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THE MILITARY EXPENDITURE-EXTERNAL DEBT NEXUS: NEW EVIDENCE FROM A PANEL OF MIDDLE EASTERN COUNTRIES

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ABSTRACT

This paper examines the impact of military expenditure and income on external debt for a panel of six Middle Eastern countries; namely, Oman, Syria, Yemen, Bahrain, Iran, and Jordan, over the period 1988 to 2002. Using Pedroni's (2004) test for panel cointegration, we find that there is a long-run relationship between external debt, military expenditure and income. The estimated long-run elasticities suggest that an increase in military expenditure contributes to a rise in external debt, while an increase in income helps the Middle Eastern countries to pay off their external debt.

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INTRODUCTION

Several studies have examined various dimensions of the economic effect of military expenditure. However, most focus has been on the relationship between military expenditure and economic growth, while the effect of military expenditure on external debt has received much less attention. In countries with large military expenditure, the role of military spending in contributing to external debt is important because of the potential adverse economic effects of external debt. While foreign borrowing need not harm economic growth, excessive foreign debt accumulation can cause deterioration in the terms of trade, an overvaluation of the domestic currency and slower economic growth. Brzoska (1983) and Looney and Frederiksen (1986) suggest that borrowing to finance military expenditure will have a negative effect on a country's growth rate if it faces constraints on international borrowing. Consistent with the 'guns butter trade-off', the rationale is that arms purchased with scarce foreign exchange reduces resources available for importing intermediate and investment goods that promote sustainable long-run economic growth (Looney, 1989; Dunne, Perlo-Freeman & Soydan, 2004a).

The objective of this paper is to examine the role of military expenditure in contributing to the external debt of six Middle Eastern countries; namely, Oman, Syria, Yemen, Bahrain, Iran, and Jordan using data for the period 1988 to 2002. To realize this objective we use a panel unit root and panel cointegration framework and calculate the long-run estimates using three different long-run estimators: the panel dynamic ordinary least squares (DOLS), the fully-modified ordinary least squares (FMOLS), and the dynamic fixed effects (DFE) estimators. The Middle East is an interesting region for which to examine the effect of military expenditure on external debt because it is one of the largest importers of arms in the world. To illustrate, Alami (2002) estimates that that military debts of $US45-90 billion accounted for over 40% of the total debt in the Arab/Middle East region in 1989-1990. By contrast, in "non OECD developing countries, official military debt was about 10% of total reported long-term debt" in the 1980s (Brzoska, 1992, p.81).

The contribution of this paper is twofold. One contribution is that it is the first study to examine the effect of military expenditure on external debt for a group of Middle East

countries. The second contribution is that it is the first study to use a panel cointegration framework to examine the effect of military expenditure on external debt. Previous studies to employ a panel cointegration framework in the defence economics literature are Yildirim and Ozdemir (2005) and Kollias, Mylonidis & Paleologou (2006). Yildirim and Ozdemir (2005) examine the relationship between military expenditure and economic growth for 10 Middle East countries and Turkey over the period 1989 to 2002 within a panel cointegration framework. Kollias, Mylonidis & Paleologou (2006) examine the relationship between military expenditure and economic growth for 15 European Union countries from 1961 to 2000 within a panel cointegration framework

The remainder of the paper is organized as follows. The next section provides a review of the existing literature. Section 3 provides an overview of the relationship between military expenditure and external debt in the Middle East. The analytical framework for examining the relationship between military expenditure and external debt is presented in Section 4. Section 5 contains the empirical specification and discusses the data. The econometric methodology is discussed in Section 6. The empirical results are presented in Section 7, while the final section concludes.

EXISTING LITERATURE

Since the seminal contribution by Benoit (1973, 1978) several studies have examined the effect of military expenditure on economic growth (see Deger & Sen, 1995; Ram, 1995; Dunne, 1996; Dunne, Smith & Willenbockel, 2005 for extensive reviews). The empirical evidence on the military expenditure-economic growth nexus varies across countries and time and is sensitive to the theoretical framework. Conceptually military expenditure could have a positive or negative effect on economic growth. On the one hand, military expenditure could have a positive effect on economic growth through Keynesian-type aggregate demand stimulation and the creation of positive externalities from human capital and infrastructure. Studies which have found that military expenditure has a positive effect on economic growth include Mueller and Atesoglu (1993); MacNair *et al.* (1995), Chlestos and Kollias (1995), Dunne and Nikolaidou (2001) and Yildirim and Sezgin (2002) among others. Equally military spending may have a negative effect on economic growth through reducing the availability of public funds for spending in the supposedly more productive civilian sector and creating inflationary pressures. Studies which have found that military

expenditure retards economic growth include Antonakis (1997), Heo (1998), Dunne and Mohammed (1995), Linden (1992) and Dunne, Nikolaidou & Smith (2002) among others.

