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MILITARY EXPENDITURE ECONOMIC GROWTH NEXUS IN JORDAN:

AN APPLICATION OF ARDL BOUND TEST ANALYSIS IN THE PRESENCE OF BREAKS

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Abstract

The Hashemite Kingdom of Jordan is a nation that has persisted through turbulent times. The country's leaders have long attempted to balance the allocation of resources between a strong military and a developing economy in their quest for stability, peace and prosperity. This paper examines and sheds further light on the relationship between Jordan's military expenditure and its economic growth during the period 1970–2015. Using cointegration techniques allowing for structural breaks based on Gregory and Hansen (1996), and the ARDL methodology this paper tests the short– and long–run equilibrium relationship between military expenditure and economic growth in Jordan. Furthermore, with the error correction model (ECM) and the CUSUM and CUSUMSQ tests, we examine the stability of the above relationship. The results reveal positive short– and long–run relationships between military expenditure and economic growth in Jordan, during the period under study. This finding has important policy implication for the Jordanian state, as it justifies the transfer of resources to the military, showing that it has not had a negative impact on economic growth.

Keywords: Jordan; economic growth; military spending; cointegration; ARDL

JEL Classification: C22, H30, O40

Introduction

To date, little consensus has existed as on the nature of the relationship between military spending and economic growth. Since Benoit's (1978) seminal paper, which supported the existence of a positive relationship between military expenditure and economic growth in less developed countries (LDCs hereafter), dozens of other empirical studies have approached the milex–growth nexus from different theoretical and methodological perspectives and/or on different periods. The prior literature have suggested three main conclusions: a positive relationship (e.g. Dixon and Moon 1986; among others), mainly due to the creation of positive externalities (e.g. a developed infrastructure, peace and a secure climate for investment, to name a few); a negative relationship (e.g. Deger and Smith 1983; Gyimah-Brempong 1989; among others), mainly due to the misallocation of resources; and, in a number of papers, no clear relationship between milex and economic growth (e.g. Biswas and Ram 1986; Hess 1989; Alexander 1990; among others).

Nevertheless, even though armed conflicts have declined in the last decades, many countries continue to spend on defence, tackling either external threats, for example the nuclear, chemical, radiological and biological weapons accumulated by their rivals (Aizenman and Glick 2006), or internal threats, such as the various political groups that often engage in acts of terrorism and/or militancy (Collier and Hoeffler 2007).

Jordan, a small and developing country in the Middle East, has stood among the heavy military[1] spenders for several decades, as it is located in a persistently troubled area where LDCs have achieved a sustainable balance between defence and prosperity (Hassan and Al-Saci 2004). As Jordan attempts to balance security and economic progress, it is crucial to understand how a geopolitically important country has coped in recent decades. Research on Jordan has focussed mainly on multi-country, cross-section analysis, suggesting that milex hinders economic growth, whilst the actual relationship varies across countries. As such, a more in-depth analysis of case studies is crucial, mainly for policy purposes and decision making (Antonakis and Apostolou 2003). Consequently, the present study is of particular value, since, firstly, it is among the few studies that explores the milex–economic growth nexus in Jordan over a longer period, to the best of our knowledge, and follows a methodology that includes testing for the short- and long-run equilibrium relationship. Secondly, given the country's unique attributes, a detailed study of the effects of milex on Jordanian economic growth will make an important contribution to the literature and provide valuable guidance for policy makers. Finally, Jordan is selected for this study because of the role that the Government[2] has played in its economic development.

Given the issues raised above, this paper explores the short- and long-run effects of military spending on economic growth in the Hashemite Kingdom of Jordan between 1970 and 2015. First, the Gregory–Hansen (GH hereafter) (1996) cointegration technique, allowing for the presence of an unknown potential structural break in the data, is applied, supporting the existence of at least one cointegration relationship in the presence of single structural breaks in the system. By applying the above, we find that most of the endogenously determined structural breaks coincide with the gradual effects of the 1989 financial crisis on the Jordanian economy.[3] Considering the resulting endogenously determined structural breaks, the error correction version and the ARDL procedure are then employed, to specify the short– and long–term effects of milex on economic growth in the presence of structural breaks. Based on the empirical findings obtained, we conclude that military expenditure promotes economic growth in the country under study. Our findings are of particular importance considering the changes to the regional and global security environment with security concerns as an integral component (Al-Hamdi and Alawin 2017).

The remainder of the paper is organized as follows. The next section provides a brief overview of the milex–economic growth nexus in Jordan. Section 3 provides a short review of the existing literature. Section 4 contains the empirical specification and discusses the data. Section 5 presents the econometric methodology and discusses the empirical results, while section 6 concludes the study.

The Growth–Military Nexus in Jordan

Jordan is a small, rather mixed economy[4], which is characterised by a variety of private freedoms, a lack of natural resources (92% of its land is semi-arid), a limited industrial base, high human capital and especially exposure to external shocks (Metz 1989). To date, the Government has played a large economic role both in development planning and as a financier. Jordan's small size and lack of major economic resources have also made it dependent on aid from Western and various other sources (e.g. US military aid since 1957 and external inflows of private capital, particularly through workers' remittances and transfers) (IMF 2012).

The Jordanian economy has also experienced periods of economic turbulence since the 1970s due to both internal and external factors. Jordan's social and economic welfare have been tied to its relations with neighbouring Arab countries in terms of population movements and flows of trade and finance. Half of the country's exports and a quarter of its imports have involved neighbouring Arab states. The Jordanian economic growth in the late 1970s and early 1980s was mainly driven by the private sector construction underpinned by workers' remittances (considered as foreign assistance and rents) earned by Jordanian oil labourers[5] working in Arab oil countries and public infrastructure projects that allowed the Government to pay generous subsidies to a broad swath of its population (Brynen 1992). At the same time Jordan was recovering from the effects of the 1967s Israeli war and adjusting to costs consisting of a loss of territory and an influx of refugees (Abdul-Khaliq, Soufan, and Abu Shihab 2013).

