The welfare cost of terrorism

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Abstract

Data from 117 countries over the period 2006 to 2011 are used to estimate a macroeconomic cross-country system of equations that examines the association between terrorism, self-reported life satisfaction and national income. Results indicate that terrorism is negatively associated with life satisfaction, whereas no such association is found between terrorism and real GDP per worker. Stark contrasts are found, however, between OECD and non-OECD members. In all, our results suggest that the social costs of terrorism are potentially much higher than the economic costs, and measuring only the conventional economic costs of terrorism significantly underestimates the true costs.

INTRODUCTION

Terrorism is an enduring consequence of the willingness of humans to use violence with the goal of affecting politics or forcefully promoting ones ideology by inducing fear in the populace. Such use of violence dates back, for example, to the Sicarii, a 1st century Jewish group who murdered enemies and collaborators in their campaign to remove their Roman rulers from Judea (Weingrod, 1997). The more modern notion of terrorism, believed to be derived from Maxmilien Robespierre, follows the French revolution of the late 18th Century. Robespierre was the leader of a Committee of Public Safety, elected by the National Convention. A form of state terrorism, the committee enforced a reign of terror with the goal of expatiating democracy. According to Cobban (1946):

> [Robespierre's] view [was that] the people resorted to direct action for the purpose of protecting the principles of the Revolution by intimidating its enemies. This was only another way of saying that France was undergoing a revolution, in which intimidation was necessarily a part. Direct popular action, in fact, was another word for terrorism (p. 57).

The 20th Century saw a rise in ethnic nationalism with an increase in the use of guerrilla tactics by non-state actors such as the Castilians in Basque (Greenwood, 1985), the Irish Republican Army (Horgan and Taylor, 1997) and various anti-colonial movements in British, French and German colonies in Africa (Ekeh, 1975, Cooper, 1994). Many of these groups agitated for self-rule in order to break away from what they saw as an oppressive state (e.g., Nelson Mandela's African National Congress). They were, however, at that time viewed as terrorist groups. Terrorism as we know it in modern times is defined by acts such as the hijacking of the El AL

Israel jet by the Popular Front for the Liberation of Palestine (Steelman, 1977) and the kidnapping and murder of Israeli athletes at the 1972 Olympic games (Reeve, 2011).

The 1990s saw an increase and escalation in religiously inspired groups (e.g., Al Qaeda, Hamas and Hezbollah) employing violent terrorist tactics to achieve their goals, the most notable being the attack on the World Trade Centre in New York on September 11, 2001 (9/11) (Schuster et al., 2001). More recent terror events include the kidnapping of Nigerian school girls by Islamist terror group Boko Haram, and the activities of the Islamic State of Iraq and the Levant (ISIL), who aim to create a caliphate or Islamic state in the Middle East (ABS, 1995).

Alarmingly, the frequency of terror attacks appears to be increasing (see Figure 1). For example, the 2012 Global Terrorism Index Report (Institute for Economics and Peace, 2012) notes that between 2002 and 2011 the total number of terrorist incidents increased by 464%. Further, the Institute's most recent Global Peace Index Report (Institute for Economics and Peace, 2014a) notes that terrorist activity (a composite weighted measure of the number of fatalities, injuries and property damage caused by terrorism) is one of the four indicators that recorded the greatest deterioration over the period 2008 to 2014.[1] Between 2013 and 2014, terrorist activity recorded the greatest deterioration of all the Global Peace Index indicators, declining by 10%, more than double the change of the next largest deteriorating indicator (the number of external and internal conflicts fought).

'Figure 1 here'

In the context of increased terrorist activity, there is a growing body of literature that examines the macroeconomic cost of terrorism (Enders and Sandler, 2008, Blomberg et al., 2004a, Blomberg et al., 2004b). Our study takes a somewhat

different approach to estimating the cost of terrorism – we measure the cost in terms of lower levels of life satisfaction. Specifically, we employ data from 117 countries over the period 2006 to 2011 to estimate a macroeconomic cross-country system of equations that examines the association between terrorism, self-reported life satisfaction and national income. This approach allows the welfare cost of terrorism to be expressed in life satisfaction terms and allows two effects to be estimated. First, the effect of terrorism on life satisfaction and second, the effect of terrorism on national income, which in turn effects life satisfaction (the 'direct' and 'indirect' effects respectively).

This paper extends the existing body of literature by: (1) demonstrating that, in addition to conventional objective measures such as per capita Gross Domestic Product (GDP), subjective measures of well-being should also be taken into account when evaluating the effects of terrorism; (2) estimating the link between life satisfaction and terrorism using a large cross-national sample (to the best of our knowledge previous studies of life satisfaction and terrorism have only focused on a single country or region); and (3) estimating both the direct effect of terrorism on life satisfaction as well as the indirect effect of terrorism on life satisfaction via its effect on national income - existing studies only focus on the direct effect.

The paper proceeds by first discussing the literature with respect to the economic and psychological effects of terrorism. The empirical strategy is then outlined, followed by the data and variables employed. Results are presented and, finally, discussed.

I. RELATED LITERATURE

The Economic Effects of Terrorism

A significant body of literature considers the cross-country macroeconomic effects of terrorism, in particular the effect of terrorism on GDP, national consumption, national investment, stock markets, Foreign Direct Investment (FDI) and foreign trade. For example, Blomberg et al. (2004a, 2004b) find that, on average, terrorism significantly reduces per capita growth in GDP. The negative association between terrorism and economic growth, however, is small and statistically insignificant for Organisation for Economic Cooperation and Development (OECD) member countries. Tavares (2004) also finds that terrorism has an immediate negative impact on economic growth. However, when controlling for additional determinants of growth (for example, trade openness, the inflation rate, educational spending) the effect of terrorism becomes insignificant. More recently, Gaibulloev and Sandler (2008, 2011, 2009) find that international terrorism has a negative and significant effect on income per capita growth in Western European countries, African countries and developing countries in Asia. Domestic terrorism, in contrast, has a lower effect than international terrorism in Western European countries, while no impact is found in African countries. At a microeconomic level, Abadie and Gardeazabal (2003) estimate that per capita GDP in the Basque country of Spain decreased by more than 10% due to the terrorist attacks which occurred between 1975 and 1995. Similarly, Eckstein and Tsiddon (2004) show that terrorist attacks reduced Israel's GDP per capita by 10% to 15% during the initial period of the Palestinian Al-Aqsa.

