STRUCTURAL BREAKS IN MILITARY EXPENDITURES: EVIDENCE FOR EGYPT, ISRAEL, JORDAN AND SYRIA

Aamer S. Abu-Qarn and
Suleiman Abu-Bader

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Monaster Center for Economic Research
Ben-Gurion University of the Negev
P.O. Box 653
Beer Sheva, Israel

Fax: 972-8-6472941
Tel: 972-8-6472286

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Aamer S. Abu-Qarn and Suleiman Abu-Bader
Economics Department, Ben-Gurion University, Israel

Abstract

This paper endogenously determines the timing of structural breaks in military expenditures and military burdens for the major parties involved in the Israeli-Arab conflict, namely Egypt, Israel, Jordan, and Syria over the period 1960-2004. Utilizing a test proposed by Vogelsang (1997), we find that all these countries experienced structural breaks, though at different periods in the late 70s and during the 80s. These structural breaks mark a sharp decline in the military burden that can be attributed to the peace talks that were initiated shortly after the 1973 war. When applying the Bai and Perron (1998, 2003) multiple structural break tests we detect two structural breaks for every country. The first break occurred during the 60s and demonstrated a significant rise in the military burden prior to the 1973 war, whereas the second break occurred in the late 70s and during the 80s and was characterized by a sharp decline in the military burden following the instigation of peace negotiations.

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Corresponding Author:
Aamer S. Abu-Qarn
Economics Department, Ben-Gurion University of the Negev
P.O. Box 653, Beer-Sheva, 84105, Israel
Telephone: +972-8-6472296; Fax: +972-8-6472941
Email: aamer@bgu.ac.il

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1. Introduction

The historical visit of the Egyptian President Anwar Al-Sadat to Jerusalem in 1977 marked a significant milestone in the Israeli-Arab conflict. The subsequent peace treaty and the Israeli withdrawal from the Sinai Desert, the peace talks with the Palestinians, and the peace treaty with Jordan further boosted hopes for bringing about an end to the long-lasting conflict. However, stalled Israeli-Palestinian talks coupled with the outbreak of the second *Intifada* in 2000 as well as the 2006 Israel-Lebanon war have underscored the devastatingly volatile nature of the conflict and undermined any chances for a long-lasting peace in the Middle East.

Three Arab countries, Egypt, Jordan, and Syria, have constituted the front line against the State of Israel since its establishment in 1948. Significant shares of the limited resources of these countries, in addition to aid from the rich Gulf countries to the Arab side and generous American aid to Israel, have been allocated to military expenditures. The military burden, defined as the share of military expenditures in GDP, of the four parties has been among the highest in the world for many years now and obviously has had an adverse impact on economic growth.[1] Figure 1 depicts the evolution of the military burden over the period 1960-2004. The graph shows that the military burden of the four countries peaked in the mid and late 70s to reach 0.55 for Egypt, 0.25 for Israel, 0.45 for Jordan, and 0.29 for Syria. The relative calm of the 90s with the initiation of Israeli-Palestinian peace talks resulted in a sharp decline in the military burden to a level of less than 0.1. Despite this drastic decline the military burden of the four countries is extremely high when compared with international standards. For example, the world's average military burden during the period 1990-2005 was 2.5%. In the same period, the military burden for the US was less than 4% despite its engagement in anti-terrorism wars and military actions in the aftermath of September 11. A similar pattern of decline is also observed in the real military expenditures (Figure 2). The Arab countries experienced a sharper decline than Israel. For Israel, threats at other fronts (Lebanon and the Occupied Territories) led to maintaining high military expenditures, although its share of GDP dropped significantly. There is no doubt that the decline of military burden in the Middle East was, at least partially, the product of the cessation of the state of war between Israel and Egypt and Jordan and the commencement of direct negotiations between Israelis and Palestinians.

Most of the studies to date that addressed the economic aspects of the Israeli-Arab conflict focused either on the causality between military expenditures and economic growth (Lebovic and Ishaq, 1987; Linden, 1992; Cohen et al., 1996; DeRouen, 2000; Abu-Bader and Abu-Qarn, 2003; and Yildirim et al., 2005) or the causal relationships between the military expenditures of the warring parties (McGuire, 1982, 1987; Linden, 1991; Chen et al., 1996, Beenstock, 1998; and Lebovic, 2004).

In this paper we take a different approach for investigating the links between military expenditures and political developments by assessing whether Egypt, Israel, Jordan, and Syria experienced statistically significant structural breaks in both real military expenditures and the military burden over the period 1960-2004 and determine the timing of such breaks and its association with the political developments in the region. By this means, we attempt to identify patterns in the military outlays and examine whether they reflect hostile activities as well as the peace negotiations that took place during the last four decades. To do so, we apply a sequential test of structural breaks developed by Vogelsang (1997) to endogenously determine the timing of such structural breaks if any exist. The test that is valid for both stationary and unit root series, and allows both linear and quadratic trending of the data. Additionally, we allow more than a single breakpoint by using the Bai and Perron (1998, 2003) test for multiple endogenous breakpoints in military expenditures. These tests are widely used for determining the timing of structural breaks of many economic variables but have not been applied to military expenditures. The only exception is a recent paper by Amara (2006) who applies the Bai and Perron (2003) test to determine the timing of the structural breaks in defense expenditures of NATO members.

The rest of the paper is organized as follows. In the next section we outline the major developments in the Israeli-Arab conflict that may have shaped the pattern of defense expenditures of the involved parties. Section 3 describes our dataset and its resources. The econometric methodologies are described in section 4. Our results are presented in section 5. A summary and some concluding remarks are provided in section 6.

2. The Israeli-Arab Conflict: A Timeline[2]

Since the establishment of the State of Israel in 1948 the Middle East region has undergone several wars and numerous military actions. In 1947 the United Nations proposed a “Partition Plan” that called for the establishment of two independent states for Arabs and Jews in Palestine. However, the Arabs rejected this plan and shortly after the withdrawal of the British mandate forces and the independence declaration of Israel they declared war on Israel. At the end of the “Independence War” or “Al-Nakba” (the disaster), hundreds of thousands of Palestinians were expelled and more than half of the area allotted to Arabs under the UN plan was controlled by Israel.

