

# **The Terrorism Labor Market**

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**Abstract:** This paper presents a labor market analysis of terrorism. First, I review selected literature to understand how economic models can be applied to terrorism behavior. I then mathematically model the supply and demand for terrorism labor. The theoretical model gives rise to a number of labor oriented hypotheses, which are empirically tested for a sample of 112 countries over the 1975-97 period. The theoretical and empirical results suggest that there are labor factors that influence the amount of transnational terrorist events in a region.

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## **1. Introduction**

The United States came face to face with its vulnerability to transnational terrorism after it was brought fully into the lime light by the events of September 11, 2001 (hereafter 9/11), the subsequent War on Terror and broad media coverage of significant terrorist incidents in Europe, Asia and the Middle East. In order to analyze terrorism it must be defined. For the purposes of this thesis terrorism is “the premeditated use or threat to use violence by individuals or sub national groups in order to obtain a political or social objective through the intimidation of a large audience beyond that of the immediate victims” (Enders and Sanders 2006, p. 3).

At first, when thinking about terrorists, many may think of these people as irrational. However, terrorist organizations have goals, and it is reasonable to assume that they attempt to reach them by planning carefully and using their resources effectively. In looking at the events of 9/11, for example, it is clear that they carefully planned their attack by recruiting and training appropriate types of labor funded from the organization’s income. So, while the output produced may seem irrational to the average person, the methods they employed to create the product can be viewed as economically rational. Therefore, it is reasonable to use economic models and techniques to understand the behavior of terrorist organizations (Sandler, 1991). A number of economists have carried out rational choice analyses of terrorist behavior (e.g. Wintrobe 2003, Enders and Sandler 1991). Most such studies delve into how terrorists rationally substitute attacks across target classes (e.g. political versus civilian), regions (Europe versus the United States), and tactics (e.g. hijacking versus assassinations) (e.g. Landes

1978; Enders and Sandler 1990). Other studies analyze the strategic interdependence between terrorist organizations and governments using game theory, e.g. (Sandler 2003). Surprisingly, very few studies formally model or statistically test hypotheses concerning the fundamental raw material of terrorism, namely the terrorist recruits. Without labor, terrorist organizations would not be able to function. And so, an understanding of how supply and demand work in the labor market for terrorists is crucial in understanding terrorism behavior and how to counter it.

This paper presents a labor market analysis of terrorism. First, I review selected literature to understand how economic models can be applied to terrorism behavior. I then mathematically model the supply and demand for terrorism labor. The theoretical model gives rise to a number of labor oriented hypotheses, which are empirically tested for a sample of 112 countries over the 1975-97 period. The theoretical and empirical results suggest that there are labor factors that influence the amount of transnational terrorist events in a region.

## **2. Literature Review**

Landes (1978) was one of the first scholars to focus on terrorism economics. The impetus for this paper was that between 1961 and 1972, 132 skyjackings took place in the United States. After 1973 (when metal detectors were implemented), skyjackings dramatically slowed with only 11 in the next three years. Landes (1978) looks into what explains the pattern of hijackings. First he built a deterrence model whereby the incentive to engage in illegal versus legal activities is a function of the differential returns of the two, measured by unemployment and per capita spending. A key prediction of the model is that decreases in unemployment and increases in per capita spending should

decrease illegal activities. In addition, the size of the population is included as a variable because a population increase increases the supply of potential hijackers. The empirical analysis of this model suggests that increases in unemployment and increases in population each reduce the time and flight intervals between successive hijackings. The idea that unemployment, per capita spending, (which can be a proxy for wages), and population affect the number of terrorist acts is very important because these variables could affect the amount of labor available to terrorist organizations.

Ehrlich (1973) also addressed participation in illegal activities. This paper, while not addressing terrorism, addressed the choice to participate in illegal activities rather than legal activities using U.S. crime data. This paper is important because it shows that people who commit crime are not necessarily irrational. Rather, the criminals' actions are based upon the opportunities that are presented to them. In the model, personal and family wealth, efficiency in self-protection, and insurance provided by family members or criminal organizations contribute to the decision to participate in illegal activity. Also, a person's preference for risk and inclination towards violence will make some opportunities more favorable than others. These ideas are important in thinking about the supply side of the labor market for terrorism because people with a preference for risk and an inclination towards violence can become potential recruits for terrorist organizations.

Enders and Sandler (1990) examined four U.S. policies designed to reduce transnational terrorism: the installation of metal detectors in airports in 1973, the increase in the security budget to protect embassies and personnel, Reagan's "get tough policy" and the U.S. retaliatory strike against Libya in 1986. In order to examine these policies,

Enders and Sanders considered the utility and resource constraints of terrorist groups. Terrorists have three modes of attack: skyjackings ( $a_1$ ), kidnappings ( $a_2$ ), and non-hostage taking incidents ( $a_3$ ). Modes  $a_1$  and  $a_2$  are considered close substitutes because they achieve similar results; they both make it appear that the government cannot protect the lives and freedom of its people. This substitution between  $a_1$  and  $a_2$  yields the following utility function:

$$U = U[z_1(a_1, a_2), z_2(a_3)] \quad (1)$$

and the following resource constraint:

$$p_1 a_1 + p_2 a_2 = I - p_3 a_3 \equiv \hat{I} \quad (2)$$

The model implies that if methods are implemented to reduce  $a_1$  and  $a_2$  then  $a_3$  will be relatively more affordable, which may lead to an increase in  $a_3$ . In other words, terrorists rationally substitute across tactics.

Enders and Sandler (1990) used interrupted time-series analysis to estimate the effects of the four policies. They found that the implementation of metal detectors was very successful, with no substitution into other models of attack detected. (However, Enders and Sandler (1993) found that there was a substitution into kidnappings, barricade and hostage-taking missions.) Enders and Sandler (1990) also found that increases in the security budget to protect embassies and personnel led to reduced crimes against U.S. diplomats by 9 incidents per quarter. Reagan's "get tough policy" was completely ineffective. Finally, the U.S. retaliatory strike against Libya was ineffective in the long run, with an increase in terrorist incidents in the short run. This paper is important because it presents a constrained optimization model of terrorism behavior and it finds empirical support for rational behavior by terrorists.

Collier (2000) addresses rebellion groups as criminal groups. While rebel groups are not typically viewed as terrorists, they share many characteristics with terrorists. In regard to labor recruitment, Collier notes that the rebel leader must offer an income to his labor that is related to the opportunity cost of labor within the economy. One problem with hiring labor for illegal activities is that contract enforcement problems cannot be addressed through the law as normal labor contracts would be addressed. Also, in these military groups secrets must be shared amongst many which implies that the military groups have to be careful that their labor does not share information with the government for personal rewards. Another problem for rebel groups is that success for the group requires that officers be given command over troops, but this makes it easier for officers to challenge the rebel leadership. Hence, retaining the rebel hierarchy can be a challenge. To solve these problems rebel leaders restrict their recruitment to people of similar ethnic, religious or class background. These constraints, on who can be recruited, impose an additional cost to recruitment. Collier's ideas are relevant for understanding complications in demanding labor for illegal activities like terrorism.

Frey and Luechinger (2003) addressed alternatives to deterrence in fighting terrorism. In Frey and Luechinger's view, deterrence measures, such as attacking terrorist groups, give rise to a negative sum game between governments and terrorists because government attacks can cause an increase in the solidarity and recruitment of terrorists. Frey and Luechinger argued that a system of benevolence would yield a positive sum game. The terrorist group has a budget constraint with terrorist activities on one axis and all other activities on the other. In the Frey and Luechinger model it is argued that by increasing the opportunity cost of terrorist acts, more legal activities will

be produced and the equilibrium amount of terrorist activities will decrease. It is assumed that if legal activities are less expensive the terrorist groups will get more utility by consuming more legal activities and by cutting down on illegal activities. Frey and Luenchinger (2003) offered several ideas about how to increase the opportunity costs. The “obvious solution” is to increase the income of peaceable occupations. The other recommendations are sending potential terrorists to other countries for visits, principle witness programs to encourage terrorists to betray their groups for awards from the government, and contact and discussion in political processes to give terrorists a way other than violence to achieve their political goals. These strategies break down the power of the group and encourage terrorists to discontinue their supply of labor to terrorist organizations.