The Iran–Iraq war (which started in September 1980) initially boosted the Jordanian economy (e.g. soft loans of US$189.2 million and grands of US$58.3 million), as well as exports to Iraq of many industrial products. The continuation of the Iran–Iraq war, though, created problems (the economic assistance for Iraq dried out and Iraq was deeply in debt to Jordan). Additionally, the claim of sovereignty over the West Bank led to a capital outflow of US$250 million. From 1983 to 1988, the Government followed expansionary policies based on external borrowing and running down reserves (the reserves of the Central Bank fell to US$68 million in 1989). Hence, the mid -1980s witnessed a decline in oil prices that caused aid and remittances to dry up; the lack of this external funding affected the economy, and economic growth declined (Abdul-Khaliq, Soufan, and Abu Shihab 2013). This periodic external and domestic unrest, (represented by the 1967 Israeli occupation of the West Bank, the short civil war in 1970, the nation-wide riots in 1989 and high debt) caused an economic catastrophe that cost Jordan a large part of its infrastructure, resources and manpower (Salibi 1998). The current account and budget deficits enlarged: by 1989, the total public debt had reached US$9.5 billion, and the country could no longer service its foreign debt obligations, driving the country into the financial crisis of 1988-1989 (Knowles 2005). Therefore, Jordan had no choice but to resort to the IMF's and the World Bank's financial support to reschedule its foreign debt. Whilst the period of adjustment led to increased economic openness and a stronger market-orientation, the state remained the main actor to form economic policies.

Furthermore, and due to the 1988–1989 financial crisis and the 1991 Gulf War, economic growth became negative in the period 1988–1991, averaging -2%. Growth returned with the structural adjustment reforms of the 1990s (5.5% for the period 1992–1998) but slowed slightly late in the decade (2.9% of the GDP for the period 1996–1999) due to falling oil prices and persistent economic rigidities (Abdul-Khaliq, Soufan, and Abu Shihab 2013). The economy began to shine in the early to middle 2000s (4.4% for the period 2000–2002 to 8.2% in 2007) mainly due to expansionary monetary policies and payoffs from a decade of reforms. However, in the late 2000s, growth was hit hard by the onset of the global economic crisis (the growth rate of Jordan's GDP reached 7.2%, 5.5% and 2.3% in the years 2008, 2009 and 2010, respectively) (Jaradat 2010).

No less prominent on Jordan's political and economic landscape, is the state military expenditure. Jordan's high military burden is driven primarily by regional security concerns.[6] Jordan shares borders with Israel, Syria, Iraq and Saudi Arabia and has traditionally maintained a large military force to address periodic hostilities with its neighbours and conflicts in the wider region.[7] Jordan is a high militarised nation, along with Israel, Singapore, Syria and Russia (BICC 2012), as can be seen in Table 1.

[Table 1 here]

Additionally, Jordan's maintenance of a large standing army may act as a salve for the high unemployment level (Tarawnah 2012). The Jordanian Armed Forces consists of 100,500 active personnel along with 65,000 reserve personnel[8] (IISS 2010). This combined force represents 2.6% of the total population of 6.5 million (CIA 2013) and has 1 soldier for every 65 citizens, the highest ratio among the Arab countries. Its military personnel are more numerous than those of France, which has a population almost 8 times larger. A large amount of the country's military expenditure directly supports this pool of labour: in 1997, it was estimated that 85% of the national military expenditure covered manpower costs (Government of Jordan 2013). In 1999, 20.6% of total government expenditure was on education, while military spending constituted 23.7% of the total government expenditure in the same year (World Bank 2013). However, the Jordanian military earns rent by sending its officers to Gulf Arab countries, where the salaries are higher than in Jordan, (by offsetting the funds that are allocated to defence budget) (Droz-Vincent 2006). Interestingly, though, from 1988 to 2002 milex (as a percentage of the GDP) fell from 10.7% to 3.0% (mainly due to the peace agreements of the Israel–Oslo Accords in 1993, the Washington Declaration in 1994 and the replacement of the Israeli boycott laws in 1995, which brought a significant peace dividend to the Jordanian economy) but increased to 4.6% on average in the following decade (Knowles 2005; Narayan and Smyth 2009) (fluctuations shown in Figure 1).

[Figure 1 here]

Literature Review

Benoit's (1973, 1978) finding that military expenditure affects economic growth in LDCs positively sparked the current debate. Dunne (1996) contended that Benoit's equations, correlations and regressions are *ad hoc*. The improvised nature of these methods forms the basis of much of the subsequent criticism levelled at Benoit. Ball (1983) offered a wide-ranging critique of Benoit's work, taking exception to the statistical methods used and the conclusions drawn from the data. In order to clarify the milex–economic growth relationship, Ball (1983, 522) called for case studies that are 'founded on the socio-economic, political, ecological realities of individual countries'. Similarly, Grobar and Porter (1989) considered Benoit's findings to be anomalous, noting that the majority of subsequent studies has found that milex affects economic growth negatively.

Additionally, several surveys of the literature have been issued, with little agreement regarding the nature of the milex–growth relationship. Dunne and Uye (2008) surveyed 102 studies and found that, among 62 cross-sectional studies, 19% reported a positive relationship, 39% a negative relationship and 42% an unclear relationship. The authors contended that the differences are the results of the econometric modelling. Mintz and Stevenson (1995) reported a positive relationship for 103 countries, which was supported by Alptekin and Levine (2012). Looney and Frederiksen (1986) also reported a positive relationship with similar findings to those of Halicioglu (2004) and Tiwari and Shahbaz (2013). Using a Barro-style growth model, Dimitraki and Menla-Ali (2015) found a net positive relationship between military expenditure and economic growth in China for the period 1950–2011. These studies represent a range of theoretical approaches, demonstrating that analyses built on different theoretical foundations may lead to broadly similar findings.

Focussing on a similarly large set of developing countries, Deger and Smith (1983) posited that there is a negative relationship between milex and economic growth. Similar results were provided by Lim (1983) and Faini, Annez, and Taylor (1984).

Moreover, a few studies have attempted to focus on smaller groups of countries with shared characteristics. Assembling a cluster of 39 similar developing countries, Gyimah-Brempong (1989) found that milex does not have any significant direct effects on economic growth, but that the total effect is strongly negative as milex negatively affects the supply of skilled labour. This finding may hold some validity, because, despite the country's diversity, all nations fielding an army divert skilled individuals from the labour force. Focussing on African countries, Smaldone (2006) observed that the overall effect of military spending on economic growth is rarely noticeable and that, in the case of countries experiencing security and economic difficulties, a negative relationship is most evident. This finding echoed the conclusions of Looney and Frederiksen (1986) and Lebovic and Ishaq (1987).

