Macroeconomic Consequences of Terror: Theory and the Case of Israel

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Abstract

This paper analyzes the effect of terror on the economy. Terror endangers life such that the value of the future relative to the present is reduced. Hence, due to a rise in terror activity, investment goes down, and in the long run income and consumption go down as well. Governments can offset terror by putting tax revenues into the production of security. Facing a tide in terror, a government that acts optimally increases the proportion of output spent on defense, but does not fully offset the tide. Thus, when terror peaks the long run equilibrium with an optimizing government is of lower output and welfare. Next, we show that this theory of terror and the economy, helps to understand changes in trend and business cycle of the Israeli economy. The estimates show that terror has a large impact on the aggregate economy. Terror, that changed the death toll by about the same size as due to car accidents, is expected to decrease output and consumption per capita by about 10 percent. Everything else equal, had Israel not suffered from terror over the last three years, output per capita would have been 5 percent higher than it is today.

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1 Introduction

Recent events brought the economic effects of terrorism to our attention. This work conceptualizes some of the economic costs of terrorism. Once these costs of terrorism are imprisoned in a formal model, we take the analysis in two directions. First, we build a framework that allows for a cost-benefit analysis of counter-terror expenditures. Second, we analyze the case of Israel and document the impact of changes in perceived insecurity on its economic performance.

Terror, among other things, endangers civilians’ life. Needless to say, civilians’ life is a very wide concept, perhaps so wide that trying to put it in one frame, no lens can avoid ambiguity. Assuming, that the level of imminent danger is constant and known, it is still very hard to measure insecurity in a way that provides a wide-enough basis for the assessment of its effects; fears, bewilderments, and different types of uncertainties, are all responsible for redirecting economic activity the wrong way when insecurity prevails. This paper does not provide a general treatment of the many aspects of insecurity on economic behavior. Instead, the focus is on one especially relevant dimension of insecurity. It is assumed that insecurity manifests itself in daily life by an increase in uncertainty about life. More specifically, it is assumed that as terror increases, life become less certain and shorter on average. Terror in this model is measured by a rise in death toll; a rise which is distributed across all age-groups and among all agents. The costs of terror emerge from the fact individuals change their behavior in response to the perceived change in the probability to survive.\footnote{The model we use leans heavily on ideas that are due to Fisher (1930), which were first formalized by Yaari (1965). How life has been affected for an Israeli since October 2000? In each activity: shopping, eating, sport, tourism, choice of occupation, work location and decisions at work; the perceived probability of being affected by terror, becomes a major daily concern.}

When life is endangered by an enemy, real resources must be spent to increase safety. In such cases, the public good aspect of defense expenditures, the increasing returns to scale in the production of security, and the fact security is both non-rival and non-excludable, all lead governments to be the main provider of security for its people. Moreover, since markets generate very weak signals about the appropriate level of defense, it remains to the government to determine what is the appropriate level of defense and to provide it to its...
citizens. The second component of the model is, therefore, that defense is produced by the
government. To simplify the analysis this work assumes that security is all produced by the
government.\textsuperscript{2} Since safety does not come free, the government must take real resources from
the private sector to produce security. In this work, therefore, the decision of the government
about how much to spend on defense is based on comparing the social costs of resources, i.e.,
the costs of forgone consumption and forgone future consumption (investment), which are
used to provide security, with the benefit that emerges from making life safer and longer, i.e.,
the benefit of reducing terror.

To portrait these ideas we use a variant of the closed-economy-infinite-horizon model
where the government is in charge of the supply of defense. The outside threat (terror) is
assumed to be both exogenous and constant and its level is neither too high (does not stop
all economic activity) nor too low (cannot be ignored). In the core of the analysis we assume
that insecurity is manifested “only” in the threat to each individual’s life.\textsuperscript{3} To reduce death
toll the government supplies security. Not only we assume investment in defense is done solely
by the government, but, to keep the model as simple as possible, it is also assumed that the
government does nothing but supply security.\textsuperscript{4} The costs of providing defense are, therefore,
the resources used in the production of defense, i.e., foregone current and future consumption.
The benefits are also clear: when a government produces more security, lives are expected to
last longer.

We use the “Blanchard-Yaari Model” of finitely-lived individuals in an infinitely-lived

\textsuperscript{2}The well documented inefficiencies in the procurement process of defense products are ignored in this work.
The coproduction of security by both private and public sector is an important issue we discuss elsewhere
(Tsiddon et. al., Cesarea 2002 Conference Papers (Hebrew)).

\textsuperscript{3}Tsiddon (1995) inspected two other effects of terrorism: (a) Terror induces personal stress or fatigue (or
perhaps inflicts an injury with a constant probability), which reduces an individual’s productivity over time.
(b) Terror causes damage to physical capital.

\textsuperscript{4}Since this work has nothing to say on the public finance aspects of defense expenditures, we think this
simplification is not too harmful. The fact that, in this model, the government deals only with defense helps
us to focus on the main thrust of this paper and does not imply anything about the relative importance of
other government activities.
demonstrate the costs and the benefits of defense expenditures, and to analyze the *optimal* response of a government to a certain level of outside terror.\(^5\)

Equipped with the above discussed framework we go to the data. First, we interpret the Israeli economy growth relative to that of the USA in light of the theory. We show that the theory that emphasizes the role of perceived security is helpful in understanding the observed correlations between economic performance and the outcomes of geopolitical events (wars and terror realizations). Second, we quantify the effects of terror on GNP, private consumption and private investment, using the Vector Autoregression (VAR) as the statistical reduced form framework for the economy.

We constructed a simple and intuitive index of terror outcomes in Israel. Using a simple VAR system, we show that the index of terror has a significant effect on the evolution of all important macroeconomic variables. We find the effect of terror to be significant both in (log) level VAR of GNP, consumption, investment and exports, with linear trend, as well as in a VAR of log-differences of these variables. The data strongly supports the claim that terror has a large negative and statistically significant impact on the short run dynamics of the economy.

To estimate the impact of terror on low frequency changes ("medium run" fluctuations) in output and consumption, we estimate the effects of the index of terror on changes in the trend estimated by the *H-P filter* of these variables. We find changes in the *H-P filter* data to be negatively correlated with the level of terror. We claim that these results are consistent with the view that the effect of terror is not easily washed away with time. Moreover, the effect of terror, that has been observed in Israel, has a long-lasting impact on the economy, while the wars that Israel has experienced have only a transient impact.

These effects are not only statistically significant, but they are of an important magnitude too. We find that the level of terrorism that Israel experience for the years 2001 - 2003, (which is similar in magnitude with the number of casualties in car accidents in the country), induces a drastic reduction in both output and consumption per capita. Our forecasts show that if

\(^5\)It should be noted that the structure of production of defense in the model is simple. See Trajtenberg (2003) for a recent analysis of defense research and development and structure of the terror threat on the economy.
terrorism prevails at its current level to the end of 2004 then per-capita GNP will be about 4% lower then if terrorism stops now. The same comparison for non-durable consumption per-capita shows a gap of about 10%!

Towards the end of 2000 output per-capita in Israel was around 55% of output per-capita in the US. By the end of 2002, after 2 years of terror, output per-capita in Israel was only 45% of output per-capita in the US. >From the end of 2002 to 2003:3 output per-capita in Israel is still on the decline and as noted above is predicted to decline further if terror prevails. Looking back at the 3 years of terror, output per-capita declined by over 5% while (nondurable) consumption per-capita declined by over 10%. During that period, the ratio of government expenditures on defense to GNP climbed up from hovering around the 9 percent of GNP to hovering around 12 percent of GNP.6

The rest of the paper is organized as follows. We first remind ourselves with the Blanchard - Yaari model. Second, we extend the model to allow for defense spendings and analyze the optimal government response to terror. The third step detours into a simple diagrammatic exposition of the main ideas. After we are equipped with the theory we go the data. We first give an overview of the economic history of Israel from the perspective of our theory. Second, we estimate different VAR systems to quantify the effects of the geopolitical situation as manifested by war and terror. In the last step we use data on tourism to analyze the quantitative role of substitutability on economic behavior at times of terror.

\section{The Blanchard - Yaari model}

This section describes the model we use parsimoniously. As noted above, the general idea we follow dates back at list as far as Irving Fisher and was first formalized in Yaari (1965). The model we use here is due to Blanchard (1986; hereafter Blanchard) and the specific version

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6The fact that output decreased by less than private consumption is due to the large expansionary fiscal policy that let the budget deficit to hike to around 6% of GNP (from around 3% target). Obviously, it is not feasible to maintain such a gap for an economy with negative per-capita growth rate, and, therefore, the government is currently decreasing the deficit. It is clear that in the absence of increased government expenditures, of which all went into additional defense expenditures, the decline in GNP would have been much larger.
of the model that we follow is taken from Blanchard and Fischer (1989; hereafter B&F).

### 2.1 Population

Population is composed of many cohorts at the same time. At birth, all individuals, both within as well as across cohorts, are alike. Three key assumptions make this model different from the classroom macro-model:

1. As a risk of terror or war, each living individual faces a probability of dying at any moment.

2. The probability of dying depends on the amount of resources the government spends on defense.

3. The more the government spends on defense, the less probable are individuals to die.

For simplicity it is assumed that the probability to die per unit of time, \( d \), is constant through life. Note that perhaps unrealistic for life in general, in the context of terror, this assumption seems innocuous. Moreover, Yaari (1965) analyzed the effect of uncertain life-time on the individual’s economic behavior and showed that under some fairly general restrictions (e.g., continuity, differentiability, etc.) the solution to the individual’s optimization when life is uncertain is very much of the same kind as in the constant-death-rate case analyzed in Blanchard. The constant death rate is however key to the aggregation performed in Blanchard and used below.