Results of studies for countries in the Middle East are mixed. Lebovic and Ishaq (1987) found that military expenditure had a negative effect on economic growth in a panel data study for 20 Middle Eastern countries over the period 1973 to 1982. Abu-Bader and Abu-Qarn (2003) found that military expenditure had a negative effect on economic growth in Egypt, Israel and Syria over the period 1972 to 2001 within a Granger causality framework. DeRouen (2000) reaches the same findings in a single country study of Israel. However, Yildirim, Sezgin & Ocal (2005) examine the effect of military expenditure on economic growth for 12 Middle Eastern countries and Turkey using cross-sectional and dynamic panel data estimation techniques from 1989 to 1999 and find that military expenditure enhances economic growth in the Middle Eastern countries and Turkey as a whole. Several studies have considered the relationship between military expenditure and economic growth in Turkey. Sezgin (1999b, 2000) and Yildirim and Sezgin (2002) find a positive relationship between military expenditure and economic growth, while Dunne, Nikolaidou & Vougas (2001) and Sezgin (1999a) find a negative relationship between military expenditure and economic growth in Turkey.

Several studies have estimated the demand for military expenditure. In most empirical models the demand for military expenditure is specified as a function of economic resources, threats to security and various political factors. The results of such studies are mixed, suggesting that the demand for military expenditure is influenced by a range of economic and strategic factors (Dunne & Perlo-Freeman, 2003). Some studies have concluded that the determinants of military expenditure are country specific and, as such, cannot be generalized (Hartley & Sandler, 1990), although this finding has been questioned by Hewitt (1991) who finds that a common set of economic and financial determinants explain military expenditure for a broad cross-section of countries. Limited empirical evidence exists on the determinants of military expenditure in the Middle East. Chen, Feng & Masroori (1996) and Seigle and Liu (2002) examine the arms race between the Middle East and Israel. Chen, Feng & Masroori (1996) found that up to the signing of the Camp David Peace Treaty in 1979 Egypt was in a fierce arms race with Israel, but there was little evidence of such competition between Israel and Jordan, Lebanon or Syria. However, after the Camp David Peace Treaty, Jordan, Lebanon and Syria were forced to increase their

military expenditure. Seigle and Liu (2002) found unidirectional Granger causality running from military expenditure in Israel to military expenditure in Egypt, Iran, Jordan and Syria. Sezgin and Yildirim (2002) examined the determinants of military expenditure in Turkey and found that in the short run Turkish defence spending was influenced by defence spending in Greece, while in the long-run it was determined by other factors such as NATO commitments, fears of Islamic fundamentalism and a desire to suppress Kurdish militants. Yildirim, Sezgin & Ocal (2006) estimate the demand for military expenditure for the Middle Eastern countries and Turkey over the period 1989 to 1999 using static and dynamic panel data estimation techniques and find that military expenditure depends on the military expenditure of neighbours as well as internal and external conflicts.

A number of studies have considered the determinants of debt servicing difficulties, following the debt crisis of the early 1980s. Among the early studies McFadden *et al.* (1985) found that external debt, GDP per capita and liquidity measures such as non-gold reserves are significant predictors of debt distress for a sample of 93 countries over the period 1971 to 1982. More recently, Aylward and Thorne (1998) examined countries repayment history to the IMF, finding that repayment histories and IMF specific financial variables were the best predictors of the likelihood of arrears. Kraay and Nehru (2006) examined the determinants of debt servicing difficulties in 132 low- and middle-income countries over the period 1970 to 2002, finding that the main determinants of debt servicing difficulties were the debt burden, the quality of policies and institutions and shocks. There are few studies of the determinants of external debt as such. A notable exception is Lane (2004) who examined the determinants of external debt for a set of 55 low and middle-income countries from 1970 to 1998. Lane (2004) tests a range of specifications where external debt per capita is considered a function of one or more of GDP per capita, the ratio of exports to GDP, human capital, an index of social infrastructure, an index of political stability, the ratio of fuel exports to total exports and the share of debt that is concessional. He finds that the statistically significant determinant of external debt is GDP per capita and this remains true after controlling for creditworthiness and productivity.