D'Agostino, Dunne, and Pieroni (2019) contended that the omission of endogeneity in the literature may cause an underestimation of the damaging effect of milex on economic growth. Abu Bader and Abu Qarn (2003) found a negative relationship between military expenditure and growth over time in Egypt, Syria and Israel using multivariate cointegration. The studies finding no relationship between military expenditure and economic growth have little consistency in their theoretical approach or country sample size. One cannot discern from these studies whether the divergence is caused by the different econometric models used, but it is also possible that military expenditure might have different effects in different time periods (Smith 1977). Aizenman and Glick (2006) found that economic growth is generally impeded by higher military spending, except in the presence of external threats. This adds credence to the notion that external threats are relevant to the milex–economic growth relationship (see Lebovic and Ishaq 1987).

A small number of papers have explored the milex–growth relationship in Jordan, and most of these papers have included the country as part of a multi-country cross-section. Note that Jordanian data play an important role in Benoit's seminal studies. Grobar and Porter (1989) contended that Benoit's finding of a positive relationship between military spending and economic growth was highly dependent on a few observations, and that Taiwan and Jordan strongly influenced the overall results. Similar results were reported by Yildirim, Sezgin, and Öcal. (2005) for Middle Eastern countries and Turkey. Benoit (1978) argued that countries with highly military governments, including Jordan, might overstate their growth rates. Notwithstanding Benoit's (1978) mislabelling of Jordan as a 'military government' (the nation has been a constitutional monarchy since becoming independent from British rule), he claimed that the exclusion of Jordan, along with Burma and S. Vietnam (bona fide military governments in the period under study), does not change his results. Lebovic and Ishaq (1987), by focussing on a set of Middle Eastern countries (and by incorporating an index of the threat level into their analysis, as milex may be simply a response to external threats), found that, overall, the military burden appears to dampen economic growth in the non-oil exporting Middle Eastern countries.[9] Similar results have been reported by Abu-Bader and Abu-Qarn (2007), Korkmaz (2015), Künü, Hopoğlu, and Bozma (2016) and Çetin and Simla (2019). However, Rashid and Arif (2012) identified a positive relationship between growth and military spending in Jordan. These results were confirmed by Alawin (2013) who reported a significant positive relationship in the milex–growth nexus for Jordan from 1970 to 2010.

To sum up, the prior literature provides only a partial picture of the military expenditure-growth relationship in Jordan. Multi-country studies necessarily lack depth at the individual country level. Additionally, the examination of the previous studies highlights a lack of consistency regarding whether the relationship in Jordan is positive, negative or not discernible. A study of Jordanian growth and military spending at a more granular level and over a longer period may clarify the nature of the relationship, and potentially lend strength to the conclusions of previous studies or undermine them.

Data

This study uses annual time-series data covering the 45-year period from 1970 to 2015, reflecting the data availability. The following section provides the background on the data for each variable in the empirical model. The model incorporates variables considered to be important determinants of economic growth in the Barro-type model: *GDP*: annual rate of the gross domestic product per capita; *MILEX*: military expenditure as a percentage of the GDP; *GEXP*: non-defence government expenditure as a percentage of the GDP*; INV*: government investment as a percentage of the GDP*;* and *POP*: log of total population.

The data for Jordan's GDP are sourced from the Central Bank of Jordan; the military expenditure data come from SIPRI; and government expenditure is obtained from the World Bank's Development Indicators. Population and investment data are sourced from the Penn World Tables. The descriptive statistics are presented in Table 2.

[Table 2 here]

Table 2 reports a summary of the descriptive statistics of the relevant variables: GDP, milex, investment, government expenditure and population. The annual mean of all the variables is positive. With regard to volatility, GDP, INV and POP exhibits higher volatility than military spending whilst GEXP shows lower volatility. Furthermore, all the variables exhibit strong kurtosis and skewness. The Jarque–Bera (JB) test statistics show that normality is rejected at the 1% level for GDP, GEXP and milex.

Furthermore, by using both the augmented Dickey–Fuller (Dickey and Fuller 1981) (ADF) and the Phillips and Perron (1988) (PP) (Panels A and B in Table 2) test, all the variables are found to be I(1) (except the GDP, which is I(0)), which indicates that they may exhibit some long-run linear combination, but the GDP is integrated at level and justifies the use of the ARDL, as the series are integrated at different levels. The ADF test is sensitive to lag length selection criteria (see Hall 1994; Ng and Perron 2001). We use the general-to-specific procedure suggested by Hall (1994) for the ADF tests to select the optimal lag lengths of these tests. The extant literature on unit root tests further reinforces that such selection criteria provide better power and size for the corresponding tests. However, Perron (1989) showed that failure to consider a break in a time series produces false results (with the condition of not rejecting a false unit root null hypothesis).

[Table 3 here]

The study period covers 45 years during which both the economic policies and the macroeconomic and the political environment in Jordan changed substantially. All these changes are likely to have caused structural changes in the series. Thus, the Zivot and Andrews (1992) (ZA) test, with a single endogenous structural break, is also conducted in this paper. The endogenous breakpoint in the ZA test is chosen at the value at which a one-sided test statistic on the coefficient in the ADF test is minimised (e.g. the most negative value). Employing a test that allows for a structural break is likely to be informative, as our long span of data contains continuous policy reforms in Jordan during all the decades that we investigate. The test results, displayed in Table 2, indicate that all the variables are non-stationary in levels, but stationary in first differences with the exception of the GDP regardless of the inclusion of the deterministic time trend. However, the ZA test shows that the variables are stationary with a single break and that the breakpoints are significant in all cases (Panel C).

Methodology

Our model follows the Barro-style[10] model of economic growth developed by modifying the Barro (1990) model. The Barro-style specification, controls for variation in the size of the central government (milex and other government expenses) as explanatory variables for economic growth. Other control variables are governmental investment and labour. Furthermore, the Gregory–Hansen (1996) cointegration technique which allows for potential breaks in the data followed by the ARDL methodology, are applied. In the following section the GH cointegration is explained and applied (in the presence of endogenously determined breaks in the system), followed by the ARDL methodology to obtain the short- and long-run effects of economic growth in Jordan.

Gregory–Hansen Methodology

Perron (1989) noted that ignoring potential structural breaks can extract invalid results not only from the unit root but also from the cointegration tests. Moreover, Gregory, Nason, and Watt (1996) confirmed that, in the presence of a structural break the ADF test tends to under-reject the null hypothesis of no cointegration. Additionally, in the presence of structural breaks, tests that do not allow for them might produce *spurious cointegration* (Kunitomo 1996). Thus, it is of high importance to be aware of the effects of structural breaks[11] in the cointegration results as they usually occur due to major policy changes or shocks in an economy. Furthermore, Hendry (1996) argued that it is important to distinguish between breaks in the individual variables and breaks in the cointegrating vectors.