Given the constant death rate, time to death is exponentially distributed, and the expected duration of life is \((1/d)\). We assume that an exogenous increase in the threat of terror (or war) by a rise in \( d \); A higher level of terror, every thing else equal, means a higher (perceived) probability to die.

The assumption that an increase in government expenditures on defense increases security implies that, holding the exogenous threat constant, a rise of government spending on defense decreases \( d \). For simplicity, it is assumed that government expenditures are constant, are financed by a lump-sum tax, and are spent only on defense. Less innocuous, is our assumption

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7. A brief look at the Israeli experience suffices to make this clear (Tsiddon in Cesarea Report, 2002, (Hebrew)).

8. We abstract from any form of response to the change in defense by the enemy (terrorists).
that the government is the only provider of security services.\footnote{Individuals have a clear incentive to take direct actions against terror at their own costs. The optimal mix of private and government funding in the war against terror (as in any other type of war), is a very important issue which we relegate to another work.}

Given the above structure, each individual maximizes his expected utility:

\[
E \left[ \int_t^\infty \log c(z) \cdot \exp \left[ -\rho(z - t) \right] dz \mid t \right], \tag{1}
\]

where \( E \) is an expectation operator, \( t \) is the time at which the maximization is done, \( z \) is the index of time, \( c(z) \) is the consumption at time \( z \), and \( \rho \) is the subjective rate of time preference. Equation (1) implies that the instantaneous utility is logarithmic; the saving function is simple and individuals have no bequest motive.\footnote{Yaari shows that a direct bequest motive does not change much.}

At any instant of time a new cohort of individuals is born. Each cohort is formed by a continuum of similar agents. The continuum, when born, is of measure one. At the moment of birth, due to the external conflict, each cohort suffers casualties of the size \((1 - d)\). Thus, while each individual’s life is uncertain, the initial size of the cohort upon entering the workforce is \( d \), and the rate at which the cohort size decreases over time is \textit{deterministic} and equals \( d \). Therefore, at any time \( t \) population size equals:

\[
\int_{-\infty}^{t} d \cdot \exp \left[ -d(t - s) \right] ds = 1. \tag{2}
\]

Each individual faces uncertainty about duration of life. However, in the aggregate there is no uncertainty. Since individuals maximize their expected utility, and since this is a model of complete information, there is a clear role for insurance in the form of an annuity market or a pension plan. The insurance arrangement is as follows: As long as a person is alive, he gives (pays) \textbf{all} his non-human wealth, \( v_t \), to the insurance company. In return, at every instant, he receives a premium. When a person dies, the insurance company gets all that person’s non-human wealth (positive or negative) and his human wealth disappears. This arrangement is similar in spirit to a pension-plan, except that the premium paid out by the insurer starts at birth. Given the constant death rate, and a competitive-zero-profit insurance market, Blanchard showed that a constant premium is sustainable and efficient and that with free
entry and zero profit insurance companies, the premium an individual gets is \( d \cdot v_t \) per unit of time.\(^{11}\)

### 2.2 Individual consumption

Denote \( c(s, t), w(s, t), v(s, t) \) and \( h(s, t) \) as consumption, labor income, non-human wealth, and human wealth at time \( t \) of a person belonging to the cohort born in \( s \) (\( t > s \)). Using the exponential probability density of death one can rewrite equation (1) as:

\[
\int_t^\infty \log(c(z)) \exp[-d(z - t)] \exp[-\rho(z - t)] dz = \int_t^\infty \log(c(z)) \exp[-(d + \rho)(z - t)dz].
\]

The only difference between (3) and the usual infinite horizon maximization problem, is that the discount rate is not only the subjective rate of time preference, but it is augmented by the death rate. This feature of the model implies that every economic activity is affected by significant changes in the (perceived) death rate.

The maximization of the utility (3), subject to: (i) a person’s dynamic budget constraint, and (ii) the return to savings satisfies the annuity insurance market institution that we describe above, was shown by Blanchard (1986) to provide the following consumption decision rule:

\[
c(t) = (\rho + d)[v(t) + h(t)].
\]

In this decision rule \( v(t) \) is the non-human wealth of the individual at time \( t \) and \( h(t) \) is the individual human capital at each date \( t \).\(^{12}\)

### 2.3 Aggregate dynamics

Assume a closed economy, and suppose, momentarily, that: (i) \( d \) has a “natural” positive level although there is no conflict, and (ii) government expenditures are zero. Under these conditions, Blanchard characterizes the behavior of all aggregates in the economy by:

\[
C(t) = (r - \rho) \cdot C(t) - (d + \rho) \cdot V(t),
\]

\(^{11}\)The insurance company is exactly balanced at every moment since it receives \( d \cdot v_t \) from those who die and pays our \( d \cdot v_t \) to those who are alive. For a more detailed discussion of this arrangement see Yaari (1965) and B&F (1989).

\(^{12}\)As standard in these models, we rule out non-stationary solutions in the form of a consumption path that could go to an infinite debt (“Ponzi games”). The formal definitions of \( v(t) \) and \( h(t) \) are given below.
\[ \dot{V}(t) = rV(t) + W(t) - C(t), \]  

where \( r \) is the risk-free rate-of-interest.

To close the model one must specify the risk free rate. Assume the aggregate production function, \( \Gamma \), is CRS and:

\[ F(K) \equiv \Gamma(K,1) - \delta K, \]

where \( K \) is the stock of capital, 1 is population size (Equation 2), and \( \delta \) is the rate of depreciation.\(^{13}\) Since capital stock is the only form of non-human wealth, the other equilibrium condition is \( V = K \). Using equations (5)-(7) and \( V = K \) one gets:

\[ \dot{C} = [F'(K) - \rho] C - (d)(d + \rho)K, \]

\[ \dot{K} = F(K) - C. \]

Absent initial conditions, these two equations provide a complete characterization of the economy that does not face a threat of terror or war. This characterization is depicted by the loci \( CC \) and \( KK \) in Figure 1. As was shown in Blanchard the equilibrium in this model is of the saddle-path type and its only, non-trivial, steady state equilibrium is of less capital, higher rate of interest and lower consumption than in the equally sized Ramsey economy.

3 Aggregate behavior in face of a conflict

3.1 Preliminaries

To maintain death rates under (some) control, the government takes actions against opponents. Needless to say, these actions cost money. The production function of defense is characterized in the following assumption:

**Assumption:** Resources the government devotes to defense increase the expected duration of life; the more the government spends the longer is life expectancy. Government spending on defense affects life expectancy at a decreasing rate. Government effect on security is bounded

\(^{13}\)We elaborate below on a different interpretation that the depreciation rate could get in the context of terror or war.
from above, it cannot make life infinite. Defense is financed efficiently. The production of security uses the same factor mix as output does and there are no increasing returns to scale.\textsuperscript{14}

Momentarily, the level the government chooses to invest in defense is assumed exogenous. Since this work deals only with steady state effects, we assume that government expenditures on defense, $G$, are constant over time. Given the above assumption, \textit{Equation (10)} summarizes the effects of defense expenditures on the death rate, $d$:\textsuperscript{15}

$$\begin{align*}
d = d(G) & ; \quad 1 > d(0) > 0 ; \quad d'(G) < 0 ; \quad d''(G) > 0 ; \quad 0 < G < F ; \quad d(F(\cdot)) > 0 . 
\end{align*}$$ (10)

It follows immediately from the structure of the model that when government expenditures on defense are positive, constant, and are financed with a non-distortionary lump sum tax of size $G$, then the $KK$ locus shifts down by a constant $G$.\textsuperscript{16}

Assume now that the rate of death increases due to, terrorism, a continual state of war, an ongoing "low intensity conflict", or due to any other form of conflict that endangers human life. It is easy to show that an increase in the death rate $d$ tilts the locus $CC$ to the left (counter-clockwise).

\textit{Lemma 1}

(i) The steady state in the Blanchard model is necessarily comprised of a lower capital stock and a lower level of consumption than in the Ramsey model.

(ii) The higher is the death rate, $d$, the lower are capital stock and the level of consumption in the steady state (the deviation from the Ramsey model increases as $d$ increases).

\textit{Proof:} immediate.

\textit{Figure 2} depicts the two partial effects of the conflict in a terrorized economy when the government invest bringing security to its citizens. \textit{Figure 2.a} shows the effect of the rise of insecurity; The $CC_0$ represents the low-terror locus of stationary points (the "\textit{Euler Equation}"). $CC_1$ represents the case the death rate has hiked due to the external conflict, and $CC_G$ stands for the case the government has increased its defense spending to reduce death toll. \textit{Figure 2.b} shows the effects of government expenditures on available resources

\textsuperscript{14}Perhaps each of these assumptions is challenged in the literature of defense economics. We find however that this simplification is essential for the points we would like to make.

\textsuperscript{15}One could make less restrictive conditions on the production of defense at the cost of more notation.

\textsuperscript{16}The region where $KK$ becomes negative is excluded from the discussion by assumption.
(the “dynamic budget constraint”); $KK_G$ depicts the locus for the resource constraints when government expenditures are constant and larger than zero.

With a rise in the death toll, the market generates a lower level of security.\footnote{It is not essential to follow our extreme assumption that the market produces no defense. All needed is that a government invest in defense more than the market does.} With lower security, individuals die at a faster rate ($CC_1$ in \textit{Figure 2}). With a shorter expected life the individual’s incentive to save is lower, thus pushing down both steady state capital stock and steady state consumption.