Brzoska (1983) was one of the first to emphasize the importance of military expenditure as a component of external debt in developing countries. He estimated that in 1979 expenditure on arms was responsible for 20% to 30% of external debt in developing countries. Looney and Frederiksen (1986) use factor analysis to categorise developing countries as resource constrained and unconstrained in 1970

and 1982 and find that unconstrained countries are able to support a higher level of arms imports. Looney (1989) examined how military expenditure and arms imports contributed to external debt for 61 developing countries using models for the determinants of arms imports, military expenditure and external debt and running two stage least squares for the whole sample as well as sub-samples of resource constrained and unconstrained countries. He found arms imports to have a positive impact on the external debt of developing countries. In a later study, Looney (1998) found that higher defence spending affects the capability of external borrowing in Pakistan. In a study indirectly related to this literature, Bruck (2000) found that the civil war in Mozambique has generated a higher external debt burden.

Dunne, Perlo-Freeman & Soydan (2004a) used an autoregressive distributed lag model to model external debt in Argentina, Brazil and Chile as a function of military expenditure, GDP, exports, foreign exchange reserves and the six-month London Interbank Offer Interest Rate over the period 1970 to 2000. Their main finding was that military expenditure had a positive impact on external debt for Chile, but not Argentina or Brazil. Feridun (2005) examined the causal relationship between military expenditure and external debt in Argentina using Granger causality testing between 1971 and 2002 and found that the two variables are independent. Dunne, Perlo-Freeman & Soydan (2004) modelled external debt as a function of GDP, international reserves, total exports, arms imports, military burden, interest payments, financing from abroad, tax revenue, and debt service using a panel framework of 11 small industrialising countries for the period 1960-2000. Their main conclusion was that military expenditure had a positive impact on external debt.

A few studies have examined the relationship between military expenditure and external debt in Turkey. Gunluk-Senesen (2004) estimated that total military debt in Turkey was half the outstanding debt of Turkey to the IMF in 2001 and 75% of total foreign direct investment inflow to Turkey during 1980-2001. Sezgin (2004) modelled growth in external debt as a function of growth in real GDP, growth in imports, growth in exports, real growth in defence expenditure and arms imports over the period 1979 to 2000. He found that military expenditure had a negative effect on external debt, while arms imports had a positive effect on external debt. Karagol (2006) extended the Looney and Frederiksen (1986) study to examine the relationship between external debt, defence expenditure and GDP in Turkey for 1960-2002. He found that defence expenditure had a positive impact on external debt. Karagol and Sezgin (2004) used a probit model to examine the importance of financial and political

variables in explaining debt rescheduling in Turkey for 1955 to 2000. The political factors included the ratio of defence expenditure to government expenditure and the ratio of defence expenditure to GDP. Neither of these variables were statistically significant determinants of debt rescheduling in Turkey.

OVERVIEW OF MILITARY EXPENDITURE AND EXTERNAL DEBT IN THE MIDDLE EAST

Over the period 1988 to 2002 the Middle East experienced a downward trend in the military burden (military expenditure/GDP), with some cyclical fluctuations with spikes in times of war such as the 1991 Gulf War. The Middle East continues to have one of the highest military burdens in the world. In 2001 the military burden in the Middle East was 6.3%, which was more than double the next highest region which was 3% in North America and considerably higher than the global average of 2.3% (Skons ***et al.,*** 2003). Figure 1 plots the military burden for the six Middle Eastern countries considered in this study. Each of the six countries exhibits a general downward trend in military burden with some such as Bahrain exhibiting a spike in 1991. The average military burden across the six countries in 2002 was 4.5%. There are several reasons for high military expenditure in the Middle East. These include the existence of civil conflicts in Bahrain, Egypt, Saudi Arabia and Yemen; low level border conflicts involving, for example Israel and Hezbollah, Bahrain and Qatar and Saudi Arabia and Yemen as well as political instability associated with the spread of Islamic fundamentalism (Yildirim, Sezgin & Ocal*,* 2006). Israel, Jordan and Syria maintain expansionist objectives which fuels military expenditure (Chen, Feng & Masroori 1996). Isreal has maintained an expansionist policy in the illegally occupied territories and both Iran and Syria have provided extensive support for the Palestinians in the conflict with Israel. Jordan has ambitions of creating a Hashemite state incorporating Jordan, Iraq and parts of Palestine, while Syria has ambitions to create a state of 'Greater Syria' (Yildirim, Sezgin & Ocal*,* 2006).