Following the nationalization of the Suez Canal by President Nasser and the blockade of the Tiran Straits to Israeli shipping in 1956, Israel, backed by Britain and France, invaded and subsequently occupied the Sinai Peninsula and Gaza Strip. Soviet warning for intervention on behalf of Egypt and American economic pressures forced the three parties to withdraw from the occupied lands by early March 1957. The hostile operations reached a peak in 1967 when in a massive and quick assault that lasted for six days, Israel succeeded in seizing the Sinai Peninsula and Gaza Strip from Egypt, the West Bank from Jordan and the Golan Heights from Syria.

On October 6, 1973 Israel was caught by surprise as the Egyptian and Syrian forces coordinated a joint attack and advanced beyond the cease-fire lines into Sinai and the Golan Heights and inflicted heavy casualties on the Israeli Army. Israel counter-attacked and pushed the Egyptian and Syrian armies back advancing deep into Egypt and Syria. A ceasefire ended the war and paved the way for peace negotiations between Egypt and Israel that culminated in a peace treaty in 1979. According to this agreement, the state of war between the two countries was terminated, Israel pulled out its armed forces and civilians from Sinai, and normal diplomatic relations were established. However, this dramatic Egyptian move was confronted by a unified Arab front that objected to a separate peace treaty that neglected the Palestinian issue. Moreover, Egypt was suspended from the Arab League, and most Arab countries cut their diplomatic relations with Egypt.

Once the Israel-Egypt peace treaty was finalized, the focus shifted to the Palestinian issue. The articles in the treaty that called for the establishment of an autonomous self-governing authority in the West Bank and Gaza were never materialized. Palestinian forces were stationed in Southern Lebanon under the leadership of the Palestine Liberation Organization (PLO) and initiated attacks on Northern Israel. On June 1982, Israel launched a massive assault on Palestinian targets in Southern Lebanon with the stated objective of pushing PLO forces to the north. Israel extended its operations deep into Lebanon beyond the initial plan and many Lebanese cities, including Beirut, and Syrian military targets were bombed and suffered heavy destruction and casualties. After a long siege of Beirut, PLO forces were forced out of Lebanon and Israel withdrew from most of the Lebanese territories, however, Israel maintained a “security zone” of approximately 10 miles north of the border that was eventually evacuated in 2000.

The growing frustration among Palestinians in the Occupied Territories over the status quo, their suffering under the occupation, and the lack of progress towards a permanent solution to their nationalistic claims led to many violent incidents and confrontations with the Israeli Army in late 1987. The *Intifada* (uprising) that began in Gaza and spread to other cities and villages involved hundreds of thousands of people including children, teenagers and women. This popular resistance included not only stone throwing, burning tires, Molotov cocktails and the erection of barricades but also massive demonstrations, general strikes, refusal to pay taxes, and boycotts of Israeli products. The Palestinian uprising continued, though to a lower intensity, until the signing of the Oslo Accords in 1993. In the midst of this period Israel suffered a massive missile attack by Iraq when the US backed by a wide international coalition drove Iraq out of Kuwait in 1991. The end of the Gulf War paved the way to direct negotiations between Israel and Arab countries (Egypt, Lebanon, Syria, and a joint Jordanian/Palestinian delegation that excluded the PLO due to Israel’s objection) in Madrid in 1991 under the sponsorship of the US and USSR.

Several rounds of negotiations and the subsequent recognition of Israel by the PLO brought Israel and the PLO together for more intensive rounds of confidential talks that culminated by the signing of the "Declaration of Principles On Interim Self-Government Arrangements" in Oslo on August 20, 1993. The Oslo Accords called for the withdrawal of Israel from parts of Gaza Strip and the West Bank and the establishment of the Palestinian Authority (a self-ruled entity that was extended later on to include more cities and villages in the West Bank) and negotiating for a permanent agreement that would begin no later than August 1996. The progress in the Israeli-Palestinian channel led to a peace treaty between Israel and Jordan in 1994 under which all the territorial and water disputes were resolved, and relations were normalized.

The outbreak of the *Al-Aqsa Intifada* in 2000 marked the escalation of hostile actions by Palestinians and Israelis when the negotiations on a permanent agreement ended in a deadlock. Currently, with Hamas in power and Israel, the US and Europe refusing to cooperate with Hamas led government, the odds for reviving the peace talks are at best slim.

3. Econometric Methodologies

Most of the previous work on military expenditures which have been devoted mostly to assessing causality between growth and military expenditures or the evolution of arms races, for which it has relied on the traditional Augmented Dickey Fuller (ADF) unit root test. A typical ADF involves running the following regression:

$$\Delta y_t = \mu + \alpha y_{t-1} + \sum_{i=1}^{k} c_i \Delta y_{t-i} + \varepsilon_t \qquad (1)$$

and testing whether the coefficient of y_{t-1} is significantly different from zero. Rejecting the null hypothesis $\alpha=0$ implies that the series is stationary, $I(0)$.

In his seminal article, Perron (1989) argued that failing to account for at least one structural break in the trend function may lead researchers who use the conventional unit root tests not to reject the null hypothesis of unit root process when in fact the series is stationary around a one time structural break. Contrary to many earlier studies that found that the US post-war GNP series is a unit root process, Perron (1989) showed that if the first oil shock in 1973 is treated as a structural breakpoint in the trend function then one can reject the unit root hypothesis in favor of a trend stationary hypothesis.

Zivot and Andrews (1992) suggested a variation of Perron's (1989) test that allows endogenously determined breakpoints in the intercept, the trend function , or in both. In its general form (breaks in both the intercept and the trend function), the test entails running the following regression for all potential breakpoints, T_B, ($1<T_B<T$):

$$\Delta y_t = \mu + \beta t + \theta_1 DU_t + \gamma_1 DT_t + \alpha y_{t-1} + \sum_{i=1}^{k} c_i \Delta y_{t-i} + \varepsilon_t \qquad (2)$$

where DU_t and DT_t are break dummy-variables that are defined as follows:

$$DU_t = \begin{cases} 1 & if\ t > T_B \\ 0 & otherwise \end{cases} \qquad \text{and} \qquad DT_t = \begin{cases} t - T_B & if\ t > T_B \\ 0 & otherwise \end{cases}$$

and k is the number of lags determined for each possible breakpoint by one of the information criteria.