Gregory and Hansen (1996) addressed the problem of estimating cointegration relationships in the presence of structural breaks. They introduced a residual-based technique to test the null hypothesis of *no cointegration* against the alternative of *cointegration in the presence of a break*. The break point is unknown in this technique and is determined by finding the minimum values for the ADF t-statistic: in other words, the absolute ADF test statistic is at its maximum. By considering the existence of a potential unknown and endogenously determined one-time break in the system Gregory and Hansen (1996) introduced four alternative models.

Model 1: Standard Cointegration

$$Y_t = \mu_1 + \alpha_1 X_t + e_t \qquad (1)$$

Model 2: Cointegration with Level[12] Shift (C/C)

$$Y_t = \mu_1 + \mu_2 \varphi_{tk} + \alpha_1 X_t + e_t \qquad (2)$$

Model 3: Cointegration with Level Shift and Trend (C/T)

$$Y_t = \mu_1 + \mu_2 \varphi_{tk} + \beta_{1t} + \alpha_1 X_t + e_t \qquad (3)$$

Model 4: Cointegration with Regime Shift (C/S)

$$Y_t = \mu_1 + \mu_2 \varphi_{tk} + \alpha_1 X_t + \alpha_2 X_t \varphi_{tk} + e_t \qquad (4)$$

where: Y is the dependent variable; X is the independent variable; t is the time subscript; e is the error term; k is the break date and φ is a dummy variable such that:

$$\varphi_{tk} \begin{cases} 0 & \text{if } t \leq k \text{ [k is the breaking point]} \\ 1 & \text{if } t > k \end{cases}$$

where the unknown parameter t ϵ (0,1) is defined as the relative time of the change point.

Gregory and Hansen (1996b) constructed three statistics for those tests: ADF*, Zα* and Zt*. They correspond to the traditional ADF test and the Phillips-type test of the unit root on the residuals. The null hypothesis of no cointegration with structural breaks is tested against the alternative of cointegration by using the GH approach. The single break date in these models is endogenously determined. They tabulated critical values by modifying the Mackinnon (1991) procedure for testing cointegration at the Engle–Granger method for unknown breaks. The null hypothesis is rejected if the statistic –ADF*, Zα* or Zt*– is smaller than the corresponding critical value. Additionally, the null hypothesis of no cointegration with structural breaks is tested against the alternative of cointegration by the GH approach. The single break date in these models is endogenously determined. The break date is found by estimating the cointegration equations for all the possible break dates in the sample. We select the break date on which the test statistic is the minimum, or in other words, the absolute ADF test statistic is at its maximum.

This study only considers and applies the model 4 – cointegration with regime shift[13] – in the case of Jordan, that is, a shift in the mean and slope coefficients. The empirical results of the GH cointegration procedure indicate that the calculated statistic, 7,006, [14] is smaller than its respective 5% value of -6.40 reported by Gregory and Hansen (1996). This confirms the rejection of the null hypothesis of no cointegration against the alternative of at least one cointegration relationship in the presence of a structural break. The estimated long-run relationship using the CS is of the following form:

$$GDP = 2.82 + 1.93MILEX - 1.66POP -0.018INV +0.012GEXP +0.19TREND \qquad (5)$$

(8.64) (0.97) (0.006) (37.90) (0.25) (8.64)

where dummy *D = 0 if t ≤ 1989 and D =1 if t ≥ 1989*

[Table 4 here]

As the results above show, the most important structural break in the economy of Jordan, as endogenously identified by the GH procedure, occurred in 1989 (the break has been determined by all the variables in the system), which coincides with the financial crisis in 1988–1989 and the beginning of the IMF's and the World Bank's guided economic liberalisation programme[15] and its subsequent impact.[16] Equation 5 further show that milex and GEXP affect economic growth positively, whilst POP and INV have a negative effect.

The ARDL Cointegration Approach

The autoregressive distributed lag or ARDL bound test (ARDL hereafter) approach is one of the cointegration techniques used for determining long– term relationships among the variables under study (M.H. Pesaran and B. Pesaran 1997; Pesaran, Shin, and Smith 2001). The ARDL model is a dynamic specification that includes lagged values of the dependent and the explanatory variables as well as contemporaneous values of the explanatory variables to estimate both short– and long–run relations among several variables of interest. The main advantage of ARDL modelling lies in its flexibility: it provides better results (performs better) when the sample size T is small (as in our case) compared with traditional approaches to cointegration for example those of Engle and Granger (1987), Johansen and Juselius (1990), and Phillips and Hansen (1990) (Ghatak and Siddiki 2001; Haug 2002). Furthermore, the unrestricted error correction model seems to take satisfactory lags that capture the data-generating process in a general-to-specific framework of specification (Laurenceson and Chai 2003). This method avoids the classification of variables as I (1) and I (0) by developing bands of critical values that identify the variables as being stationary or non-stationary processes. Unlike other cointegration techniques (e.g. Johansen's procedure), which entail certain pre-testing for unit roots and that require the underlying variables to be integrated of the same order, the ARDL model provides an alternative test for examining a long–run relationship regardless of whether the underlying variables are purely I(0) or I(1), even fractionally integrated. Furthermore, traditional cointegration methods may suffer from the problems of endogeneity, while the ARDL method can distinguish dependent and explanatory variables. Thus, estimates obtained from the ARDL method are unbiased and efficient, since they avoid the problems that may arise in the presence of serial correlation and endogeneity. The difficulty in determining the order of VAR, the optimum number of lags and so on found in Johansen cointegration is overcome by the ARDL test. Finally, the ARDL method captures the co-integrating vector from the multiple co-integrating vectors (Pesaran, Shin, and Smith 2001; Nkoro and Uko 2016).

