*PAA 2010 Extended Abstract*

# The Impact of Terror Attacks on Birth Rates in Israel from 2000-2005

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## Introduction

How do births respond to conflict and crisis? There is a rich and varied literature on the social response to war examining a range of countries (Carlton-Ford 1998; Curlin et al 1976; Khlat et al 1997) as well as Israel (Landau et al 1998; Soskolne et al 1996). This comes as no surprise given the magnitude of war's impact on social, economic and political structures. Also, a literature exists evaluating the impact of various sorts of manmade and natural crises on births (Udry 1970; Catalano et al. 2006). On top of this, exciting new findings have been presented in recent years showing the impact of crises on sex ratios at birth (Catalano 2005; Fukuda et al. 1996). None of these studies however have attempted to examine the impact of repeated crises – as in the case of endemic terror – and its impact on births. In this paper, we offer an intensive examination of the impact of repeated terror attacks on births and sex ratios at birth in Israel in order to shed light on the complex reproductive responses to terror.

## Background

There is a long history of research relating reproductive outcomes to conflicts and their enduring demographic implications. The traditional perspective on war and fertility, based on demographic behavior following the past two world wars (particularly WWII), indicates that fertility declines during times of war but the cessation of hostilities are often followed by a baby boom (Rindfuss and Sweet 1977; Hobcraft 1996). Yet, this pattern is not universal. At least in poorer countries, there no evidence of fertility increases and some argument about whether crisis may lead to fertility decline. However, fueling this debate Agadjanian and Prata (2001) find little to indicate that war has directly led to a reduction in fertility levels in Angaola while evidence for Eritrea supports the crisis-led decline argument (Woldemicael 2008).

Gaining traction on the mechanisms that may be driving fertility responses to war remains a considerable challenge. Responses such as the US baby boom followed large scale wars. Yet, these wars created massive social and industrial turmoil. In the US, a substantial fraction of the male population was mobilized along with industrial and economic resources. The mobilization makes it difficult to know whether fertility dynamics during and after such extended wars are due to massive structural shifts or micro-level behavioral changes. That is, are fertility levels depressed during war because men are gone or because parental preferences are altered in times of crisis and shortly thereafter.

The disadvantages inherent in studying the massive transformation during and war's termination highlight the advantages from studying short-term crises and birth responses. Short-term crises may in some though certainly not all cases prove useful precisely because they leave society's primary structures relatively intact. They also make it easier to test empirically because it is relatively straightforward to identify the causal effect and its timing. A well known example is the debate on the New York City electricity blackout of 1965. The popular press reported on a large rise in births nine months following the blackout – a

claim which several scholars have subsequently tested and rejected (see for example, Udry 1970). However, in a different example, Catherine Cohan found that the 1989 Hurricane Andrew led to an increase in childbearing *following* the crisis, particularly by families in those areas most directly affected (Cohan and Cole 2002).

Most of these studies are based on before-after designs. In the best of cases they use data collected before the war and compare it to data collected after the war. Data is rarely available during the war and sometimes only retrospective data is used. Thus, most of these studies regard the socioeconomic and demographic consequences of war as the total changes over the long term wrought by conflict. This makes it impossible to separate the effects of structural changes associated with war, including migration, massive male mobilization during wartime, and economic fluctuations, from the effects such as social stress which might in and of themselves inhibit parental desires for children (Boadu and Krovato 1998).

More recently and more directly related to the substance of this research, John Haaga and others have been discussing the effect of the September 11$^{th}$ attacks on birth levels in the US. While press reports have already begun to publish accounts of baby booms in various hospitals nine months following the attacks, scholars are divided about the expected outcome and the necessary statistics are not yet available for a full enquiry. Yet, even when the September 11$^{th}$ statistics are available, the information will be far less informative than that which is provided by Israeli's unique experience, which includes over a hundred events of smaller magnitude rather than a single terrible terror attack. Thus, instead of a single before-after quasi-experimental design, we may treat each of the bombings as an event.

We focus on two specific outcomes, which in combination provide a novel perspective on the demographic impact of conflict. The first perspective targets the relationship between terror attacks and subsequent birth rate levels. There are many mechanisms through which terror might conceivably affect births. However, the primary mechanisms are likely to involve altering conception probabilities through either altered demand or biological processes. The section mechanism is through changing the probabilities of fetal mortality over the course of gestation. Thus, birth levels might be analyzed from the perspective of both factors that alter conceptions and factors that alter fetal mortality. Unfortunately, disentangling these factors is likely not feasible without further information. Our method of identification here comes from one additional impact of highly stressful environments on fetal mortality. The evidence indicates that highly stressful environments that alter fetal mortality are likely to increase male fetal mortality more strongly than female (Catalano et al. 2006; Catalano and Bruckner 2006; Fukuda et al. 1998). This unequal impact on fetal mortality by sex will have an effect on the sex ratio at birth.

We pose three specific questions in this preliminary study:

1. To estimate the effect of terrorist attacks on both births rate levels using statistical times series methods and to explore the variation in the response

according to the size of the attack, the timing and intensity of proximate attacks, and the regional target of the attacks.

2. To examine the impact of terrorist attacks on the sex-ratio at birth in Israel during this same period to determine whether variation in the sex ratios are associated with the terror attacks.
3. To distinguish the effect of terror on births and sex-ratios in order to identify whether the main impact of terror is on conceptions or fetal death.