In regards to national consumption, the empirical evidence is mixed. Fielding (2003a) suggests that terrorism in Israel leads to an increase in savings and a concomitant decrease in consumption. In contrast, Eckstein and Tsiddon (2004) find a

negative association between terrorism and consumption in Israel, noting that a continued level of terrorism will lead to a decrease in per capita annual consumption by about five percent. These contrasting findings may be explained by the fact that consumption may be affected by terrorist activity in different ways. On the one hand, political violence might increase perceived risks associated with savings, either because legal claims on assets are compromised or because individuals are prevented from accessing their financial assets. On the other hand, terrorism may induce individuals to place their money in safe havens rather than buy, for example, durable consumer goods. The two effects point in opposite directions; how consumption is affected by terrorism is, therefore, ultimately an empirical question that remains to be answered (Frey et al., 2007).

As noted by Frey et al. (2007), the effect of terrorism on aggregate consumption and savings is important as it influences the level of investment. One can also hypothesize that political violence not only affects the level, but also the composition, of investments (Collier, 1999). Fielding (2003b) investigates the impact of political instability on the level and composition of investments in Israel. The indicators of political instability are the number of Israelis killed, the number of Palestinians killed, and the rate of growth of the Jewish settlements in the West Bank and Gaza areas. The author finds that both the number of Israelis killed and the rate of growth of Jewish settlements have a significantly negative impact on investment in non-residential construction. Manufacturing and equipment investment, however, is significantly lowered by an increase in the total number of deaths and the rate of growth of settlements.

Terrorist attacks are also found to have an impact on stock markets. Stock prices reflect expected future gains of a company, as well as the likelihood that these

expected gains materialise - terrorist attacks influence both (Frey et al., 2007). Abadie and Gardeazabal (2003) find that stocks of firms with a significant part of their business in the Basque Country of Spain show a positive relative performance when a truce between the Basque separatists Euskadi Ta Askatasuna (ETA) and the Spanish state became credible, and a negative relative performance at the end of the ceasefire. Eldor and Melnick (2004) find that the number of suicide attacks had a permanent effect on Israel's stock and foreign exchange markets, as did the numbers of victims, while location of a terror attack had no effect on either market. In a cross-country study of 22 countries, Drakos (2010) finds that terrorist activity leads to significantly lower returns on the day a terrorist attack occurs, and that the negative effect of terrorist activity is substantially amplified when terrorist incidents cause higher psychosocial impact. Most recently, Essaddam and Karagianis (2014) focus on the stock return volatility of American firms targeted by terrorist attacks. The authors find that terrorism risk is an important factor in explaining the volatility of stock returns, which should be taken into account when modelling volatility. Specifically, the authors find that volatility increases on the day of the attack and remains significant for at least fifteen days thereafter. Further, their analysis indicates that the impact of terrorist attacks differs according to the country characteristics in which the incident occurred. That is, firms operating in wealthier, or more democratic countries, face greater volatility in stock returns relative to firms operating in developing countries.

In regards to FDI, Enders and Sandler (1996) estimate that terrorism in Spain reduced average annual FDI inflow by 13.5% over the period 1975 to 1991. Similarly, terrorism in Greece reduced FDI by 11.9% per annum over the period 1976 to 1991. These reductions in FDI are likely due to the fact that terrorism affects the allocation decision of firms investing money in real foreign assets. Terrorists can quite easily

attack and damage foreign-owned firms, seriously disrupting their activities. As foreigners have a large choice of countries to invest in, even quite mild terrorist activity tends to considerably reduce the inflow of capital to a terror-stricken country (see Abadie and Gardeazabal (2008) for a formal exposition of this argument).

Terrorist activities can also affect foreign trade in several ways. First, the costs of doing business are raised by a general increase in insecurity as a result of terrorism. Second, augmented security measures in response to a terrorist campaign increase transaction costs. Third, there is the risk of a direct destruction of traded goods. Empirical evidence includes a study by Nitsch and Schumacher (2004) who show that terrorism has a negative association with foreign trade. Specifically, the authors find that countries that are targeted by terrorism trade less with each other than countries that are not targeted. Similarly, Blomberg and Hess, (2006) reveal the negative effect of terrorism on trade, suggesting that a terrorist incident is associated with a 5.1% decline in bilateral trade. Further, in many countries, one of the largest export industries is the tourism industry; this is particularly vulnerable to terrorism (Frey et al., 2007).

The Psychological Effects of Terrorism

Several studies estimate the effect of terrorist attacks on psychological and emotional states. For example, Salguero et al. (2011) analyse 11 studies on the prevalence of major depressive disorder (MDD) in the general population and in victims directly affected by terrorist attacks. On average, 4% to 10% of the general population displayed MDD within the first few months following a terrorist attack, while the risk of MDD in direct victims ranges between 20% and 30%.

An extensive body of literature has explored the influence of the 2001 9/11 terrorist attacks on the mental health of citizens of the United States (US) (Silver et

al., 2002, Schuster et al., 2001, Galea et al., 2002, Schlenger et al., 2002). Results consistently show that the effect of the terrorist attack was substantial during the first week. For example, Silver et al. (2002) show that 90% of interviewees displayed at least one symptom of stress for at least three to five days following the terrorist event. Symptoms significantly subsided, however, after two months. Schuster et al. (2001) and Schlenger et al. (2002) estimate that approximately 7.5% to 20% of adults living in New York City displayed symptoms of Post-traumatic Stress Disorder (PTSD) up to two months after the attack; whereas 5.8% of the US population living outside the city displayed PTSD symptoms up to six months post attack (Silver et al., 2002).

Emotional reactions by Londoners, as a result of the July 2005 terrorist attacks in London, and citizens of Madrid, after the March 2004 terrorist attacks, were similar to the reaction of US citizens. Rubin et al. (2005) report that substantial stress symptoms were reported by 31% of those interviewed 11 to 13 days after the London attacks. Salguero et al. (2011) report that 13.3% of citizens interviewed in Madrid had PTSD symptoms two to three weeks post attack.