The ARDL method involves four steps: the first step is to examine the presence of cointegration using the bounds testing procedure; the second step is to estimate the coefficients of the long–run relationships identified in the first step; the third step is to estimate the short– run dynamic coefficients; and, the fourth stage involves testing for the stability of the model by using the CUSUM and CUSUMSQ tests (M.H. Pesaran and B. Pesaran 1997; Pesaran, Shin, and Smith 2001). According to M.H. Pesaran and B. Pesaran (1997), the ARDL procedure is represented by the following equation:

$$\varphi\ (L, p)\ y_t\ = \sum_{i=1}^{k}\ \beta_i(L, q_i)\ x_{it}\ + \delta'\ w_t\ + u_t \qquad (6)$$

where:

$$\varphi\ (L,p)y_t = 1-\varphi_1 L - \varphi_2 L^2 - \ldots - \varphi_p L^p \qquad (7)$$

and

$$\beta_i(L, q_i)\ x_{it}\ = 1 - \beta_{i1}L^2 - \beta_{i2}\ L - \cdots - \beta_{iqi}L^{qi} \quad i=1, 2, \ldots, k \qquad (8)$$

where: y_t denotes the dependent variable, x_{it} is the i dependent variables, L is a lag operator and w_t is the *SX1* vector representing the deterministic variables employed, including the intercept terms, dummy variables, time trends and other exogenous variables. The optimum lag length is generally determined by minimising either the Akaike Information Criterion (AIC) or the Schwarz Bayesian Criterion (SBC). Using the ARDL specific model, the long-run coefficients and their asymptotic standard errors are then obtained. The long-run elasticity can then be estimated as follows:

$$\hat{\theta} = \frac{\hat{\beta}_{i0}+\hat{\beta}_{i1}+\cdots+\hat{\beta}_{qi}}{1-\hat{\varphi}_1 - \hat{\varphi}_2-\cdots-\hat{\varphi}_p} \quad \forall \quad i=1,2\ldots, k \qquad (9)$$

The long run cointegrating vector is then given by:

$$y_t - \hat{\theta}_0 - \hat{\theta}_1 x_{1t} - \hat{\theta}_2 x_{2t} - \cdots - \hat{\theta}_k x_{kt} = \varepsilon_t \quad \forall \ t=1, 2, \ldots, n \qquad (10)$$

In this equation the constant term is equal to:

$$\hat{\theta}_0 = \frac{\hat{\beta}_0}{1-\hat{\varphi}_1 - \hat{\varphi}_2-\cdots-\hat{\varphi}_p}$$

We can now rearrange Equation (6) in terms of the lagged levels and the first differences of

y_t, x_{1t}, x_{2t}, …, x_{kt} and w_t to obtain the short-term dynamics of the ARDL as follows:

$$\Delta y_t = -\varphi(1,\hat{p})EC_{t-1} + \sum_{i=1}^{k} \beta_{i0}\, \Delta x_{1t} \delta' \Delta w_t - \sum_{j=1}^{\beta-1} \varphi^* y_{t-j} - \sum_{l=1}^{k} \sum_{j=1}^{\hat{q}_{i-1}} \beta_{ij} * \Delta x_{i,t-j} + u_t$$

(11)

finally, one can define the error correction term in the following manner:

$$EC_t = y_t - \sum_{i=1}^{k} \hat{\theta}_i\, x_{it} - \psi' w_t \qquad (12)$$

In Equation (11) φ *, δ ' and β_{ij} are the short-run dynamic coefficients and $\varphi(1,\hat{p})$ denote the speed of adjustment.

Empirical Results Based on the ARDL Approach

The first step in the ARDL approach to cointegration is to estimate Equation 8 by using OLS estimation techniques. The second step is to test the joint hypothesis that the long–run multipliers of the lagged level variables are all equal to zero (H0: δ0 = δ1 =. δ2 = δ3 = δ4 =δ5=δ6 = 0 – see Equation 13 below) against the alternative that at least one is non-zero using the standard Wald or F-test statistics. The test for cointegration is provided by two asymptotic critical value bounds when the independent variables are either I(0) or I(1). The lower bound assumes that all the independent variables are I(0), and the upper bound assumes that they are I(1). If the test statistics exceed their respective upper critical values, the null is rejected, and we can conclude that a long–run relationship exists. The F-statistics obtained by performing the Wald test on Equation 11 has a non-standard distribution. The asymptotic critical values of the F-statistics are provided by Pesaran, Shin, and Smith (2001). However, Narayan (2005) argued that these critical values are inappropriate in small samples ranging from 30 to 80 observations. Since our study has 45 observations, we use the critical values of Narayan (2005). The results are reported in Table 5.

[Table 5 here]

The computed F-statistic is 6.96. As it is larger than the upper bound critical value of 4.450 at the 5% level of significance, the null of no cointegration is rejected implying a long–run relationship between economic growth and military expenditure.

Following Pesaran, Shin, and Smith (2001) the error correction representation of the ARDL model is:

$$\Delta lnGDP = a_0 + \sum_{j=1}^{n} b_j \Delta lnGDP_{t-j} + \sum_{j=0}^{n} c_j \Delta lnINV_{t-j} + \sum_{j=0}^{n} d_j \Delta lnMILEX_{t-j} + \sum_{j=0}^{n} e_j \Delta lnGEXP_{t-j} + \sum_{j=0}^{n} f_j \Delta lnPOP_{t-j} + \delta_1 lnGDP_{t-1} + \delta_2 lnINV_{t-1} + \delta_3 lnMILEX_{t-1} + \delta_4 lnGEXP_{t-1} + \delta_5 lnPOP_{t-1} + \delta_6 D89 + \varepsilon_{1t} \quad (13)$$

The parameter δ_i , where i=1,2,3,4,5, and 6 is the corresponding long-run multipliers, whereas b, c, d, e, and f are the short–run dynamic coefficients of the underlying ARDL model.

Furthermore, Equation 13 should be estimated (by excluding the ECM term, which subsequently will be incorporated into the ARDL model) to obtain the long run results. An important issue when incorporating the ARDL approach is to choose the order of the distributed lag function. The optimal number of lags is (4, 4, 4, 1, 1) selected based on the AIC. The short–run adjustment process is then measured by the error correction term ECM_{t-1} and it shows how quickly variables adjust to a shock and return to equilibrium. Table 6 below presents the long run– and short–run coefficients of the variables under investigation. The regression results for the short–run, which are presented in Table 6, are consistent with the long–run results. The statistical significance of the ECM_{t-1}[17] confirms the presence of a long-run equilibrium relationship between the variables under study. The estimated coefficient is -0.66 (with the expected negative sign implying the existence of a short–run relationship between the explanatory variables), which suggests that the deviation from the long-term GDP path is corrected by 66% over the following year. This means that the adjustment takes place quite rapidly.