Equation (2) is sequentially estimated and T_B is chosen so as to minimize the one-sided t-statistics of the hypothesis $\alpha=0$. Thus, the break point is the point least favorable to the null hypothesis of unit root process with a drift and excludes any structural breakpoints.

Since it is possible for an economic series to exhibit multiple breakpoints, Clemente et al. (1998) suggested a unit root test that allows for two changes in the mean of a series under the assumptions of either innovational (IO) or additive outliers (AO). For the case where the two breaks belong to the IO, we estimate the following regression:

$$\Delta y_t = \mu + d_1 DTB_{1t} + d_2 DTB_{2t} + \theta_1 DU_{1t} + \theta_2 DU_{2t} + \alpha y_{t-1} + \sum_{i=1}^{k} c_i \Delta y_{t-i} + \varepsilon_t \qquad (3)$$

where DTB_i ($i=1, 2$) are pulse variables that take the value 1 if $t=TB_i+1$ and zero otherwise, DU_i are defined as in equation (2), and TB_1 and TB_2 are the dates when the shifts in the mean occur. Equation (3)is sequentially estimated and the unit root hypothesis is tested by obtaining the minimal value of the pseudo t-statistic for the hypothesis $\alpha=0$ for all break time combinations.

For the purpose of our work, we apply the test for detecting shifts in the trend function of a dynamic time series developed by Vogelsang (1997) which allows for both serial correlation and trending data, and is valid whether the series is stationary or not. Vogelsang (1997) addresses three cases of the trend function; no trend, linear trend, and quadratic trend for which the following regressions are, respectively, estimated:

$$y_t = \mu + \theta DU_t + \sum_{i=1}^{k} c_i y_{t-i} + \varepsilon \tag{4}$$

$$y_t = \mu + \beta_1 t + \theta DU_t + \gamma_1 DT_t + \sum_{i=1}^{k} c_i y_{t-i} + \varepsilon \tag{4a}$$

$$y_t = \mu + \beta_1 t + \beta_2 t^2 + \theta DU_t + \gamma_1 DT_t + \gamma_2 DT_t^2 + \sum_{i=1}^{k} c_i y_{t-i} + \varepsilon \tag{4b}$$

where the dummy variables *DU* and *DT* are defined as in equation (2) and the truncation lag parameter, k, is selected as based on a procedure developed by Perron (1989). For any given break date, T_B, we start with an a priori chosen upper bound k_{max} and test whether its coefficient is significant. If it is significant then the procedure is stopped and we choose $k=k_{max}$. Otherwise, we reduce the lag order by one and continue until the last lag becomes significant. If no lags are found to be significant, we choose $k=0$.

To endogenously determine the timing of the structural break with no *ex ante* preference for any particular year, we sequentially estimate equations (4, 4a, 4b) for each break year with 15 percent trimming from both ends of the sample ($0.15T< T_B <0.85T$) and calculate the Sub Wald (SubW_t) statistic for the hypotheses $\theta = 0, \theta = \gamma_1 = 0, \theta = \gamma_1 = \gamma_2 = 0$ for the no trend, linear trend, and quadratic trend, respectively. The maximum SubW_t is compared to the critical values tabulated by Vogelsang (1997). These critical values depend on the type of trend, whether the series is stationary or not, and the size of trimming. If the maximum SubW_t exceeds the respective critical value, then we infer that a structural break has occurred at the period for which the statistic is maximal.

Another test that allows multiple endogenous structural breaks was proposed by Bai and Perron (1998, 2003). Consider the following multiple regression with *m* breaks (and *m+1* regimes):

$$y_t = x_t^{'}\beta_j + \varepsilon_t \quad (t = T_{j-1}+1,...,T_j; \quad j = 1,...,m+1) \tag{5}$$

where *y* is the dependent variable, *x* is a vector of covariates, β is the corresponding vector of coefficients that may vary over time, ε is the disturbance term, *T* is the number of observations, and $T_0=0$ and $T_{m+1}=T$ by convention. In this study, $x_t = \{1\}$, i.e. we test for breakpoints in the mean of the series.[3] Under the above specification there are *m+1* segments in which the regression coefficients are constant.

To detect structural breaks, we first calculate the double maximum tests developed by Bai and Perron (1998) where the null hypothesis of no structural breaks is tested against the alternative of an unknown number of breaks. Once we get evidence of structural break of an unknown number of breaks we use the dynamic programming search algorithm that was proposed by Bai and Perron (2003) to determine the optimal number of breaks and their timing. The algorithm involves finding a global minimizer of the Residual Sum of Squares (RSS) or the Bayesian Information Criteria (BIC) over all possible combinations of up to *m** given a number of breakpoints.

4. Data Description and Sources

Raw data were obtained from the following two main sources. (1) Real military expenditures in 2003 constant prices in US dollars as well as the share of military expenditures in GDP for the years 1988-2004 which were obtained from the SIPRI online database available at http://www.sipri.org. (2) Real military expenditures in 1993 constant prices in US dollars and the share of military expenditures in GNP for the period 1963-1987 which were obtained from a database compiled by Beenstock (1998). For the years 1960-1963 we derived the real GNP series using growth rates from the World Development Indicators (WDI) online database (http://devdata.worldbank.org/dataonline), with the exception of Jordan for which the growth rates were taken from the PWT database available at http://pwt.econ.upenn.edu. Military expenditures were converted to real 2000 prices US dollars using the GDP deflator and the GNP/GDP ratio series from the WDI online database. The final product consists of military expenditures in US dollars at 2000 constant prices and the military burden proxied by the share of military expenditures in GDP.

We also constructed an aggregate series for the three Arab countries which we refer to it as “Arab.” For real military expenditures this series is simply the sum of the military expenditures whereas for military burden, it is defined as this sum divided by the total GDP of these countries. These series are dominated by the figures for Egypt since its figures constitute the bulk of the "Arab" series.