While external debt in most Middle Eastern countries peaked at the beginning of the 1990s, the Middle East continues to be one of the most indebted regions in the world (Sahliyeh, 2000; Alami 2002, 2003). Figure 2 plots the ratio of external debt to GDP in the six countries examined in this study. Most of the countries exhibit a downward trend, although the external debt/GDP ratio in Oman increased and remained higher in the second half of the 1990s. In 2002 external debt as a percentage of GDP was

higher than 10% in Bahrain, Syria, Oman and Jordan. Government overspending and the allocation of a large share of government consumption to GDP in several Middle Eastern countries have contributed to government deficits and foreign borrowing. In addition to government consumption, overvaluation of local currencies, a general reduction in governmental economic liberalization and modest steps to liberalize the private sector have promoted imports at the expense of exports. Military expenditure has also been an important contributor to external debt. Alami (2002) estimated that up to 1990 military debts were particularly significant (ie. above 10% of external debt) in seven Middle East/Arab countries: Egypt, Jordan, Libya, Somalia, Syria, Yemen and Iraq and that with the exception of Lybia each of these countries were severely indebted economies as defined by the World Bank.

ANALYTICAL FRAMEWORK

Military expenditure can be expected to have a positive effect on external debt through three channels. First, military expenditure is a budget item that needs to be financed. If taxation is not sufficient to finance military expenditure, a budget deficit will ensue. If the means to finance deficits domestically is limited, budget deficits may create a need for foreign borrowing and thus debt accumulation. Second, a component of military expenditure may be allocated to arms imports, which will require foreign exchange. If the country lacks foreign exchange, it will need to borrow externally, contributing to external debt (see Dunne, Perlo-Freeman & Soydan, 2004, 2004a). Third, indigenous arms production may generate demand for foreign exchange in the form of high-tech imported intermediate inputs and machinery (Gunluk-Senesen, 2004).

In terms of the existing literature there are no firm guidelines on what explanatory variables to include in addition to military expenditure. As Dunne, Perlo-Freeman & Soydan (2004a, p.182) noted: “In developing a model of military spending and debt, the aim is not to provide a complete explanation of the evolution of debt, but to discern the specific effects of military expenditure on debt, given the capacity of the economy to finance the domestic and foreign spending that military expenditure involves”. To account for the effects of military expenditure on external debt, existing studies have typically included variables to capture a country’s capacity to engage in international borrowing and/or variables to reflect alternative financing sources.

In this study, in addition to military expenditure we focus on a country's capacity to engage in international borrowing. Brzoska (1983) and Looney and Frederiksen (1986) emphasised that the effect of military expenditure on external debt depends on a country's capacity to engage in international borrowing. We use real GDP as a proxy for a country's capacity to engage in international borrowing (see eg. Looney, 1989; Dunne, Perlo-Freeman & Soydan, 2004, 2004a; Sezgin, 2004). One line of reasoning is that an increase in the level of output should have a positive effect on external debt (Lane, 2004). Two reasons have been offered for this line of thought. First, theories of constrained access to international credit markets suggest an increase in output will expand the debt ceiling available to debtor countries. Second, in order for international borrowing and lending to occur in the presence of repudiation risk, creditors must have the ability to punish countries that default. Countries can either put up a fraction of output as collateral or be prepared to incur sanctions such as seizure of assets in the event of default. In either case, richer countries can offer more collateral and incur a greater decline in total production in the event of sanctions.

However, while this line of reasoning is true to a certain extent, if external debt increases beyond a certain level it will not be sustainable. Once external debt reaches such a point, countries need to switch from external borrowing to either printing money, running down foreign exchange reserves or internal borrowing and start repaying external debt to reduce debt levels to a sustainable level. From this perspective richer countries or countries with higher rates of economic growth have greater capacity to repay external debt. If a country has a commitment to repay external debt, a rise in real income will increase its capacity to repay that debt, suggesting an inverse relationship between real income and external debt. Dunne, Perlo-Freeman & Soydan (2004) found that in static and dynamic panel data models for a panel of 11 small industrialising countries for the period 1960-2000 economic growth had a negative effect on external debt as a proportion of GDP. When discussing these findings in a subsequent article, the same authors interpreted their results as suggesting "that a strong economy makes it easier to mange debt" (Dunne, Perlo-Freeman & Soydan, 2004a, p.182). As a matter of arithmetic, rising GDP automatically lowers external debt as a proportion of GDP, suggesting a negative relationship is possible (Dunne, Perlo-Freeman & Soydan, 2004a, p. 182).

The experience of the Middle Eastern countries is consistent with this scenario. The IMF (2004) regards the upper bound for sustainable debt at 30% of GDP for countries considered to have poor institutions and policies, 45 % of GDP for

countries considered to have medium institutions and policies and 60 % of GDP for countries considered to have strong institutions and policies. In the late 1980s Jordan and Yemen had external debt levels at 60% or above and external debt levels in Syria approached 60%. In the 1990s Oman had external debt approaching 30%. Since the late 1980s most of the countries in the region have experienced a downward trend in the ratio of external debt to GDP on the back of high economic growth generated through booming oil prices (see Figure 2).