In a world where the government invests in defense to offset terror (or war) life is longer, and, therefore, the incentive to accumulate is stronger ($CC_G$). On the other hand, government expenditures can come only at the cost of a decline in resources available for private use. In this world, therefore, the claim that government expenditures reduce steady state consumption (or investment) is not necessarily true. It may very well be the case that with an appropriate level of government expenditures on defense both equilibrium and steady state consumption are higher than otherwise, and, therefore, consumption and utility are higher with government military buildup than without.

3.2 The reaction of the government to insecurity

This section analyses the case that facing a probability to die, $d$, the government decides to increase investment in defense. Since the Blanchard model is based on both individual maximization and explicit aggregation, only minor changes are necessary in the set of equations that depicts the dynamic system. These changes amount to linking government expenditures, $G$, to the decline in the death rate $d(G)$.

Under the assumptions specified above, the equations that characterize the dynamic evolution of the economy become:

\begin{align}
\dot{C} &= [F'(K) - \rho] C - (d(G))((d(G) + \rho)K, \tag{11} \\
\dot{K} &= F(K) - C - G \tag{12}
\end{align}

where all variables were denoted above and $d(\cdot)$ has the properties as defined in \textit{(10)}.\footnote{It is not essential to follow our extreme assumption that the market produces no defense. All needed is that a government invest in defense more than the market does.}
For this system of equations to maintain the local saddle path stability of the original system some technical assumptions on the co-behavior of $d(G)$ and $F(\cdot)$ are in necessary. Since these assumptions do not shed new light on the economics of this model, and since almost nothing is empirically known on the function $d(G)$, we assume that all the necessary technical assumptions hold. The system (11)-(12) is, therefore, saddle path stable.\textsuperscript{18} Throughout this work we assume parameters are such that both the model’s equilibrium saddle path property as well its local uniqueness are maintained.

An increase in government spending on defense, $G$, affects both equations. Suppose that the government collects a constant $G$ with a lump-sum tax. Holding the $CC$ curve momentarily fixed, an increase in $G$ shifts the $KK$ locus down to reduce the steady-state levels of capital, investment, and consumption (Figure 2.b). Resources that the government use crowd out both consumption and investment. The exact extent of the burden on consumption or investment depends on the slope of the $CC$ curve at the steady state. The steeper the $CC$ locus, the greater is the burden on consumption.

In this model however, government expenditures are not a waist. Government expenditure are all spent on the production of defense to make life safer and longer. Government expenditures, therefore, have an impact on the $CC$ locus. An increase in $G$ increases the expected duration of life (reduces $d$). Suppose, momentarily, that defense comes free, i.e., a reduction in $d$ is achieved with no shift in the $KK$ locus. A decrease in $d$ (an increase in the expected duration of life) tilts the $CC$ locus to the right, (from $CC_1$ to $CC_G$ in Figure 2a) and increases consumption, investment, and the capital stock at the steady state. Thus, an increase in security, or personal safety, as long as it is realized in safer and longer life, has exactly the opposite effect of government expenditures on the steady state levels of consumption, investment, and the capital stock. On the one hand the (balanced budget) finance of government expenditures “appropriates” real resources and, therefore, reduces steady state consumption and investment. On the other hand, security, or personal safety, by extend-

\textsuperscript{18}One need to make sure that around the steady state, the Jacobian is well defined and negative-definite, i.e., that all derivatives exist and that for $K$, around the steady state level of $K$, the following equation holds:

$$F''(F' - \rho) + F''(F - G) - d(G)(d(G) + \rho) < 0.$$
ing the expected duration of life, increases the desire to save, and, therefore, increases both consumption and investment in the long-run. If defense expenditures are used efficiently, it possible to get an increase consumption, investment, and the capital stock in the steady state.

In such a world, as long as the equilibrium remains locally saddle-path-stable and unique, there is a clear role for (a well bounded) government intervention. The role of government is to extend life and it does that by using resources to increase personal security. While general statements about utility are impossible without more structure, it can be shown that a government that wants to maximize steady state output invest in defense as much is needed for equation (13) to hold. A government that wants to maximize steady state consumption invest in defense to satisfy equation (14).19

\[
(F'(K, 1) - \rho) = -d'(G) \cdot K \cdot (2d(G) + \rho)
\]

\[
K \cdot F''(K, 1) \cdot [-d'(G)](2d(G) + \rho) = [F''(K, 1)]C + d(G)(d(G) + \rho)
\]

The case for an active role for a government in the production of security is depicted in Figure 3. Whether a country can act to reduce death toll while consumption, output, or both increase depends on the exact functional forms. Figure 3 depicts a case in which the government can decrease the death rate to increases private consumption and the capital stock.20

This section established the fact that there are circumstances a government can and should act to reduce death toll. Two assumptions make this setup better suited for the analysis of external conflicts in the form of terrorism or in other forms of “low intensity conflicts” and less adequate to either wars or car accidents: (i) The model imposes a continuous long run impact of the external conflict - the death rate. (ii) The market does not provide an optimal level of protection.

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\[19\] Each of the equations (13) and (14) holds for the values of the capital stock and government expenditures in its own steady state. Since these values are not the same one cannot make a direct inference on the relation between the two by comparing them.

\[20\] It should be noted that no dynamics are to be inferred from these steady states. The model cannot deal with a dynamically changing distribution of living individuals.

13
3.3 The optimal reaction to insecurity

There are a number of ways to analyze the optimal steady state reaction of a government to an exogenous level of insecurity. Suppose an external conflict inflicts death at constant rate upon individuals in an economy. One possible goal of a government is to maximize the utility of the representative individual. Since we analyze the steady state, and since in the steady state consumption is constant along life and across all living individuals, maximization of utility amount to the maximization of discounted integral of steady state consumption over the expected length of life. In the steady state consumption equals net production, $F$, minus government expenditures on defense (government taxes), $G$. Thus, one can integrate Equation (3) from time zero to infinity to get the total steady-state-expected-lifetime utility of individual $i$, $U_i$. It is assumed hereafter that the goal of the government is to maximize $U_i$, which is given by,

$$U_i = \frac{\tilde{F}(G) - G}{[d(G) + \rho]}$$

where $\tilde{F}$ is the steady state value of net production when the government invest $G$ in the production of defense (in Figure 3, $\tilde{F}$, is the (net) production at the intersection of $CC_G$ and $KK_G$).

Simple calculation shows that a government that maximizes Equation 15 choose $G$, such that Equation (16) is satisfied.

$$\frac{\tilde{F}(G)'}{\tilde{F}(G) - G} = \frac{d'(G)}{d(G) + \rho}$$

OR

$$\frac{\tilde{F}(G)'}{[\tilde{F}(G) - G]} = \frac{d'(G) \cdot G}{[d(G) + \rho]}$$

where $\tilde{F}(G)$, $\tilde{F}(G)'$ are the net production and the net marginal product at the steady state, respectively.

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21 We choose this criterion for the government although this is not the only criterion that seems to fit our case. Government intervention affects the “replacement rate” of individuals in the economy - an issue which is to the best of our knowledge not yet dealt from a utilitarian perspective.
Since $d'(g) < 0$, an optimal intervention of a government implies that $\frac{\Delta F(g)}{\Delta g} < 1$. This is immediate. When government expenditures increase both instantaneous consumption and the expected duration of life the government should continue to increase. Optimum exists only at level where extending life comes at the cost of a decline in steady state consumption. The LHS of (16) is the elasticity of steady state consumption with respect to changes in government expenditures. The RHS of (16) is just the elasticity of the total economic rate of discount with respect to government expenditures. Hence, Equation (16) implies that at the optimum, the elasticity of consumption with respect to government expenditures equals the elasticity of the total economic discount rate with respect to government expenditures. If one momentarily sets $\rho$ to zero, then, at the optimum a percentage decline (increase) in the death rate must be accompanied by a percentage decline (increase) in consumption. When $\rho > 0$, ‘a percentage change in the death rate’ should be replaced with ‘a percentage change in the total economic discount rate’.

To simplify the discussion below we assume:

$$d(g) = d_{\text{max}} \exp(-a\rho) - \rho, \quad F > g \geq 0, \quad 1 > d_{\text{max}} > 0, \quad a > 0.$$  

Thus, when the government does not spend on defense the death rate is finite and strictly larger than zero ($d_{\text{max}}$). The larger are expenditures on defense, the lower is the death rate (the death rate never gets down to zero). The sole purpose of deducing $\rho$ is to save notation. Given Equation (17) the elasticity of insecurity (or, the total economic discount factor) with respect to government spending equals $(-a\rho)$ and the RHS of the first equation in (16) is constant and equals $(-a)$.

Assume that government expenditures on defense are at their optimal steady state level. Suppose now the world is changing in an adverse way, i.e., for every level of defense expenditures, the death toll becomes higher. Assume further that $d_{\text{max}}$ increases while $(-a)$ does not change.

Compare now the two “optimal” steady states. Before the government chooses to change its intervention, the rise in $d_{\text{max}}$ reduces steady state discounted utility. Also, the rise of $d_{\text{max}}$, since it changes the incentive to save, decreases steady state production, $F$, and, thus, increases the steady state net marginal product, $F'$. The latter two forces cause Equation
(16), not to hold. Inspection of this equation reveals that at the new optimal steady state when $d_{\text{max}}$ is higher, the optimal proportion of defense expenditures to consumption is higher (the government spends a higher percentage of total output on defense) but the increase in spending does not fully offset the rise in insecurity. At the new steady state people have less consumption and shorter lives.