[Table 6 here]

The empirical results (Table 6) indicate that both government expansion and milex improve economic growth in Jordan in the short– and the long–run. The positive effect of government spending (or expansion) confirms the Keynesian[18] view that government spending can be utilized as a policy instruments that promotes economic growth. These results are consistent with Bose, Haque, and Osborn (2007) regarding LDCs and Dandan (2011) for Jordan among others. In the short–run, economic development is associated with structural changes, and in specific institutional settings, can add to inequalities and the risk of internal conflict. This situation may increase defence budgets to secure peace and stability (Maizels and Nissanke 1986). Regarding the short– and long–run positive effect of milex[19], it has long been documented in the literature, for LDCs, especially the ones at a stage of development, at which defence spending is seen as a social good with positive effects on the economy (e.g. Benoit

1978; Weede 1983; Alexander 1990; Dimitraki and Menla-Ali 2015; among others). The above can further be explained via the capital utilisation (an increase in milex results in the use of unemployed resources, which affects growth positively and increases the strategic reserve of essential commodities), especially when an economy is in recession, when increased milex can boost the economy (Alptekin and Levine 2012). In addition, according to Yildirim, Sezgin, and Öcal (2005) the armed forces are the instruments to maintain political stability. Government expenditure affect economic growth positively by providing training, construction, and technological and industrial spill-overs which contribute to economic growth (productive component of government expenditure). The results are consistent with Dandan (2011), Al-Bataineh (2012), Alawin (2013) and Al-Fawwaz (2015). The negative impact of public investment on economic growth is in line with Devarajan, Swaroop, and Zou (1996), who argued that public investment can have potentially negative effects on economic growth, perhaps because of the inefficient and unproductive nature of such investments, combined with budget deficits (Gupta et al. 2005). Additionally, higher government investment might enhance macroeconomic uncertainty and hinder economic growth in the long-run (crowding–out effects) (Landau 1983). The above is true for Jordan, which, according to Knowles (2005) has a narrow production base, investments in the defence sector, extensive subsidy programmes (from food to infrastructure/housing), investment in consumption of imported goods, and growing external debt (from the mid-1980s). Hence, the state used those expenditures for political purposes, for many years, with signs of induced state rentierism. Similarly, labour affects economic growth negatively in the short– run which is consistent with Dunne (1996): Jordan might attract scarce skilled labour and crowd out resources from the civilian sector. Lastly, with the end of the second oil boom (early 1980s), an overall curtailment of economic activity in the Gulf countries took place, leading to budgetary cutbacks and consequently reduced demand for Jordanian labour (almost 300,000 workers returned to Jordan, increasing the number of unemployed) and those who remained suffered cuts in their salaries. The above supports the negative long -run effect between public investment and economic growth.

Stability Tests

This section presents the test for the stability of the of short–run and long–run coefficients using the conventional methods of the CUSUM (Figure 2) and CUSUMQ (Figure 3) stability tests proposed by Brown, Durbin, and Evans (1975) for AIC-based error correction models. Testing for the stability of the coefficients for the indicators under study is important for policy setting. The tests applied to the residuals are based on the first set of N observations. It is updated recursively and plotted against the break point, that indicate the absence of any instability of the coefficients, because the plots of the CUSUM (Figure 2) and CUSUMQ (Figure 3) statistics are confirmed to be within the 5% critical bounds of parameter stability[20].

[Figures 2 and 3 here]

Conclusively, the stability of the parameters remains within the critical bounds of parameter stability by confirming the stability of the long– run coefficients of the GDP functions in our model.

Conclusions

The allocations of states' national income to defence spending has attracted considerable interest in the last decades, mainly due to the perceived negative implications for private investment and domestic savings, and lower consumption due to the lower aggregate demand. A reason for such controversies in the literature was the identification of milex as non-productive expenditure. From the geopolitical point of view, Jordan is within close proximity to major regional conflicts, facing internal (e.g. austerity measures and the increasing confidence in the country's Muslim Brotherhood and Salafist movements) and external threats (e.g. spillover effects from the civil wars in the neighbouring countries, such as Syria). Jordan is constantly facing risks of possible military entanglement in the border zone, the spread of Salafist radicalisation, the heavy cost of sustaining a large refugee population, and the potential interference in Jordan of Islamist movements from other regional countries (Satloff and Schenker 2013). Hence, it is inevitable that Jordan will need to allocate a significant amount of resources to military expenditure for internal and external stability. This is because the uncertainty associated with an unstable internal environment may reduce investment (unsafe environment for investors) and the overall pace of economic growth. Unlike scholars who have claimed that milex has opportunity costs, as it crowds-out productive spending (e.g. Smaldone 2006), our findings suggest that military expenditure promotes economic growth. This could be attributed to the potential spillover effects that it continuously faces due to the political unrests in the neighbouring countries, for example Israel, Syria and Iraq.

To test the above, this paper uses annual data from 1970 to 2015 to determine endogenously the most significant and important structural breaks in Jordan's economic growth. The empirical results based on GH models show that the most significant structural breaks occurring over the last five decades, which are detected endogenously, in fact coincide with the 1989 financial crisis followed by economic structural adjustments. Next, we employ an ARDL approach to estimate and validate the long- and short-term determinants of economic growth in Jordan. Applying the ECM version of the ARDL model shows that the error correction coefficient, which determines the speed of adjustment, has an expected and highly significant negative sign. The results indicate that deviation from the long-term growth rate of the GDP is corrected by approximately 66% in the following year. The estimated model passes a battery of diagnostic tests, and the graphical evidence (CUSUM and CUSUMQ graphs) indicates that the model is fairly stable during the sample period. Finally, our results indicate that, in the long–term, military expenditure promotes economic growth by providing a safe environment for investment and a convenient environment for the production process, which may lead to the attraction of foreign investors.

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Notes

[1] According to the CIA World Factbook (2015), Jordan was among the 12 countries with the highest military spending as a percentage of its GDP (4.31%), in 2015 figures.

[2] The Jordanian Government follows a state market continuum model 'based along five continua: contribution to the economy; involvement in planning; institutional development; support for the private sector; and government ownership of productive assets' (Knowles 2005, 43).

[3] Potential structural breaks can undermine the existence of the long-run relationship between GDP and milex. (e.g. the structural weaknesses in the Jordanian economy during the 1980s that led to the financial crisis of 1988-1989).

[4] That is supported further by the Economic Freedom Index (2018) with an average score of 66% from 1995 to 2019 (the countries with a score from 60% to 70% are considered as moderately free). In addition, the average value for governmental spending for Jordan during the period 1970–2015 was 24.03% of the GDP (own data). According to Chobanov and Mladenova (2009, 9), 'the optimal government size (total government spending as a share of GDP) is between 17% and 40% of GDP'.

[5] Almost one-third of the country's labour force was working in the Gulf, remitting an annual average of US$918 million between the mid-1970s and the mid-1980s, amounting to more than 21% of the GDP at market prices (Knowles, 2005).

[6] See Yildirim, Sezgin, and Öcal (2005) for a discussion on the changes in military balances in Middle Eastern countries.