Researchers have also studied the long-term effects of the Second Palestinian *Intifada* in Israel, which started in September 2000 and ended in February 2005. Results from a study by Bleich et al. (2003) show that, of the 512 participants, 84 (16.4%) had been directly exposed to a terrorist attack and 191 (37.3%) had a family member or friend who had been exposed. Of the 510 respondents who answered questions related to traumatic stress related (TSR) symptoms, 77% had at least one symptom, 9.4% of respondents had PTSD and 58.6% reported feeling depressed. Bleich et al. (2006) conducted a telephone survey using strata sampling of 828 households. In total, 501 people agreed to participate. Employing the same method as in the 2003 study, the authors estimate that after 44 months of *Intifada* over 86% of

the population had at least one TSR symptom, 9% had PTSD symptoms and 29.5% felt depressed.

While PSTD symptoms appear to substantially decrease several months after a terrorist attack, Braithwaite (2013) concludes that terrorists are often successful in installing a significant sense of fear into a broader population in the long-term. Individuals overestimate the likelihood of terrorism attacks and the risk that they will be a victim of future terrorist actions. For example, over 66% of Londoners remained concerned about another terrorist attack in London over two years after the July 2005 terrorist attacks and 25% of UK citizens believe that terrorism risk has increased in the five years after the event. Similar patterns are observed among US citizens. For example, Braithwaite (2013) reports that over 91% of US citizens considered terrorism as a vital threat in 2002, and over 70% in 2008 (Braithwaite, 2013).

A very small body of literature considers the relationship between terrorism and life satisfaction. For example, Frey et al. (2009) use combined cross-section time-series data to estimate the costs of terrorism for France and the British Isles. The authors find large negative effects of terrorism on life satisfaction. Specifically, an increase of one standard deviation in the number of recorded incidents lowers life satisfaction by 0.012 and 0.013 points on a four point scale for residents of the British Isles and France respectively. An increase of one standard deviation in the number of recorded fatalities is associated with a decrease in life satisfaction of 0.009 points in both countries. These results translate into considerable compensating surpluses for a hypothetical reduction in terrorism. The costs of terrorism are estimated to be approximately 4% of annual household income in France and 26% in the British Isles when the most terrorism prone regions are compared to the least terrorism prone regions.

In a similar study, Romanov et al. (2012) employ data from Israel's Social Survey for the years 2002 to 2004 to investigate the relationship between terrorism and the happiness of Israelis during the second Palestinian *Intifada*. They find that terrorism has a limited impact on the life satisfaction of Jewish Israelis, while the life satisfaction of Arab citizens of Israel was negatively affected. The authors suggest that terrorist acts have become a part of everyday life for Jewish Israelis and, as such, does not affect their life satisfaction. On the other hand, the negative effect on the life satisfaction of Arab citizens of Israel may be explained by increasing fear of discrimination.

In terms of inter-country affects, Metcalfe et al. (2011) examine the influence of the 9/11 attacks on the happiness of residents of the United Kingdom. They found that the attack led to a significant increase in mental distress among the United Kingdom population. This impact, however, was short; lasting for only approximately three months.

In a study most closely related to our own, Blomberg et al. (2011) employ a large cross-national sample to examine the effect of terrorism on income, including its indirect role through lowering trust. The authors show that terrorism has a negative and statistically significant impact on individual income. This impact is larger than that previously found in the literature. Blomberg et al. (2011) suggest that this is possibly due to aggregation effects and data selection. The authors then estimate the societal impact of terrorism on economic growth by examining the extent to which terrorism reduces trust and how this, in turn, hinders economic performance. A measure of the economic consequences of terrorism is then developed through the estimation of the magnitude of the 'trust tax' from terrorism. This effect, however, is relatively minor compared to the direct impact of terrorism on income.

II. EMPIRICAL STRATEGY

This paper employs cross-country data on life satisfaction and terrorism, building on recent developments in the economics of happiness literature. Frey and Stutzer (2002a, 2002b) provide seminal reviews. The method employed requires that self-reported life satisfaction be regarded as a good proxy for an individual's utility. Strong support for this position is provided by Lucas and Donnellan (2012) and Diener et al. (2013). The theoretical model is similar to that employed by Welsch (2008) and consists of two equations: the life satisfaction equation and the income equation.

The life satisfaction equation is specified as:

(1) $w = f(y, t, \mathbf{Z}_1)$

where w is mean life satisfaction in a country (a measure of social welfare), y is per worker income (real GDP), t is the measure of the level of terrorism, and, $\mathbf{Z}_1$ is a vector of control variables (e.g. median age and educational attainment) that might confound the link between terrorism and life satisfaction. *A priori*, worker income is expected to be positively associated with life satisfaction, while terrorism is expected to be negatively associated.

The income equation is a standard production function, as follows:

(2) $y = g(k, t, \mathbf{Z}_2)$

where k is the capital stock per worker and $\mathbf{Z}_2$ is a vector of other relevant controls (e.g. human capital and research). Capital stock per worker is expected to be positively associated with income, while terrorism is expected to be negatively associated.

Substituting Equation (2) into (1) yields the reduced form of the model:

(3) $w = f(g(k, t, \mathbf{Z}_2), t, \mathbf{Z}_1)$

Estimation strategy

The life satisfaction and income equations are specified as Cobb-Douglas functions, which explain variation in long-run economic growth rates across countries (Hall and Jones, 1999). The Cobb-Douglas specification for the life satisfaction equation introduces nonlinearity between the level of terrorism and life satisfaction (Welsch, 2008).

The estimating equation for life satisfaction can be stated as follows:

(4) $w_{i,t} = \alpha_0 + \alpha_1 y_{i,t} + \alpha_2 t_{i,t-1} + \sum_{j=3}^{k} \alpha_j \mathbf{Z}_{1,i,t} + \tau_t + \varepsilon_{1i,t}$

where $w_{i,t}$ is the natural log of mean life satisfaction of country *i* at time *t*; $y_{i,t}$ is the natural log of real GDP per worker; $t_{i,t-1}$ is the lag of the natural log of the terrorism measure; $\mathbf{Z}_{1i,t}$ represents control variables including, for example, the natural log of median age and the natural log of mean educational attainment (with coefficients α_j where j = 3...k, where k is the sum of the independent and control variables); τ_t denotes year fixed effects; and $\varepsilon_{1,i,t}$ is the error term. Employing the lag of the terrorism measure makes a causal interpretation plausible.