3.4 Two simple extensions

Terror and the depreciation of wealth. A major effect of an act of aggression, whether in the form of a war or continuous terror, is to be found in its effect on individuals’ wealth. 9/11 is a clear case for the destruction of capital. The simplest way to capture this effect is to assume that the depreciation rate, $\delta$, is a function of government expenditures on defense. The more security services the government provides, the less likely it is that the conflict will damage wealth (capital is the only form of wealth in this model). Thus, the depreciation function, $\delta$, now becomes $\delta(G)$ with $\delta'(G) < 0$. In this case, a higher $G$, while it shifts the $KK$ vertically down due to the reduction in private resources, also tilts it up and to the right (Counter-clockwise). While the downward shift is due to the reduction in private resources, the counter-clockwise tilt is due to the increase in the net productivity of capital. The total effect of investment in defense activities is, therefore, ambiguous. Even with this simple consideration, which resembles the effect of a conflict on property rights, it is easy to come up with examples where defense expenditures encourage investment in productive capital and foster steady state consumption.

Terror and human capital. Tsiddon, (1995) discussed also the effects of individual psychological stress on the labor force that accumulates as the conflict evolves. Stress, could also be relabeled as a probability to be injured in the conflict. A third interpretation of this “stress rate” is that as the conflict continues, individuals divert activities from the market to less efficient non-market activities (hide in the forest, stop shopping down-town, etc.). As long as “stress rate” is independent of the death rate it can be incorporated into the analysis.
4 Death, fears and the discount rate

The model we use is fairly specific. Needless to say, we have no evidence terror is distributed exponentially. Moreover, terror is not exogenous. The time and place it hits crucially depends on the timing and type of expenditures that are put into preventing it. In most countries that are subject to terror, actual death toll caused by terror is not high. Given these three facts one can question to what extent the above argument can stand as a useful tool to analyze the effects of terror on economic activity.

It is important to note that, in a general utility maximization, Yaari (1965) shows that an increase in randomness of life expectancy is translated into a rise of the discount factor. It is shown there that under fairly general conditions about the distribution of death, and even if there exists a direct bequest motive, randomness in life is translated into discounting the future; the higher is uncertainty, the further away the future looks and the higher is the discount rate. Specifically, in Yaari’s setup, uncertainty can vary over time and need not be memoriless. In general, it can be shown that an increase in terror can be translated into a decrease in the discount rate. In fact, the restrictions used in Blanchard (1986) are required for the aggregation and not for solving the consumer problem. We can only conjecture at this stage that a more general model of uncertainty will produce similar steady state behavior as we get in our specific example. Fisher (1930) was the first to make such a conjecture in a different context.

An important additional issue regarding the empirical implications of the theory is related to the magnitude of death due to terror. In the context of the Israeli case, we observe a very low increase in the probability to die due to terror, nonetheless, economic slow-down is large. Why? One way to consider this issue is done by Nir (2003) who analyzes a similar model to ours with the difference that individuals subjectively evaluate their probability to die. Following Kahanman and Tversky, and given the fact that terror events have small probability but each event can hit life in a different way, the perceived impact on the probability to die may be larger than the actual one. In an OLG setup this formulation generates results similar to the results presented here while a small change in the probability has a relatively large impact.

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22 At its peak terrorism in Israel cause the same death rate as the death rate due to car accidents.
5 A diagrammatic exposition

In this section we present a set of diagrams that summarize the interlinks between economics and defense. This exposition provides the basis for a more general discussion.

Figure 4.a is the production function of defense. It stands within the lines of Equation (10). With no expenditures the death rate is \( d_{\text{max}} \), as expenditures on defense increase the death rate declines at a declining rate (so life expectancy increases at a slower and slower rate). However, even if all available resources are spent on defense, absolute security cannot prevail \( (d_{\text{min}} > 0) \). Note that in the diagrammatic exposition we keep the assumption that defense expenditures are used efficiently to reduce death toll. At times, however, political constraints or other, less direct, government goals, are put on the production of defense. In such cases, non economic bounds on available resources, or on the transformation from expenditures to output (a reduction in the death toll) may change the nature of the production function from the neoclassical. With the help of the diagrammatic exposition below one can see that as long as equilibrium exists, such constraints do not change it qualitatively.

Figure 4.b presents the transformation from defense expenditures to defense output (a reduction in the death toll) when the outside threat is considered. Clearly, with zero production of defense, the threat to life exists at an exogenous level. When the threat is higher and nothing is invested in providing security the death toll is higher. Figure 4.b accounts for this fact. The exposition here include the constraints from Equation (17). The shift in the production function of defense is assumed homothetic. The fact that the nature of the production function of defense does not change much with a rise in outside threat is an important ingredient of our results. \( d_{\text{min}} 1, d_{\text{min}} 2, d_{\text{min}} 3 \) all represent a sequence of exogenously deteriorating levels of security that defense expenditures are used to attenuate. \( F \) denotes an upper bound on defense expenditures, for simplicity of exposition we keep it constant and not binding throughout our diagrammatic exposition.

Figure 5 presents an indifference map between “two evils”: (i) Individuals dislike early death. (ii) Individuals dislike giving up available resources for present consumption (pay taxes). However, as the future gets shorter and shorter individuals are willing to pay more and more in terms of current consumption to prolong life. Clearly, individuals do not care about a unit of expenditures spent on defense. What they do care about is the forgone current
(marginal) utility (which is used to provide a future). Thus, although the indifference map is drawn in the $G - d$ space, one should be careful not to draw conclusions on size of investment in defense but only on the relative size of investment in defense (i.e., the conclusion is only with regards to $G/Y$). Given the increased willingness to give up on current consumption, when life becomes shorter, the indifference curve becomes steeper as the death rate increases. Also, as we go to the right, we go wrong. An indifference curve which is more to the right represents a higher initial death rate and, therefore, a lower level of utility. Given the fact that both death and postponement of consumption are ‘bad’ events, the utility increases as we move towards the origin.

In this model resources for defense are all provided by the government. It is important to note, therefore, that the indifference map is orthogonal to the way defense is being produced and, therefore, one could extend these diagrammatic exposition to account for private investment in defense. Figure 5 is a diagrammatic representation of Equation (15). Note that while the numerator of (15) is equal to steady state production minus government expenditures, the indifference map is drawn in the $G - d$ space, where $F$ (output) is exogenous.

Figure 6.a presents the partial equilibrium level of expenditures on defense. With a low level of threat the equilibrium level of expenditures, and the equilibrium death rate are depicted by the coordinates of $E_1$. If the exogenous threat is higher, and output is to be kept constant, then expenditures on defense would have been necessarily higher, the equilibrium death rate would have been higher, and utility would have been lower. This is depicted in the figure when comparing $E_2$ (high exogenous threat) to $E_1$ (low exogenous threat). The lower level of security at $E_2$ implied that Figure 6.a is only the first step. Figure 6b is drawn to expand on this effect. Its upper quadrant replicates (6.a) with one change: as we move horizontally, right along the indifference map, “from one curve to the other” the curves become flatter. This is done to account for the income effect. That is, as we move to the right, equilibrium output is lower, such that giving up resources to extend life, becomes more expensive in terms of forgone current utility. Its lower quadrant shows that with a decline in equilibrium security, the incentive to wait for output in the future declines, and, therefore, long run output declines. Without specifying functional forms one cannot conclude whether...

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23 It is a partial equilibrium since output in this figure is kept constant.

24 Remember that a homothetic indifference map is drawn for a fixed level of output. The decline in the
the optimal spending on defense goes up or down when the threat increases. However, the proportion of output spent on defense necessarily increases. Figure 6.b is drawn for the case that when the threat of death is high, \( G_{crisis} \), that stands for the optimal spending on defense is higher than \( G_1 \), the optimal spending on defense when the threat to life is relatively low. At \( G_{crisis} \) the level of long run output is \( F_{crisis} \).

6 A Case Study: Israel

Israel is a country that from the early 1960’s reached the level of GDP per-capita that is about one-half the US GDP per-capita (Figure 7). From its very first day Israel has experienced several wars and periods of terror, each ended with different geopolitical and economic outcomes. These events make Israel an interesting case for an empirical evaluation of the above theory of terror, security and defense expenditures. Our goal is to evaluate how this theory can help us to interpret and analyze the economic impact and potential policy response to times of terror and times of wars of which each had its own different implications on individuals’ perception of security as well as on the perceived life expectancy.

We divide our empirical analysis to two parts. The first part is composed of three stages. In its first stage, we review the stylized facts about main changes in GDP per-capita ("low-frequency") and point out how wars and periods of terror might be related to these documented changes. This part is intended to show that the model is able to shed new light on how one interpret low frequency changes in the GDP per-capita growth rates affected by changes in the geopolitical environment due to certain events. The second stage focus on the business cycle ("high frequency") co-movements of GDP (\( GDP \)), consumption (\( C \)), exports (\( EXP \)) and investment (\( I \)) per-capita with exogenous levels of terror activities (\( TER \)) and a war dummy variable (\( WAR \)). The main idea is to hypothesize that the business cycle

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amount of available resources makes investment in defense more costly in terms of forgone current consumption. That tilts the indifference map counter-clockwise, and, therefore, lifts the death rate further up.

\(^{25}\) Much of the literature in defense economics is about the relationship between defense expenditures and growth. This model, or even the above diagrammatic exposition shows that this is a wrong question to ask. The link from defense expenditures to growth and back goes first and foremost through the threat the economy faces. Absent threat this discussion is irrelevant. With threat the discussion cannot be done until threat is seriously taken into account.
movements of these aggregate macro variables, which are all endogenously determined in the model, show statistical significant changes in response to exogenous realizations of the level of terror \((TER)\) and indicators of war \((WAR)\) periods. Once high frequency correlations are documented, we conduct the third stage; using simple \(H-P\) filter, we decompose the data into low and high frequency movements and test our assumption that terror \((TER)\) impacts the low frequency, medium term, evolution of the economy.