To conduct our tests we used Eviews 5.1 for the ADF test, and for the Vogelsang (1997) test. Stata 8 was used to conduct the Zivot and Andrews (1992) test as well as the Clemente et al. (1998) unit root test of double changes in the mean. The package *strucchange* of the open source statistical software R version 2.5.0 was utilized to detect multiple breakpoints based on Bai and Perron (2003).[4]

5. Results

The Vogelsang (1997) test can be applied to both stationary and unit root series, although, the critical values differ. Since the critical values of the Vogelsang (1987) breakpoints test for stationary series are much lower than for unit root ones, relying on the traditional ADF may lead to infer that a series does not exhibit a structural break when in fact it does. Thus, we need to establish whether the series under investigation is stationary or has a unit root also in the presence of structural breaks in order to use the appropriate critical values. Table 1 shows that based on ADF, both the military burden and military expenditures variables have a unit root, I(1) for all countries. However, as we mentioned earlier, the test does not address the possibility of structure breaks in the series. When we subjected the series to the Zivot-Andrews unit root test (Table 2), the results remained the same except for Israel where the real military expenditures were found to be stationary when a break is allowed in both the intercept and the trend function. Likewise, the military burden was found to be stationary for the cases of breaks in the trend and in both the intercept and the trend function.. Table 3 presents the results of the Clemente et al. (1998) unit root test for up to two shifts in the mean of the series for both the AO and IO cases. Allowing two structural breaks in the mean of the series we found that in all but five cases the series are unit root. The exceptions are the Israeli military expenditures under the IO representation and the military burden under the AO assumption, Egypt's military burden under IO, and Arab military expenditure under AO and the military burden under IO. Summing up the results of the unit root tests, we found that using the traditional ADF all the series have a unit root when in fact some series are stationary around a one or two structural breaks.

Once we have established which series are stationary and which are not, we used the Vogelsang (1997) test for detecting structural breaks, for both linear and quadratic trend functions with 15% trimming. Generally speaking, as graphs 3 and 4 demonstrate, a quadratic trend with a break seems to capture to a great extent the evolution of military expenditures and military burden for all countries. Thus, we focus mainly on the results of the quadratic trend function which are summarized in Tables 4 and 5. We first examined real military expenditures and subjected them to the test. As Table 4 shows, all countries experienced significant structural breaks, though at different periods. Allowing for a quadratic trend function, we found that all countries went through a structural break in that can be associated with the peace process that gained momentum after the 1973 war. This is illustrated by a drop in the level of real military expenditures for all countries (Graph 3). Our results determined that 1985 was the likely breakpoint for Israel's military expenditures. Due to the redeployment of the armed forces withdrawn from the Sinai Dessert and the invasion of Lebanon, Israel's military spending did not drop so the post/pre-break ratio, 1.63, was relatively high. This ratio is deceiving, however, especially when the series has a positive trend, as is the case for Israel. As can be seen from Graph 3, the military expenditures after 1985 continued to grow, though at a lower pace. When considering a ten year interval around the breakpoint, we find that the post/pre-break ratio of military expenditures for Israel was lower than one (0.81).

Egypt experienced a structural break in 1975 following the 1973 war that many believed it to be the war that paved the way to peace negotiations that were officially initiated after the historical visit of Al-Sadat to Israel in 1977. The post-break military expenditures were about two thirds of the level that preceded the breakpoint and 0.72 when relating to the ten year interval around the breakpoint. For Jordan and Syria the breakpoints were in the early 80s (1981, and 1983, respectively). Unlike Egypt, the post/pre-breakpoint ratio was around one, meaning that the mean level did not change significantly.

The sharp decline in the military burden for the four countries is clearly demonstrated in Graph 4. The trend function for all countries for the post-break period has a negative slope, indicating a continuous decline in military expenditures relative to GDP. Table 5 presents the results of the Vogelsang (1997) structural breakpoint tests for the military burden series. Once again, we focus on the quadratic trend function since it captures the evolution of the military burden of the four countries more closely than the linear trend function. While Egypt and Jordan, the two Arab countries that signed peace treaties with Israel, experienced structural breaks in the military burden in the mid-70s (1975 and 1974, respectively), both Israel and Syria who are still, at least officially, in a state of enmity experienced their structural breaks in the mid 80s (1985 and 1986, respectively). The post/pre-break ratio was less than one for all countries. The sharpest decline is recorded for Egypt for which the post-break military burden was only 0.27 of the average level prior to the break. The test for the aggregated Arab military burden yielded almost identical figures to those of Egypt. Similar results demonstrating a sharp decline in the military burden were obtained when we examined a ten-year interval around the break dates.

Visual inspection of the real military expenditures and military burden (Graphs 1 and 2) indicates the possibility of more than one breakpoint. To accommodate such a possibility we employed the Bai and Perron (2003) test of multiple breakpoints in the mean of the series, allowing for a maximum of two breaks.[5] The results reported in Table 6 indicate that all countries experienced significant structural breaks in their real military expenditures in the late 60s or early 70s. For all but Jordan, the post-break levels were substantially higher than before it. For instance, Egypt's military expenditures shifted from a mean of 4144 to 10640 after 1969, while Israel's mean military expenditures shifted from 1900 to 8730 after its break year of 1972. The second breakpoints occurred at different times in the late 70s and during the 80s and were characterized by a sharp fall in military expenditures. An exception is Israel, whose second breakpoint was in 1982, and which was not followed by a decline in expenditures but rather by a modest rise possibly due to its invasion of Lebanon and the deployment of armed forces from the Sinai Peninsula to the Negev. We attempted to assess whether the four countries experienced structural breaks in the growth rates of the military expenditures, however, most of the breakpoints were either insignificant or only marginally significant.

When we turn to examining the breakpoints in the military burden, we can observe a clear pattern in which all of the countries, except Jordan, experienced a sharp hike in the military burden in the late 60s and early 70s in the aftermath of the 1967 war and prior to the 1973 war. The mean military burden for Egypt rose from 0.26 to 0.46 after 1969, whereas Israel's military burden grew from 0.08 to 0.21 after the first breakpoint, 1972. Jordan did not witness a structural break in the military burden during the years of mounting tension in the region, but rather experienced its first breakpoint in 1981 with a plunge from 0.32 to 0.15. A further decline is detected in 1989 when the mean military burden drops to a level of 0.09. The optimistic atmosphere in the late 70s and during the 80s is captured by the second breakpoints, as manifested by a plunge to less than 0.1 with Egypt being the first to experience a drastic cut from about 0.46 to a level of 0.07 after 1977. The other countries experienced their breakpoints later in the late 80s. Israel's military burden dropped considerably from a ratio of 0.21 to a ratio of 0.1 in the post-1986 period. The late breakpoint of Israel could be attributed to the continuation of hostile operations both in Lebanon and in the Occupied Territories. A sharp decline in the military burden is also detected for Syria following its second breakpoint in 1986 when it reached a low of 0.07.

