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Evading terror? Terror Attacks and Internal Migration in Israel*

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Abstract

This paper empirically analyses the relationship between terror incidents and internal migration in Israel. Using a newly created database of region-to-region migration flows for the years 1998-2012, the empirical model regresses the annual flow of migrants from an origin subdistrict to a destination subdistrict on measures of terror incidents in the origin and the destination, respectively. The results indicate that terror in the destination subdistrict acts as a deterrent to migration into that region, whereas we find no evidence in support of the hypothesis that terror brings about outmigration.

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Key words **Israel, terror attacks, internal migration**

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1 Introduction

Etymologically, the word terror is derived from the Latin word for fright or fear. It describes events that evoke an exceptional emotional or psychological response in contrast to other threats to health. This leads to substantial consequences for the society that go beyond the immediate impact on victims of the violence (Becker and Rubinstein, 2011). Hazam and Felsenstein (2007) point out that individuals face two option when confronted with terrorist attacks: they could either avoid their exposure to terror or try to cope with an unsecure environment. Both options lead to a change in people's behaviour compared to the no-terror case. Terror is highly prevalent in Israel. Though it cannot be characterized by continuous violence but rather by geographic and cyclical fluctuations, there is no question that the bloody Israeli-Palestinian conflict has considerable implications in the short and long run. Consequently, the literature analysing the effects of terrorist acts on the Israeli economy and society is extensive. However, although terror avoidance might induce migration no attempt has so far been made to empirically assess the impact of terrorism on internal migration flows in Israel. We address this research gap by building our paper upon a newly created database of region-to-region migration flows, up-to-date figures of terrorist events occurring in each region as well as socio-demographic and economic control variables comprising the period 1998 to 2012.

To derive our hypothesis how terror affects migration, we refer to terror as an impediment to the fundamental public good security. It induces large social and economic costs, eventually reducing people's welfare (Frey, Luechinger and Stutzer, 2009). In the literature, different aspects of the costs of terror have been stressed: Being subject to terror attacks makes sick. For instance, Lahad and Leykin (2010) conducted a clinical study and found that ongoing exposure to terror attacks increases the overall level of posttraumatic stress disorder (PTSD) of the participants. According to Becker and Rubinstein (2011) terror has direct costs by inducing fear and indirect adjustment costs which occur due to controlling emotions and altering behaviour such that subjective beliefs and objective uncertainty can be brought in line. They claim that "even in a world with emotionally motivated individuals, economic incentives shape the degree to which emotions distort choices." (p. 3) Regardless of whether the (perceived) risk of being affected by terror stems from irrational perceptions or objective assessments, the literature has defined three main transmission channels which influence the activity of economic agents. Firstly, terror decreases utility from consumption by inducing fear although the likelihood of being affected is relatively low (Becker and Rubinstein, 2011). Secondly, terror lowers the discount rate due to the increased level of uncertainty. Economic consequences of both channels have been studies for Israel as well[1]. Becker and Rubinstein (2011) find that occasional users and less-educated individuals tend to evaluate the utility derived from the consumption of public transportation less than their frequent-user and higher educated counterparts. The latter are assumed to estimate risks associated with terror more appropriately. Eckstein and Tsiddon (2004) as well as Zelekha and Bar-Efrat (2011) emphasize the discount rate channel. Both studies reveal that a high incidence of terrorist events might discourage investments in productive capital, thus lowering the economic prosperity in a certain region. It is worth mentioning that both studies do not rely on the hypothetical destruction of physical capital by terror which seems to be a realistic assumption for the Israeli case[2]. Elster, Zussman and Zussman (2014) and

[1] Economic consequences of terror in other countries or in an international setup have also been studied extensively (see, among others, Abadie and Gardeazabal (2003), Powers and Choi (2012), or Llussa and Tavares (2011).

[2] However, there might be sectoral differences. Berrebi and Klor (2005) and Berrebi and Klor (2010) show that the impact of terrorism on firms that are in particular active in the defense sector is significantly positive. On the other hand, Fleischer and Buccola (2002) and Krakover (2005) find the tourist industry to be at least moderately sensitive to terrorist events.

Hazam and Felsenstein (2007) have shown that terror has a negative impact on housing prices or housing rents in terror-prone regions in Israel. To summarize, the literature has shown that perceived uncertainty, proxied by terror incidence, has psychological costs which people have to deal with in Israel. The subjective assessment of risk as a function of the objective exposure to risk translates into a lower valuation of future utility. Economic consequences of this mechanism are not negligible. We assume that people react to these costs as they draw less utility from the public good security.

It is plausible to assume that Israeli citizens are able to evade terrorism through the choice of their home district. Berrebi and Lakdawalla (2007) identify observable regional characteristics that contribute to the likelihood of a geographical entity being affected by terror.

Following from that, migrating out of terror-prone regions is associated with several benefits. Migration is an escape from fear, allows consumers to realise a higher level of utility, protects human capital from devaluation and promises a better economic environment. However, there are several effects that might lessen the expected utility gains by moving. Behavioural changes and their effect on utility have so far been found to be rather short-term than long-term (Becker and Rubinstein, 2011; Hazam and Felsenstein, 2007). Gould and Stecklov (2009) find evidence that, through higher police presence, terrorism significantly reduces property crimes. Moreover, the nature of terror events might also increase the costs of migration. For one, the depreciation of capital devalues non-movable assets making moving more costly. Also, under the psychological pressure of terror social costs of moving might be higher than in a case with no terror[3].

If moving away from terror increases utility, terror can be seen as push factor (expulsion effect), but also as a (negative) pull factor (evasion effect)[4]. So far, the empirical literature has found evidence for the former. Dreher, Krieger and Meierrieks (2011) finds robust evidence for terror among the push factors for skilled international migration. Also, in an analysis for Germany from 1981 to 1995, Vogler and Rotte (2000) found that terrorism in the host country has a significant positive impact on the number of asylum seeking migrants coming to Germany. Morrison and May (1994) identify terror over a certain threshold as a main driver for internal migration in Guatemala. Ibanez and Velez (2007) show that politically motivated violent attacks against civilians are amongst the driving forces of displacement in a civil war environment in Colombia. Comparability to our results, however, is limited since the decision-making processes vary with regard to the severity of threat, the subjective probability of being affected and the degree to which people are actually forced to leave their home district (voluntary vs. forced migration).

Based on the aforementioned literature, we derive the following hypotheses: on the one hand, people who are exposed to terror events try to evade the negative effects on utility and educational returns (expulsion effect). On the other hand, the prevalence of violent attacks in a certain target region might prevent people from migrating to this area (evasion effect). By exploiting the time and geographical variation in terror and inter-regional migration flows within Israel, we are able to assess empirically whether and to which extent these effects are relevant determinants of migration in Israel.