In the second part of our empirical analysis we turn away from macro-data to the industry level and analyze data on tourism in Israel. We look at the behavior of Israelis and foreigners by number of bed-nights in Israel in order to document the impact of terror on the demand for goods (tourism) that have different elasticities of substitution. This inspection goes beyond the theory. These evidence can help us to look at the impact of terror in terms of changes in relative prices of goods, rather than on aggregate variables that affect directly all sectors of the economy. The different impact on different products may cause some aggregate changes such as making investment (in housing, hotels, etc.) obsolete when terror increases. We return to these issues towards the end of that section.

### 6.1 An Overview of the Israeli Economy: 1950-2003

This section uses the above theoretical framework as a way of interpreting the observed correlations between wars and terror episodes and the performance of the Israeli economy.\(^{26}\) Israel became independent in 1948 during a war that involved local Palestinian militias, and the Egyptian, Jordanian, Iraqis, and Syrian armies. The war ended with an Israeli victory but at a large cost of many casualties and brought upon a major economic contraction.\(^{27}\) At the same time the population of Israel grew at more than 25\% annually from about 650 thousands to almost 2 million from 1948 to 1952. Although the wave of immigrants brought practically no wealth with them, GDP per-capita grew at about 5 percent annually. It is certainly the case that the success in the war and the establishment of a Jewish state, as

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\(^{26}\)This description is not a brief history of the Israeli economy, but a casual attempt to use theory above to shed new lights on the association of GDP per-capita changes and geo-political major events.

\(^{27}\)The number of Israeli soldiers and civilian death and wounded of the 1948 War was much larger than any war later, including the October 1973 Yom Kippur war. The Jewish community in the country lost about 1 percent of its 650,000 population.
well as the large inflow of population cause a positive change in the rate of the individual security and the perceived life expectancy in Israel. It should be noted that the population was dominated by immigrants from Eastern Europe and from the Arab countries, who have survived the holocaust and the overall oppression that Jews have experienced from late 1930’s to 1948. In Israel in the early 1950’s we observe a very high rate of savings and an overall optimistic view. For the first time in decades Jews in Israel could hope for better life.

From 1950 to 1965 growth in GDP per-capita was among the highest in the world (Figure 7). At the early period, 1950 to 1956 Israel was under terror attacks from Jordan and Egypt (Gaza Strip) which were contained due to both the successful counter-terror military activities and the Suez war that Israel coordinated with the British and the French (1956). Once a wide international and active basis of support for containing terror from Jordan and Egypt was gained, Israel withdrew from Sinai. The overall level of security in Israel was on the rise and the main focus was on economic development. Defense expenditures were kept low relative to GDP (Figure 8) and the government instructed the army to make sure that wars are to be carried away from civilian centers and should be concluded fast. Those instructions where given in order to minimize the economic costs of a war which was always expected.28

The levels of private and public savings and investment in the period until 1965 was large. The recession of 1965-67 result from a drastic change in government investment policy and other issues, all not related to external insecurity. Nevertheless, in part, the low GDP in 1967 was due to the long period the reserve army was all drafted prior to the 1967 war. Israel was isolated in May 1967 where the armies of Syria, Jordan and Egypt where ready to attack. USSR supported Syria and Egypt and the US, UK and France shifted to a neutral position.29 In June 6 Israel attacked Egypt, Syria and Jordan and in 6 days defeated all three armies. Clearly, that unexpected success in the Six Days War increased substantially

28During that period the major economic costs a war was the halt of almost all economic activity due to the fact that the counter-attack capacity of the IDF (Israeli Defense Force) was built on a draft of almost all working men in prime age (“reserves”). A small country with many enemies could not rely on a professional army. “Peak-load” pricing made the use of a large reserve army the only way Israel could survive and thus wars are to be designed to be short and to take place on the enemy’s land.

29These three countries where the main source of military equipment for Israel at that time. In May 1967 they announce that they stop all sales of military equipment to Israel. Germany supplied Israel with gas masks since at the time the Egyptians use gas in the war they defeated in Yemen.
the level of perceived security, life expectancy and self confidence of the people of Israel. 
The large growth that followed during the years until October 1973 is consistent with the 
predictions of our theory and certainly can be related to the impact of the war on perceived 
individual security. It is important to point out that the military actions and terror activities 
that followed the 1967 war were all far away from the urban-economic centers of the country 
and did not require a shift from the civilian labor force to military uses in the form of reserve 
military service as was the case during the 1948 war.30

At the eve of the Yom Kippur War in October 1973 the GDP per-capita of Israel was 
about 56% that of the US, relative to less than 40% 25 years before in 1948 (Figure 7). At 
the time, economic policies were influenced by high private savings rates and large public 
investment, and a large increase in the stock of human capital. Growth was also influenced 
by the economic policies of micro management that promoted by the socialists in the eyes of 
some, or social-democrats in the eyes of others, governments. There are many competing and 
complementing explanations for this economic success, one of them, which we promote here, 
is that this period is associated with relatively low levels of defense expenditures relative to 
GDP (Figure 8) that, given the perceived threat, generated increasing and very high levels 
of security and life expectancy in the Israeli population.

The Yom Kippur war was a major shock to the country. The level of individual security, 
the confidence in the power of the IDF and the intelligence community to contain Arab 
aggression within few days, even if it comes as a surprise attack, all collapsed. As a response to 
this hike of insecurity, the government increased substantially the level of defense expenditures 
relative to GDP. This rise in defense expenditures went far beyond rebuilding inventories and 
was independent of the economic performance. The large economic and military support 
from the US overcame part of the large decrease in the level of individual security and life 
expectancy in two ways: (i) It crowded out some of the expenditures the government would

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30 Following the 1967 war Israel was attacked by Palestinians from Jordan which ended with few invasions of
Jordan by Israel and the expel of the Palestinian leadership to Lebanon. At the same time the Egyptian army 
attacked Israeli positions along the Suez Canal. These attacks also ended with a cease fire agreement in 1970 
and overall where viewed as Israeli success in containing Arabs attempts from damaging the Israeli economy 
and society. The outcome of these wars should be interpreted as overall increasing the level of security of the 
Israeli population.
have done otherwise. \textit{(ii)} At last Israelis had super-power to offset growing fears from the Soviet Union. Important as US aid could be, there is no question that the high level of defense budget that hovered around 30\% of GDP helped to balance the immediate impact of the 1973 war on the level of individual security. On the other hand, the increase in defense expenditures contribute to the high level of budget deficit that was financed by increasing domestic and external debt. The economy experienced a large economic slowdown that has been attributed directly to the war, and the Israeli GDP per-capita reduced to about 47\% of the US GDP per-capita. At the aftermath of the Yom Kippur war Jewish population in Israel went down for the first time since the beginning of the century, and the overall prospects for a Jewish state in Israel reached a new low levels among both Israelis and non-Israelis supporters of the Jewish state.

1978 was a new beginning. The peace process that quickly developed into the Egypt-Israeli Camp David accord dramatically reduced the prospects for major war at the scale of 1948 and 1973. Given the fact that Egypt was the strongest enemy of Israel at the time, this peace process and peace treaty were indeed a great change in the individual and the national security. It became clear that the great danger for the Israel existence as a state has been removed. Growth of GDP per-capita was high. If it was not for the mismanagement of the economy with excessive defense expenditures (still 25\% of GDP, \textit{Figure 8}) and high budget deficit (13\% of GDP) this growth could perhaps continue for many years.

Several points should be made. First, the defense expenditures went up rather than down as response to the peace treaty in 1980. Second, from 1978 the Israeli army was not successful in containing the shelling and terror activities from Lebanon as Israel successfully did in the 1950’s. The invasion of Lebanon by Israel in 1982 was a great military disappointment and signaled again, together with overall economic mismanagement, the instability and insecurity that exist in Israel given the unresolved disputes with Syria, Jordan and the Palestinians. However, all these negative military activities were far from the population centers of Israel, and did not change substantially the level of individual security among the majority of the people of Israel. Nevertheless, the impact of these unsuccessful military actions in Lebanon, the high inflation and the economy mismanagement caused the economic slowdown of 1982-
The unilateral partial withdrawal from Lebanon in 1985 and the stabilization of inflation by balancing the budget, exchange rate stabilization, US financial support and Central Bank independence enabled the economy to stop the deteriorating economic performance and return to what one may call "normal" economic growth under the level of insecurity existed at that time. The Palestinians in the West Bank and Gaza started in 1988 the first Intifada. This uprising involved mainly the collapse of the civilian Israeli occupation control of the West Bank and Gaza territories and did not affect the level of individual security of the people of Israel. The army was successful in containing the uprising to instability in the Palestinian cities where the level of insecurity of Israelis decreased but no one had to be there for any type of economic activity.

At the same time, in October 1989 the large immigration flow of Jews from the former Soviet Union started which amount to almost million immigrants by the year 2000. This immigration flow together with the collapse of the Intifada in 1991, and the first Oslo agreement of 1993 generated a sustained period of growth. Private savings rose significantly and the level of private and nation confidence increased. The level of GDP per capita relative to that of the US reached the 1973 peak of 57% in 1996, a year after Rabin’s assassination, after the first large wave of suicide bombing at the urban centers of Israel and after a subsequent deterioration of the peace process. A change in governments from the dovish to the hawkish and back, left the country unsure whether this clear deterioration in security is temporary or permanent.

The final collapse of the peace process and the beginning of the El-Akza Intifada in September 2000, that followed with a wave of terror into the Israeli urban centers has drastically reduced the level of individual security. Moreover, the nation’s belief in its capacity to survive reached a new low record only to “compete” with the time following the Yom Kippur war. For the first time since 1965 the GDP per-capita reduced by 3 percent in 2001 and 2002 while the economic performance of 2003 show that GDP will decline further by 1 to 2 percent.