Summing up, by allowing for two structural breaks we observe one break that is associated with hostile operations and another that reflects a sharp decline in the military burden following the initiation of peace talks.

6. Summary and Conclusions

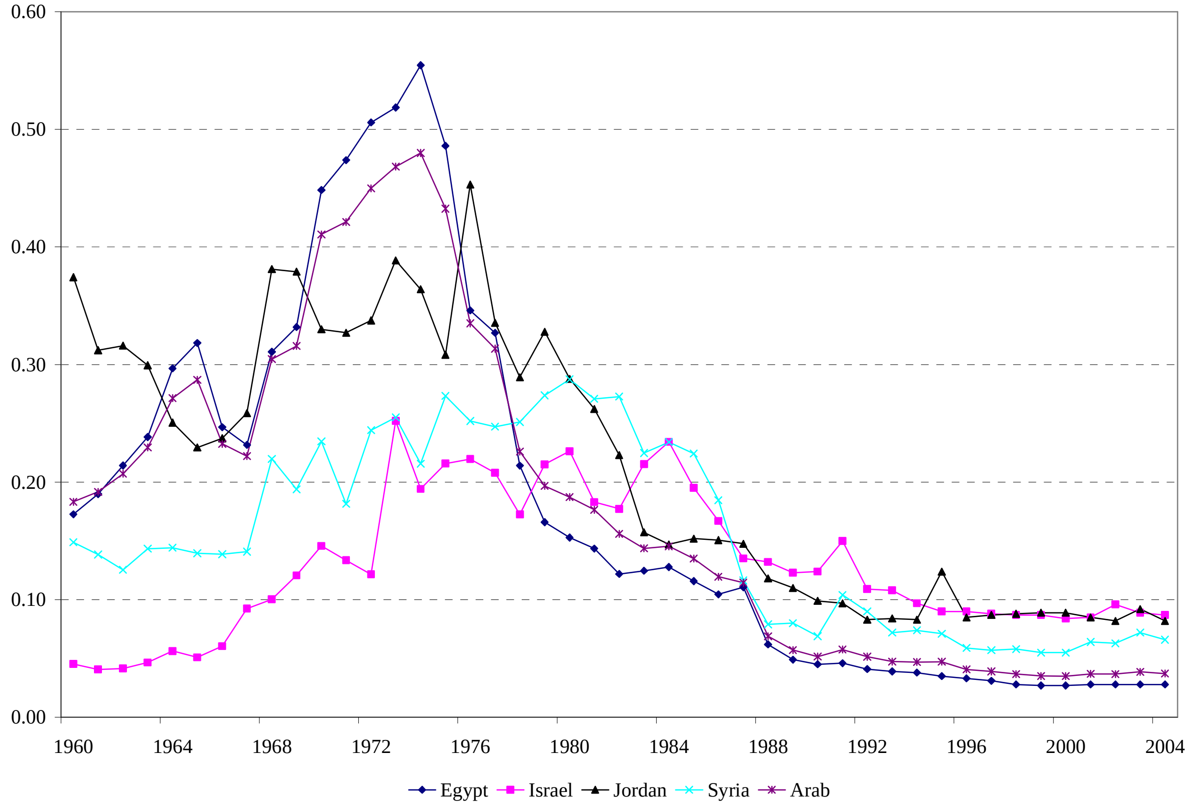
This paper has addressed the relationships between hostile operations and political developments on the one hand and military expenditures on the other hand for the four major parties involved in the Israeli-Arab conflict, Egypt, Jordan and Syria, and Israel. Specifically, we applied tests for detecting endogenous structural breaks in military expenditures and the military burden over the period 1960-2004. We first utilized the Vogelsang (1997) test for a single structural break that allows for linear and quadratic trend functions. Second, we used the multiple structural break test of Bai and Perron (1998, 2003) to examine whether there were multiple breaks in the mean of the real military expenditures and in the military burden. These tests allowed us to detect the timing of significant changes in military expenditures in reaction to and/or in anticipation of major political developments and security threats.

When allowing for a single structural break in the trend functions, we found that the quadratic trend function nicely captures the evolution of the military expenditures of the four countries. All countries were subject to significant structural breaks, though at different dates in the late 70s and early 80s, a period that marks the initiation of the peace talks, first between Egypt and Israel and later on between Israel, Jordan and the Palestinians. These breakpoints reflected a sharp decline in military burden from levels of 0.2-0.3 to below 0.1.