A special report from the United States Institute of Peace (2002) focuses on how Islamic extremists mobilize support. The report highlights the humiliation of being treated as “second class” citizens by their governments as a major reason people join extremist groups. Other reasons include the desire to promote political goals, and for financial, spiritual, and emotional incentives. Two types of labor are sought by the extremist groups: young, uneducated “foot soldiers” and better educated elite operatives. The media is often used as a means to rally support, and in Pakistan the educated members are often plucked from religious schools called madaris. These ideas suggest that a number of social, political, cultural, and economic conditions might create a fertile environment for some individuals to form preferences for terrorism.

Yom and Saleh (2004), in an empirical paper, looked at the labor supply of Palestinian suicide bombers. Although suicide strategies started seven years before 9/11

and even though the lives of the Palestinians have not improved since then, they still continue with the bombings. The bombers are not just the instruments of terrorist leaders nor are they brainwashed. The suicide bombers are generally young, with large families, and better educated than the average Palestinian citizen. However, it is found that many of the bombers had violent encounters with the Israel Defense Forces and as a result many were injured, imprisoned, or lost a family member, so revenge could be a factor in their participation in terrorist groups. Participation in terrorist organizations is also increased due to closures that Israel enforces on Palestinian territories. These closures leave thousands unemployed because many Palestinians rely on Israel for jobs. The closures also disturb the prospects for good jobs within the territories. Because the closures hurt earning potential, those who are highly qualified for jobs, such as many of the suicide bombers, face high losses relative to the investment that they have made in education and job training. This can create incentives to join illegal activity. Yom and Saleh suggest that increasing income per capita will reduce Palestinian attacks against Israelis, and that decreasing unemployment will discourage youth from joining terrorist groups. These suggestions parallel the results of Landes (1978) in which the time and flight interval of hijackings decreased when per capita spending increased and unemployment decreased.

Li and Schaub (2004) addressed a very important potential cause of terrorism. Many people, especially after the 9/11 attacks, believe that increases in economic globalization (foreign trade, foreign direct investment and financial capital flows) leads to increases in transnational terrorism. Some of the reasons for this belief can be found in journalistic accounts. The large amounts of international financial transactions and flow

of goods and people that come with greater economic interdependence make it difficult to trace the passing of terrorist funds, weapons, and terrorists themselves. In the United States, for example, 18 million cargo containers arrive by sea each year but only about two percent of them are searched (Li and Schaub 2004, p. 235). This incredibly small number of searched cargo containers would make it easy for terrorists to smuggle weapons into the country. Also, economic globalization yields a large amount of targets for terrorists, and it is easier for terrorists to plan and carry out successful attacks with more potential targets. Li and Schaub (2004) empirically tested these ideas for a sample of 112 countries over the 1975-97 period. They found that trade, foreign direct investment and portfolio investment of a country did not significantly affect the amount of transnational terrorism in a country. Li and Schaub did find that the economic development of a country and of its trading partners decreased the amount of terrorism in the country. They concluded that economic globalization should be considered part of the solution to transnational terrorism, rather than part of the cause. Li and Schaub's view is that globalization does not directly affect terrorism, but it does indirectly reduce terrorism via its increase in economic development.

Although much of the literature directly or indirectly touches upon terrorism labor market issues, none of the contributions formally modeled the market for terrorism labor. Using many of the facts and ideas from this literature, I will now propose a mathematical model for the market for terrorism labor.

### **3. The Demand and Supply of Terrorism Labor**

The labor market of terrorism is broken into two pieces: the supply of labor by individuals and the demand for labor by terrorist groups. First, the demand side of the

market will be explored using a constrained output maximization model. In this approach the terrorist organization can be thought of as a “firm” that hires labor. The supply of terrorism labor is modeled by adapting the labor/leisure model of labor supply to a terrorism context.

### 3.1 Labor Demand

When deciding to demand labor, terrorist groups have two types of labor to choose from: unskilled ( $L_u$ ) and skilled ( $L_s$ ) labor, each with its own wage rate ( $W_u, W_s$ ). In addition to purchasing labor, a terrorist organization must also pay for capital ( $K$ ) with rental rate ( $r$ ). I assume that a terrorist organization’s main objective is to produce terrorist incidents according to a CES production function. A terrorist organization will try to maximize the amount of terrorist incidents that it can produce given its income constraint as follows:

$$\begin{aligned} \text{Max } T &= A[\alpha_u L_u^\rho + \alpha_s L_s^\rho + \alpha_k K^\rho]^{1/\rho} \quad \text{where } \rho \leq 1 \text{ and } \rho \neq 0, \quad (3) \\ &L_u, L_s \\ \text{Subject to } I &= W_u L_u + W_s L_s + rK \\ K &= \bar{K} \\ \alpha_u + \alpha_s + \alpha_k &= 1 \end{aligned}$$

Where A is a parameter reflecting the state of terrorism technology,  $\alpha_i$  ( $i = u, s, k$ ) are parameters indicating the relative importance of the three production inputs, and  $\rho$  captures the ease of or difficulty of substitution among inputs. The  $K$  is fixed for two reasons. First, about 90 percent of terrorist organizations last for less than one year and of those that exist for one year, 50 percent cease to exist within a decade (Hoffman 1998, p. 170). Therefore very few of the organizations exist in the long run, and consequently see little or no change in  $K$ . The other reason that I fix  $K$  is for mathematical simplicity of the models.

Using the model in (3), the optimal amount of both skilled labor and unskilled labor ( $L_u, L_s$ ) can be found based on the following marginal products:

$$MP_u = \frac{\partial T}{\partial L_u} = \alpha_u A [\alpha_u L_u^\rho + \alpha_s L_s^\rho + \alpha_k K^\rho]^{\frac{1}{\rho}-1} L_u^{\rho-1} \quad (4)$$

$$MP_s = \frac{\partial T}{\partial L_s} = \alpha_s A [\alpha_u L_u^\rho + \alpha_s L_s^\rho + \alpha_k K^\rho]^{\frac{1}{\rho}-1} L_s^{\rho-1} \quad (5)$$

Taking the ratio of the marginal products in (4) and (5) gives the marginal rate of technical substitution (MRTS). Assuming an interior solution, I set the MRTS equal to the ratio of wages:

$$MRTS = \frac{MP_u}{MP_s} = \frac{\alpha_u L_u^{\rho-1}}{\alpha_s L_s^{\rho-1}} = \frac{W_u}{W_s} \quad (6)$$

which implies:

$$L_u = \left( \frac{W_u \alpha_s L_s^{\rho-1}}{W_s \alpha_u} \right)^{\frac{1}{\rho-1}}, \quad L_s = \left( \frac{W_s \alpha_u L_u^{\rho-1}}{W_u \alpha_s} \right)^{\frac{1}{\rho-1}} \quad (7)$$

Plugging  $L_u$  and  $L_s$  into the income constraint in (3) yields the following demand functions for unskilled and skilled labor:

$$L_u^* = \frac{I - rK}{W_s \left( \frac{W_s \alpha_u}{W_u \alpha_s} \right)^{\frac{1}{\rho-1}} + W_u} \quad (8)$$

$$L_s^* = \frac{I - rK}{W_u \left( \frac{W_u \alpha_s}{W_s \alpha_u} \right)^{\frac{1}{\rho-1}} + W_s} \quad (9)$$

Note that the optimal amount of unskilled labor is not only dependent on the wage of unskilled labor; it also is determined by the wage of skilled labor. The same is true with regards to skilled labor.