Summary: A brief review of the history of Israel’s economic performance provides a case

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31 The budget deficit stayed at the 10 to 12 percent of GDP, the external and internal debt to GDP was rising and inflation accelerated to about 450% in 1984-5.
for the conclusion that war, terror and military activities that generated increase (decrease) in the national perception of security and increase (decrease) in individual perception of life expectancy, are associated with large swings in economic growth. The comparison to the US provides a benchmark for economic performance for a small open economy that depends crucially on it’s ability to keep the standard of living at a reasonable distance from that of the potential alternative place for the main existing Jewish population. It should be emphasized that many other factors affect economic growth and the discussion above did not try to make the point that the geopolitical state is the ONLY factor in affecting economic performance. Moreover, we did not even try to measure the relative importance of the defense and security level on the economic performance. We only made the point that the Israeli case provides a story of correlations overtime that is consistent with the implications provided by the above theory. The "arm chair" description above provides our best defense for the theory that claims that perceived and actual individual security has a large affect on economic performance. 55 years of wars and terror west of the Jordan river, provide a good number of stylized facts which are consistent with basic analysis of changes in security and economic performance.

6.2 Terror and the business cycle

The Israeli quarterly data from 1970 to 2003 provide the best case study to document the conditional empirical impact of terror and war on the high frequency and low frequency properties of the business cycle of GNP ($GNP$), investment ($I$), exports ($EXP$) and non-durable consumption ($NDC$).\footnote{These are the main variables included in any open economy model. We restrict our analysis to non-durable consumption since this part of consumption fits better the theory.} The four macro variables are set in logs of real per-capita terms. The terror variable, ($TER$), is the log of an index that is equal to 1 plus the of sum of the number of fatal Israeli victims of terror (multiplied by 1/3), the number of injured Israeli from terror (multiplied by 1/3), and the number of terror event (multiplied by 1/3). \textit{Figure 9} shows the graph of the log of this index. The war dummy (WAR) get the value of one for 1973:4 (Yom Kippur, 1982:2-3 (Lebanon), 1991 (first Iraq), 2003:1 (second Iraq). \textit{Table 1} provides the Basic VAR (standard vector autoregression) estimation of quarterly data with two lags and the exogenous variables are: the real interest rate ($R$) with one and two lags,
(WAR), the log of terror index (TER) at one lag, seasonal dummies and linear trend. The VAR estimated equations provide a very good fit to the data, except for investment (Figure A1).33

The war dummy (WAR) indicates that at time of war non-durable consumption and GNP per-capita are reduced by about 3.2%, while exports and investment are reduced by 14%. These significant results are consistent with the model and show an immediate and large response to unexpected war events that lasted for one to two quarters. The terror index captures the impact of the flow of terror activity in Israel. We find that one lag of this index has a significant negative impact on all economic activities. Again the impact on exports and investment is larger than that on non-durable consumption and GDP per-capita, as the coefficient is about -.02 vs. -.007, respectively.34

We estimated first difference VAR for the same variables without trend, for two reasons. First, this specification implies a stochastic random walk process for the trend as indicated by the co-integration model and, therefore, this specification provides a robustness check on the results of the standard VAR. Second, this specification is viewed to be a better model for forecasting macro economic variables (Stock and Watson, 1993). The important result, displayed in Table 2, is that the estimated coefficients of WAR and TER are about the same as in the basic VAR, both regarding the value of the estimators and their standard errors. That is, the war dummy indicates a 3.2 to 3.6 percent reduction in NDC and GDP per-capita, respectively, and the terror index (TER) has a lower (but smaller standard error), impact on NDC and GDP than on EXP and I. When multiplied by the average index of terror one sees that the effects of terror and war are of the same order of magnitude.

The results indicate strongly that wars and terror activities have negative aggregate economic impact that is consistent with the prediction of the model. That is, the model guides us to expect changes to affect the entire economic activity and not just some branches of the

33 It should be noted that the turning points of GDP at the beginning of 2001 fits well the data due to the terror variable.
34 It should be noted that we run many alternative specifications and many lag tests. We do find that in NDC and GDP equations the inclusion of non-linear effects of the terror index and the inclusion of a dummy for the El Akza intifada are not rejected. We preferred to present the equations in a common simple formate to avoid confusion and keep the transparency of the main results.
economy. Clearly, some activities, such as, exports and investment, are more sensitive but also more volatile in their response.

In order to analyze the quantitative importance of terror on the economy we provide in Figure 10a-10d predictions for the four variables under three alternative geopolitical cases:

1. Terror stops as of the second quarter of 2003 (2003:2)
2. Terror continues until the end of 2003 (2003:4)
3. Terror continues until the end of 2004 (2004:4)

For all cases we assume that as long as terror continues its continuation is at the average level of the period 2002:2-2003:1, the real interest rate is set at the average level of 2002:2-2003:1 and the error term is set to zero. The implications on the GNP per-capita growth rates are strikingly interesting. Without terror the GNP per-capita grow at about 4 percent from 2003:2 to 2003:3 and Israeli per-capita income gain about one-half of the loss from the beginning of the intifada at the forth quarter of 2000 (2000:4). If the terror would have ended by the end of 2003 we should expect about zero per-capita growth rate, and if terror continues for the entire next year, GNP per-capita is expected to decrease by almost 4 percent. The impact on the other aggregate macro indicators is qualitatively and quantitatively similar. It has lower impact on non-durable consumption but larger (in percentage points) on exports and investment.

The following experiment that helps to quantify the effect of terror on economic performance is: (i) Assume that we are at the start of the El-Akza Intifada (last quarter of 2000). (ii) Estimate the same VAR as in Table 2 but for the pre-intifada period only (1970:4 to 2000:3). (iii) Forecast the effect of the intifada and compare the forecast to the actual performance of the economy. Since, we could not get reliable estimates of terror without using the last three years, we predict the impact of the terror of the current situation by setting

\footnote{Note that the current predictions of the Israeli Ministry of Finance in the 2004 budget proposal is that GNP per-capita will increase in 2004 by about .5% (2.5% GNP growth minus 2% population growth) but the Bank of Israel forecast is that GNP per-capita will in 2004 decrease by about .5%. Most other forecasts are for a GNP per-capita increase of about zero in 2004.}
the WAR dummy to one from 2000:4 to 2003:1. Figure 11 shows the predicted and actual GNP per capita for the period since the beginning of the Intifada. The model provides a good quantitative prediction for the hefty economic depression of Israel since the beginning of the wave of terror (which started in 2000:4). The result implies that from the economic point of view each quarter of the continuation of the El-Akza Intifada is equivalent to a quarter of a war we observed between 1970 to 2000!

We now analyze the impact of the WAR and Terror Index on the low frequency trend in GNP and non-durable consumption. We do it by regressing the standard H-P filter estimate for the trend (low frequency) of NDC and GNP per-capita.\(^37\) The first two columns in Table 3 reports the OLS of the first difference of the trend of each series as depended variable on a constant, real interest rate \((R)\), WAR and TER. The result is that WAR does not affect the medium term trend, while the terror has a negative impact on the trend of both GNP and consumption.\(^38\) Column three and four in Table 3 reports the OLS of the first difference of deviation from the H-P filtered data, the cyclical part of the series, on the same variables, that is, real interest rate and WAR and TER. Here, the coefficient of TER is close to zero and that for WAR is negative and somewhat larger than in former two regressions. These results indicate that the wars that Israel has experienced had a transitory impact on deviations of the low frequency of GNP and NDC per-capita, while terror activities that we observe in the 1990’s had a significant negative impact on short term trend (low frequency).

\(^36\) We do that partially because in the full sample, the impact of terror and war variables is of the same order of magnitude. It should be noted that at the time no one expected that the terror at the current level would be so damaging to the economy so that we could not estimated the effect of such terror given the existing events until 2000:4. What we actually simulating here is the following case: “suppose one expected that Intifada El-Akza would be as effective as the Yom Kippur war, then, what would be his/her prediction on the Israeli economy using standard VAR model?”.

\(^37\) We first run unrestricted standard HP filter for the log of GNP and NDC per-capita. Then, we use as depended variable the estimated change in the trend which is approximately the change in the moving average of each series. This trend represents the low frequency property of each series.

\(^38\) Note that the coefficients on WAR are very small and insignificant.
6.3 Substituting away from terror: the case of tourism

Looking at the windows of major hotels in Israel during nights of terror or war cannot leave the casual observer ignorant of the severe causal effect from threat to life to the demand for tourism. The elasticity of foreign visits to Israel with respect to threat of terror or war is seen to be so high no regression is needed to verify it. Do similar patterns govern local tourism? Do Israelis cancel vacations at the same rate foreigners do? This section uses quarterly Israeli data on bed-nights to analyze the composition of tourism in Israel over the cycles of terror. Variations in the composition of tourism from time of peace (by Israeli standards) to times of terror (or war) allow the comparison of the reaction of foreigners to that of Israelis to a change in the threat that stems from external conflicts.

The diverse response to terror across groups with different outside options sheds light on the importance of the substitution effect in the case of threat to life. We find this issue important although it goes beyond the main argument presented here. We document these facts since we think they may have some implications on cross-section variations one should expect to find in response to large terror attacks on specific targets in the US, such as US urban centers like NYC, Washington, Chicago, etc..

We use the same quarterly index of terror (\(T ER, Figure 9\)), a dummy variable for the Intifada and a dummy variable for wars (\(W AR\)). The demand for foreign tourism is measured by the number of observed bed-nights in a quarter used by foreign tourists in Israel. Table 4 provides a simple demand (reduced form) equation. The price is the ratio of the price of recreational services in Israel in dollar terms divided by the US CPI. The result from a standard OLS regression (Table 4) is that the coefficient of this price is positive but insignificant, which can be interpreted as a standard result of the endogeneity determination of the price with the unobserved changes in actual bed-nights (demand or supply) shocks. The evidence that emerge are just more of the same.