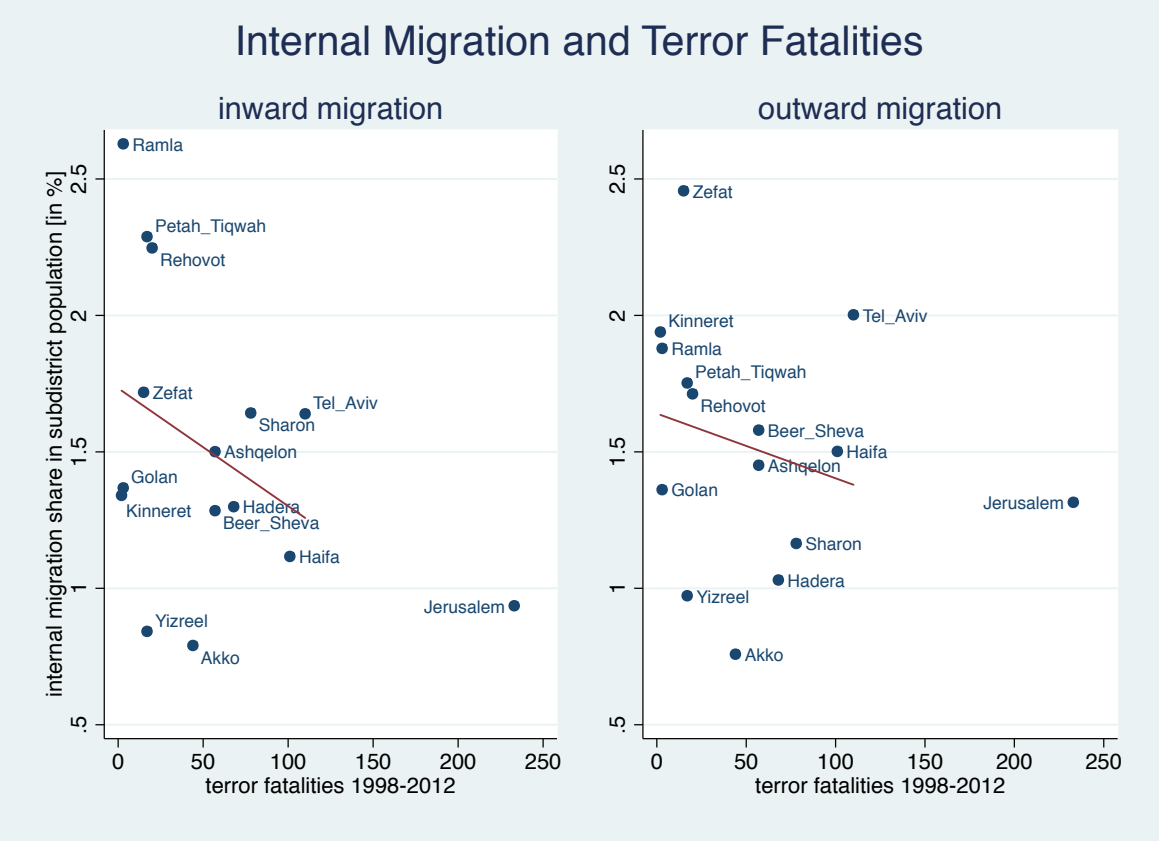
Other studies deal with non-economic influences of terrorism in Israel. For instance, Berrebi and Klor (2006) or Gould and Klor (2009) found a change in political attitudes of the Israeli electorate towards right-wing views.

[3] Savitch (2005) states that "the major objective of terror is to intimidate, instill fear and paralyse […]" (p. 365).

[4] We assume that terror does not come with such political or economic instability. For the sake of completeness, we refer however to the literature on forced migration.

To give a first glimpse on the subject, figure 1 shows the migration rates to and from Israeli regions against the sum of all terror fatalities between 1998 and 2012. This preliminary analysis suggests that the number of terror fatalities in a region is negatively correlated to the stream of migrants into that region relative to its population (left panel). This would be in line with our hypothesis of an evasion effect. The expulsion effect predicts a positive correlation between the flow of migrants leaving a region and the number of terror fatalities in that region (right panel). This relationship, however, cannot be seen in this simple correlation that does not control for any other influences on migration.

Figure 1: Internal migration to and from subdistricts



Note: The linear fit is calculated without the outlier Jerusalem.

The paper proceeds as follows. Section 2 provides an overview of the data and section 3 introduces the empirical model. Section 4 discusses the estimation results and section 5 concludes.

2 Data

The data on terror events are taken from the Global Terrorism Database for the period 1998 to 2011. Statistical information contained in the Global Terrorism Database is based on reports from a variety of open media sources. Among others, the database comprises information on the date, location of the incident, and the number of casualties and injured. The Global Terrorism Database defines terror as an "intentional act of violence or threat of violence by a non-state actor". Moreover, a terror event has to meet two of the following three criteria: meeting a political, economic, religious, or

social goal; evidence of an intended intimidating message to a larger audience than the immediately affected; and violating International Humanitarian Law.[5]

We assign to each terror location taken from the Global Terrorism Database the corresponding subdistrict[6]. Subdistricts are Israel's smallest geographical and political entities for which we have data (see Appendix for a map). Since we use official Israeli data, East Jerusalem is incorporated in the subdistrict Jerusalem and Golan constitutes an additional subdistrict[7]. We do not consider migration to and from settlements in other Israeli-controlled territories[8], which leaves us overall with 15 subdistricts to study.

Data on internal migration are provided by the CBS directly or taken from the CBS website. Income and housing expenditures are from the CBS Household Income and Expenditure Survey[9], the other control variables are taken from the the Statistical Abstract of Israel published by the CBS for the corresponding years. Our dataset contains information on 15 times 14 subdistrict pairs over 14 years yielding 2,940 observations (see appendix for a table of descriptive statistics).

3 Model and estimation strategy

The central part of our specification is the construction of our terror proxy and its functional form. There is no consensus on how to empirically measure terror. Generally, terror proxies used in terror literature can be classified into direct-outcome and event-based[10]. Direct outcomes of terror effects can be personal and material damage. In the literature, the most common proxy is the number of fatalities (see, for instance, Berrebi and Klor (2006), Romanov, Zussman and Zussman (2012), Zussman (2013)). Indicators that use the number of terror victims (including injured) or material damage are rarely used. We follow mainstream literature and use fatalities as our first terror indicator. Event-based terror proxies count the number of attacks (for instance, Elster, Zussman and Zussman (2014) use confidential military data on rocket attacks between 2000 and 2012). Non-confidential data that use media sources to identify terror events lack coverage especially of unsuccessful or detected terror attacks, however they automatically weight attacks by media

5 There is no general acceptance of a precise definition of terror. Schmid and Jongman (2005) analyze the prevalence of 22 definitional criteria in 101 definitions of terror. The chosen criteria of the Global Terrorism Database meet 5 out of 6 of the most frequently used (appearance in more than a third of definitions).

6 Due to our framework, we exclude within subdistrict migration if not stated otherwise. This might be a serious drawback of our analysis since especially subdistricts in the south have a quite large area, making it possible to evade terror through moving within this subdistrict. Also note that short-time migration to other subdistricts is not recorded by the administrative bodies in Israel.

7 Both areas were annexed by Israeli in 1980 and 1981 respectively. The annexations remain internationally not recognized.

8 Apart from the problematic territorial status of the Westbank and Gaza, the decision was also fueled by lack of data. Many control variables were not available for our time period. Also, we did not have direct information on infrastructure and housing programs as well as politically driven motives that seem to exceptionally drive migration to this area.

9 The variables for 2012 were estimated from the PUF dataset of the Household and Expenditure Survey since official figures were not available. For the provision of the dataset we are thankful to the Social Datacenter at Hebrew University, Jerusalem.