[7] See Al-Hamdi and Alawin (2017) for the reasons behind the peaceful changes and developments between Jordan and its neighbours. See also Chen, Feng, and Masroori (1996) for a detailed discussion regarding the collective action problem and increases in milex for the countries neighbouring Israel and the motives for Jordan's involvement in the Israeli wars.

[8] Those employed by the military and security agencies and their families also have medical insurance and receive assistance with their housing, education and social security. Additionally, thousands of physicians, engineers, computer technicians and others have been trained by the military. Thus, military expenditure helps not only security but the national economy as well (The Jordan Times 2012).

[9] Jordan is a member of this group

[10] For a detailed discussion regarding the choice of the Barro-style model and variables, see: Dimitraki and Menla -Ali (2015).

[11] Any policy evaluation based on conventional methods ignoring the structural break can be grossly misleading.

[12] Level shift means that there is a shift in the constant term of the cointegrating equation.

[13] Gregory and Hansen (1996) found that the power of the conventional ADF test with no allowance for regime shifts falls sharply.

[14] The description here is based on the Gregory and Hansen (1996) tables.

[15] See Harrigan, El-Said, and Wang (2006) for a detailed discussion of the IMF's and World Bank's liberalisation programme.

[16] The implementation of the IMF/WB-sponsored economic-adjustment and austerity plan in 1989, had violent results with riots across the country. See more in Ryan (1998).

[17] According to Bannerjee, Dolado, and Mestre (1998) the ECM coefficient shows how quickly or slowly the variables return to the equilibrium path and it should have a significantly negative coefficient. It is also further proof of the existence of a stable long–term relationship.

[18] The notion that military expenditure promotes economic growth by stimulating the aggregate demand and reducing the excess capacity.

[19] We have also tested the direction of the relationship between milex and economic growth by employing a bivariate Granger causality test that proves that military expenditure (Granger causes) drives changes in economic growth in the period under study but not the other way around. The results are available on request.

[20] If the plots of the CUSUM and CUSUMQ statistics stays within the 5% significance level (portrayed by two straight lines, the equations for which are given in Brown, Durbin, and Evans (1975), then the coefficient estimates are said to be stable.

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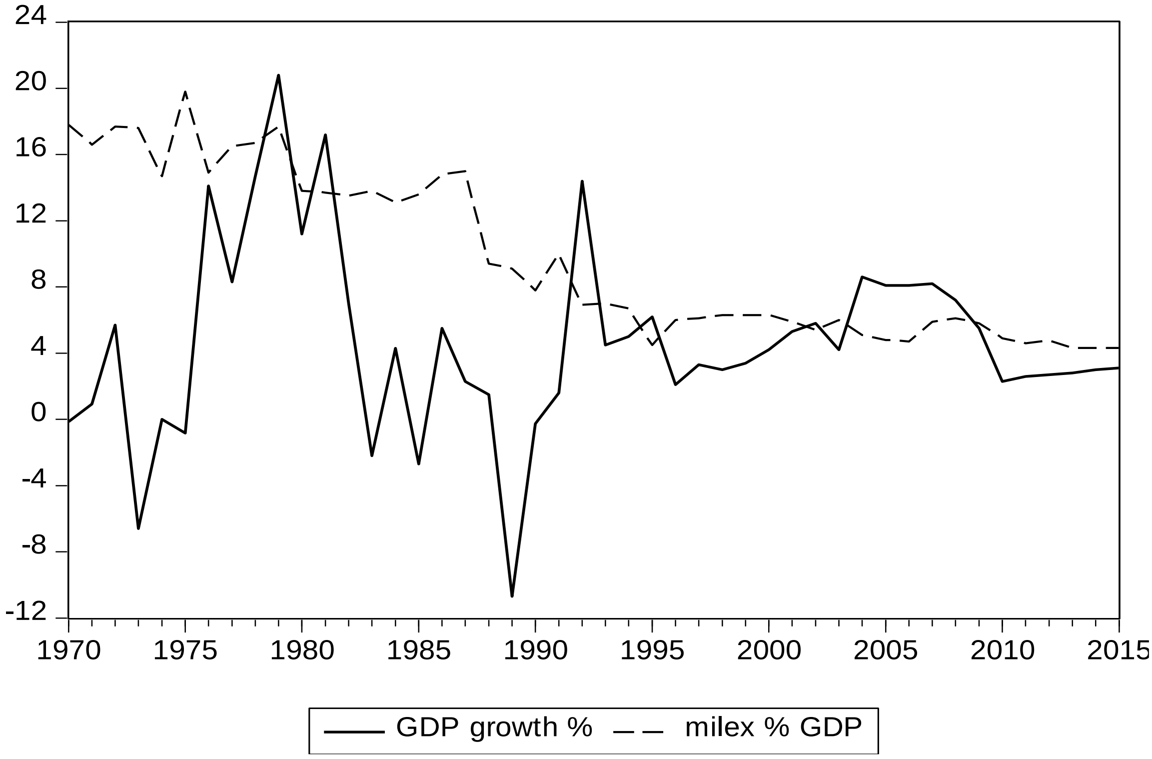
Figure 1: JORDAN: GDP% vs. MILEX 1970-2015



Source: Central Bank of Jordan (2017); SIPRI (2017)