We also used each of the indicators as well as other indicators to measure terror activities in Israel. The inclusion of the lag dependent variables is due to the high serial correlation and the idea that foreign travel is a long term commitment. The results without the lag dependent variable are basically the same. Tourism is a seasonal product that we control by seasonal dummies.

A simple model is that the number of available beds is pre-determined but the industry price of bed-night is determined in equilibrium where hotel managers determine the price and the total foreign bed-nights and
negative, large, and significant coefficients on wars and terror activities show the sensitivity of demand of foreign tourism for local Israeli security. A joint test for the exclusion of the terror and war variables is rejected. Only little or no work is necessary to demonstrate the main result we want to document here. Note however, that given the composition of foreign visits to Israel, this observation implies a reduction in the demand for business trips to Israel as well. This result raise seems to imply exports of goods that require foreign supervision will also decline.\[42\]

Table 5 provides the estimated demand for the bed-nights of Israelis. We regress Israelis bed-nights on the same price of recreational activities relative to Israeli CPI, Israeli GNP per-capita, the same terror and war variables, and seasonal dummies. The estimated results for demand for domestic tourism are almost a mirror image of the demand of foreign tourist to Israel. (i) Price elasticity is negative and significant. (ii) Income elasticity is positive and close to one. (iii) The terror index is zero or positive. (iv) The intifada dummy is either uncorrelated or positively correlated with higher local demand for bed-nights. (v) The war dummy has no significant impact on demand. Remote tourist locations, like Eilat and the Dead-Sea, are much less vulnerable to terror than the center cities. For Israelis the vacation in a rural/touristic place is a relaxing activity vs. regular shopping, eating and traveling on buses in the centers of Haifa, Tel Aviv and Jerusalem.\[43\]

What do we learn from these two simple regressions? First, that terror and wars affect strongly the demand for individuals depending on their alternative consumption goods through the perceived effect of danger to life. Given the information set of the potential foreigner-tourist on daily life in Tel Aviv, and given the close substitutes he or she obtains, local Israeli bed-nights are determined by the demand. Then the regressions here are the demand but the price is expected to be correlated with the shocks to demand. Assuming that the terror and wars are uncorrected with the shocks to demand, the coefficients on these indicators are consistent if these are not correlated with the contemporaneous price. Also, one may assume that the supply response to the shocks in foreign tourists demand and not to changes in local shocks.

\[42\] Trade in an open economy most likely increase the negative impact of local instability since local individuals can invest abroad and the demand of foreigners to local goods is very sensitive to local security as the tourism analysis shows.

\[43\] A simple F - test for the restriction of no terror/war variable in this equation is rejected using 5% significance level.
the perceived “effective” price of a trip to Israel for the non-Israeli is extremely high and, hence, the demand for visits to Israel of overseas people decrease substantially. On the other hand, for Israelis who live and work at city centers where most terror activities are targeted, tourism to rural locations is an activity with a lower “effective” price and the demand may go up.

To learn about the cross-sectional impact of terror one has to analyze carefully the different perceptions of the “effective” price of the products by different consumers in the different locations. Terror will always hit heavily populated areas. Thus, migration from the center of cities to less populated (rural) locations seems as a natural prediction for the impact of terror of that kind of the 9/11. The reason we have not seen major demographic trends in Israel thus far may be due to the fact that to a large extent rural Israel is on the borders of enemy countries so one does not run from one source of insecurity into another. Moreover, in rural areas labor markets are very thin in Israel and given the major economic slump no jobs are open in those areas.

7 Indirect evidence on the impact of the threat of death

The empirical assessment of the interlinks from consumption to insecurity and back is not simple. It is not defense expenditures per se that are important. It is the combination of expenditures together with personal security (or perception of safety) that matters. While in the model, the external threat is constant and the analysis is of the steady state type, in reality, the threat to different countries at a point in time, or threat to the same country at different times, varies considerably. Moreover, at times, arms race considerations, make the level of threat endogenous. The common habit of regressing growth variables or investment on defense expenditures is, therefore, very misleading. Thus, even if regressing investment on defense expenditures would have yield a clear-cut conclusion about the sign and size of its coefficient, these coefficients could not serve as a guideline to any policy-making.

While our work discusses the effect of the actual expected duration of life on savings, studies on the “atomic clock” discuss the subjective perception of individuals of their own life expectancy. This creates a clear distinction between the two issues. However, these
studies consider the response to a nuclear war, which once expected, never happened. If a nuclear war is not prevented, it is clear that it would have drastically affect expected life. Investigating subjective fears from a nuclear war is not that different from investigating actual death probabilities in a “low intensity conflict”.

Joel Slemrod (1990) analyzed data from twenty OECD countries in the period 1981-1984. In his work he combines data on fears of a nuclear war gathered by Gallup International with the Feldstein’s original data and re-estimates the original Feldstein (1980) saving equations. Slemrod showed that the index of fear of a nuclear was is negatively related to savings to GNP ratio. In a typical Feldstein-type regression, after including other variables, the coefficient of the index of fears is negative, very significant and drastically increases the overall power of the regression. In a more recent paper, Russett and Slemrod (1993) analyzed a survey conducted in April and October 1990 across individuals in the United States. Their results show the same qualitative effect of fears of war on savings.

8 Concluding remarks

Terror endangers civilians’ life. This work does not provide a general treatment of the many aspects of insecurity on economic behavior. Instead, it focuses on insecurity in daily life which increases the uncertainty about life expectancy. Specifically, it is assumed that increase in terror realizations makes life less certain and shorter.

The main forces in the model are two. On one hand, stands the exogenous level of terrorism that shortens expected duration of life, and, on the other hand, stands the government provision of security which aims to reduce some of the malice inflicted by terrorists. Since safety does not come free, the government must take real resources from the private sector to produce security. In this work, the decision of the government about how much to spend on defense is based on comparing the costs of forgone consumption and forgone future consumption (investment), that are used to provide security, to the benefits from reducing terror. When terror increases the optimal response of the government is shown not to fully offset the tide. Thus, economies that face terror turn to lower steady states of output and consumption.
This theory shed new light on the economic performance of Israel. We show that the main observed correlations between economic performance and geopolitical events in Israel could be better understood using our theory of individual security. Moreover, using the VAR methodology we are able to show that an index of terror increases significantly the predictive power of the model. A high rate of terror had a negative impact on output, consumption, investment, and exports. Was terror absent from the street of Israel over the last three years, per-capita output and consumption are predicted to be about 5 percent higher than they actually are. Six additional quarters of terror are predicted to decrease per-capita output and consumption by additional 3 percent.

An important assumption behind this result is that more spending on defense produces more security. This assumption can be disputed on at least two grounds. First, a potential arms race. This model isolates the economy and does not let its investment in defense to affect the opponents’ decision. In a more general framework, which considers the opponents’ retaliation to an increase in spending at home, it is not clear whether an increase in defense spending increases safety. However, as long as the arms race is not in its inefficient zone, i.e., as long as a dollar spent increases safety by at least a little, even after considering the total effect of retaliation and counter-retaliation, the above presented arguments still hold. Second, the efficacy of investment in defense. It seems as a fact that when the defense sector grows too large, spending becomes a waste. Obviously, if this is the case one cannot question the inefficacy of this investment. However, once again, as long as the marginal dollar is not fully waisted our arguments go through.
References


[6] Kahanman Daniel and Amos Tversky,


Table 1: Basic VAR: 1970:1-2003:1

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Notes:
1. For each explaining variable the first raw is the coefficient value and the second raw is the Standard error.
2. Detailed data description for this table appears in Appendix A1.1
### Table 2: First Difference VAR: 1970:1-2003:1

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**Notes:**
1. For each explaining variable the first raw is the coefficient value and the second raw is the Standard error.
2. Detailed data description for this table appears in Appendix A1.2
### Table 3: Low Frequency Trend 1970:1-2003:1

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Notes:
1. For each explaining variable the first raw is the coefficient value and the second raw is the Standard error.
2. Detailed data description for this table appears in Appendix A1.3
Table 4: Demand for Foreign Tourism: 1970:1-2003:1

<table>
<thead>
<tr>
<th>Dependent Variable: LOG_Visitors-Beds</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>-0.051510</td>
<td>0.245997</td>
</tr>
<tr>
<td>Log_Foreign-Price</td>
<td>0.181020</td>
<td>0.158983</td>
</tr>
<tr>
<td>TER</td>
<td>-0.050588</td>
<td>0.019446</td>
</tr>
<tr>
<td>TER(-1)</td>
<td>-0.057221</td>
<td>0.020183</td>
</tr>
<tr>
<td>INTIFADA</td>
<td>-0.133543</td>
<td>0.043095</td>
</tr>
<tr>
<td>WAR</td>
<td>-0.516074</td>
<td>0.088088</td>
</tr>
<tr>
<td>@SEAS(1)</td>
<td>0.027484</td>
<td>0.047092</td>
</tr>
<tr>
<td>@SEAS(2)</td>
<td>0.252198</td>
<td>0.048004</td>
</tr>
<tr>
<td>@SEAS(3)</td>
<td>0.020493</td>
<td>0.047342</td>
</tr>
<tr>
<td>Log_Visitors-Beds(-1)</td>
<td>0.566593</td>
<td>0.058358</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.804315</td>
<td></td>
</tr>
<tr>
<td>F-statistic</td>
<td>55.71667</td>
<td></td>
</tr>
</tbody>
</table>