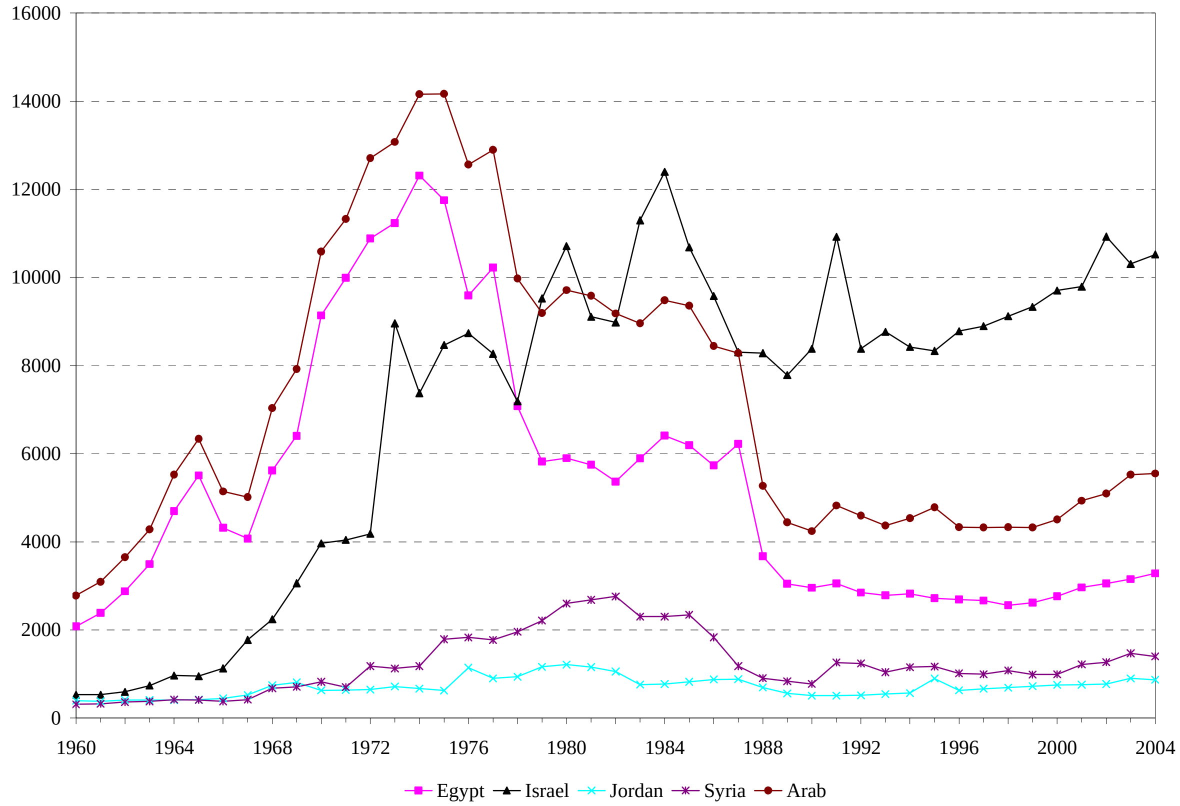
Tests of double shifts in the mean of military expenditures and burden pointed to two significant breakpoints that belong to two different regimes. The first breakpoint occurred in the late 60s and the early 70s and reflected the times of soaring military expenditures before the 1973 war. However, when peace negotiations were initiated in the late 70s, hopes of reaching a just and lasting peace for the long-lasting conflict were translated to a substantial reduction in military burden for all countries.

Our results may provide us with a ray of hope since all countries have, in practice, translated their aspiration for peace and for an end to the conflict to major cuts in their military spending. With all the difficulties and obstacles, sounds of hope are still raised on both sides. Undoubtedly, not only the region but also the whole world would reap the dividends of peace.

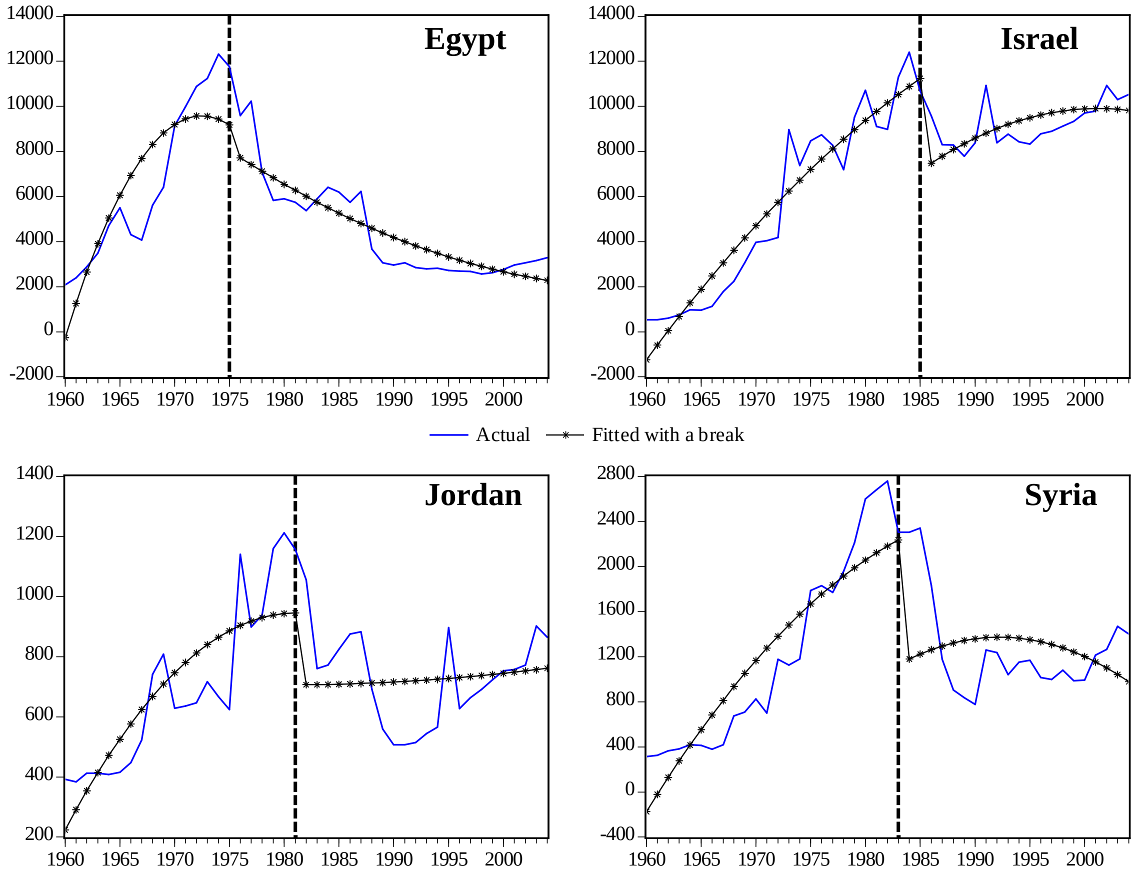
Graph 1 – Military Burden (1960-2004)



Graph 2 – Real Military Expenditures (1960-2004), Millions of $US



Graph 3 – Actual and Fitted Military Expenditures (Millions of $US)