The next step in understanding the demand for labor involves taking the partial derivatives of the optimal amount of unskilled and skilled labor with regard to various parameters. The derivative of  $L_u^*$  with respect to  $W_u$  is:

$$\frac{\partial L_u^*}{\partial W_u} = -(I - rK) \cdot \frac{1 + \frac{W_s}{\rho - 1} \cdot \left( \frac{\alpha_u W_s}{W_u \alpha_s} \right)^{-\rho+2} \cdot \left( \frac{-\alpha_u W_s}{\alpha_s W_u^2} \right)}{\left[ W_u + W_s \left( \frac{\alpha_u W_s}{W_u \alpha_s} \right)^{\frac{1}{\rho-1}} \right]^2} \quad (10)$$

Because  $(\rho - 1) < 0$ , the entire fraction is negative implying that as the wage of unskilled labor increases, the amount of unskilled labor demanded decreases.

Taking the derivative of  $L_s^*$  with respect to  $W_s$  leads to:

$$\frac{\partial L_s^*}{\partial W_s} = -(I - rK) \cdot \frac{1 + \frac{W_u}{\rho - 1} \cdot \left( \frac{\alpha_s W_u}{W_s \alpha_u} \right)^{-\rho+2} \cdot \left( \frac{-\alpha_s W_u}{\alpha_u W_s^2} \right)}{\left[ W_s + W_u \left( \frac{\alpha_s W_u}{W_s \alpha_u} \right)^{\frac{1}{\rho-1}} \right]^2} \quad (11)$$

This fraction is also negative implying that as the wage of skilled labor increases the amount of skilled labor demanded will decrease.

The next question is what happens to skilled labor when the wage of unskilled labor increases, and vice versa. First, look at what happens to the amount of unskilled labor when the wage rate of skilled labor increases:

$$\frac{\partial L_u^*}{\partial W_s} = (I - rK) \cdot \frac{-\left(\frac{W_s \alpha_u}{\alpha_s W_u}\right)^{\frac{1}{\rho-1}} + \frac{W_s}{p-1} \cdot \left(\frac{\alpha_u W_s}{W_u \alpha_s}\right)^{\frac{-\rho+2}{\rho-1}} \cdot \frac{\alpha_u}{W_u \alpha_s}}{\left[W_u + W_s \left(\frac{\alpha_u W_s}{W_u \alpha_s}\right)^{\frac{1}{\rho-1}}\right]^2} \quad (12)$$

This partial derivative is negative if  $\left(\frac{W_s \alpha_u}{\alpha_s W_u}\right)^{\frac{1}{\rho-1}} > \frac{W_s}{p-1} \cdot \left(\frac{\alpha_u W_s}{W_u \alpha_s}\right)^{\frac{-\rho+2}{\rho-1}} \cdot \frac{\alpha_u}{W_u \alpha_s}$ . The

derivative is positive if  $\left(\frac{W_s \alpha_u}{\alpha_s W_u}\right)^{\frac{1}{\rho-1}} < \frac{W_s}{p-1} \cdot \left(\frac{\alpha_u W_s}{W_u \alpha_s}\right)^{\frac{-\rho+2}{\rho-1}} \cdot \frac{\alpha_u}{W_u \alpha_s}$ . This implies that an

increase in the amount of unskilled labor can increase or decrease if the price of skilled labor increases. In other words, if skilled labor becomes more expensive a group may decide to cut back on unskilled labor because of the greater cost of skilled labor. On the other hand, a group may decide to hire unskilled labor instead because of the greater cost of skilled labor.

I also look at what happens to the amount of skilled labor as the price of unskilled labor increases:

$$\frac{\partial L_s^*}{\partial W_u} = (I - rK) \cdot \frac{-\left(\frac{W_u \alpha_s}{\alpha_u W_s}\right)^{\frac{1}{\rho-1}} + \frac{W_u}{p-1} \cdot \left(\frac{\alpha_s W_u}{W_s \alpha_u}\right)^{\frac{-\rho+2}{\rho-1}} \cdot \frac{\alpha_s}{W_s \alpha_u}}{\left[W_s + W_u \left(\frac{\alpha_s W_u}{W_s \alpha_u}\right)^{\frac{1}{\rho-1}}\right]^2} \quad (13)$$

Like  $\frac{\partial L_u^*}{\partial W_s}$ , this partial can be either negative or positive depending on which term in the numerator is greater in absolute value. Therefore, as the price of skilled labor increases, a terrorist organization may choose to either increase or decrease the amount of unskilled labor that they demand.

Finally, what happens to the amount of skilled and unskilled labor as the rental rate ( $r$ ) changes?

$$\frac{\partial L_u^*}{\partial r} = \frac{-K}{W_s \left( \frac{W_s \alpha_u}{W_u \alpha_s} \right)^{\frac{1}{\rho-1}} + W_u} \quad (14)$$

$$\frac{\partial L_s^*}{\partial r} = \frac{-K}{W_u \left( \frac{W_u \alpha_s}{W_s \alpha_u} \right)^{\frac{1}{\rho-1}} + W_s} \quad (15)$$

These partial derivatives imply that as the rental rate decreases the amount of unskilled and skilled labor will increase.

### 3.2 Labor Supply

Assume that a person decides whether or not to supply labor to a terrorist group based upon the following constrained maximization problem:

$$\begin{aligned} \text{Max } U &= \left[ \beta C^\rho + (\alpha) t^\rho \right]^{\frac{1}{\rho}} \\ l, t \\ \text{Subject to } C &= w l + w_t t \\ l+t &= 1 \end{aligned} \quad (16)$$

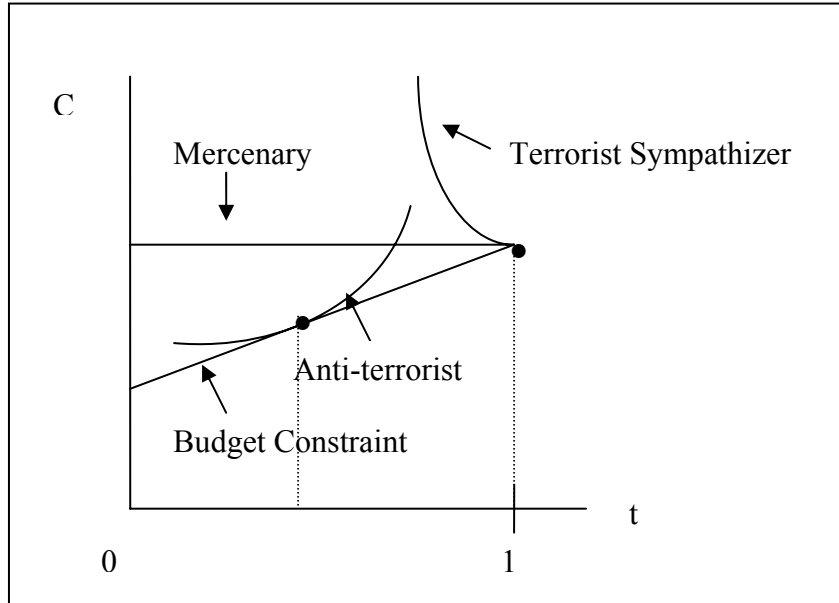
where  $C$  is consumption,  $t$  is time devoted to terrorist activities,  $l$  is time devoted to legal work,  $w$  is the wage rate for legal work,  $w_t$  is the wage provided by the terrorist organization, and  $\beta$  and  $\alpha$  are weights reflecting the individual's preferences for  $C$  and  $t$ . People can be divided into three groups based upon their preferences for terrorism. The "terrorist sympathizer" is one who receives utility from being involved with a terrorist group. This person will have an  $\alpha$  value greater than zero. The second type is the mercenary, who has an  $\alpha$  value of zero. The final type of person is the anti-terrorist, with an  $\alpha$  value less than zero. In trying to maximize utility all individuals will gain from

more consumption. The terrorist sympathizer, however, will also be able to increase utility by participating in terrorist activities.