10 Occasionally, they are also combined. Larocque, Lincourt and Normandin (2008) and Eckstein and Tsiddon (2004) derive a composite terror index adding the respective counts of attacks and victims. The Global Terrorism Index uses event-based and direct-outcome indicators with individual weights averaged over time.

coverage.[11] We use data on terror attacks from the Global Terror Database as an event-based proxy.[12]

We develop the functional form of terror effects in reference to studied effects on individuals. There is some evidence that the impact of terror might depend on the severity of past terror events. In a qualitative analysis for the years 2000 and 2005, Liebes and Kampf (2007) find evidence for established routines in reactions to terror attacks. Until the end of 2002, acts of terror received high media coverage, provided medial attention to political right-wingers and led to noticeable shifts in political attitudes and individual behaviour. After two years of increased terror activity, media coverage and range decreased sharply and followed an established routine underlining individual suffering. In this period, changes in political attitudes and behaviour of Israelis are less visible. This is supported by a representative medical sample study made in 2002, which finds comparably low levels of mental health symptoms and impairment in Israel. This was associated with a process of adaption and accommodation (Bleich, Gelkopf and Solomon, 2003). However, Lahad and Leykin (2010) find in their study on post-traumatic stress by shelling that "a population living under conditions of overall, on-going exposure to shelling and constant threat evidence significantly higher levels of overall PTSD severity." Based on these findings, we include two lags of our terror variable in our basic specification. However, some of these findings might also be explained by non-linearity of terror effects. We, therefore, test an extended specification with squared terror proxies.

This paper utilizes an augmented version of the popular gravity model.

(Eq. 1) $$\ln(intmig_{odt}) = \beta_{1,o(t-1)}terror_{o(t-1)} + \beta_{2,o(t-2)}terror_{o(t-2)} + \beta_{3,d(t-1)}terror_{d(t-1)} + \beta_{4,d(t-2)}terror_{d(t-2)} + \boldsymbol{\beta_o}'\boldsymbol{x}_{o\,(t-1)} + \boldsymbol{\beta_d}'\boldsymbol{x}_{d\,(t-1)} + \boldsymbol{\beta_o}'\boldsymbol{x}_{o\,(t-2)} + \boldsymbol{\beta_d}'\boldsymbol{x}_{d\,(t-2)} + \sum_{t=2}^{T}\gamma_t\delta_t + \alpha_{od} + u_{odt}$$

The dependent variable $intmig_{odt}$ represents the absolute number of migrants moving from subdistrict *o* to subdistrict *d* at time *t*. Our variable of interest, $terror_{jt}$, is the terror prevalence in the subdistrict of origin (*j* = *o*) and destination (*j* = *d*), respectively, at time *t*. As explained above, we test three different terror proxies. Additionally, we include a vector of explanatory variables $\boldsymbol{x}$ in the subdistrict of origin (*o*) and destination (*d*), respectively, at time *t*: Terror is measured in absolute numbers, while the dependent and all control variables are measured in logs.[13] The control variables are defined as follows:

- *Population*: Population
- *Gross_income:* Average monthly gross income
- *Employment*: Number of employees
- *Housing_exp:* Average monthly housing expenditure (including rent) per household
- *Standard_persons:* Average household size (in standard persons)
- *Jews:* Number of persons with Jewish denomination

[11] Since attacks with fatalities can be assumed to be reliably reported, several authors count events with one or more (i.e., 5 or 10) fatalities (see, for instance, Berrebi and Klor (2010)) as an alternative event-based proxy. However, not deadly rocket attacks are missed by this indicator, although they have shown effects at least in psychological and medical studies.

[12] The coverage loss is still substantial. Roughly comparing rocket and mortal shells reported by Btselem (with reference to the Israel Security Agency) for 2005 to 2012 with attacks in the southern subdistricts gives coverages between 1.1 to 5.8 percent.

[13] Our dependent variable, *intmig*, displays a high degree of skewness. In connection with the aforementioned underlying multiplicative theoretical model, all control variables other than terror appear in natural logarithms.

By including population we control, firstly, for the size in the subdistrict of origin and destination, respectively. The more people live in the sending subdistrict, the more people are likely to migrate. On the other hand, the more people there are in the receiving subdistrict, the larger is the labour market for migrants and the more amenities in form of, for instance, infrastructure, can be expected (Lewer and Van den Berg, 2008). *Income* and the number of *employees* are two additional measures to capture the labour market opportunities of a certain subdistrict[14]. By including *housing* we take the financial constraints migrants might face into consideration (Andrienko and Guriev, 2004). Since the aforementioned variables are not standardized and hence do not constitute a concise price measure, we control for the average number of *standard persons* per household. Empirically, it has been found that the Arab population in Israel is less mobile than the Jewish population. To control for this and ethnic agglomeration we control for the number of *Jews* in our model[15]. Finally, we include year[16] and subdistrict pairs dummies to control for annual shocks that are common to all subdistrict as well as for subdistrict pair idiosyncracies that are constant over time.[17] Within this set-up, identification of the effect of the terror-related variables on migration therefore relies on the deviations of these variables from their means within each subdistrict-pair-year combination.

The explanatory variables of the model are lagged by two years. While we believe that terror events are contemporaneously exogenous with respect to migration flows, the use of lagged values is motivated by the fact that migration flows are only available in the form of annual sums. Due to the lack of information about when exactly migration took place, the use of contemporaneous values of terror would not ensure that at the time of moving all terror events had already taken place. The use of lagged values therefore ensures that the terror variable only includes those events that are actually part of the population's information set at the time of moving. Furthermore, migration and certain control variables (e.g. *income* or *employment*) might be contemporaneously jointly determined. The motivation for using lagged values for the control variables is therefore to avoid contemporaneous reverse causality between the former and internal migration. It is reasonable to believe that lagged terror is exogenous to internal migration.

4 Results

4.1 Measuring terror

As discussed in section 3, the existing literature on the economic consequences of terrorism uses different measures for the prevalence of terror. Since it is ex ante unclear which of these measures are relevant for internal migration flows between subdistricts, we start by estimating Equation 1 using the number of attacks (Model 1), the number of associated fatalities (Model 2) and both variables (Model 3). Table 1 shows the estimated coefficients of origin and destination terror in the first and the second lag for each of these specifications.[18]

[14] Dividing the number of employees by the total population (which is the sum of all age groups) yields the employment share of a subdistrict as a proxy for the likelihood to find a job. Better measures like the unemployment rate or the labour force were not available on a subdistrict level.

[15] The CBS provides figures according to ethnicity and religion. We stick to the data on religion because ethnicity is subject to changes in definitions and groups included within the time period under consideration.

[16] Concerning year dummies in the first difference estimation, we follow Wooldridge (2001) and include non-differenced year dummies starting with period 3.

[17] Note that this specification implicitly controls for the inclusion of subdistrict dummies as these represent linear combinations of the subdistrict-pear dummies.

[18] Full results can be found in Appendix A1.

Table 1: Coefficients of terror-related variables

Dependent variable: ***Ln_intmig***	**Model 1**	**Model 2**	**Model 3**
Attacks (origin)			
L1.	-0.070		-0.051
	(0.049)		(0.049)
L2.	-0.075		-0.023
	(0.071)		(0.071)
Attacks (destination)			
L1.	-0.264***		-0.263***
	(0.053)		(0.055)
L2.	-0.279***		-0.298***
	(0.070)		(0.078)
Fatalities (origin)			
L1.		-0.098**	-0.082*
		(0.045)	(0.042)
L2.		-0.072*	-0.071*
		(0.041)	(0.042)
Fatalities (destination)			
L1.		-0.112***	0.004
		(0.038)	(0.039)
L2.		0.022	0.048
		(0.037)	(0.041)
N	2730	2730	2730
R^2	0.310	0.323	0.316

The reported coefficients take the form of semi-elasticities and are obtained by multiplying the original coefficients by 100.
Cluster-robust standard errors in parentheses (210 clusters)
*/**/*** indicate the 0.1/0.05/0.01 level of significance, respectively.