Graph 4 – Actual and Fitted Military Burden

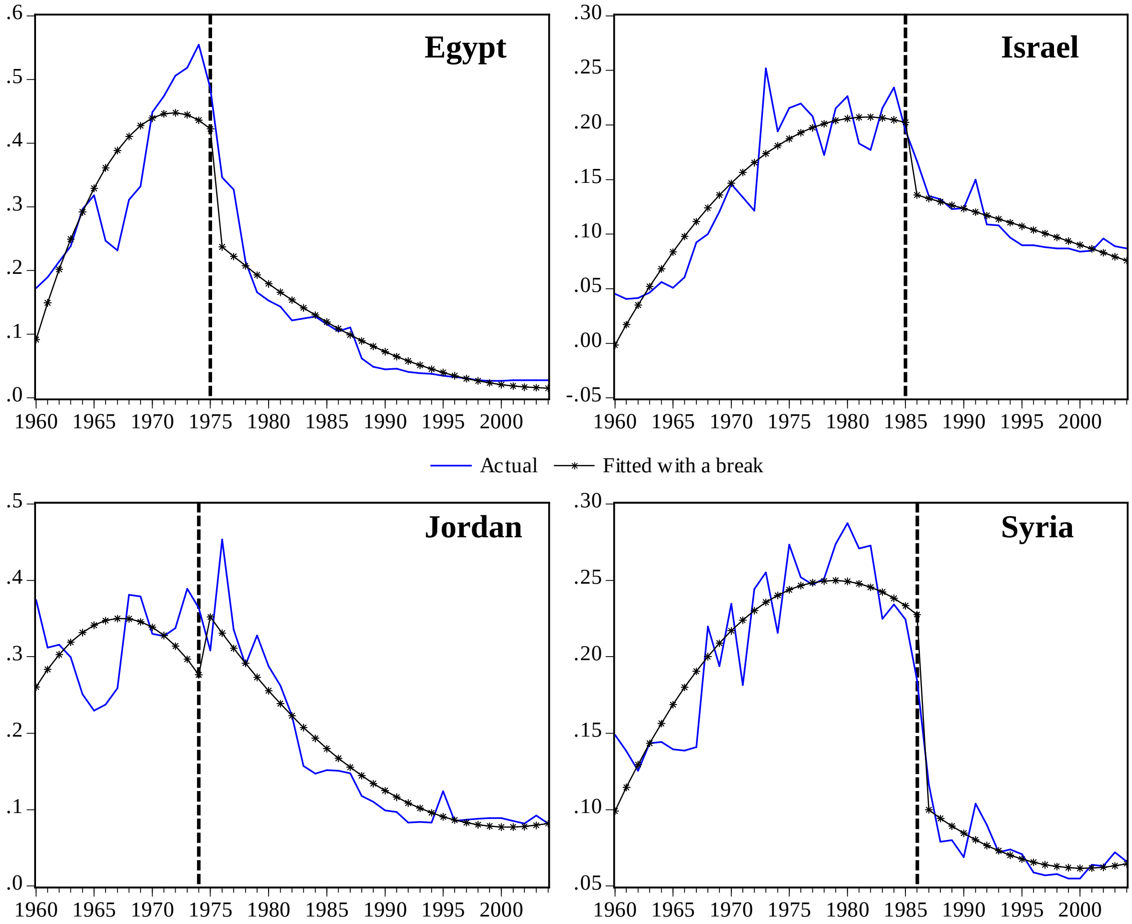


Table 1 – Augmented Dickey-Fuller Unit Root Test

Country	Level		First Difference	
	k	ADF	k	ADF
	Military Expenditures			
Egypt	3	-2.83	4	-2.94**
Israel	0	-1.96	0	-7.85***
Jordan	0	-2.38	0	-7.65***
Syria	1	-1.63	0	-5.04***
Arab	2	-2.41	1	-3.04**
	Military Burden			
Egypt	3	-2.89	4	-2.94**
Israel	2	-1.62	0	-8.30***
Jordan	8	-3.04	1	-6.07***
Syria	0	-1.70	0	-7.96***
Arab	2	-2.71	3	-2.74*

Notes
- Estimation with intercept and trend for the level and intercept for the first differences. Lag order is determined using AIC with a maximum of 8 lags allowed.
- *, **, *** denote significance at the 10%, 5%, and 1% levels, respectively.

Table 2 - Zivot-Andrews Unit Root Test

Country	Intercept		Trend		Both	
	k	t	**k**	t	**k**	t
			Military Expenditures			
Egypt	0	-3.36	0	-2.90	0	-3.35
Israel	0	-4.33	0	-4.18	0	-5.40**
Jordan	0	-4.04	0	-3.16	0	-4.36
Syria	1	-4.30	1	-2.80	1	-4.62
Arab	0	-3.68	0	-3.07	0	-3.54
			Military Burden			
Egypt	2	-3.60	2	-3.02	2	-4.54
Israel	0	-3.49	0	-5.14***	0	-6.78***
Jordan	0	-3.93	0	-3.30	0	-4.25
Syria	0	-4.00	0	-3.01	0	-3.85
Arab	2	-3.28	2	-3.18	2	-3.80

Notes:

- Estimation with 0.15 trimmed. Lag length is determined by general to specific method with a maximum of 8 lags allowed.
- Critical values – intercept: -5.43 (1%), -4.80 (5%); trend: -4.93 (1%), -4.42 (5%); both: -5.57 (1%), -5.08 (5%)
- *, **, *** denote significance at the 10%, 5%, and 1% levels, respectively.

Table 3 - Clemente et al. (1998) Unit Root Test

Country	Additive Outliers			Innovative Outliers		
	Breaks	k	t	Breaks	k	t
			Military Expenditures			
Egypt	1	2	-2.44	1	5	-2.72
Israel	2	0	-5.25	1	0	-4.27**
Jordan	2	0	-3.13	2	0	-3.87
Syria	2	0	-3.40	2	0	-4.79
Arab	2	7	-5.64**	1	1	-2.85
			Military Burden			
Egypt	1	0	-2.43	1	8	-6.37**
Israel	2	0	-5.80**	2	0	-4.55
Jordan	2	0	-4.29	1	0	-4.12
Syria	2	0	-3.65	2	0	-4.81
Arab	2	0	-2.56	2	5	-8.90**

Notes
- Estimation with 0.15 trimming. Maximum lags allowed 8.
- Critical values - single break: -4.27; two breaks: -5.49
- *, **, *** denote significance at the 10%, 5%, and 1% levels, respectively.