The estimating equation for income can be stated as follows:

(5) $y_{i,t} = \beta_0 + \beta_1 k_{i,t} + \beta_2 t_{i,t-1} + \sum_{j=3}^{k} \beta_j \mathbf{Z}_{2,i,t} + \tau_t + \varepsilon_{2i,t}$

where $k_{i,t}$ denotes the natural log of physical capital stock per worker; $\mathbf{Z}_{2,i,t}$ represents control variables including, for instance, the natural log of mean total years of schooling; τ_t is year fixed effects; and $\varepsilon_{2,i,t}$ denotes the error term.

Equations (4) and (5) are estimated as a system. It should be noted that the system is not independent; income is assumed to affect life satisfaction, although not

the reverse. For a recursive system of equations such as this, where the errors are conjectured to be correlated across equations, it is useful to estimate the system using Seemingly Unrelated Regressions (SUR). SUR estimation is equivalent to maximum likelihood estimation in the present circumstances, providing gains in terms of efficiency whilst also accounting for heteroskedasticity and correlation of errors across equations (Welsch, 2008). Standard errors are robust to clustering at the country level.

Many researchers in the economics of happiness literature appeal to the findings of Ferrer-i-Carbonell and Frijters (2004) to justify the estimation technique employed. In particular these authors find that treating the life satisfaction variable as a continuous variable with cardinal qualities yields qualitatively similar results to those estimation techniques that treat the dependent variable as strictly ordinal. Kahneman (1999) is often cited as considering this distinction more of a theoretical, rather than a practical, difficulty. Nonetheless, treating the dependent variable as continuous may result in estimates that predict values outside of the ordered range. As a result, a single equation tobit model is compared to a single equation ordinary least squares (OLS) model to check the robustness of results presented in Section IV. As reported in Appendix A, this does not significantly change the results.

III.   DATA AND VARIABLES

The dataset contains data for 117 countries covering the period 2006 to 2011, yielding a total of 626 observations. The panel is unbalanced as mean life satisfaction is missing for some counties over this period.

The life satisfaction variable comes from the *World Happiness Database* (Veenhoven, 2014). The database provides average self-reported levels of life satisfaction by country and year, elicited from individuals' responses to the question:

Here is a ladder representing the 'ladder of life'. Let's suppose the top of the ladder represents the best possible life for you; and the bottom, the worst possible life for you. On which step of the ladder do you feel you personally stand at the present time?

The responses are rated on a scale of 0 (worst possible life satisfaction) to 10 (best possible life satisfaction). Country level mean life satisfaction is linearly interpolated over time for countries missing data on life satisfaction for particular years.

Data on the level of terrorism is obtained from the Global Terrorism Database (GTD). The GTD defines terrorism as "the threatened or actual use of illegal force and violence by a non-state actor to attain a political, economic, religious, or social goal through fear, coercion, or intimidation." In addition, at least two of the following three criteria has to be met to be included in the GTD: (1) the act must be aimed at attaining a political, economic, religious, or social goal; (2) there must be evidence of an intention to coerce, intimidate, or convey some other message to a larger audience (or audiences) than the immediate victims; and (3) the action must be outside the context of legitimate warfare activities. (Global Terrorism Database (GTD), 2014).

From the GTD a Global Terrorism Index (GTI) can be calculated as follows:

(6) *Terrorism Index =*

1 x incidents + 3 x fatalities + 0.5 x injuries + 2 x property damage

Where *incidents* is the total number of terrorist incidents in a given year, *fatalities* is the total number of fatalities caused by terrorists in a given year, *injuries* is the total number of injuries caused by terrorists in a given year and *property damage* is the approximate level of total property damage from terrorist incidents in a given year.

The GTI is an index designed to systematically rank and compare countries according to the impact of terrorism. The weightings of each component are intended to reflect the latent psychological effect of terrorist acts over time (Institute for Economics and Peace, 2014b).

Initially Equations 4 and 5 are estimated for the full sample of countries separately for each of the four components of the GTI and for the GTI itself. Noting that 27 of the countries in the sample did not experience any form of terrorist attack between 2006 and 2011, the sample is then truncated to exclude these countries in an attempt to more clearly identify the effect of a terrorist attack on social welfare. The list of countries included in each sample is provided as Appendix B. The list of all variables employed, their respective data sources and summary statistics are provided in Table 1. Pairwise correlations are presented as Appendix C.

'Table 1 here'

IV. RESULTS

Considering first the estimation of Equation 4 for the full sample (Table 2 Part A), irrespective of the measure of terrorism employed, it is clear that real GDP per worker and polity (a measure of democracy) are strongly positively associated with life satisfaction. No statistically significant relationship is found between life satisfaction and age or human capital. Terrorism measures are of the expected (negative) sign. The only significant terrorism measure, however, is fatalities (p-value 0.059). It should be noted that both injuries and the GTI are close to being significant at the 10% level (p-values of 0.106 and 0.194 respectively).

In regards to the estimation of Equation 5 for the full sample (Table 2 Part B), human capital and capital stock per worker are strongly positively associated with real

GDP per worker across all models. No relationship is found between polity and real GDP per worker. Counter to *a priori* expectations, all of the terrorism measures indicate a positive relationship between terrorism and real GDP per worker, although none are significant.

'Table 2 here'

Results for the estimation of Equation 4 with the truncated sample are presented in Table 3 Part A. The explanatory power of this model is substantially higher than the full sample model (adjusted-R^2 of approximately 0.64 compared with 0.56). Results between the two models are also substantially different. For example, age is now negatively associated with life satisfaction across all terrorism measures (statistically significant at the 5% level). Similarly, and contrary to *a priori* expectations, human capital is also negatively associated with life satisfaction (statistically significant at the 5% level). Consistent with the full sample model, both real GDP per worker and polity are strongly positively associated with life satisfaction. With respect to terrorism, results differ to the full sample model in that fatalities, injuries and the GTI are all negatively associated with life satisfaction, statistically significant at the 10% level. Further, terrorism incidents and property damage are negative and close to being significant at the 10% level (both with p-values of 0.101).

Results from the estimation of Equation 5 with the truncated sample are presented in Table 3 Part B. Results demonstrate that both human capital and capital stock per worker, similar to the full sample results, are positively associated with real GDP per worker at the 1% level. All terrorism measures, however, have changed sign − now showing a negative association (although not significant at conventional

levels). It should be noted that injuries and fatalities are close to being significant (both with p-values of 0.115).