The results of the specifications based on a single measure of terror support the hypothesis that terror in the destination acts as a deterrent to migration, whereas there is no evidence for the hypothesis that terror in the origin engenders outmigration. Specifically, we find that a ten-unit increase in the number of attacks decreases next year's flow of migrants by approximately 2.64% and by another 2.79% the year after. The number of fatalities in the destination is significant only for the first lag with a ten-unit increase predicted to decrease migration by approximately 1.12%. The estimated coefficients of origin terror show that in contrast to Hypothesis 2 increases in either the number of attacks or the number of fatalities are associated with a decrease in the size of the migration flow, though these effects are significant only in the case of fatalities. Specifically, a ten-unit increase in the number of fatalities in the origin is predicted to decrease migration by 0.98% in the following year, whereas the effect of the second lag is only marginally significant.

If both variables are included (Model 3), we find that the coefficients of the variable attacks have the same sign and similar magnitude as in Model 1. In contrast, after conditioning on the number of attacks, the coefficient of the number of fatalities in the destination becomes small and statistically insignificant, while the coefficients of origin fatalities also decrease in size and are only marginally significant. These results suggest that the significance of the number of fatalities in the destination in Model 2 is due to picking up effects from the omitted variable attacks, but that the former is no significant determinant of migration once the latter is controlled for.

Against the background of these results we assess whether all variables based on the number of fatalities are insignificant in Model 3 by testing the following hypothesis:

Hypothesis 3: Conditional on the number of attacks, the effects of the number of fatalities in origin and destination on internal migration flows are jointly insignificant.

The associated F-statistic is sufficiently small that the above hypothesis cannot be rejected at the 0.05 level of significance.[19] Given this result, the subsequent analysis uses the results of Model 1 to quantify the effects of terror on internal migration and specifically the effects of the number of attacks in the destination.[20]

4.2 Measuring the effect of terror

To better gauge the size of the estimated effect of destination terror on internal migration flows we calculate the predicted change in these flows for each combination of origin and destination subdistrict that would follow from an increase in the number of attacks in the destination. Specifically, we take the average value of migration for each combination of subdistricts and multiply this by the marginal effect of destination attacks evaluated at the value of the standard deviation of the former variable in the specific subdistrict.[21] Thereby we are able to produce a ranking of the predicted change in the migration flow for each of the 210 combinations of subdistricts. Table 2 shows the subdistrict combinations with the five largest and the five smallest changes following a change in destination attacks[22].

Table 2: Predicted changes in migration flows following a change in destination attacks

No.	Origin	Destination	Av. migration flow	Destination attacks (std. dev.)	Change in migration flow (lag 1)	Change in migration flow (lag2)
1	Tel Aviv	Ashqelon	2,376	22.73	-142.43	-150.67
2	Be'er Sheva	Ashqelon	1,939	22.73	-116.22	-122.94
3	Rehovot	Ashqelon	1,636	22.73	-98.07	-103.74
4	Jerusalem	Ashqelon	933	22.73	-55.93	-59.16
5	Petah Tiqwah	Tel Aviv	5,605	3.64	-53.84	-56.95
6	Tel Aviv	Jerusalem	2,470	7.94	-51.70	-54.68
7	Rehovot	Tel Aviv	4,047	3.64	-38.87	-41.12
8	Tel Aviv	Petah Tiqwah	10,153	1.37	-36.77	-38.89

[19] Hypothesis 3 can be formulated as a joint test of four linear restrictions. The F-statistic and p-value are given by 2.15 (0.076).

[20] We also assess whether Model 3 can be simplified by adding the number of attacks and the number of fatalities by testing whether the coefficients of the variables attacks and fatalities are statistically identical in the origin and the destination and for each lag. This hypothesis can be expressed in terms of four linear restrictions. A joint test of these restrictions yields an F-statistic of 5.12 and an associated p-value of 0.001. We therefore abstain from implementing such a specification.

[21] For example, the average flow of migrants from Tel Aviv to Ashqelon over the sample period (1998-2012) is approximately 2,376, while the standard deviation of the number of attacks in the subdistrict Ashqelon takes a value of approximately 22.73. The marginal effect for the first lag of the variable attacks evaluated for a change of one standard deviation is thus given by (-0.264%)*22.73 = -6.00%. The corresponding marginal effect for the second lag is (-0.279)*22.73 = -6.34%. Multiplying these values with the average flow of migrants yields a reduction in the number of individuals migrating from Tel Aviv to Ashqelon of approximately 142 and 151, respectively.

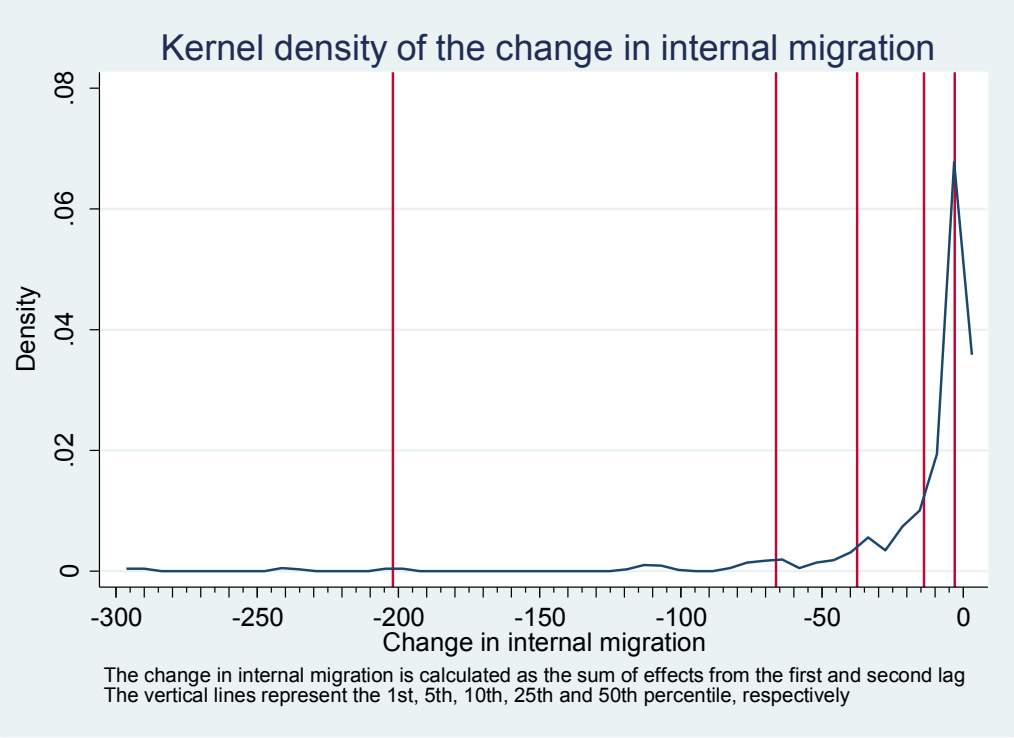
[22] The full set of results for every combination of origin and destination subdistrict can be obtained from the authors upon request.