Table 4 – Structural Breaks in Real Military Expenditures

Country	Breakpoint	Sup*W*	k	Post/Pre-Break Ratio	Ratio of 10 years around break
Linear: $y_t = \mu + \beta_1 t + \theta DU_t + \gamma_1 DT_t + \sum_{i=1}^{k} c_i y_{t-i} + \varepsilon$					
Egypt	**1975**	21.7***	1	0.67	0.72
Israel	**1972**	24.1*	1	4.87	2.77
Jordan	**1982**	15.0**	1	1.00	0.77
Syria	**1985**	29.5***	1	0.88	0.44
Arab	**1975**	17.5***	1	0.86	0.88
Quadratic: $y_t = \mu + \beta_1 t + \beta_2 t^2 + \theta DU_t + \gamma_1 DT_t + \gamma_2 DT_t^2 + \sum_{i=1}^{k} c_i y_{t-i} + \varepsilon$					
Egypt	**1975**	35.1***	5	0.67	0.72
Israel	**1985**	44.8***	0	1.63	0.81
Jordan	**1981**	83.3***	0	1.04	0.80
Syria	**1983**	30.1***	8	1.03	0.70
Arab	**1989**	35.3***	8	0.55	0.55

Notes:

- Estimation with 15% trimming and 8 maximum lags allowed.
- Critical values: Linear – 17.51(1%), 13.29(5%), 11.25(10%) for stationary and 30.36(1%), 25.10(5%), 22.29(10%) for non-stationary series. Quadratic trend – 19.90(1%), 15.84(5%), 13.96(10%) for stationary and 38.35(1%), 31.29(5%), 27.99(10%) for non-stationary series.
- *, **, *** denote significance at the 10%, 5%, and 1% levels, respectively.

Table 5 – Structural Breaks in Military Burden

Country	Breakpoint	Sup*W*	k	Post/Pre-Break Ratio	Ratio of 10 years around break
Linear: $y_t = \mu + \beta_1 t + \theta DU_t + \gamma_1 DT_t + \sum_{i=1}^{k} c_i y_{t-i} + \varepsilon$					
Egypt	**1974**	36.3***	8	0.31	0.68
Israel	**1972**	318.1***	0	1.82	1.84
Jordan	**1976**	21.0***	3	0.44	0.87
Syria	**1985**	17.1**	1	0.37	0.41
Arab	**1974**	41.6***	1	0.37	0.73
Quadratic: $y_t = \mu + \beta_1 t + \beta_2 t^2 + \theta DU_t + \gamma_1 DT_t + \gamma_2 DT_t^2 + \sum_{i=1}^{k} c_i y_{t-i} + \varepsilon$					
Egypt	**1975**	119.2***	7	0.27	0.48
Israel	**1985**	53.3***	0	0.74	0.66
Jordan	**1974**	85.4***	0	0.50	0.97
Syria	**1986**	36.5***	1	0.35	0.37
Arab	**1975**	91.8***	7	0.33	0.56

Notes:

- Estimation with 15% trimming and 8 maximum lags allowed.
- Critical values: Linear – 17.51(1%), 13.29(5%), 11.25(10%) for stationary and 30.36(1%), 25.10(5%), 22.29(10%) for non-stationary series. Quadratic trend – 19.90(1%), 15.84(5%), 13.96(10%) for stationary and 38.35(1%), 31.29(5%), 27.99(10%) for non-stationary series.
- *, **, *** denote significance at the 10%, 5%, and 1% levels, respectively.

Table 6 – Bai and Perron (2003) Test of Multiple Break Points

Country	Military Expenditures			Military Burden		
		Break 1	Break 2		Break 1	Break 2
	β_1 (t-stat)	β_2 (t-stat)	β_3 (t-stat)	β_1 (t-stat)	β_2 (t-stat)	β_3 (t-stat)
		1969	**1977**		**1969**	**1977**
Egypt	4144	10640	4074	0.26	0.46	0.07
	(3.1)***	(20.5)***	(5.3)***	(7.5)***	(3.0)***	(4.8)***
		1972	**1982**		**1972**	**1986**
Israel*	1900	8730	9494	0.08	0.21	0.10
	(0.3)	(20.7)***	(21.2)***	(1.1)	(39.4)***	(11.0)***
		1975	**1983**		**1981**	**1989**
Jordan	5534	1040	709	0.32	0.15	0.09
	(5.0)***	(16.2)***	(11.1)***	(17.8)***	(24.3)***	(31.8)***
		1974	**1986**		**1967**	**1986**
Syria	626	2198	1109	0.14	0.24	0.07
	(1.0)	(8.5)***	(11.8)***	(74.0)***	(24.1)***	(16.2)***
		1968	**1987**		**1969**	**1977**
Arab	4761	10608	4704	0.24	0.41	0.09
	(4.8)***	(6.1)***	(17.5)***	(7.6)***	(2.4)***	(4.6)***

Notes:

- Estimation with minimum 8 years between breakpoints.
- β_1, β_2, β_3 denote the mean prior to the first breakpoint, the mean between the first and the second breakpoints, and the mean after the second breakpoint, respectively.
- *, **, *** denote significance at the 10%, 5%, and 1% levels, respectively.

Notes

[1] Numerous studies emphasize the adverse effects of the high military burden on economic growth, such as Lim (1983), Deger and Smith (1985) and Abu-Bader and Abu-Qarn (2003). However, other studies have found a positive effect (Benoit, 1978) or no effect at all (Dakurah et al., 2001) of military spending on economic growth.

[2] Based mainly on Sachar (1998) and Morris (2001). Our purpose is to only provide a chronological survey of the conflict accounting for historical events rather than interpreting them, in order to understand the factors that shaped the patterns of military expenditures of the warring parties.

[3] We also performed the tests with a linear trend, however, in some cases the trend coefficients were not significantly different from zero. Moreover, it is easier to interpret the results of the breaks in the mean.

[4] For details see Zeileis et al. (2003).

[5] Indeed, the optimal number of breaks based on BIC was two for most of the cases.

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Biographical Notes

AAMER S. ABU-QARN, b. 1969, PhD in economics (Northeastern University, 2002); Assistant Professor, Ben-Gurion University (2004-); Current main interests: Israeli-Arab conflict, productivity measurement, determinants of economic growth, mainly of the MENA region; Recent articles published in *World Development*, *Review of Development Economics*, and *Journal of Policy Modeling*.

SULEIMAN ABU-BADER, b. 1963, PhD in economics (Cornell University, 1999); Assistant Professor, Ben-Gurion University (2002-); Current main interests: Israeli-Arab conflict, poverty measures, the effect of GATT/WTO on international trade; Recent articles published in *World Development*, *Review of Development Economics*, *Journal of Policy Modeling*, and *Applied Economics*.