'Table 3 here'

Robustness checks

To check the robustness of the findings, a number of tests are undertaken. First, noting that while the pairwise correlation coefficients between polity and our measures of terrorism are low (Appendix C), previous research finds a significant association between democracy and terrorism (Eyerman, 1998, Li, 2005, Abadie, 2006, Kis-Katos et al., 2011). The low pairwise correlation coefficients could, therefore, be a result of a non-linear relationship between democracy and terrorism (Abadie, 2006, Kurrild-Klitgaard et al., 2006, Eyerman, 1998). For this reason, we re-estimate the model without the polity control variable. As shown in Table 4 Part A, excluding polity strengthens the significance of the terrorist variables in the life satisfaction equation. Specifically, fatalities and injuries are now negatively associated with life satisfaction at the 1% level. Further, terrorism incidents, property damage and GTI are now negative statistically significant at the 5% level.

'Table 4 here'

The pairwise correlation between age and human capital is large (0.76). To check for possible multicollinearity, we re-estimate the model without the inclusion of the age control variable. Table 5 provides evidence that the results of our analysis are stable and do not substantively change with the exclusion of the age variable. However, by removing the age control variable, all terrorism measures in the life satisfaction equation become significant at the 10% level.

'Table 5 here'

We then split the truncated sample by OECD and non-OECD members. In regards to the estimation of Equation 4 for OECD members (Table 6 Part A), the terrorism measures are all negative and significant at the 1% level. In regards to the estimation of Equation 5, (Table 6 Part B), the terrorism measures are all positive but not significant, with the exception of fatalities which is positively and significantly associated with GDP per worker at the 1% level. For non-OECD members, the estimation of Equation 4 (Table 7 Part A) shows that all terrorism measures are negatively associated with life satisfaction, but at statistically insignificant levels. Conversely, the estimation of Equation 5 (Table 7 Part B) reveals that incidents, injuries and the GTI have a negative and statistically significant association (at the 5% level) with real GDP per worker (Table 7 Part B).

'Table 6 here'

'Table 7 here'

V.   DISCUSSION

This paper extends the existing literature by analysing the impact of terrorism on life satisfaction across a large sample of countries. Arguably, the most notable finding is the generally significant and negative association found between terrorism and life satisfaction, while no such association is found between terrorism and real GDP per worker. This implies that the true social costs of terrorism may not be adequately reflected in conventional economic data and, therefore, studies seeking to evaluate the cost of terrorism should consider employing datasets that capture subjective elements of welfare. This is not to say that conventional economic data is of no use; simply that subjective data can also contribute to our understanding of this issue. This view is consistent with the growing recognition that subjective measures (such as those provided by self-reports of life satisfaction or happiness) have an important role to

play in policy development and evaluation. For example, the Commission on the Measurement of Economic Performance and Social Progress (Stiglitz et al., 2009) reports that both objective and subjective indicators of progress are important, placing them on an equal footing. The Commission states:

> Research has shown that it is possible to collect meaningful and reliable data on subjective as well as objective wellbeing. Subjective wellbeing encompasses different aspects (cognitive evaluations of one's life, happiness, satisfaction, positive emotions, such as joy and pride, and negative emotions such as pain and worry): each of them should be measured separately to derive a more comprehensive appreciation of people's lives....

> (Stiglitz et al., 2009 p. 16)

With respect to the lack of any significant relationship between terrorism and real GDP per worker, this result is consistent with a number of other studies that observe very modest and short-term economic consequences of terrorism (Enders and Sandler, 2008, Chen and Siems, 2004). For example, Chen and Siems (2004) find that the effect of major terrorist attacks on capital markets, on average, lasts from one to three days. Further, our results are consistent with Tavares (2004), who shows that terrorism has no significant relationship with economic growth after controlling for conventional economic growth indicators (e.g. human capital, capital stocks etc.).

Truncating the sample to those countries that have experienced a terrorist incident in the years under consideration increases the strength of the negative association between life satisfaction and our measures of terrorism. This suggests that direct experience of terrorism heightens the sensitivity of the population to the

consequences of terrorism. In other words, the effect of terrorism on life satisfaction is greater in those countries that have experienced a terrorism event than in those that have not. In regards to our alternative measures of terrorism, we find people are more sensitive to fatalities and injuries than to property damage or the number of terrorist incidents. This suggests that the human cost of terrorism is more damaging than the material cost. These results are robust to the exclusion of the polity and age control variables.

For OECD members, terrorism has a pronounced effect on life satisfaction, with a negative and statistically significant association found across all measures of terrorism at the 1% level. Somewhat surprisingly, a positive association is found between terrorism and GDP per worker, although this is only significant for the fatalities terrorism measure. This suggests that, to some extent, terrorism promotes economic activity in these countries. For non-OECD members, however, the reverse is true. That is, no significant association is found between terrorism and life satisfaction, whereas a negative association is found between three of the terrorism measures (incidents, injuries and GTI) and GDP per worker. These associations between terrorism and GDP per worker are broadly consistent with the findings of (Blomberg et al., 2004a), who show a small and statistically insignificant negative association between terrorism and economic growth within OECD members, and a negative and significant association for non-OECD members.

In all, the results of this study suggest that the social costs of terrorism are potentially much higher than the economic costs, particularly for OECD member countries. This suggests that measuring only the conventional economic costs of terrorism significantly underestimates the true costs of terrorism. This has implications for the evaluation of policy responses to terrorism, in particularly when

weighing up the benefits and costs of public expenditure. *Ceteris paribus*, ignoring the social costs may lead to lower levels of expenditure than that which is truly optimal.