Table 5: Demand for Local Tourism: 1970:1-2003:1

<table>
<thead>
<tr>
<th>Dependent Variable: LOG_Domestic-Beds</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>-3.586736</td>
<td>0.277328</td>
</tr>
<tr>
<td>Log_Domestic-Price</td>
<td>-0.755314</td>
<td>0.357753</td>
</tr>
<tr>
<td>LOG_GNP</td>
<td>0.898784</td>
<td>0.139213</td>
</tr>
<tr>
<td>TER</td>
<td>0.016339</td>
<td>0.025752</td>
</tr>
<tr>
<td>TER(-1)</td>
<td>0.053576</td>
<td>0.025831</td>
</tr>
<tr>
<td>INTIFADA</td>
<td>0.122755</td>
<td>0.055107</td>
</tr>
<tr>
<td>WAR</td>
<td>-0.085814</td>
<td>0.113601</td>
</tr>
<tr>
<td>@SEAS(1)</td>
<td>-0.171971</td>
<td>0.060954</td>
</tr>
<tr>
<td>@SEAS(2)</td>
<td>0.151646</td>
<td>0.061690</td>
</tr>
<tr>
<td>@SEAS(3)</td>
<td>0.634304</td>
<td>0.062425</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.730694</td>
<td></td>
</tr>
<tr>
<td>F-statistic</td>
<td>36.77965</td>
<td></td>
</tr>
</tbody>
</table>

Notes for both tables:
1. For each explaining variable the first raw is the coefficient value and the second raw is the Standard error.
2. Detailed data description for this table appears in Appendix A1.4,5 respectively.
Figure 1: The Yaari - Blanchard model

Figure 2a: The effect of a decline in security on the Euler equation
Figure 2b:
The effect of a decline in security on the Euler equation

Figure 3:
The effect of a decline in security on the Euler equation
Figure 4.1: The production function of security

Figure 4.2: The (inverted) production of security as the exogenous threat of death (d) increases
Figure 5: The disutility indifference map
Insecurity ($d$) versus government expenditures ($G$)

Figure 6a: Equilibrium level of defense expenditures
Figure 6b: Equilibrium threat and long run output
Figure 7: Real GDP Per Capita of Israel and ISRAEL-USA Real GDP Per Capita (PPP) Ratio 1950-2003

Detailed data description for this figure appears in Appendix A.1.6
Figure 8: Defense Consumption to Gross National Product Ratio
(1950-2002)

Detailed data description for this figure appears in Appendix A1.7
Figure 9: Terror Index (TER)

Detailed data description for this figure appears in Appendix A1.8
Figure 10a: Real Non Durable Consumption Per Capita Prediction for 2003-2004

- no terror
- terror until 20034
- terror until 20044
- actual

The Y-axis values are the Non Durable Consumption in thousand 1993NIS Per Capita Per Quarter.

Figure 10b: Real Gross National Product Per Capita Prediction for 2003-2004

- no terror
- terror until 20034
- terror until 20044
- actual

The Y-axis values are the Gross National Product in thousand 1993NIS Per Capita Per Quarter.
\textbf{Figure 10c:} Real Investment Per Capita Prediction for 2003-2004

The Y-axis values are the Gross Domestic Investment in thousand 1993NIS Per Capita Per Quarter.

- no terror
- terror until 2003
- terror until 2004
- actual

\textbf{Figure 10d:} Real Total Export Per Capita Prediction for 2003-2004

The Y-axis values are the Total Export in thousand 1993NIS Per Capita Per Quarter.

- no terror
- terror until 2003
- terror until 2004
- actual

\textbf{Assumptions for figures 10a-10d:}
1. The predictions are deterministic.
2. The real interest rate for 2003-2004 is the average of the last four quarters.
3. The terror index for the future periods is the average of the last four quarters.
Figure 11: Basic VAR - War Prediction of Real GNP Per Capita for 2000-2003

The Y-axis values are the Gross National Product in Thousands 1993NIS Per Capita Per Quarter.

- Actual Real GNP Per Capita
- Predicted Real GNP Per Capita
Figure A1: BASIC VAR fit to Real GNP Per Capita

The Y-axis values are the Gross National Product in Thousands 1993 NIS Per Capita Per Quarter.

Actual Real GNP Per Capita
Within Sample Real GNP Per Capita Prediction
Appendix: Data Sources

1. The definitions and sources of the variables in Table 1:
   - **NDC** - Private consumption expenditure on non-durable goods that was drawn from PRAEDICTA (series CAB015, CAB020, CAB025, CAB030 that are taken from the Central Bureau Of Statistics) and from the Central Bureau Of Statistics. These data is an accumulation of expenditure on fuel, clothing, food and other goods. The raw figures are in Million NIS. To turn the data into real we divided those figures by the Consumer price index from the Central Bureau Of Statistics and multiply by 100. To turn the real data into Per Capita we divided by the Population from the Central Bureau Of Statistics.
   - **GNP** – Nominal Gross National Product that were drawn from the Central Bureau Of Statistics. The figures are in Thousands NIS (to get them in Millions NIS we divided by 1000). To turn the data into real we divided those figures by the Consumer price index from the Central Bureau Of Statistics and multiply by 100. To turn the real data into Per Capita we divided by the Population from the Central Bureau Of Statistics.
   - **I** - Nominal Gross Domestic Investment that were drawn from the Central Bureau Of Statistics. The figures are in Thousands NIS (to get them in Millions NIS we divided by 1000). To turn the data into real we divided those figures by the Consumer price index from the Central Bureau Of Statistics and multiply by 100. To turn the real data into Per Capita we divided by the Population from the Central Bureau Of Statistics.
   - **EXP** - Nominal Total Export that were drawn from the Central Bureau Of Statistics. The figures are in Million US Dollars. To turn the data into NIS we multiply by the Nominal Exchange Rate from the Bank of Israel. To turn the data into real we divided those figures by the Consumer price index from the Central Bureau Of Statistics and multiply by 100. To turn the real data into Per Capita we divided by the Population from the Central Bureau Of Statistics.
   - **R** – Nominal Short Term Debitory Interest Rate. These data were built from an annual short term interest rate as was found in the IFS, the Bank Of Israel and from the Central Bureau Of Statistics. It was turned to a quarterly interest rate by the formula
     \[ r_{\text{quarterly}} = (1 + r_{\text{short}})^{\frac{1}{4}} - 1. \]  Then it was turned into real interest rate by the formula
     \[ ((1+\text{nominal\_interest})/(1+\text{"inflation rate"})) - 1. \]  The inflation rate was calculated as the ratio of successive Consumer price indices (from the Central Bureau Of Statistics).
   - **WAR** - Dummy variable, which gets 1 if a relevant war, took place in the given quarter. The relevant wars are Yom Kipur, Lebanon and the two Iraqi episodes.
   - **TER** - The terror database was taken from the International Policy Institute for Counter-Terrorism at the Interdisciplinary Center Herzliya (www.ict.org.il). The data in this web site was organized in a database, which includes the terror actions on a monthly bases including details like number of injured, Number of killed, method of operation, etc. For terror index we used the average of the following:
     - The number of fatal victims of terror within the green line..
     - The number of Injured from terror actions within the green line..
     - The number of terror events within the green line..
     Notice: All inside the green line only.

2. The definitions and sources of the variables in Table 2 are the same as in section 1.
3. The definitions and sources of the variables in Table 3 are the same as in section 1.
4. The definitions and sources of the variables in Table 4:
   - **Visitors-Beds** - Number of Occupied Beds by Foreign Guests at Hotels in Israel in Thousands. The numbers were drawn from the Central Bureau Of Statistics. We divided the
data by the relevant domestic population (in Thousands from the Central Bureau Of Statistics) and got the data in per capita values.

- **Foreign-Price** – The basic data is the domestic Consumer Price Index for vocational activity, which was drawn from the Central Bureau Of Statistics. To turn the data into dollars we divided it by the exchange rate (Nominal Exchange Rate from the Bank of Israel) and to turn it into real price we divided it by the US consumer price index of the US that was drawn from the Federal Reserve Bank Of St. Louis Database.

- **INTIFADA** – Dummy variable, which gets 1 if an Intifada took place in the given quarter. There are two periods of Intifafa – The first during 1987:3 – 1993:3 and the second since 2000:3.

The rest of the variables are explained above.

5. The definitions and sources of the variables in Table 1:

- **Domestic-Beds** - Number of Occupied Beds by Domestic Guests at Hotels in Israel in Thousands. The numbers were drawn from the Central Bureau Of Statistics. Then we divided the data by the relevant domestic population (in Thousands from the Central Bureau Of Statistics) and got the data in per capita values.

- **Domestic-Price** – Domestic Consumer Price Index for vocational activity, which was drawn from the Central Bureau Of Statistics.

The rest of the variables are explained above.

6. The data for 1950-2000 for the PPP Graph was taken from "Alan Heston, Robert Summers and Bettina Aten, Penn World Table Version 6.1, Center for International Comparisons at the University of Pennsylvania (CICUP), October 2002 (CGDP)". Data for 2001, 2002 were calculated by the real growth rates of Israel and the US relative to the 2000 GDP-PPP. Projection for 2003 was calculated using an estimation of 0% growth for Israel and 2.6% growth for the US. The data for the GDP Graph is Gross Domestic Product (MLN NIS 1995 prices) taken from PRAEDICTA (Series CAA304 that are taken from the Central Bureau Of Statistics) and Population taken from Central Bureau Of Statistics (Thousands).

7. The Data of the Defense consumption in the early years was taken from the Central Bureau of Statistics special publication number 1097 and the more recent data were taken from the yearly publication of the Central Bureau of Statistics as was the yearly GNP. Calculating the ratio is straight forward – defense consumption divided by GNP.

8. The definition and source of this variable are explained in section 1.