9	Tel Aviv	Be'er Sheva	1,912	7.28	-36.70	-38.82
10	Ashqelon	Be'er Sheva	1,695	7.28	-32.54	-34.42

The largest effect is predicted for the flow from Tel Aviv subdistrict to Ashqelon subdistrict: an increase in the number of attacks in Ashqelon by one standard deviation is predicted to reduce the number of individuals arriving from Tel Aviv by 142 in the following year and by another 151 the year after which represents a decrease of approximately 6% of the average annual flow. Out of the ten combinations shown in Table 2, the four largest represent flows destined for Ashqelon district – a finding driven mainly by the relatively large standard deviation in the number of attacks in that subdistrict. Similarly, Jerusalem and Be'er Sheva are also characterised by larger standard deivations while in contrast the large effects for flows into the subdistricts of Tel Aviv and Petah Tiqwah are due to the large number of migrants.

The specification of the model implies that an increase in the number of attacks in one period has an effect on the flow of migrants in the coming year and in the year after. While the sum of the predicted changes in the number of migrants is almost 300 for the flow between Tel Aviv and Ashqelon, Figure 1 shows that for one half of the 210 combinations of subdistricts this sum is smaller than 5 and for in three quarters of cases it is smaller than 15 implying that in the majority of cases the effects of destination terror on individual flows are likely to be negligible.

Figure 1: Kernel density plot of the effect of destination attacks on internal migration flows



So far the analysis has been based on a model of between-subdistrict migration flows which allowed estimating the effects of terror-related variables in the origin and the destination on size of flows between two subdistricts. In order to assess the effect of a change in the number of attacks in a subdistrict on the total number of immigrants arriving from other subdistricts, we regress the annual inflow of migrants into a destination subdistrict *j* ($inmig_j$) on the number of attacks in that subdistrict

as well as on the other control variables used in Equation 1.[23] Table 3 shows the estimated coefficients of the variable attacks.[24]

Table 3: Estimated coefficients of attacks on total annual in-migration

Dependent variable: ***Ln_inmig***	**Model 1**
Attacks	
L1.	-0.205
	(0.063)
L2.	-0.163
	(0.049)
N	195
R^2	0.642

The reported coefficients take the form of semi-elasticities and are obtained by multiplying the original coefficients by 100.
Cluster-robust standard errors in parentheses (210 clusters)
*/**/*** indicate the 0.1/0.05/0.01 level of significance, respectively.

The estimated coefficients are identical in sign and comparable in terms of magnitude to those estimated for the variable destination attacks in Table 1: a ten-unit increase in the number of attacks is predicted to decrease the number of immigrants from all other subdistricts by approximately 2.05% in the following year and by 1.63% in the year after. Table 4 shows the predicted change in the number of immigrants following an increase in the number of attacks in the destination subdistrict by one standard deviation.[25]

Table 4: Predicted changes in in-migration following a change in destination attacks

No.	**Destination**	**Av. in-migration**	**Destination attacks (std. dev.)**	**Change in migration flow (lag 1)**	**Change in migration flow (lag2)**
1	Ashqelon	9,411	22.73	-438.52	-348.68
2	Be'er Sheva	10,060	7.28	-150.14	-119.38
3	Jerusalem	9,125	7.94	-148.53	-118.10
4	Tel Aviv	15,028	3.64	-112.14	-89.16
5	Petah Tiqwah	18,163	1.37	-51.01	-40.56
6	Sharon	8,741	2.23	-39.96	-31.77
7	Haifa	8,733	1.86	-33.30	-26.48
8	Hadera	6,200	2.62	-33.30	-26.48
9	Akko	6,047	1.54	-19.09	-15.18
10	Yizreel	5,136	1.23	-12.95	-10.30
11	Rehovot	4,047	0.92	-7.63	-6.07
12	Ramla	9,473	0.35	-6.80	-5.40
13	Zefat	2,382	0.82	-4.00	-3.18
14	Kinneret	1,865	0.26	-0.99	-0.79
15	Golan	725	0.59	-0.88	-0.70

Given the large value of the standard deviation the largest effect on the number of immigrants is predicted for the subdistrict Ashqelon followed by Be'er Sheva, Jerusalem and Tel Aviv. For other

[23] Given a number of 15 subdistricts and 13 periods, the total number of observations available in such a model is 195. As in the model of equation 1, the first and the second lag of the explanatory variables are included.
[24] The full set of results can be obtained from the authors upon request.
[25] The calculations are identical to those used in Table 2.

subdistricts, however, the predicted change in immigration is considerably smaller, especially in the Northern subdistricts Kinneret and Golan.

4.3 Model extension: Conditional Logit Model

As was mentioned before, our fixed effects analysis cannot explain within-subdistrict migration. However, Davies et al. (2001) argue that a migration decision is a rational consideration of all alternatives relative to the present location including the option to stay and propose a conditional logit approach as an alternative migration model for aggregated data. A similar approach that replicated the core results of the aggregated study for Germany was recently applied to micro-level census data by Schündeln (2014). This framework allows to estimate only repeated cross-sections. Following Davies et al. (2001) we estimate the following log-likelihood function for each year:

$$\ln L = \sum_{o=1}^{15}\sum_{d=1}^{15} IntMig_{od} \ln P(m_{od}=1) = \sum_{o=1}^{15}\sum_{d=1}^{15} IntMig_{od} \frac{e^{\beta' X_{od}}}{\sum_{a=1}^{15} e^{\beta' X_{oa}}}$$

where $IntMig_{od}$ is the migration flow from subdistrict *o* to subdistrict *d* and the probability to migrate from subdistrict *o* to subdistrict *d*, m_{od}, is a representation of choice-specific attributes of subdistrict *o* and subdistrict *d* in relation to attributes of all subdistrict-pair combinations[26]. As controls, we use the same specification as for the baseline fixed effects model without the year effects and the second lag. Additionally, the framework allows the inclusion of interregional specific variables, therefore we add district constants, the distance between subdistrict capitals and distance squared to our base specification.

Table 4 shows the estimated coefficients of the multinominal model if terror is represented by attacks for each year. With the exception of 2001, 2002 and 2009, we see in many cases a negative significant coefficient for terror attacks in potential migration destinations. This means that if terror increases in one destination, migration to this destination decreases relatively to the remaining destinations. The overall finding seems to support our hypothesis of terror as negative pull factor for migration. However, the positive and significant coefficients in 2001, 2002 and 2009 indicate the opposite relationship.

The coefficients for origin terror are interpreted relative to the base subdistrict Tel Aviv. We choose Tel Aviv as base category because it is a central subdistrict that displays continuous terror over the

[26] To sum up Davies et al. (2001), the basic idea behind this function assumes a comparison of individual's utility levels attainable in alternative locations. An individual's *i*'s utility of alternative *d*, U_{id}, is assumed to be a representation of weighted (β) choice specific attributes (vector X) with ε_{id} an error term.

$$U_{id} = \beta' X_{id} + \varepsilon_{id}$$

Each individual chooses the destination *d* of all alternatives that promises the highest utility. The probability of moving from area *o* to destination *d* facing alternatives *a* can then be written as:

$$P(y_{i,o=d}) = P(U_{i,od} > U_{i,oa})$$

If the disturbances are iid with the Weibull distribution (see McFadden (1973)), then the probability of an individual *i* in region *o* choosing region *d* is:

$$P(y_{i,o=d}) = \frac{e^{\beta' X_{i,od}}}{\sum_{a \to A} e^{\beta' X_{i,oa}}}$$

The log likelihood function for moving from area *o* to a specific area d is then:

$$\ln L = \sum_{o} m_{i,od} \ln P\left(m_{i,od}=1\right)$$

where m_{od}=1 if an individual in area *o* chooses destination *d*. The above representation is aggregated to subdistrict level (neglecting individual migrants' attributes).