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FIGURE 1

Number of terrorist attacks since 1970
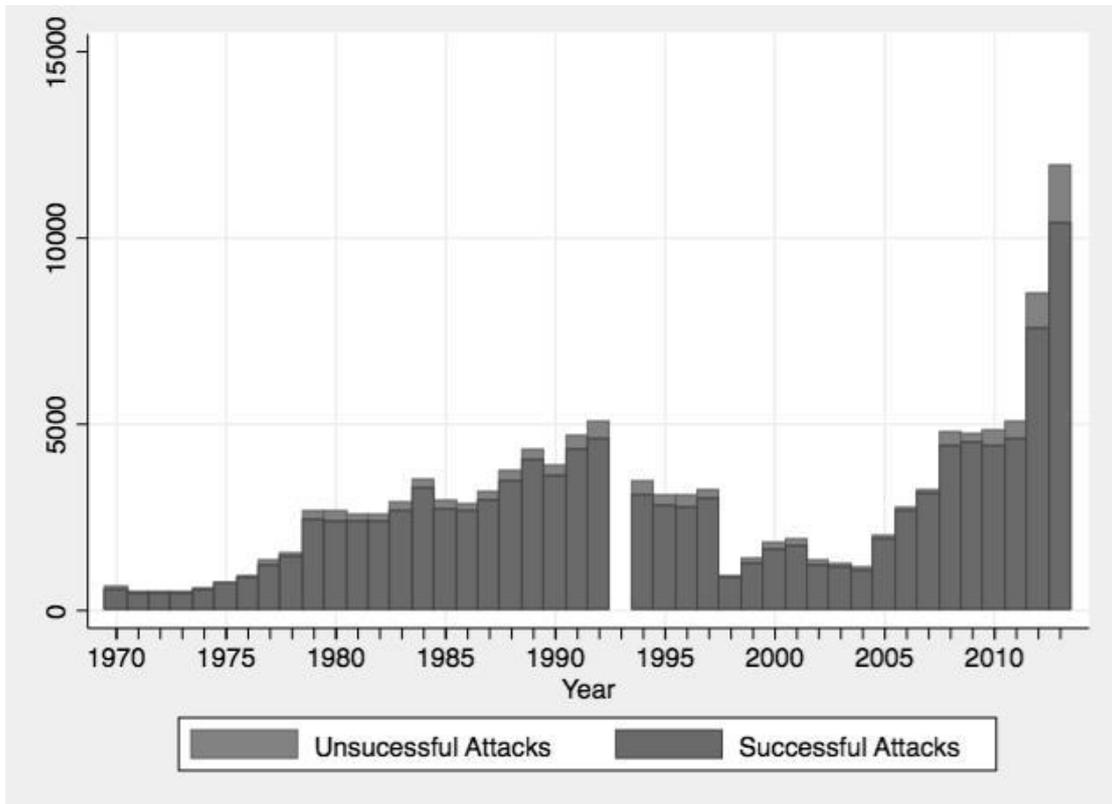
Source: Global Terrorism Database (GTD) (2014)

Note: 1993 data were lost in an office move and have never been fully recovered.

TABLE 1

Data summary statistics

Variable name	Definition	Source	Observations	Mean (SD)	[Minimum, Maximum]
Life satisfaction	Mean self-reported life satisfaction (scale 0-10) (linearly interpolated between available observations)	(Veenhoven, 2014)	629	5.60 (1.09)	[2.9, 8]
Incidents (lag)	Total number of terrorist incidents in a given year	(Institute for Economics and Peace, 2014b)	629	25.31 (113.39)	[0, 1,158]
Fatalities (lag)	Total number of fatalities caused by terrorists in a given year	(Institute for Economics and Peace, 2014b)	629	59.68 (381.33)	[0, 6,100]
Injuries (lag)	Total number of injuries caused by terrorists in a given year	(Institute for Economics and Peace, 2014b)	629	131.52 (841.38)	[0, 11,938]
Property damage (lag)	A measure of the total property damage from terrorist incidents in a given year	(Institute for Economics and Peace, 2014b)	629	8.13 (42.31)	[0, 673]
GTI (lag)	A weighted average of four terrorist measures, calculated by 1 x incidents + 3 x fatalities + 0.5 x injuries + 2 x property damage	(Institute for Economics and Peace, 2014b)	629	286.38 (1713.00)	[0, 25,666]
RGDP per worker	Output-side real GDP at chained PPPs per worker (in 2005 USD) (linearly interpolated between available observations)	(Feenstra et al., 2013)	629	29,953.00 (27,084.52)	[410.98, 131,809.60]
Capital stock per worker	Capital stock per capita at constant 2005 national prices (in 2005 USD) per worker	(Feenstra et al., 2013)	629	93,354.15 (87,229.89)	[1,246.86, 404,698.20]
Human capital	Mean total years of schooling (linearly interpolated between available observations)	(Feenstra et al., 2013)	629	8.23 (2.71)	[1.35, 13.09]
Polity	Rescaled from 1 (full autocracy) to 10 (full democracy)	(Marshall, 2011)	621	7.99 (2.49)	[1, 10]
Age	Median age of a country's citizens	(UNESCO Institute for Statistics, 2014)	629	29.09 (8.70)	[14.90, 44.90]

TABLE 2

Model results – full sample

	Incidents	Fatalities	Injuries	Property Damage	GTI
Part A	ln(Life satisfaction)	ln(Life satisfaction)	ln(Life satisfaction)	ln(Life satisfaction)	ln(Life satisfaction)
ln(Age)	-0.0330	-0.0362	-0.0333	-0.0330	-0.0340
	(0.0342)	(0.0342)	(0.0341)	(0.0342)	(0.0342)
ln(RGDP per worker)	0.1336***	0.1334***	0.1333***	0.1336***	0.1337***
	(0.0085)	(0.0084)	(0.0084)	(0.0085)	(0.0085)
ln(Human capital)	-0.0114	-0.0135	-0.0117	-0.0107	-0.0123
	(0.0216)	(0.0216)	(0.0215)	(0.0216)	(0.0220)
ln(Polity)	0.0532***	0.0517***	0.0521***	0.0533***	0.0525***
	(0.0125)	(0.0125)	(0.0125)	(0.0125)	(0.0150)
ln(Terrorism) (lag)	-0.0039	-0.0061*	-0.0044	-0.0048	-0.0031
	(0.0035)	(0.0032)	(0.0027)	(0.0047)	(0.0024)
Constant	0.4269***	0.4492***	0.4352***	0.4242***	0.4337***
	(0.0651)	(0.0661)	(0.0653)	(0.0651)	(0.0653)
Adjusted-R^2	0.5642	0.5660	0.5653	0.5641	0.5646
Part B	ln(RGDP per worker)	ln(RGDP per worker)	ln(RGDP per worker)	ln(RGDP per worker)	ln(RGDP per worker)
ln(Human capital)	0.3737***	0.3721***	0.3700***	0.3730***	0.3761***
	(0.0586)	(0.0588)	(0.0585)	(0.0585)	(0.0588)
ln(Capital stock per worker)	0.7789***	0.7797***	0.7796***	0.7787***	0.7789***
	(0.0181)	(0.0180)	(0.0180)	(0.0181)	(0.0180)
ln(Polity)	-0.0056	-0.0039	-0.0044	-0.0060	-0.0044
	(0.0353)	(0.0353)	(0.0353)	(0.0353)	(0.0352)
ln(Terrorism) (lag)	0.0057	0.0028	0.0006	0.0081	0.0053
	(0.0104)	(0.0095)	(0.0081)	(0.0137)	(0.0070)
Constant	0.6002***	0.5936***	0.6017***	0.6043***	0.5893***
	(0.1461)	(0.1495)	(0.1472)	(0.1461)	(0.1471)
Adjusted-R^2	0.8980	0.8980	0.8980	0.8980	0.8981
Observations	621				