As oil prices have surged, most states in the Middle East have benefited from increased revenue. Oil producing states, and especially the large producers such as Iran, Iraq, Kuwait, Qatar, Saudi Arabia and the UAE, benefited directly in the form of higher export earnings. The resource poor Middle Eastern states such as Jordan, the Palestinian areas and Yemen benefited from the sharp increases in oil prices through transmission mechanisms from the oil producers including labor remittances and aid (World Bank, 2006b). From 1995 to 2005 real GDP in the Middle East and North Africa grew at 4% per annum (World Bank, 2006a). Between 2003 and 2005 real GDP in the Middle East and North Africa (excluding Iraq) grew at 6.2% per annum, the highest three year average growth rate for the region in almost three decades (World Bank, 2006b). This high regional growth rate was a manifestation of extraordinarily high growth among the major oil producers in the region which together accounted for 84% of growth in the Middle East and North Africa in 2005, compared with less than 70% in the late 1990s (World Bank, 2006b).

In preliminary results that are not reported in the paper we also included the balance of trade series as a proxy for alternatives to international borrowing as a means of financing a budget deficit and importing arms. However, our panel is small (T=15, N=6), sufficient to econometrically accommodate only two explanatory variables. When we attempted to expand Equation (2) below with the balance of trade series, we got meaningless results with very large standard errors. For individual countries with the FMOLS estimates we found the long-run elasticities to be same, implying loss of degrees of freedom. Thus, on econometric grounds, given the small size of our panel, we proceed to only model the impact of two explanatory variables.

EMPIRICAL SPECIFICATION AND DATA

We augment the bivariate model of debt and military expenditure with a real gross domestic product (GDP) variable, and estimate the following model.

$$\ln \mathrm{ED}_t = \alpha_0 + \alpha_1 \ln \mathrm{ME}_t + \alpha_2 \ln \mathrm{Y}_t + \varepsilon_t \qquad (1)$$

The panel version of Equation (1) can be written as follows:

$$\ln \mathrm{ED}_{it} = \beta_{0i} + \beta_{1i} \ln \mathrm{ME}_{it} + \beta_2 \ln \mathrm{Y}_{it} + \varepsilon_{it} \qquad (2)$$

Here, ln represents the natural log of the variables, ED represents real external debt, Y represents real GDP, ME represents real military expenditure, and ε is the error term with the conventional statistical properties. The nominal values are deflated using the consumer price index (CPI). Equation (2) was estimated for six Middle Eastern countries; namely, Oman, Syria, Yemen, Bahrain, Iran, and Jordan using annual data for the period 1988 to 2002. These are the six Middle Eastern countries for which there is consistent data on debt and military expenditure available over the period. Data on the CPI and external debt is from the *World Bank World Tables* and military expenditure from the *Stockholm International Peace Research Institute* (SPIRI).

ECONOMETRIC METHODOLOGY

To estimate Equation (2) we use a panel unit root and panel cointegration framework and calculate the long-run estimates using the DFE, DOLS and FMOLS estimators. One problem that the defence economics literature has faced is the lack of variation between military expenditure data and other economic variables. Recently, several studies have sought to overcome the lack of independent exogenous variation in the data through employing panel data for a relatively homogenous set of countries. While the use of panel data has the advantage that one can exploit both the cross-

sectional and time series dimensions of the data, using panel data presents other problems stemming from the presence of trending variables in the regressions, such as ED, ME and Y. If any or all of ED, ME and Y are non-stationary, conventional panel data estimations of the effect of military expenditure on external debt such as, for example, Dunne, Perlo-Freeman & Soydan (2004) will be spurious. The panel unit root and panel cointegration approach avoids the problem of spurious regression through first examining the order of integration of the variables and if the variables are non-stationary, testing whether the variables are cointegrated. If the variables are cointegrated, it follows that a linear combination of the non-stationary variables will be stationary. The panel cointegration framework also has the advantage that because it tests whether there is a long-run relationship between the variables it allows us to distinguish between short-run and long-run impacts of military expenditure on external debt, which is not possible with conventional panel data analysis.