Table 3: Estimated Coefficients from Conditional Logit, Primary Explanatory Variables, 1999-2012

Variable	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Attacks (all destinations)	-10.819***	-6.796***	11.525***	1.274***	-33.612***	-0.918***	-2.511***	-0.910*	-0.247**	-0.104	0.130***	-0.429	-22.480***	-5.445***
	(2.260)	(0.791)	(1.264)	(0.294)	(2.260)	(0.332)	(0.492)	(0.528)	(0.121)	(0.115)	(0.042)	(0.565)	(2.067)	(1.014)
Attacks (origin: Ashquelon)	-0.063***	0.062***	-0.142***	-0.029***	0.028***	-0.055***	0.033***	0.046***	-0.002	0.012***	0.004***	0.040***	0.071***	0.029***
	(0.009)	(0.021)	(0.025)	(0.004)	(0.009)	(0.005)	(0.007)	(0.006)	(0.002)	(0.002)	(0.001)	(0.005)	(0.015)	(0.003)
Attacks (orig: Beer Sheva)	-0.321***	-0.030*	-0.140***	-0.047***	0.152***	0.100***	0.150***	0.108***	0.024***	0.043***	0.012***	0.100***	-0.005	-0.005
	(0.010)	(0.018)	(0.021)	(0.004)	(0.008)	(0.005)	(0.007)	(0.006)	(0.002)	(0.002)	(0.001)	(0.006)	(0.016)	(0.003)
Attacks (origin: Jerusalem)	-0.212***	-0.109***	0.034	-0.035***	-0.035***	0.010*	0.103***	0.145***	0.020***	0.044***	0.019***	0.125***	0.279***	0.032***
	(0.010)	(0.022)	(0.023)	(0.004)	(0.009)	(0.005)	(0.007)	(0.006)	(0.002)	(0.002)	(0.001)	(0.006)	(0.015)	(0.003)
Attacks (orig: Petah Tiqwah)	-0.100***	-0.079***	0.018	-0.033***	-0.054***	-0.017***	0.049***	0.061***	-0.004***	0.015***	0.009***	0.099***	0.223***	0.026***
	(0.010)	(0.016)	(0.020)	(0.004)	(0.008)	(0.005)	(0.007)	(0.006)	(0.001)	(0.002)	(0.001)	(0.006)	(0.014)	(0.002)
Attacks (origin: Ramla)	0.019*	-0.174***	-0.174***	-0.027***	0.095***	-0.041***	0.035***	0.036***	0.007***	0.018***	0.005***	0.005	-0.043**	0.022***
	(0.011)	(0.022)	(0.027)	(0.005)	(0.010)	(0.006)	(0.009)	(0.008)	(0.002)	(0.002)	(0.001)	(0.007)	(0.018)	(0.003)
Attacks (origin: Sharon)	-0.061***	0.042**	0.077***	-0.023***	-0.119***	0.020***	0.061***	0.158***	0.013***	0.034***	0.011***	0.103***	0.260***	0.042***
	(0.012)	(0.018)	(0.020)	(0.005)	(0.009)	(0.006)	(0.010)	(0.008)	(0.002)	(0.003)	(0.001)	(0.007)	(0.018)	(0.003)
Attacks (origin: Rehovot)	-0.221***	-0.334***	-0.315***	-0.084***	-0.044***	-0.006	0.107***	0.132***	0.019***	0.047***	0.018***	0.112***	0.354***	0.056***
	(0.010)	(0.021)	(0.023)	(0.004)	(0.008)	(0.004)	(0.007)	(0.005)	(0.001)	(0.002)	(0.001)	(0.005)	(0.013)	(0.003)
Attacks (origin: Haifa)	-0.088***	-0.073***	0.018	-0.011***	0.002	-0.039***	0.054***	0.045***	0.014***	0.018***	0.004***	0.019***	0.120***	0.024***
	(0.012)	(0.023)	(0.018)	(0.004)	(0.008)	(0.007)	(0.009)	(0.008)	(0.002)	(0.002)	(0.001)	(0.007)	(0.017)	(0.003)
Attacks (origin: Hadera)	-0.190***	0.181***	0.258***	0.057***	0.062***	-0.079***	0.005	0.141***	0.001	0.008***	0.008***	0.068***	0.191***	0.014***
	(0.015)	(0.019)	(0.020)	(0.005)	(0.010)	(0.008)	(0.011)	(0.009)	(0.002)	(0.003)	(0.001)	(0.008)	(0.019)	(0.003)
Attacks (origin: Akko)	-0.079***	0.171***	-0.476***	-0.002	-0.032***	-0.002	0.021*	-0.007	-0.001	-0.001	0.001	0.012	0.023	0.017***
	(0.015)	(0.026)	(0.023)	(0.005)	(0.010)	(0.008)	(0.011)	(0.011)	(0.002)	(0.003)	(0.001)	(0.008)	(0.022)	(0.004)
Attacks (origin: Golan)	-0.110***	0.127**	0.242***	0.017	0.113***	0.051***	0.126***	0.057**	0.003	0.027***	0.013***	0.024	-0.163***	-0.023**
	(0.038)	(0.063)	(0.064)	(0.015)	(0.027)	(0.017)	(0.020)	(0.025)	(0.005)	(0.008)	(0.002)	(0.020)	(0.049)	(0.009)
Attacks (origin: Kinneret)	-0.181***	-0.043	-0.201***	-0.005	0.071***	0.035***	0.055***	0.111***	0.002	0.016***	0.009***	0.015	0.061**	0.007
	(0.023)	(0.042)	(0.038)	(0.009)	(0.017)	(0.013)	(0.017)	(0.014)	(0.003)	(0.004)	(0.002)	(0.012)	(0.030)	(0.005)
Attacks (origin: Zefat)	-0.135***	0.115***	-0.155***	-0.024***	-0.016	0.009	0.046***	0.014	0.006**	-0.002	0.001	0.001	-0.165***	0.009
	(0.021)	(0.037)	(0.031)	(0.007)	(0.015)	(0.011)	(0.015)	(0.015)	(0.003)	(0.004)	(0.002)	(0.010)	(0.030)	(0.006)
Attacks (origin: Yizreel)	-0.087***	0.059**	-0.156***	0.014***	0.032***	0.014*	0.049***	0.068***	0.003	0.003	0.005***	-0.013	-0.010	0.016***
	(0.015)	(0.026)	(0.024)	(0.005)	(0.010)	(0.008)	(0.011)	(0.010)	(0.002)	(0.003)	(0.001)	(0.008)	(0.020)	(0.003)
Log L at Convergence	-467373	-419654	-474287	-432833	-367579	-475926	-426502	-441124	-449047	-462501	-500621	-465254	-447224	-473798
Log L at β=0	-610587	-549734	-631452	-573405	-491982	-636809	-565303	-584294	-596749	-610213	-667499	-617652	-591890	-629140
Pseudo R^2	0.235	0.237	0.249	0.245	0.253	0.253	0.246	0.245	0.248	0.242	0.250	0.247	0.244	0.247

Notes: Base category for case-specific effects is attacks (origin: Tel Aviv). All explanatory variables are lagged by one period and in logs, terror attacks are in levels. Coefficients for other controls not reported.

considered time-span, but exhibits a medium terror prevalence over the whole time span (35). In table 4, we see positive significant coefficients for origin terror. This means relative to the probability to migrate out of Tel Aviv due to terror an increase of origin terror leads to an increase in the probability of outward-migration. The subdistricts Ashquelon (243) and Jerusalem (80) exhibit the most terror attacks. 220 attacks on Asquelon were reported in 2006 and later. And indeed, relative to the probability to migrate out of Tel Aviv due to terror, more terror attacks in Ashqelon lead to an increase in the probability of outward-migration from Ashquelon in all but one years since then. In Jerusalem, terror attacks appear regularly over the years while exceptionally high levels can be seen in 2001 and 2002. However, terror increases the probability to migrate from Jerusalem only after 2004.