The level of utility reached by an individual is dependent upon the budget constraint. In this budget constraint, consumption is dependent on the income of the laborer. The laborer can earn income in two ways, he can work in the legal market ( $l$ ) and earn a legal wage ( $w$ ) or he can work in the terrorism market ( $t$ ) and earn a terrorist wage ( $w_t$ ). A laborer may also divide his labor between the two markets. In order to see how the three types of people will supply their labor it is helpful to look at the following graphs.

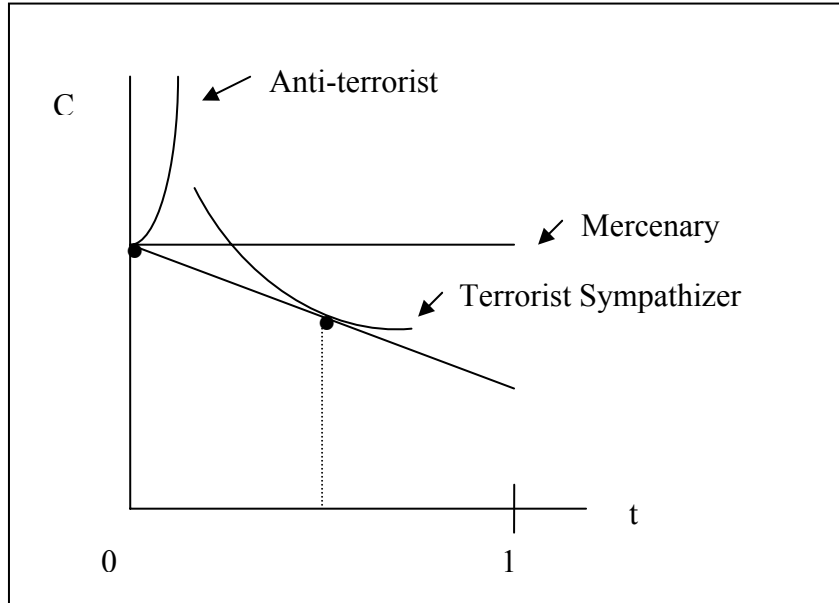
Figure 1 shows an economy in which  $w_t$  is greater than  $w$ . In the figure, the anti-terrorist receives moderate disutility from terrorism ( $\alpha$  moderately negative), so he sees the opportunity cost of devoting all of his time to legal work as too big and therefore devote some time to each market ( $0 < t^* < 1$ ). The figure also shows that both the terrorist sympathizer and the mercenary will devote all of their labor to terrorism ( $t^* = 1$ ). There are two other possibilities for the anti-terrorist. If the anti-terrorist receives substantial disutility from terrorism ( $\alpha$  highly negative), he will not devote any time to terrorist activities ( $t^* = 0$ ). If the anti-terrorist receives small disutility from terrorism ( $\alpha$  slightly negative), he may see the opportunity cost to be so great that he will devote all of his time to terrorist activity ( $t^* = 1$ ).

Figure 1



In Figure 2 the legal wage ( $w$ ) is greater than the terrorist wage ( $w_t$ ). In this situation both the anti-terrorist and the mercenary will supply all of their labor in the legal market ( $t^* = 0$ ). Much like the person who receives disutility from terrorism in the previous scenario, the person who receives utility from terrorism may do several things. If the terrorist sympathizer receives substantial utility from terrorism ( $\alpha$  large), he may supply all of his labor to terrorist activities ( $t^* = 1$ ) even though  $w > w_t$ . However, if as shown in the figure, the terrorist sympathizer receives only modest utility from terrorism ( $\alpha$  moderate), he may divide his labor between the two markets ( $0 < t^* < 1$ ). Finally, if the opportunity cost is too great, this person, although he receives utility from terrorism ( $\alpha$  small), will choose to supply all of his labor to the legal market ( $t^* = 0$ ).

Figure 2

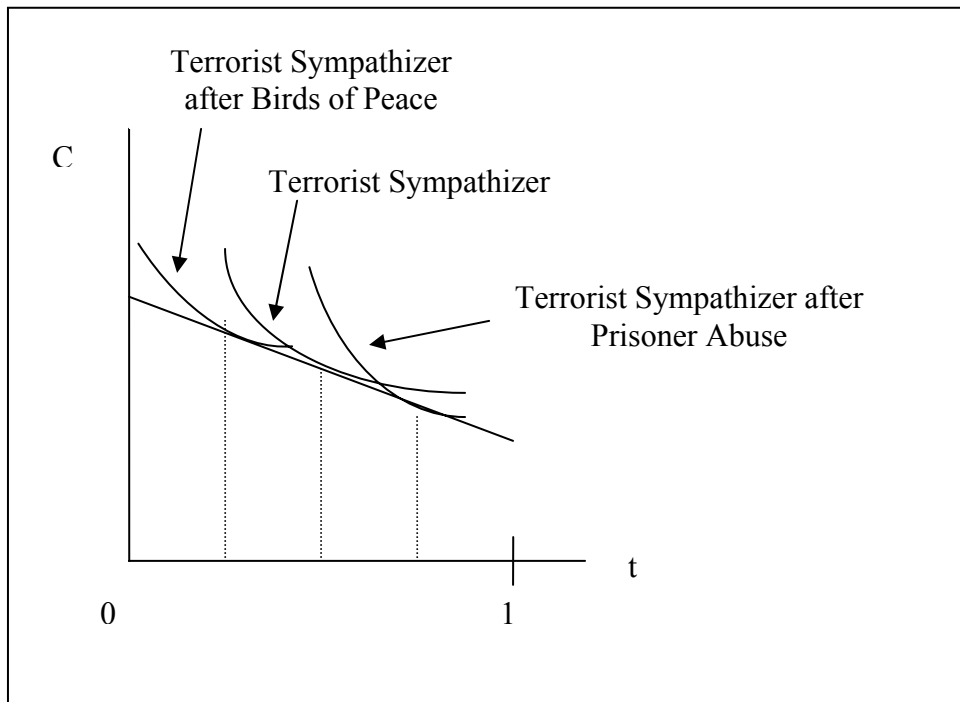


The final scenario is when the terrorism wage equals that of the legal wage. In this scenario (not shown) the anti-terrorist will supply all of his labor to the legal market, the terrorist sympathizer will supply all of his labor to the terrorist market, and the mercenary will be indifferent as to which market he supplies his labor.

An example is helpful to understand how a person's  $\alpha$  value can be determined and altered. This example, shown in Figure 3, will look at an anti-American terrorist sympathizer. Polls in Pakistan show that over 50 percent of Pakistanis have a negative view of Americans. After the South Asia Earthquake on October 8, 2005, the United States had the opportunity to change Pakistanis' negative view of Americans. Helicopters, previously used to bomb, known as "Birds of Peace," were used to deliver supplies to the Pakistani people. While many people still have a negative view of America, some have begun to change their minds after seeing the American soldiers doing their part to help (Peters 2005). This change in opinion could cause a person with a positive  $\alpha$  value (the terrorist sympathizer) to see his  $\alpha$  decrease. Now suppose an Iraqi

terrorist sympathizer learns of the Iraqi prisoner abuse at the hands of American soldiers in Abu Ghraib. Upon learning that a country, claiming to be bring democracy to Iraq, was abusing Iraqi people, the terrorist sympathizer may increase the magnitude of his negative  $\alpha$  value, making him more likely to supply labor to terrorist organizations with political goals in opposition to the United States. The changes in utility curves and amounts of labor supplied for terrorism before and after these two events are illustrated in the figure.