One disadvantage of panel cointegration is that the power of cointegration falls sharply when the cross sectional units (N) increase in samples with a small time series (T). A second disadvantage (as with all panel models) is that if the panel consists of countries with different levels of development and/or socio-economic characteristics then the application of the panel is restrictive because ideally the panel should consider countries from the same geographic region or with similar levels of social and economic development. However, given that our study is for a selected group of Middle Eastern countries, it does not suffer from these weaknesses.

The panel unit root and panel cointegration approach involves three steps. First, examine whether the variables contain a panel unit root. Second, if the variables do contain a panel unit root, examine whether there is panel cointegration. Third, if there is panel cointegration, estimate Equation (2) using DFE, FMOLS and DOLS.

Panel Unit Root

Prior to implementing the panel cointegration test, we performed the panel unit root tests proposed by Breitung (2000), Im, Pesaran & Shin (2003) and Maddala and Wu (1999). Breitung (2000) considers a panel version of the Augmented Dickey-Fuller (ADF) unit root test that restricts ϕ to be identical across cross-sectional units, but allows the lag order for the first difference terms to vary across cross-sectional units.

$$\Delta y_{it} = \kappa_i + \phi y_{it-1} + \varpi_i t + \sum_{j=1}^{k} d_{ij} \Delta y_{it-j} + \varepsilon_{it} \quad (3)$$

Here y denotes the natural log of each of the variables and the subscript *i*=1,…..*N* is an index of the six countries. Equation (3) is estimated using pooled ordinary least squares (OLS). The null and the alternate hypotheses are: H_0 ϕ=0 and H_1 ϕ<0. Under the null hypothesis, there is a unit root, while under the alternative, there is no unit root. The difference between the Levin, Lin & Chu (2002) test and the Breitung (2000) test is that the former requires bias correction factors to correct for cross-sectionally heterogeneous variances to allow for efficient pooled OLS estimation, while the Breitung (2000) test achieves the same result by appropriate variable transformations. We chose a maximum lag length of four and then used the Schwarz information criteria to obtain the optimal lag length. In each case the optimal lag length was four.

One of the drawbacks of the Breitung (2000) test is that in Equations 3 ϕ is restricted to be identical across countries under both the null and alternative hypotheses. The *t*-bar test proposed by Im, Pesaran & Shin (2003) has the advantage over the Breitung (2000) test that it does not assume that all countries converge towards the equilibrium value at the same speed under the alternative hypothesis and thus is less restrictive. There are two stages in constructing the *t*-bar test statistic. First, calculate the average of the individual ADF *t*-statistics for each of the countries in the sample. Second, calculate the standardized *t*-bar statistic according to the following formula:

$$\text{t-bar} = \sqrt{N}\left(t_\alpha - \kappa_t\right) \Big/ \sqrt{v_t} \quad (4)$$

where *N* is the size of the panel, t_α is the average of the individual ADF *t*-statistics for each of the countries and κ_t and v_t are, respectively, estimates of the mean and variance of each $t_{\alpha i}$. Im, Pesaran & Shin (2003) provide Monte Carlo simulations of κ_t and v_t and tabulate exact critical values for various combinations of *N* and *T*. A problem with the Breitung (2000) test is that it assumes cross-sectional independence. Given the nature of country interactions –arms races, alliances and rivalries - this is unlikely to be the case. The Im, Pesaran & Shin (2003) test addresses the problem of cross-sectional dependence by demeaning the data so that the standardized demeaned *t*-bar statistic converges to the standard normal in the limit. The available evidence suggests that demeaning the data dramatically reduces the presence of cross-sectional dependence, even when the observed data are highly correlated (see eg. Luintel, 2001).

Maddalla and Wu (1999) criticize the working paper version of the Im, Pesaran & Shin (2003) test on the basis that in many real world applications, cross-sectional dependence is unlikely to take the simple form proposed by Im, Pesaran & Shin (2003) that can be effectively eliminated by demeaning the data. Maddala and Wu (1999) propose a panel unit root test developed from Fisher (1932) that uses bootstrapping methods to address cross-sectional dependence. Maddala and Wu (1999) show that their test is more effective in dealing with cross-sectional dependence than the Im, Pesaran & Shin (2003) test. Maddala and Wu (1999) combine the p-values of the test statistic for a unit root in each residual cross-sectional unit. The test is non-parametric and has a chi-square distribution with $2N$ degrees of freedom, where *N* is the number of countries. Using the additive property of the chi-squared variable, the following test statistic can be derived:

$$\lambda = -2\sum_{i=1}^{N} log_e \pi_i \qquad (5)$$

Here, π_i is the p-value of the test statistic for each country denoted as *i*.

