-Klitgaard, Justensen and Klemmensen (2006) who detect a negative correlation between trade openness and terrorism production.

Next, the impact of GDP per capita on terror is significantly positive – except for the Islamic world where it is not significant. When we additionally consider a nonlinear effect of this variable as in the second specification, the impact of the quadratic term is significantly positive in the full sample and in the Islamic countries, but negative in Europe. Therefore, the results are only partly contradicting our theoretical reasoning. Similar results pointing at negative effects of higher income on terrorism production are found, e.g., in Lai (2007) and Blomberg and Hess (2008). However, for the Islamic world our findings are not in line with Piazza (2007) who does not find that economic development is significantly associated with terrorism. Interestingly, Lai (2007) also documents a positive effect of income on terrorism production in the simple specification, while finding a negative one when using a quadratic specification. He argues that a quadratic term more fittingly displays the production of terrorism in countries that are in intermediate development positions. In such countries, the terror opportunity costs may generally favor its generation. On the one hand, income is not high enough to discourage terror; on the other hand, poor institutions and few available policy resources in such countries may be incapable of solving social conflict. This idea matches our findings of a threshold effect of development.

Investment is negatively correlated with terror for the whole sample (only here statistically significant) as well as in OECD countries, including Europe, but positively in the Islamic world. Again, one can argue that a certain level of investment is necessary to increase the opportunity costs of terror.

Government expenditures show a significantly negative impact for the whole sample OECD and European countries. It is insignificantly so for the Islamic world. In rich countries, government expenditures may serve to protect from all sorts of risk, including the threats of globalization. This corresponds with the findings of Burgoon (2006) on the terror-dampening effect of social welfare policies, as related spending makes up a large part of government expenditure. In Islamic countries, the role of government spending seems to be less pronounced, perhaps because welfare states are less developed in this country group. In sum, governmental expenditures seem to discourage terror only in some world regions.

Human capital encourages terror production significantly in OECD and European countries. Its influence is not clear in the whole sample and insignificantly positive in the Islamic world. Again, the likelihood of education to deter terror is dependent on the educational level. For education, our findings contradict the ones of Krueger and Malečková (2003) and Kurrild-Klitgaard, Justensen and Klemmensen (2006) who do not attribute a strong role to education in reducing the generation of terror. From our findings, human capital encourages terrorism in the OECD and European countries. Testas (2004) finds that Islamic countries with more educated populations are also likelier targets of terrorism, indicating that an identity between the impact of education on the targets and sources of terrorism exists for these countries.

Our findings on population size fit with the general consensus that demographic stress is linked to increases in terror (e.g. Burgoon 2006; Lai 2007). We cannot state a relationship between the age structure and terror inclination for a lack of data, but may hypothesize that large but aging population has a significantly reducing impact on the opportunity costs of terror.

A high degree of economic freedom should deter terror in free countries but the influence is not significant. This may indicate a trade-off between institutional opportunities and political violence, as detected by Basuchoudhary and Shughart (2010). The poor institutional environment of these countries (e.g., Kuran 2004) may have deprived individuals of economic opportunities, resulting in rather low opportunity costs of terror. For instance, a disregard for property rights may have contributed to low levels of economic development in the region (Kuran 2004), where these institutional arrangements have been consistently found to be detrimental to economic growth. Thus, poor institutional quality may have fed through to terrorism through its negative effect on the socio-economic environment.

Patents should have a negative impact on terrorist activities. The interpretation may be that the number of patents granted in the United States is so low that an increasing number is rather making clear the technological gap and increases inclination to violence. However, this variable has no statistically significant impact. Evidently, there is no clear link from technological capacity to terrorism.

Finally, the lag terror variable suggests path dependence. This path dependence matches with previous findings of temporal contagion effects of terror, e.g. as in Enders and Sandler (2005) or Lai (2007). For instance, longer terrorist campaigns should generate more media attention, thereby making such a strategy more attractive. Terrorist inclination apparently is a long-term phenomenon, which makes it even more necessary to analyze its causes.

In addition to the specifications in Tables 1 through 3, we did a number of robustness tests. Upon excluding all observations lying in the five-year intervals 1971-1975, 1976-1980 and 2001-2005 we find the pattern of coefficient signs staying largely robust, although some changes of significance are observed. Exclusion of three countries that are suspect to be extraordinarily affected by and involved in terrorism (Afghanistan, Iraq and Israel, where Israel gets assigned also the terror attacks originating from the Palestinians) and repeating the regression analysis did not change the results much either. We also tested when several outlying observations removed from the sample. The outliers are identified by applying several diagnostics that are constructed for the detection of outliers and influential observations in linear regression to a fixed effects regression. Diagnostics applied are *dfbetas*, *dffits*, covariance ratio, cook distance, and hat values which are described and discussed in Belsley et al. (1980) as well as Cook and Weisberg (1982). Indication of one of the diagnostics triggered the exclusion of an observation. In total 28 observations (five-year intervals of particular countries) have been identified as outlying and influential in this way. The results did not change fundamentally. Finally, the further inclusion of the interaction of the human capital variable with real GDP per capita is only weakly significant in one case and does not add much explanatory power to the regressions.