**Figure 3**

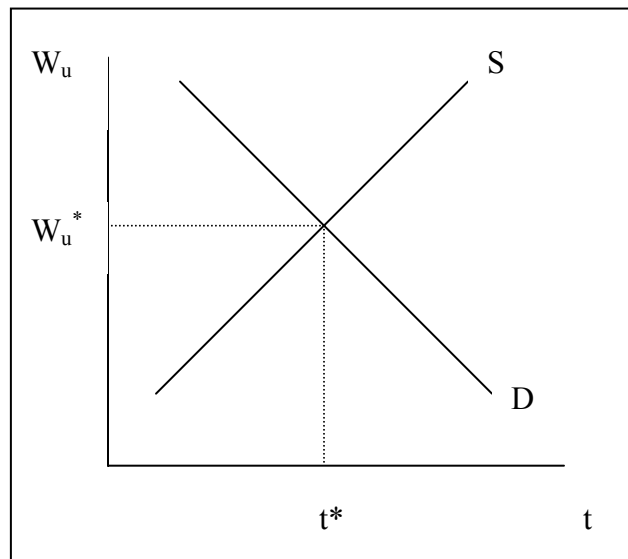


### 3.3 Market for Terrorism Labor

The final step in understanding the supply and demand for terrorism labor is to put the supply and demand together. For example, suppose I focus on the market for unskilled labor. The total supply of unskilled terrorism labor in a region will be the sum of the amount of labor supplied by the anti-terrorists, the mercenaries and the terrorist

sympathizers. The amount of unskilled labor demanded is the sum of unskilled labor demanded by all of the terrorist organizations in a region. Their intersection will determine the amount of labor hired and at what wage. This can be seen in Figure 4. The amount of unskilled labor hired, will then help to dictate the amount of terrorist events that the terrorist organizations can produce.

**Figure 4**



#### **4. Empirical Model: Data, Variables and Method**

For the empirical analysis of the terrorism labor market I will be following the method used by Li and Schaub (2004) and using their replication data set. Some of their variables will be omitted because they have no correlation to the labor market and they were found to be insignificant. The variables that I use proxy determinants of the labor market, whereas Li and Schaub used them to proxy non-labor variables. I will also add an additional variable to the replication data set, namely youth bulge. I use a negative binomial regression for the same reasons as Li and Schaub (2004). See (Li and Schaub, 2004 p. 243) for further details.

The theoretical model from section 3 has suggested several hypotheses that I shall now test empirically. First, as the wage rate increases in the legal market, does the amount of terrorist labor decrease implying less terrorist incidents? Secondly, as the population increases is it easier for terrorist organizations to recruit labor therefore increasing terrorist incidents? Related to population is youth bulge, which is the percentage of the population aged 15-24. If the youth bulge increases does terrorism labor and thus terrorism incidents increase? Do past terrorist events serve as a form of terrorism “advertising” thus increasing the magnitude of  $\alpha$ s and increasing the supply of labor for terrorist organizations which leads to an increase in terrorism? Finally, do different aspects of government make it easier for terrorist groups to organize and to recruit labor? This would imply an increase in the ease of constructing and maintaining an illegal labor market, which will then increase the quantity of terrorist incidents.

#### **4.1 Terrorism Data**

To test my hypotheses I utilize the data from *International Terrorism: Attributes of Terrorist Events* (ITERATE). This data set includes information on all reported international terrorist events since 1968, and is updated annually by its original compilers. ITERATE data are generated from several news sources including the Associated Press, United Press International, Reuters, Foreign Broadcast Information Service and major United States newspapers. The method of gathering the data has some weaknesses. For example, in some countries the reporting of terrorist incidents is more complete and more frequent than in other countries, and therefore there are biases within the data set. However, overall, ITERATE is a relatively complete representation of

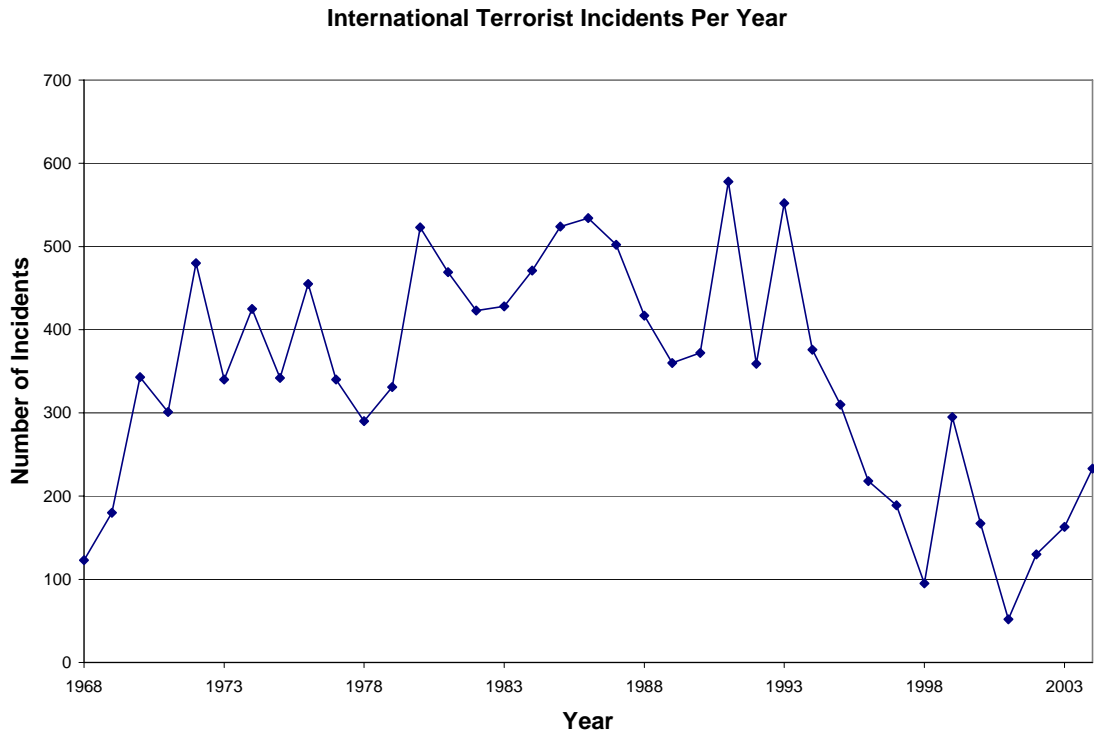
international terrorist incidents worldwide and it is employed in a large majority of empirical studies on terrorism.

The ITERATE Common File is broken into several categories of variables. The first category is Incident Characteristics, which includes information on the date and location of the terrorist incident, as well as any evidence of state sponsorship of the event and the type of terrorist events. Different types of terrorist events include bombings, skyjackings, assassinations, hoaxes and suicide bombings. Next, is the Terrorist Characteristics category which provides information about the group responsible for the incident, as well as the number of terrorists involved, their nationalities and gender. Subsequently, is Victim Characteristics, which includes the number of victims, their nationalities and the number of American victims. Finally, in Life and Property Losses, there is information about the number of victims, both wounded and killed, number of terrorists wounded and killed, the amount of damages and the types of weapons used.

Through my everyday discussion of terrorism I have found that many people automatically think of suicide terrorism as the biggest, most common type of terrorism, and many believe that terrorist events have increased in frequency in recent years. In order to obtain a firmer understanding of the terrorist scene since 1968 the following graphs can be helpful.

Figure 5 shows international terrorist incidents per year. It can be seen that in fact there have been fewer incidents in recent years than in the 1970's and 1980's.