To summarize, the multinominal model gives some support for the hypotheses of the evasion and expulsion effect of terror. It is puzzling, however, that the years during the intifada exhibit results not in line with our expectations.

6 Conclusion

This paper is a first attempt in analysing the correlation between terror events and inter-regional movements of people. Based on a rich literature on terror and its effects, we have argued that terror should function as a push-factor from and as a negative pull-factor to terror-affected regions. To analyse this effect empirically, we regresses the annual flow of migrants from an origin subdistrict to a destination subdistrict on measures of terror incidents in the origin and the destination, respectively. The empirical analysis of this paper offers limited evidence that terror is a significant determinant of subdistrict-to-subdistrict internal migration in Israel. While there is no or very limited evidence that increases in origin terror lead to increases in out-migration, our results do offer some support that, if sufficiently high, increases in destination terror lead to decreases in the amount of in-migration.

We believe that the following extensions and adjustments can add to the accuracy of our model.

To control for possible complementary or substitutional effects between terror and explanatory variables, we intend to include interaction terms. For instance, gross income can serve as an economic gain of moving and might be sufficiently large to off-set parts of the effects of terror. On the other hand, sufficiently high price levels may reinforce the effect of terror.

We also plan to differentiate between different dimensions of terror. Individuals might react differently to attacks with no victims than to attacks that cause fatalities. Therefore, we want to use separate variables representing the number of attacks (“quantitative effect”) and the number of casualties (“qualitative effect”). This procedure follows Pizam and Fleischer (2002). Moreover, the use of alternative terror databases – which might have different terror definitions – can serve as sources for robustness checks.

Our list of control variables is so far limited by data availability. In the literature, it is common to control for infrastructure, quality of life, crime level, migration policy, and political views. Terror is already found to have effects on crime and, hence, the estimated terror effect may be confounding effects of crime on migration (Gould and Stecklov, 2009; Draca, Machin and Witt, 2011). We hope to get access to appropriate proxies in the future.