Panel Cointegration

If each of the variables contain a panel unit root the issue arises whether there exists a long-run equilibrium relationship between the variables. If each variable is integrated of order one, we test for panel cointegration using Pedroni's (2004) test that allows for heterogeneity in the intercepts and slopes of the cointegrating equation. Pedroni (2004) provides 'within dimension' (panel tests) and 'between dimension' (group tests) for the test of the null of no cointegration in heterogeneous panels. The 'within dimension' tests take into account common time factors and allow for heterogeneity across countries. The 'between dimension' tests are 'group mean cointegration tests' and allow for heterogeneity of parameters across countries. We employ the within dimension panel Phillips-Perron (1988) type rho-statistic and the between dimension group Phillips-Perron (1988) type rho-statistic as recommended by Pedroni (2004). [1]

These statistics are based on the estimated residuals from the following regression:

$$\ln ED_{i,t} = \nu_i + \vartheta_i \ln ME_{i,t} + \delta_i \ln Y_{i,t} + \xi_{i,t} \qquad (6)$$

where $\xi_{it} = \eta_i \xi_{i(t-1)} + \mu_{it}$ are the estimated residuals from the panel regression. The null hypothesis tested is whether η_i is unity. The finite sample distribution for the test statistics have been tabulated in Pedroni (2004) using Monte Carlo simulations. If the

test statistic exceeds the critical values in Pedroni (2004), the null hypothesis of no cointegration is rejected, implying the variables are cointegrated.

Panel Long-run estimators

If we find a long-run relationship among the variables we proceed to estimate the long-run and short-run coefficients of real military expenditure and real GDP on real external debt. To estimate the long-run effect of real military expenditure and real GDP we use both panel FMOLS, proposed by Pedroni (2000), and DOLS developed by Stock and Watson (1993) and Kao and Chiang (2000). Monte Carlo simulations suggest that the DOLS estimator is preferable. Kao and Chiang (2000) examined finite sample properties of OLS, FMOLS and DOLS. They found that OLS exhibits substantial bias in panels up to N=60, T=60, that FMOLS does not improve significantly over OLS and that DOLS is superior to OLS and FMOLS in all cases. For comparative purposes, we also apply the DFE estimator, where the intercepts are allowed to differ across groups while all other coefficients and error variances are constrained to be the same (for an application, see Pesaran, Shin & Smith, 1999).

EMPIRICAL RESULTS

We begin by testing whether each of ED, ME and Y contain a panel unit root using the panel unit root tests proposed by Breitung (2000), Im, Pesaran & Shin (2003) and Maddala and Wu (1999). The results are reported in Table 1 where they are divided into three panels. Panel A consists of results from the Breitung (2000) test; panel B consists of the results from the Im, Pesaran & Shin (2003) test and panel C consists of results from the Maddala and Wu (1999) test. For each of these tests, the test statistics are in column 2 and the p-values for examining the statistical significance are reported in the final column. We generate two sets of results: one based on the log-levels of the variables and the other based on the first difference of the log-levels of the variables. The results from all three tests suggest that ED, ME and Y contain a panel unit root.

Given that ED, ME and Y contain a panel unit root we proceed to examine whether there is a long run relationship between the three variables for our panel of six Middle Eastern countries. For this purpose we employ Pedroni's (2004) panel Phillips-Perron (1988) type rho-statistic and group Phillips-Perron (1988) type rho-statistic. The panel rho-statistic and group rho-statistic are 2.1 and 2.5, respectively and the associated

one-sided p-value is less than 0.01. Thus, both test statistics suggest there is panel cointegration between ED, ME and Y at the 1% level of significance.

Having established that a long-run relationship exists between ED, ME and Y, we now estimate the long-run effect of ME and Y on ED. We use the panel FMOLS estimator suggested by Pedroni (2000), panel DOLS estimator proposed by Kao and Chiang (2000), and the DFE estimator. The results are reported in Table 2. For the FMOLS estimator the coefficient on ME is 1.34, suggesting that a 1% increase in ME increases ED by 1.3%. For the FMOLS estimator, the coefficient on Y is -0.8, which implies that a 1% increase in Y reduces ED by 0.8%. Both results are statistically significant at the 1% level. The signs and elasticities obtained with the DOLS estimator are similar. According to the DOLS estimator, a 1% increase in ME increases ED by 1.05 %, while a 1% increase in Y reduces ED by 0.6%. Both results are statistically significant at the 5% level or better. The results from the DFE estimator, however, suggest that while ME has a statistically significant positive effect on ED - a 1% increase in ME increases ED by around 1.6% - Y has a statistically insignificant effect on ED.