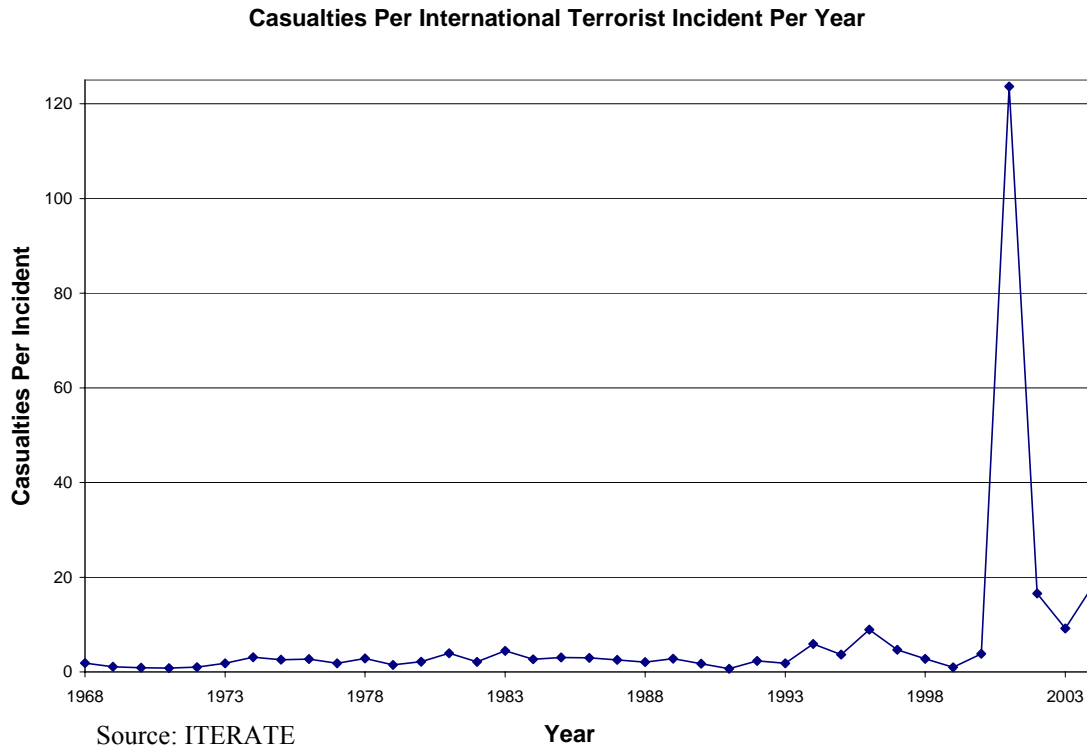
**Figure 5**



Source: ITERATE

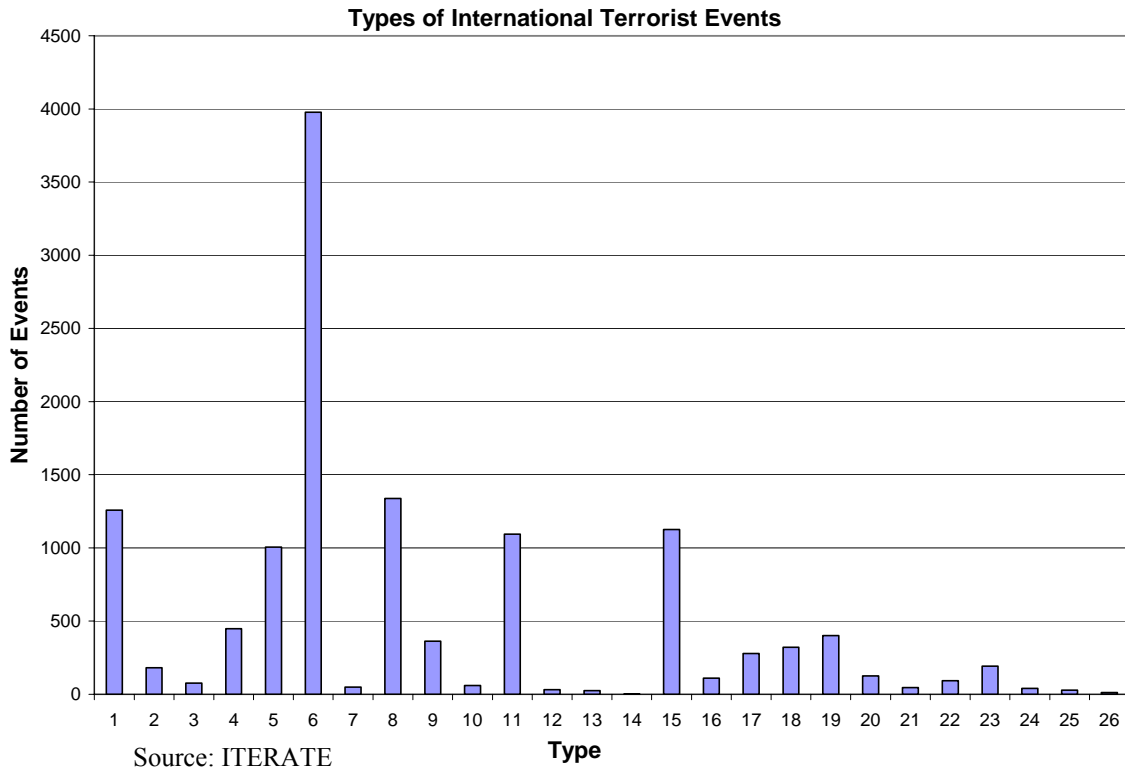
In contrast to the relatively low number of terrorist incidents in recent years, Figure 6 shows that the number of casualties per incident per year appears to be rising. The outlier in this graph is easily recognized as the terrorist events of 9/11. Yet, even when ignoring this outlier there appears to be an increase in the number of casualties per incident in recent years. So, while there may be fewer terrorist events now, they are on average more deadly or more harmful than terrorist incidents of the past.

**Figure 6**



Finally, it is interesting to look at the different types of terrorist events that have occurred as shown in Figure 7. Note that the most frequent type of incident is explosive bombings, with 3978 incidents, while suicide bombings and suicide car bombings account for only 68 incidents, which is only 0.5% of terrorist incidents. The second and third most frequent mode of international terrorist attacks are other armed attacks and kidnappings.

**Figure 7**



- |   |  |
|---|--|
| 1. Kidnapping                                       | 13. Exotic pollution, including chemical and biological agents |
| 2. Barricade and hostage seizure                    | 14. Nuclear related weapons attack                             |
| 3. Occupation of facilities without hostage seizure | 15. Theft with no subsequent terrorist action                  |
| 4. Letter or parcel bombing                         | 16. Theft, break-in of facilities                              |
| 5. Incendiary bombing, arson, Molotov cocktail      | 17. Conspiracy to commit terrorist action                      |
| 6. Explosive bombing                                | 18. Hoax   |
| 7. Armed attack, employing missile                  | 19. Other actions  |
| 8. Armed attack-other including mortars, bazookas   | 20. Sniping at buildings, other facilities                     |
| 9. Aerial hijacking                                 | 21. Shoot-out with police                                      |
| 10. Takeover of non-aerial means of transportation  | 22. Arms smuggling   |
| 11. Assassination, murder                           | 23. Car bombing  |
| 12. Sabotage not involving explosives or arson      | 24. Suicide car bombing  |
|   | 25. Suicide bombing  |
|   | 26. Unknown  |

#### **4.2 Labor and Control Variables**

From mathematically modeling the labor supply and demand for terrorism, I have identified a number of labor factors that can affect terrorist incidents. GDP per capita

will proxy the level of legal wages in the economy. Li and Schaub obtained this data from the World Development Indicators (World Bank 2002).