*** significant at the 1% level; ** significant at the 5% level; * significant at the 10% level. Year fixed effects also included as controls. Standard errors in parentheses.

TABLE 3

Model results – truncated sample

	Incidents	Fatalities	Injuries	Property Damage	GTI
Part A	ln(Life satisfaction)	ln(Life satisfaction)	ln(Life satisfaction)	ln(Life satisfaction)	ln(Life satisfaction)
ln(Age)	-0.1069**	-0.1117**	-0.1073**	-0.1066**	-0.1084**
	(0.0360)	(0.0360)	(0.0359)	(0.0360)	(0.0359)
ln(RGDP per worker)	0.1736***	0.1728***	0.1728***	0.1739***	0.1734***
	(0.0092)	(0.0092)	(0.0092)	(0.0092)	(0.0092)
ln(Human capital)	-0.0577**	-0.0575**	-0.0564**	-0.0573**	-0.0578**
	(0.0217)	(.0217)	(0.0216)	(0.0217)	(0.0217)
ln(Polity)	0.0817***	0.0796***	0.0798***	0.0818***	0.0805***
	(0.0128)	(0.0128)	(0.0128)	(0.0128)	(0.01285)
ln(Terrorism) (lag)	-0.0056	-0.0060*	-0.0046*	-0.0072	-0.0039*
	(0.0034)	(0.0031)	(0.0026)	(0.0044)	(0.0023)
Constant	0.3198***	0.3477***	0.3301***	0.3133***	0.3315***
	(0.0693)	(0.0713)	(0.0697)	(0.0692)	(0.0700)
Adjusted-R^2	0.6414	0.6424	0.6419	0.6412	0.6416
Part B	ln(RGDP per worker)	ln(RGDP per worker)	ln(RGDP per worker)	ln(RGDP per worker)	ln(RGDP per worker)
ln(Human capital)	0.4826***	0.4778***	0.4826***	0.4870***	0.4807***
	(0.0607)	(0.0607)	(0.0604)	(0.0606)	(0.0607)
ln(Capital stock per worker)	0.7112***	0.7084***	0.7097***	0.7111***	0.7104***
	(0.0196)	(0.0197)	(0.0196)	(0.0197)	(0.0196)
ln(Polity)	-0.0079	-0.0140	-0.0119	-0.0098	-0.0107
	(0.0374)	(0.0371)	(0.0372)	(0.0375)	(0.0372)
ln(Terrorism) (lag)	-0.0117	-0.0152	-0.0129	-0.0070	-0.0090
	(0.0108)	(0.0097)	(0.0082)	(0.0139)	(0.0072)
Constant	1.1660***	1.2235***	1.1953***	1.1539***	1.1893***
	(0.1607)	(0.1661)	(0.1622)	(0.1604)	(0.1628)
Adjusted-R^2	0.8962	0.8964	0.8964	0.8960	0.8962
Observations	500				

TABLE 4

Abridged model results – truncated sample, excluding polity

	Incidents	Fatalities	Injuries	Property Damage	GTI
Part A	ln(Life satisfaction)	ln(Life satisfaction)	ln(Life satisfaction)	ln(Life satisfaction)	ln(Life satisfaction)
ln(Terrorism) (lag)	-0.0075** (0.0034)	-0.0095*** (0.0030)	-0.0074*** (0.0026)	-0.0097** (0.0348)	-0.0057** (0.0023)
Adjusted-R^2	0.6113	0.6152	0.6139	0.6112	0.6123
Part B	ln(RGDP per worker)	ln(RGDP per worker)	ln(RGDP per worker)	ln(RGDP per worker)	ln(RGDP per worker)
ln(Terrorism) (lag)	-0.0054 (0.0102)	-0.0079 (0.0091)	-0.0072 (0.0078)	0.0006 (0.0131)	-0.0048 (0.0069)
Adjusted-R^2	0.8964	0.8965	0.8965	0.8964	0.8965
Observations	507				

TABLE 5

Abridged model results – truncated sample, excluding age

	Incidents	Fatalities	Injuries	Property Damage	GTI
Part A	ln(Life satisfaction)	ln(Life satisfaction)	ln(Life satisfaction)	ln(Life satisfaction)	ln(Life satisfaction)
ln(Terrorism) (lag)	-0.0058*	-0.0056*	-0.0047*	-0.0075*	-0.0039*
	(0.0034)	(0.0031)	(0.0026)	(0.0044)	(0.0023)
Adjusted-R^2	0.6399	0.6406	0.6404	0.6398	0.6401
Part B	ln(RGDP per worker)	ln(RGDP per worker)	ln(RGDP per worker)	ln(RGDP per worker)	ln(RGDP per worker)
ln(Terrorism) (lag)	-0.0119	-0.0153	-0.0130	-0.0072	-0.0092
	(0.0108)	(0.0097)	(0.0082)	(0.0139)	(0.0072)
Adjusted-R^2	0.8962	0.8964	0.8964	0.8960	0.8962
Observations	500				