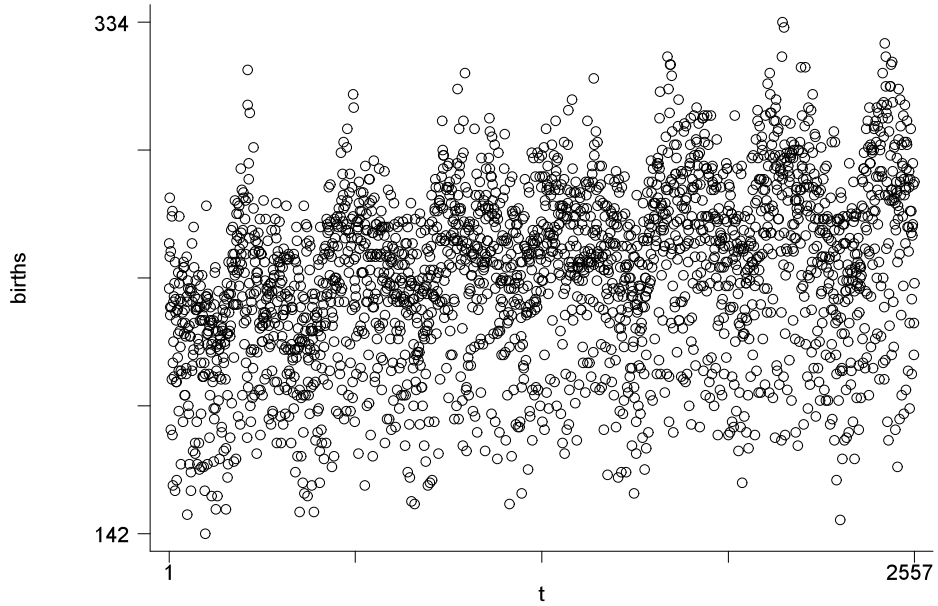
**Data and Methods**

This exploration is primarily empirical and based on detailed birth data from the Israel Central Bureau of Statistics and data on terror attacks pooled from several different sources. Our primary variables are listed below:

1. Births. The number of births per day in Israel. There are roughly 300 births per day in Israel. This data is readily available from the ICBS and the results of a subsample of the data are shown below. We so far have an older file but are in the process of obtaining updated data files from the ICBS. The birth data will also be split into two types. The first is births per day for each of the major religious groupings within Israel: Jews, Moslems, Christians and others. The second is births per day in each of the major regions of the country.

   Figure 1 shows the aggregate number of births over per day in Israel where the days are numbered consecutively from 1995 on the X-axis. Various interesting features of the birth time series stand out including the increasing trend in numbers of birth, birth seasonality, and even day of week effects (see Cohen 1983 for an interesting analysis of these issues in the Israeli context).

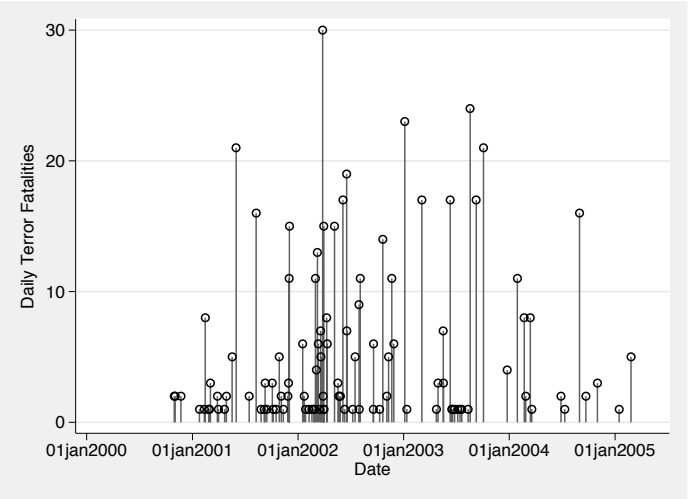
**Figure 1: Births in Israel between 1995 and 2002**




2. Bombing attacks. The number of civilians killed each day in terror attacks in Israel. An indicator will also be used to define the region where the bombings

took place. Below we show a timeline for the terror attacks occurring within Israel from 2000-2005. We intend to extend this file until the end of 2005.

Figure 2: Fatal terror attacks in Israel from 2000-2005.




3. While we are primarily interested in the relationship between births and terror incidents, further analysis will also include time series data on various spurious indicators to reject some possible alternative explanations and to begin to construct a sensible explanation for the observed behaviors.

Several methodologies will be used to examine the relationship between terror incidents and births. However, a major goal of this study is to develop appropriate tools for identifying the effects of terror on births. I have studied the effects of terror on various other outcomes including traffic and consumption. In this case, however, additional information is present in the biological process which makes the current study more intriguing. Two particular issues are particularly interesting:

1. In the process of my effort on this project, I intend to explore the best tools for use data on the maternity profile. Given that not all births follow precisely 9 full months of gestation but rather follow a distribution, we intend to use information on this distribution to help identify the effects of terror on births.

2. While births can be studied without distinguishing gender, it makes greater sense to explore the impact of terror on male and female births separately. If terror primarily affects fetal death, we would expect the impact of terror to be identified through shifting sex ratios at birth in the period 9 months later. However, if terror's primary impact is through conception, then the primary impact of terror should be visible in changes in the number of births with relatively little impact on the sex ratio.

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