Size will be included because it measures population. Recall from Landes (1978) that as the population increased the time interval between hijackings decreased, implying population size could be an important factor for this empirical analysis. Size is lagged one year behind the dependent variable. Due to skewed distribution, Size will be logged. Added to the Li and Schaub (2004) replication data set is a Youth Bulge variable. The Youth Bulge variable is the percentage of the adult population aged 15-24. According to most theories, when youth revolt it is usually due to competition with the older part of the population. In countries with few economic opportunities and a large (greater than 20 percent) youth bulge, there can be a greater risk of intrastate wars (Urdal 2004). The Youth Bulge data are taken from the World Bank.

Past terrorist incidents will be included for the same reasons that Li and Schaub (2004) included the term. Terrorist organizations often work continuously from a particular country because the cost of restructuring their organization elsewhere would be too great. Therefore countries which did not experience terrorist incidents in the past will be less likely to have terrorist incidents in the present because of the cost of organizing a group in a new country. The last important fact that Li and Schaub (2004) address is that actions by a particular group in a country can influence other terrorist groups to act in the future. From a labor standpoint it is important to include past events because terrorist incidents can act like advertisement for a terrorist group. An example of this is the Palestinian terrorist attack during the 1972 Munich Olympics. When the terrorists killed two Israeli Olympians and kidnapped nine others, the story was broadcast around the

world. An estimated 900 million people saw the story unfold as the West German police failed in a rescue attempt in which the remaining nine athletes were killed. Although the terrorists did not achieve the goal of the mission, they did manage to advertise themselves across the world. Following the incident, thousands of Palestinians offered their labor to the Palestinian terrorist organizations (Hoffman 1998). Recall from the labor supply section (3.2) that high profile terrorist incidents might shift preferences of individuals toward terrorism.

Government capability is a measure of the amount of resources that a government can apply to control terrorism. It is more expensive for terrorist organizations to exist within countries that can dedicate large amounts of resources to counter terrorism. This affects the demand for terrorism labor because the terrorist groups in a country with high government capability will probably have less money for labor. This variable is an annual composite percentage index of a country's share of the world's total population, GDP per capita, GDP per unit of energy, military manpower, and military expenditures. The variable is lagged one year and computed using data from the World Development Indicators (World Bank 2002). Government capability is a representation of how many resources a government could dedicate to terrorism, not how much it actually does dedicate.

A measure for a country's level of democracy is important to include in the model for several reasons. First, with a high level of democracy, citizens can voice their concerns and have them addressed peacefully. With this option, people will be less likely to supply their labor to terrorist organizations in order to have their political views heard. On the other hand, with high democracy, people have more freedom, which decreases the

costs and risks of running a terrorist organization. Therefore it is relatively less expensive to recruit labor in a highly democratic country. Democracy is taken from the POLITY IV data set in which countries are assigned a level of democracy.

If a country is engaged in interstate military conflict or war then it is coded 1, 0 otherwise. This Conflict variable is included to see if conflict implies a sort of state breakdown that may make it easier for terrorist organizations to organize and recruit.

Some regions of the world have a much higher frequency of transnational terrorist events than others. To control for this disparity, dummy variables are included for Africa, the Americas, Asia, Europe, and the Middle East, with the Middle East as the reference category. To control for effects of different years, I also include dummy variables for each year with 1975 as the reference category.

The labor and control variables are all related to the country in which the terrorist event took place. Due to the fact that these events are transnational terrorist events, there are some events in which all of the terrorists involved were from another country. In this case the labor variables for a country would not necessarily apply to the terrorist laborers involved. However, in many transnational terrorist events it is necessary to have a network of local laborers. Of the 8,550 terrorist incidents recorded in ITERATE from 1975-97, 3,158 incidents either have an unknown nationality of the terrorist, or an unknown target. Of the remaining incidents, 3,362 of the incidents are committed by terrorists of the same nationality as the target. This means that in incidents in which the nationality of the terrorist and target are known, 64.2% of transnational terrorist incidents have the same nationality as the country in which the incident took place.

### **4.3 Empirical Results**

In order to obtain my empirical results I first replicated the results of Li and Schaub (2004). I then ran a regression with all of my variables taken from the replication data set. Finally, I added in the youth bulge variable. Because the youth bulge data set was missing observations contained in the Li and Schaub (2004) replication data set, the final regression uses 1,915 observations, where as without the youth bulge variable 2,434 observations were used. The results reported are from the final regression and are shown in Table 1. (The results of the regression omitting youth bulge are in Table 2.) Despite the smaller amount of observations, the results are comparable to the results derived without the youth bulge variable. Youth bulge is correlated with Europe and GDP per capita, but this correlation does not affect the statistical significance of these two variables. Correlation values are shown in Table 3.

The GDP per capita variable, used to proxy wages, was not statistically significant. Li and Schaub (2004) found this variable to be significant and therefore I was initially surprised by my result. I suspect GDP per capita in Li and Schaub (2004) was significant due to correlation with the insignificant globalization variables included in their regression. My findings however are in line with studies by other economists (Berrebi 2003, Krueger and Maleckova 2003, Abadie 2004) who have found that poverty does not promote terrorism.

The population variable had the expected sign and was significant at the 5% level. The coefficient implies a 1% increase in population implies a 34.6% increase in the amount of transnational terrorist events within a country. Also, supporting my hypotheses, a one percentage point increase in the percentage of the adult population aged 15-24 (the youth bulge) leads to a 3.5% increase in the amount of incidents. This

coefficient is also statistically significant. These two coefficients imply that as the labor pool increases, more people will be willing to enter the illegal market. The coefficient on the youth bulge variable supports the theories that youth will revolt when in competition with older members of the society. In this case as the youth bulge increases, youth can revolt by supplying labor to terrorist organizations. Or, if the competition is a result of a lack of opportunities in the legal job market, the youths can broaden their options by supplying their labor to terrorism.

The positive, significant Democracy coefficient means a one unit increase in the level of democracy yields a 4.5% increase in the amount of transnational terrorist events within a country. This coefficient supports the following implication. In more democratic countries people have more freedom. Therefore, terrorists are allotted more ease in operating their organizations in a democratic country, implying that it is easier to recruit. When it is easier to recruit, terrorist organizations can find more labor which increases the production of terrorist incidents.

Government capability was positive and significant. This coefficient implies that countries with resources to fight terrorism will see an increase in the amount of terrorist incidents. Usually media coverage is larger and there are more repercussions to attacking a target in such countries. Therefore, when a terrorist organization attacks a target in a country with the resources to fight terrorism there is a much greater affect than if the organization used its resources to attack within a country with lower government control. High media coverage also acts as advertisement for the group which can increase the effect of such incidents on the  $\alpha$  values of terrorist sympathizers. This coefficient could also be positive because about 40% of transnational attacks are directed at American

targets (Enders and Sandler, 2006 pp. 41-42). In further research it would be interesting to use an American dummy variable to determine if the government capability coefficient would be negative without the influence of transnational terrorist events involving the United States.

The conflict coefficient was insignificant. This implies being involved in interstate war does not affect the number of terrorist attacks in a country. From a labor standpoint this means that interstate war does not imply a type of state breakdown that allows more ease for terrorist organizations to organize.

Every additional terrorist incident in a country implies a 1.9% increase in the amount of terrorist incidents in that country in the next year. Once again this supports the idea of advertisement for a terrorist organization.

Lastly are the region dummy coefficients. America (North and South), Asia, and Africa all had significant negative coefficients implying that less terrorist events occurred in these regions. Europe was also negative but not statistically significant.

## **5. Conclusion**

Although many economists have studied the behavior of terrorists, few have set out to formally model or empirically test the labor market for terrorism. Because terrorism organizations rely on labor to carry out terrorist incidents, understanding the terrorism labor market could prove extremely beneficial in countering terrorism.