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Appendix

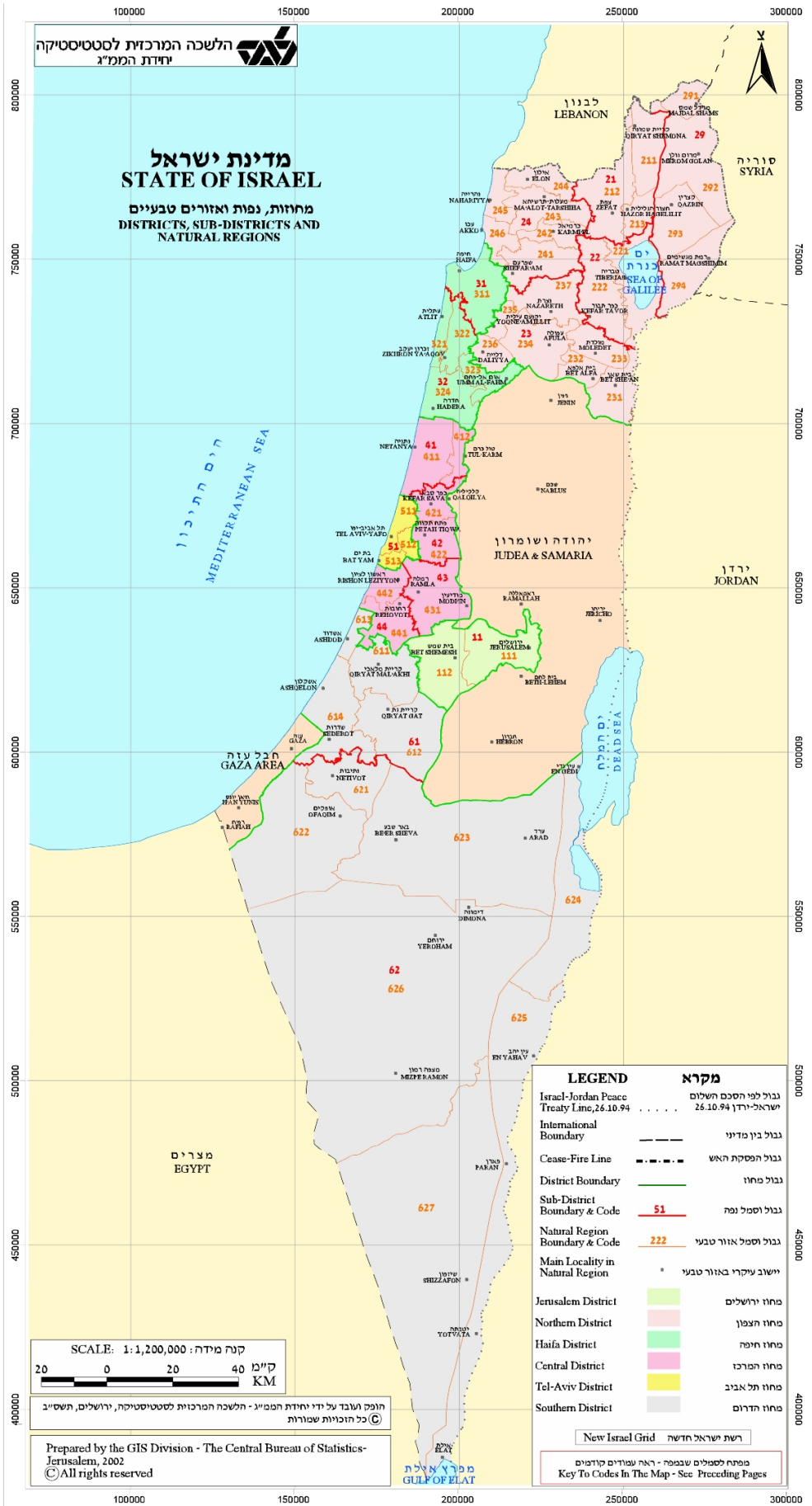
Table A1: Full regression output

	Model 1	Model 2	Model 3
L.o_attacks	-0.00070		-0.00051
	(0.00049)		(0.00049)
L2.o_attacks	-0.00075		-0.00023
	(0.00071)		(0.00071)
L.d_attacks	-0.00264***		-0.00263***
	(0.00053)		(0.00055)
L2.d_attacks	-0.00279***		-0.00298***
	(0.00070)		(0.00078)
L.o_fatalities		-0.00098**	-0.00082*
		(0.00045)	(0.00042)
L2.o_fatalities		-0.00072*	-0.00071*
		(0.00041)	(0.00042)
L.d_fatalities		-0.00112**	0.00004
		(0.00038)	(0.00039)
L2.d_fatalities		0.00022	0.00048
		(0.00037)	(0.00041)
L.ln_o_population	3.71495**	3.82611**	3.75402**
	(1.57309)	(1.55961)	(1.57581)
L2.ln_o_population	-4.35690**	-4.36624**	-4.33462**
	(1.41250)	(1.41383)	(1.41192)
L.ln_d_population	-1.62864	-1.11724	-1.63665
	(1.00218)	(1.05289)	(1.00708)
L2.ln_d_population	-0.07025	-0.22223	-0.05690
	(0.88114)	(0.90720)	(0.88611)
L.ln_o_jews	-2.26087*	-2.15100*	-2.18172*
	(1.21361)	(1.23763)	(1.21366)
L2.ln_o_jews	4.35386***	4.19288***	4.24452***
	(1.06662)	(1.09669)	(1.06710)
L.ln_d_jews	3.23275***	3.57451***	3.19976***
	(0.83127)	(0.86021)	(0.83520)
L2.ln_d_jews	-1.88552**	-2.42385**	-1.85918**
	(0.75894)	(0.78627)	(0.76262)
L.ln_o_employment	0.02030	0.02426	0.02575
	(0.08328)	(0.08335)	(0.08370)
L2.ln_o_employment	0.14875**	0.13872*	0.14500**
	(0.06977)	(0.07288)	(0.07037)
L.ln_d_employment	-0.06959	-0.07868	-0.07481
	(0.07765)	(0.07923)	(0.07859)
L2.ln_d_employment	-0.10926*	-0.16177**	-0.10644*
	(0.06283)	(0.06294)	(0.06199)
L.ln_o_gross_income	-0.18964*	-0.19387*	-0.20575**
	(0.10204)	(0.10190)	(0.10427)
L2.ln_o_gross_income	-0.10678	-0.07817	-0.08877
	(0.10029)	(0.10038)	(0.10217)
L.ln_d_gross_income	-0.24747**	-0.14957	-0.23531**
	(0.09535)	(0.09304)	(0.09509)
L2.ln_d_gross_income	-0.21488**	-0.11536	-0.21507**
	(0.09336)	(0.09038)	(0.09436)
L.ln_o_housing_exp	0.23774**	0.24361**	0.24727**
	(0.07973)	(0.08058)	(0.07921)
L2.ln_o_housing_exp	-0.07655	-0.06544	-0.06583
	(0.08626)	(0.08638)	(0.08681)
L.ln_d_housing_exp	0.02826	0.01393	0.02435
	(0.08066)	(0.07975)	(0.08139)

L2.ln_d_housing_exp	0.12824*	0.10947	0.12332*
	(0.07226)	(0.07305)	(0.07237)
L.ln_o_standard_persons	0.13630	0.11800	0.12158
	(0.14140)	(0.14707)	(0.14499)
L2.ln_o_standard_persons	0.02214	-0.06905	-0.06537
	(0.14515)	(0.14511)	(0.14324)
L.ln_d_standard_persons	-0.75342***	-0.77269***	-0.76066***
	(0.15541)	(0.15458)	(0.15351)
L2.ln_d_standard_persons	-0.33644**	-0.34744**	-0.31176**
	(0.14076)	(0.15577)	(0.15011)
2001.year	0.17155***	0.15025***	0.16847***
	(0.02673)	(0.02691)	(0.02708)
2002.year	0.13393***	0.10466**	0.13283***
	(0.03829)	(0.03816)	(0.03835)
2003.year	-0.04560	-0.06884	-0.03943
	(0.04735)	(0.04726)	(0.04758)
2004.year	0.25877***	0.22480***	0.25894***
	(0.05138)	(0.05301)	(0.05250)
2005.year	0.13439**	0.09470*	0.12853**
	(0.05197)	(0.05401)	(0.05292)
2006.year	0.17327**	0.11988*	0.16331**
	(0.06206)	(0.06318)	(0.06274)
2007.year	0.22692**	0.15186**	0.21526**
	(0.07442)	(0.07455)	(0.07494)
2008.year	0.30436***	0.20333**	0.28837**
	(0.08872)	(0.08879)	(0.08977)
2009.year	0.37918***	0.26033**	0.36056***
	(0.09612)	(0.09645)	(0.09768)
2010.year	0.25413**	0.12286	0.23136**
	(0.10515)	(0.10504)	(0.10706)
2011.year	0.19113*	0.08086	0.16950
	(0.11520)	(0.11646)	(0.11719)
2012.year	0.27367**	0.15014	0.25001*
	(0.12608)	(0.12718)	(0.12840)
_cons	6.05151**	3.27884	5.74971**
	(2.74775)	(2.62466)	(2.75273)
R^2	0.323	0.310	0.326
N	2730	2730	2730

Table A2: Descriptive statistics

	Obs	Mean	Standard deviation	Min	Max
Intmig	2,730	664.17	1,088.82	10.00	11,555.00
Attacks					
L1.	2,730	2.72	8.11	0.00	82.00
L2.	2,730	2.56	7.93	0.00	82.00
Fatalities					
L1.	2,730	4.08	11.24	0.00	102.00
L2.	2,730	4.06	11.20	0.00	102.00
Population					
L1.	2,730	450.46	290.01	34.00	1,295.00
L2.	2,730	442.04	286.34	33.04	1,285.00
Jews					
L1.	2,730	338.72	269.18	14.81	1,208.00
L2.	2,730	333.96	266.65	14.35	1,199.30
Employment					
L1.	2,730	163.16	118.83	8.80	598.27
L2.	2,730	158.56	116.18	8.80	595.93
Gross_income					
L1.	2,730	11,845.54	2,695.12	7,841.00	19,366.00
L2.	2,730	11,451.65	2,627.87	7,497.00	19,366.00
Housing_exp					
L1.	2,730	2,398.72	732.79	1,396.00	5,038.00
L2.	2,730	2,289.81	671.73	1,396.00	4,917.00
Standard_persons					
L1.	2,730	2.83	0.27	2.10	3.20
L2.	2,730	2.84	0.26	2.10	3.27


הלשכה המרכזית לסטטיסטיקה
יחידת הממ"ג
מדינת ישראל
STATE OF ISRAEL
מחוזות, נפות ואזורים טבעיים
DISTRICTS, SUB-DISTRICTS AND NATURAL REGIONS
לבנון
LEBANON
סוריה
SYRIA
ירדן
JORDAN
מצרים
EGYPT
ים התיכון
MEDITERRANEAN SEA
יהודה ושומרון
JUDEA & SAMARIA
חבל עזה
GAZA AREA
ים המלח
DEAD SEA
ים כנרת
SEA OF GALILEE
מפרץ אילת
GULF OF ELAT
LEGEND
מקרא
Israel-Jordan Peace Treaty Line,26.10.94
גבול לפי הסכם השלום ישראל-ירדן 26.10.94
International Boundary
גבול בין מדיני
Cease-Fire Line
גבול הפסקת האש
District Boundary
גבול מחוז
Sub-District Boundary & Code
גבול וסמל נפה
Natural Region Boundary & Code
גבול וסמל אזור טבעי
Main Locality in Natural Region
יישוב עיקרי באזור טבעי
Jerusalem District
מחוז ירושלים
Northern District
מחוז הצפון
Haifa District
מחוז חיפה
Central District
מחוז המרכז
Tel-Aviv District
מחוז תל אביב
Southern District
מחוז הדרום
New Israel Grid
רשת ישראל חדשה
מפתח לסמלים שבמפה - ראה עמודים קודמים
Key To Codes In The Map - See Preceding Pages
SCALE: 1:1,200,000
קנה מידה:
20 0 20 40 ק"מ KM
100000
150000
200000
250000
300000
800000
750000
700000
650000
600000
550000
500000
450000
400000
תוכן ועובד על ידי יחידת הממ"ג - הלשכה המרכזית לסטטיסטיקה, ירושלים, תשס"ב
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