## VII. CONCLUSION

This contribution has offered a stylized theoretical reasoning as to why socio-economic conditions should matter to the likelihood of the emergence of terrorism in certain countries, contrary to what some empirical studies on the genesis of terrorism have suggested. Arguing with the opportunity costs of terrorism, we have been able to show these opportunity costs (reflected in country-specific socio-economic conditions) may influence the terrorists' and terrorists' supporters' decisions.

We then provided an empirical analysis to check the validity of our theoretical reasoning. Generally, the results of our econometric analysis offered some support. The proxies chosen to reflect the opportunity costs of terror were found to have an impact on terrorism. Despite some puzzling results such as a positive impact of GDP per capita, we found that terrorist activities are clearly associated with some socio-economic factors. One very important result is that there is a threshold of development with respect to macroeconomic performance. As long as this threshold is not surpassed, better performance rather encourages terror. After that, the usual interpretation of opportunity costs of terrorism holds; they matter, in particular with respect to the environment of potential terrorists.

This evidence allows for modest policy conclusions deviating from rigid or violent counterterrorist strategies that rely on the “stick”, at least in the medium and long run. We generally argue in favor of using the “carrot”, i.e., in favor of measures influencing the opportunity costs of terror in ways that reduce violence, as proposed by Frey and Luechinger (2003) and Frey (2004). First and foremost, the results suggest that growth and better economic performance can help increasing the opportunity cost of terrorism. The sooner countries get rich the better are the prospects of a peaceful future. This result is also perfectly in line with what both trade theory and empirical evidence on trade suggest. Second, it may therefore be helpful to guide trade policy in the US and the EU towards the developing world under the given perspective. In addition (but not shown here), overcoming the institutional trap seems important also for both the economic success of a country and for the fight against terrorism.

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## APPENDIX:

Table 4  
Descriptive Statistics

	full sample	OECD	Europe	Islam	Islam2
<u>sample means:</u>					
no. of terror incidents	9.52	9.08	10.46	6.77	7.95
lagged terror dummy	0.31	0.40	0.38	0.38	0.42
openness	61.73	47.18	55.32	69.08	61.06
real GDP per capita	8365.68	15518.78	16895.01	4913.00	2567.83
investment ratio	17.12	22.87	23.54	13.34	11.79
government ratio	20.08	17.57	18.35	23.37	22.71
human capital	5.72	8.22	7.88	3.39	3.13
population	42897.63	34682.30	17986.15	38466.55	42746.85
Fraser index	5.67	6.42	6.53	5.07	4.90
no. of patents	944.71	2986.86	638.62	0.96	0.88
no. of countries	95	26	16	16	13
<u>sample variances:</u>					
no. of terror incidents	2682.13	507.85	575.17	362.29	433.52

Note: the figures are sample means and variances over all 5-year periods considered.

## COUNTRY SAMPLES:

## Full Sample:

AFG, ALB, DZA, AGO, ARG, AUS, AUT, BHS, BHR, BGD, BRB, BEL, BLZ, BEN, BOL, BWA, BRA, BGR, BDI, KHM, CMR, CAN, CAF, TCD, CHL, CHN, COL, ZAR, COG, CRI, CIV, CYP, DNK, DJI, DOM, ECU, EGY, SLV, EST, FJI, FIN, FRA, GAB, GER, GEO, GHA, GRC, GTM, GNB, GUY, HTI, HND, HKG, HUN, ISL, IND, IDN, IRN, IRQ, IRL, ISR, ITA, JAM, JPN, JOR, KEN, KWT, LAO, LVA, LBN, LTU, LUX, MDG, MWI, MYS, MLI, MLT, MUS, MEX, MAR, BUR, NAM, NPL, NLD, NZL, NIC, NER, NGA, NOR, OMN, PAK, PAN, PNG, PRY, PER, PHL, POL, PRT, ROM, RUS, RWA, SAU, SEN, SLE, SGP, SOM, ZAF, KOR, ESP, LKA, SWE, CHE, SYR, TWN, TZA, THA, TGO, TTO, TUN, TUR, UGA, UKR, ARE, GBR, USA, URY, VEN, YEM, ZMB, ZWE

## OECD Sample (current member countries):

AUS, AUT, BEL, CAN, DNK, FIN, FRA, GER, GRC, HUN, ISL, IRL, ITA, JPN, LUX, MEX, NLD, NZL, NOR, POL, PRT, KOR, ESP, SWE, CHE, TUR, GBR, USA

## Europe Sample (core European countries):

AUT, BEL, DNK, FIN, FRA, GER, GRC, ISL, IRL, ITA, LUX, NLD, NOR, PRT, ESP, SWE, CHE, GBR

## Islam Sample (countries with dominating Islamic religion):

AFG, ALB, DZA, BHR, BGD, TCD, DJI, EGY, IDN, IRN, IRQ, JOR, KWT, LBN, MLI, MAR, NER, OMN, PAK, SAU, SEN, SLE, SOM, SYR, TUN, TUR, ARE, YEM

Islam2 Sample (excluding mainly oil producing Gulf States):

AFG, ALB, DZA, BGD, TCD, DJI, EGY, IDN, JOR, LBN, MLI, MAR, NER, PAK, SEN,  
SLE, SOM, SYR, TUN, TUR, YEM

(number of observations not corresponding to the size of the country sample may be caused  
by missing data for some variables)