Modeling the terrorist organization as a firm requiring capital, skilled and unskilled labor, led to the following implications. As wage of unskilled labor increases the amount of unskilled labor demanded by terrorist organizations will decrease; likewise with the wage and amount of skilled labor. Depending on the circumstances, an increase

in the wage of unskilled labor can cause a decrease or an increase in the amount of skilled labor demanded. An increase in the wage of skilled labor has the same effect on the amount of unskilled labor demanded. Finally, an increase in the price of capital implies a decrease in the amount of skilled and unskilled labor demanded.

Regarding labor supply, individuals can be divided into three subgroups: anti-terrorists, terrorist sympathizers and mercenaries. These three types of laborers can divide their supply of labor between legal work and terrorism or they can devote all of their labor to one of the two markets. In a region where the terrorism wage is greater than the legal wage the terrorist sympathizer and the mercenary will supply all of their labor to terrorist organizations. The anti-terrorist may also supply labor to terrorist organizations if his disutility from terrorism is small enough to be outweighed by the financial benefit of working for a terrorist organization. When the legal wage is greater than the terrorist wage, the anti-terrorist and the mercenary will supply all of their labor to the legal market. The terrorist sympathizer will divide his labor between the two markets based upon the strength of his preference for terrorism.

The mathematical models suggested hypotheses for my empirical study which were tested using data from Li and Schaub's (2004) replication data set and an additional variable (youth bulge). These hypotheses examine how different factors of the labor supply and labor demand influence the amount of transnational terrorism events occurring within a given country. The regression results showed that GDP per capita is not significantly related to the amount of transnational terrorist events that occur within a country. Because I was using GDP per capita to proxy legal wages, and because the theory in section 3 suggested wages do affect the amount of labor supplied to terrorism,

this was not the result I was expecting. However, these results do line up with the results that many economists have found which is that poverty is not correlated with terrorism. Another important finding was the positive, significant coefficient on youth bulge. A large youth bulge can imply more competition for legal work, which then leads youth to turn to terrorist organizations for work.

This thesis leaves room for further research. As a result of the models in section 3, there are two other hypotheses I would like to test empirically. First, how does the rental rate of capital affect the amount of labor a terrorist organization demands and thus the amount of terrorist incidents. There are data on the price of cellular telephone calls from the World Bank that I think would serve as a good proxy for the cost of technological capital for terrorist organizations. I would also like to see how unemployment rates affect the amount of transnational terrorism in a country. GDP per capita is not an ideal proxy for wages, and wage data may be too difficult to obtain for the countries in this study. However, unemployment is directly related to labor and may have a positive and significant coefficient which would suggest some of the implications I expected from my proxy for wages.

This thesis was driven by the mathematical models of the labor market for terrorism derived in section 3. All of the hypotheses arose from labor market factors that were introduced by the models. The interpretations of the coefficients were also guided by the information provided by the models. Finally, the ideas for future research were derived from the models. Enders and Sandler (2006) note, “To date, there are few theoretical analyses of the process of recruitment to terrorist organizations” (p. 89, fn 7).

By first laying out the theory behind the labor market I was able to complete a much more informed empirical study.

**Table 1**

variable	coefficient	standard error	z	P>z	95% confidence interval	
gdppcap	0.0103	0.1172	0.09	0.93	-0.2195	0.24
poplog**	0.3457	0.05	6.92	0	0.2477	0.4436
youth*	0.0345	0.0168	2.06	0.04	0.0016	0.0674
democracy**	0.0451	0.0092	4.89	0	0.027	0.0632
gov**	0.4641	0.1514	3.07	0.002	0.1673	0.7609
previous events**	0.0193	0.0043	4.53	0	0.011	0.0277
conflict	-0.0466	0.1503	-0.31	0.757	-0.3411	0.248
Africa**	-1.1774	0.2047	-5.75	0	-1.5786	-0.7761
America*	-0.4638	0.1828	-2.54	0.011	-0.8222	-0.1055
Asia**	-1.1898	0.2211	-5.38	0	-1.6231	-0.7564
Europe	-0.1265	0.234	-0.54	0.589	-0.5851	0.3321

\*\* significant at the 1% level

\* significant at the 5% level

**Table 2**

variable	coefficient	standard error	z	P>z	95% confidence interval	
gdppcap	-0.126	0.0874	-1.44	0.15	-0.2974	0.0454
poplog	0.2988	0.0461	6.48	0	0.2084	0.3892
democracy	0.0419	0.0092	4.56	0	0.0239	0.0598
gov	0.5352	0.1458	3.67	0	0.2494	0.821
event	0.0204	0.0043	4.75	0	0.012	0.0288
conflict	0.079	0.1315	0.6	0.548	-0.1787	0.3368
Africa	-1.068	0.1954	-5.46	0	-1.451	-0.6848
America	-0.3129	0.1865	-1.68	0.093	-0.6785	0.0527
Asia	-1.074	0.2573	-4.17	0	-1.5783	-0.5697
Europe	-0.3299	0.2051	-1.61	0.108	-0.732	0.0722

Table 3

	GDPPCLOG	POPLOG	YTHBLGAP	DEM	GOV	EVENT1	CONFLICT	AFRICA	AMERICA	ASIA	EUROPE
<b>GDPPCLOG</b>	1	-0.019981	-0.74455	0.553581	0.674677	0.182394	-0.05863	-0.54661	0.043138	-0.12325	0.532327
<b>POPLOG</b>	-0.0200	1.0000	-0.0546	0.0405	0.0703	0.2666	0.2044	-0.2206	0.0060	0.2920	-0.0727
<b>Youth</b>	-0.7445	-0.0546	1.0000	-0.4214	-0.5003	-0.1562	0.0316	0.4170	0.2286	0.0957	-0.7754
<b>DEM</b>	0.5536	0.0405	-0.4214	1.0000	0.3931	0.1854	-0.0269	-0.4102	0.1508	0.0210	0.4102
<b>GOV</b>	0.6747	0.0703	-0.5003	0.3931	1.0000	0.2460	-0.0644	-0.4852	0.0496	-0.1473	0.4338
<b>EVENT1</b>	0.1824	0.2666	-0.1562	0.1854	0.2460	1.0000	0.0416	-0.1728	0.0457	-0.0724	0.1501
<b>CONFLICT</b>	-0.0586	0.2044	0.0316	-0.0269	-0.0644	0.0416	1.0000	-0.0269	-0.0387	0.1308	-0.0555
<b>AFRICA</b>	-0.5466	-0.2206	0.4170	-0.4102	-0.4852	-0.1728	-0.0269	1.0000	-0.2800	-0.2411	-0.3131
<b>AMERICA</b>	0.0431	0.0060	0.2286	0.1508	0.0496	0.0457	-0.0387	-0.2800	1.0000	-0.2615	-0.3395
<b>ASIA</b>	-0.1232	0.2920	0.0957	0.0210	-0.1473	-0.0724	0.1308	-0.2411	-0.2615	1.0000	-0.2924
<b>EUROPE</b>	0.5323	-0.0727	-0.7754	0.4102	0.4338	0.1501	-0.0555	-0.3131	-0.3395	-0.2924	1.0000

Table 4

	GDPPCLOG	POPLOG	YTHBLGAP	DEM	GOV	EVENT1	CONFLICT	AFRICA	AMERICA	ASIA	EUROPE
<b>Mean</b>	8.2462	16.0724	27.8734	2.9460	0.8211	3.3932	0.0381	0.2052	0.2329	0.1838	0.2752
<b>Median</b>	8.3887	16.0044	30.7000	7.0000	0.7851	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000
<b>Maximum</b>	10.5011	20.9303	40.7000	10.0000	3.6963	180.0000	1.0000	1.0000	1.0000	1.0000	1.0000
<b>Minimum</b>	5.3845	12.2923	13.3000	-10.0000	0.0392	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
<b>Std. Dev.</b>	1.1308	1.6303	6.7102	7.4978	0.4569	8.4035	0.1915	0.4040	0.4228	0.3874	0.4467

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