Figure 2: Plot of Cumulative Sum of Recursive Residuals

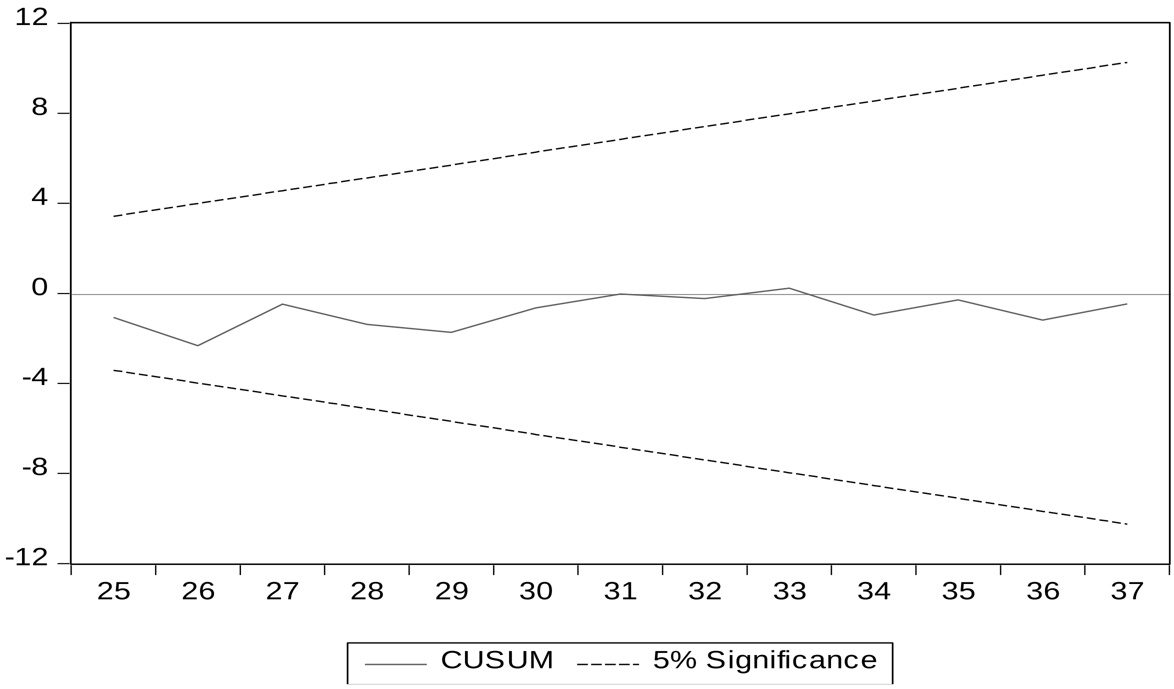


Figure 3: Plot of Cumulative Sum of Recursive Residuals Squares

Table 1					
The 10 most militarised countries in the Middle East in 2015			**The 10 most militarised countries in the World in 2015**		
Country	**GMI score* Millions $**	**Rank**	**Country**	**GMI score Millions $**	**Rank**
Israel	890.2	1	Israel	890.2	1
Jordan	808.0	4	Singapore	868.4	2
Kuwait	772.4	9	Armenia	835.8	3
Oman	750.9	13	Jordan	808.0	4
Bahrain	739.4	15	Republic of Kora	801.3	5
Saudi Arabia	734.6	17	Russia	794.5	6
Lebanon	727.7	19	Cyprus	794.2	7
United Arab Emirates	712.8	24	Azerbaijan	786.4	8
Egypt	705.2	26	Kuwait	772.4	9
Iran	700.2	27	Greece	771.7	10
**A more detailed description of the GMI score (which includes indicators such as milex-personnel and armaments) can be found at: Grebe, Jan. 2011. "The Global Militarization Index (GMI) – A tool for evaluating development orientation of states as well as regional developments." Occasional Paper, February 2011, Bonn: BICC*					

Source: Adopted from BICC GMI 2015: Table 1 p. 5 and Table 2 p. 7.

	Table 2: Summary of Descriptive statistics				
	Mean	SD	Skewness	Kurtosis	J.B
GDP	6.01	0.11	0.54	5.77	6.5***
Milex	9.0	4.30	0.66	1.84	4.71***
INV	38.73	9.14	0.22	2.28	1.09
GEXP	1.64	1.58	1.13	3.15	7.93***
POP	39925	14842	0.19	1.81	2.38
Notes: : JB is the Jarque- Bera test for normality. ***denotes significance at 1%					

TABLE 3: Unit Root Test Results						
		GDP	*MILEX*	*INV*	*POP*	*GE*
Panel A: ADF Tests						
Levels	d_{μ}	-3.51(4) ***	-1.24(0)	-1.57(2)	1.12(0)	4.67(1)
	$d_{\mu,\tau}$	-3.69(4) ***	-2.36(0)	-2.40(2)	-2.13(0)	1.61(1)
1st dif	d_{μ}		-7.42(4)***	-5.50(1)***	-3.75(4)***	-8.86(0)***
	$d_{\mu,\tau}$		-7.40(4)***	-5.41(1)***	-3.67(4)***	-6.30(0)***
Panel B: PP Tests						
Levels	d_{μ}	-5.20***	-0.96	-1.70	0.84	4.54
	$d_{\mu,\tau}$	-3.62***	-2.31	-2.59	-2.29	0.85
1st dif	d_{μ}		-8.52***	-5.51***	-2.83***	-6.30***
	$d_{\mu,\tau}$		-16.72***	-5.42***	-4.33***	-8.86***
Panel C: ZA Tests						
Levels	$d_{\mu,\tau}$	-5.33(1)** T_B = [1985]s	-5.37(1)** T_B = [1988]s	-3.56(1)** T_B = [1982]s	-4.60(3)** T_B = [1990]s	-3.51(1)** T_B=[2000]s

Notes: The proper lag length, allowing for a maximum of five lags, is on the basis of the general-to-specific approach for the ADF test, represented in parentheses (.).*** and ** indicate statistical significance at the 1% and 5% significance levels, respectively. The estimated breakpoints (T_B) for the ZA test are in square brackets [.] with s indicating that the identified breakpoint is significant at the 5% level

TABLE 4: Gregory Hansen Cointegration Test: MODEL 4: Regime Shift			
Dependent Variable	Model	Test Statistic	Break Point
GDP	C/S	-7.006*	1989

Notes: C/S denotes regime shift. The lag length is chosen based on minimum SC. denotes significant at the 5 % level. Critical values were obtained from Gregory and Hansen (1996).*

TABLE 5: Critical Value bounds of F statistics: Intercept and no trend, 45 observations, k=4						
T	**90% level**		**95% level**		**9% level**	
45	*I(0)*	*I(1)*	*I(0)*	*I(1)*	*I(0)*	*I(1)*
	2.638	3.772	3.178	4.450	4.394	5.914
Calculated F statistics Period 1970- 2015						
45	6.96					
Critical values are extracted from Table in Narayan (2005), p. 1988, Case: III.						

TABLE 6: The estimated long–run and short–run ECM		
ARDL (4, 4, 4, 1, 1): Dependent: LGDP		**ECM-ARDL: Dependent: ΔLGDS**
Variables		
Constant	0.0738*** (3.78)	0.122*** (3.95)
INV	-0.0117*** (-4.48)	-0.015*** (-11.06)
MILEX	0.0031*** (3.13)	0.04*** (12.60)
POP	-0.00*** (-0.01)	-1.55** (-2.36)
GEXPEND	0.19* (1.80)	0.13** (2.74)
D1989	0.79*** (7.84)	0.23*** (4.45)
ECM t−1		-0.66*** (-13.60)
*Notes: t-statistic in parentheses; ***,** ,* denote statistical significance at 5%, 10% and 1% respectively*		