TABLE 6

Abridged model results – truncated sample, OECD countries

	Incidents	Fatalities	Injuries	Property Damage	GTI
Part A	ln(Life satisfaction)	ln(Life satisfaction)	ln(Life satisfaction)	ln(Life satisfaction)	ln(Life satisfaction)
ln(Terrorism) (lag)	-0.0278***	-0.0378***	-0.0159***	-0.0312***	-0.0195***
	(0.0063)	(0.0088)	(0.0053)	(0.0077)	(0.0046)
Adjusted-R^2	0.3980	0.3951	0.3612	0.3906	0.3947
Part B	ln(RGDP per worker)	ln(RGDP per worker)	ln(RGDP per worker)	ln(RGDP per worker)	ln(RGDP per worker)
ln(Terrorism) (lag)	0.0080	0.0435***	0.0149	0.0128	0.0114
	(0.0124)	(0.0159)	(0.0010)	(0.0153)	(0.0089)
Adjusted-R^2	0.6548	0.6701	0.6589	0.6555	0.6576
Observations	152				

TABLE 7

Abridged model results – truncated sample, non-OECD countries

	Incidents	Fatalities	Injuries	Property Damage	GTI
Part A	ln(Life satisfaction)	ln(Life satisfaction)	ln(Life satisfaction)	ln(Life satisfaction)	ln(Life satisfaction)
ln(Terrorism) (lag)	-0.0019	-0.0025	-0.0018	-0.0020	-0.0018
	0.0040	0.0034	0.0030	0.0052	0.0026
Adjusted-R^2	0.4596	0.4601	0.4599	0.4592	0.4601
Part B	ln(RGDP per worker)	ln(RGDP per worker)	ln(RGDP per worker)	ln(RGDP per worker)	ln(RGDP per worker)
ln(Terrorism) (lag)	-0.0254**	-0.0177	-0.0192**	-0.0208	-0.0186**
	0.0129	0.0110	0.0097	.01687	0.0086
Adjusted-R^2	0.8487	0.8482	0.8487	0.8477	0.8491
Observations	348				

TABLE A1

OLS and tobit estimates, truncated sample, GTI

	OLS	Tobit model
	ln(Life satisfaction)	ln(Life satisfaction)
ln(Age)	-0.1084**	-0.0729**
	(0.0359)	(0.0365)
ln(RGDP per worker)	0.1734***	0.1543***
	(0.0092)	(0.0093)
ln(Human capital)	-0.0578**	-0.0356
	(0.0217)	(0.0218)
ln(Polity)	0.0805***	0.0754***
	(0.0128)	(0.0128)
ln(Terrorism) (lag)	-0.0039*	-0.0040*
	(0.0023)	(0.0023)
Constant	0.3315***	0.3660***
	(0.0700)	(0.0704)
Year fixed effects	Yes	Yes
Adjusted-R^2	0.6416	-
Observations	500	500

Standard errors in parentheses

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

APPENDIX B

Countries included in analysis:
Albania; Argentina; Australia; Austria; Bangladesh; Belgium; Benin; Bolivia; Botswana; Brazil; Bulgaria; Cambodia; Cameroon; Canada; Central African Republic; Chile; China; Colombia; Costa Rica; Cote d'Ivoire; Croatia; Cyprus; Czech Republic; Democratic Republic of the Congo; Denmark; Dominican Republic; Ecuador; Egypt; El Salvador; Estonia; France; Gabon; Germany; Ghana; Greece; Guatemala; Honduras; Hungary; Iceland; India; Indonesia; Iran; Iraq; Ireland; Israel; Italy; Jamaica; Japan; Jordan; Kazakhstan; Kenya; Kuwait; Kyrgyz Republic; Laos; Latvia; Liberia; Lithuania; Malawi; Malaysia; Mali; Mauritania; Mauritius; Mexico; Moldova; Mongolia; Morocco; Mozambique; Namibia; Nepal; Netherlands; New Zealand; Niger; Norway; Pakistan; Panama; Paraguay; Peru; Philippines; Poland; Portugal; Qatar; Republic of the Congo; Romania; Russia; Rwanda; Saudi Arabia; Senegal; Serbia; Sierra Leone; Singapore; Slovakia; Slovenia; South Africa; South Korea; Spain; Sri Lanka; Sudan; Sweden; Switzerland; Syria; Taiwan; Tajikistan; Tanzania; Thailand; Togo; Trinidad and Tobago; Tunisia; Turkey; Uganda; Ukraine; United Kingdom; United States of America; Uruguay; Venezuela; Vietnam; Yemen; Zambia; Zimbabwe.

Countries with no terrorist attacks between 2006 and 2011:
Botswana; Costa Rica; Dominican Republic; El Salvador; Estonia; Gabon; Ghana; Iceland; Jamaica; Laos; Latvia; Liberia; Lithuania; Malawi; Mauritius; Mongolia; Namibia; Poland; Portugal; Republic of the Congo; Sierra Leone; Singapore; Slovakia; Slovenia; Togo; Vietnam; Zambia.

OECD members in truncated sample:
Australia; Austria; Belgium; Canada; Chile; Czech Republic; Denmark; Finland; France; Germany; Greece; Hungary; Ireland; Israel; Italy; Japan; Mexico; Netherlands; New Zealand; Norway; South Korea; Spain; Sweden; Switzerland; Turkey; United Kingdom; United States of America.

TABLE C1

Pairwise correlations

	Life satisfaction	Incidents (lag)	Fatalities (lag)	Injuries (lag)	Property damage (lag)	Index (lag)	RGDP per worker	Capital stock per worker	Human capital	Age	Polity4
Life satisfaction	1										
Incidents (lag)	-0.1605	1									
Fatalities (lag)	-0.1840	0.9636	1								
Injuries (lag)	-0.1565	0.9555	0.9599	1							
Property damage (lag)	-0.1412	0.9717	0.9250	0.9178	1						
Index (lag)	-0.1734	0.9794	0.9941	0.9815	0.9468	1					
RGDP per worker	0.6780	-0.1444	-0.1599	-0.1287	-0.1219	-0.1490	1				
Capital stock per worker	0.6315	-0.1544	-0.1695	-0.1419	-0.1319	-0.1598	0.9085	1			
Human capital	0.4173	-0.1783	-0.1997	-0.1649	-0.1695	-0.1885	0.4674	0.4783	1		
Age	0.4044	-0.1731	-0.2021	-0.1717	-0.1637	-0.1908	0.5938	0.6601	0.7627	1	
Polity4	0.3361	-0.0703	-0.0747	-0.0660	-0.0584	-0.0717	0.1645	0.1505	0.4315	0.4704	1