The results for the short-run impact of military expenditure and income on external debt for the panel of six Middle Eastern countries are reported in Table 3. We find that while military expenditure has a statistically significant positive impact on external debt, income has a negative but statistically insignificant impact on external debt. The coefficient on the military expenditure variable is 0.24, suggesting that a 1% increase in military expenditure increases external debt by 0.24% in the short-run. The one period lagged error correction term, which measures the speed of adjustment to equilibrium following a shock to the system, has a negative sign and is statistically significant at the 1% level. Its sign and significance level suggests that external debt is able to revert to its equilibrium following a shock to military expenditure and/or income. But, the magnitude of the coefficient, because it is very small, suggests that the speed of adjustment to equilibrium is very slow.

Overall, military expenditure has a statistically significant positive impact on external debt in the short-run and long-run. The relationship is elastic in the long-run, but in the short-run it is inelastic. The long-run and short-run coefficient on military expenditure in this study is much larger than the coefficient on military expenditure in the panel study by Dunne, Perlo-Freeman & Soydan (2004) for 11 small industrializing economies. In the dynamic panel GMM estimates by Dunne, Perlo-

Freeman & Soydan (2004) the coefficient on military expenditure was in the range 0.010 to 0.014. This reflects the fact that military expenditure as a proportion of GDP is much higher in most of the Middle Eastern countries studied here than in the 11 economies studied by Dunne, Perlo-Freeman & Soydan (2004). In the Dunne *et al* (2004) study military expenditure as a percentage of GDP in 10 of the 11 countries was less than 4 % in the late 1990s, the only exception being Pakistan where it was 5.7% in 1997 (see Dunne, Perlo-Freeman & Soydan, 2004, table 1). In half of the Middle Eastern countries studied here, in 2002 military expenditure as a proportion of GDP was in excess of 4% and in Bahrain and Oman it was in excess of 9%. And, at the start of the time period under study in 1988, military expenditure as a percentage of GDP was in excess of 7% in five of the six Middle Eastern countries and it was in excess of 10% in Jordan, Oman and Syria.

Eyeballing figures 1 and 2, an explanation for the positive coefficient on military expenditure is that there has been a sharp decline in military expenditure as a proportion of GDP since 1988 associated with the decline in external debt in the six Middle Eastern countries over the same period. Between 1988 and 2002 military expenditure as a percentage of GDP fell from 10.7% to 3.0% in Jordan; 16.1% to 9.6% in Oman; 10.5% to 4.2% in Syria; 7.25% to 0.6% in Yemen, 10.7% to 9.4% in Bahrain and 3.8% to 0.5% in Iran. Over the same period external debt as a percentage of GDP fell from 76.8% to 30.7% in Jordan; 15.5% to 0.9% in Iran; 59.8% to 4.2% in Yemen; 52.5% to 15% in Syria and 28.6% to 18% in Oman. The only country in the sample for which external debt as a ratio of GDP did not fall was Bahrain. Of the countries that experienced the biggest drops in their external debt burden (Iran, Jordan, Syria and Yemen), military expenditure as a percentage of GDP was relatively low to begin with in Iran, but Jordan, Syria and Yemen also experienced sizeable cuts in military expenditure.

The DOLS and FMOLS estimates suggest income has a statistically significant negative inelastic effect on external debt in the long-run, while in the short-run the effect of income on military expenditure is statistically insignificant. The result using the DOLS and FMOLS estimators is consistent with the argument that the high debt levels in some of the countries in the late 1980s; namely, Jordan, Syria and Yemen and to a lesser extent Oman, were not sustainable and that the better performing economies have been better placed to reduce debt levels. Jordan, along with Morocco and Tunisia, has been the best performing of the resource poor labour abundant countries in the Middle East and North Africa. From 1995 to 1999 average

real GDP grew at 3.2% and this increased to 5.5% between 2000 and 2002. The average growth rate in Oman was similar; 3.4% between 1995 and 1999 and 4.6% between 2000 and 2002. Yemen has been the best performer of the resource rich labour abundant countries of the Middle East and North Africa, which also includes Iran, with an average annual growth rate of 5.5% between 1995 and 2000 and 4.2% between 2000 and 2002 (World Bank, 2006b).

CONCLUSION

The objective of this paper has been to examine the role of military expenditure in contributing to the external debt of six Middle Eastern countries; namely, Oman, Syria, Yemen, Bahrain, Iran, and Jordan using data for the period 1988 to 2002. To realize this objective, for the first time in the military expenditure-debt literature we used a panel unit root and panel cointegration framework. We calculated the long-run estimates using the DOLS, FMOLS and the DFE estimators as well as the short-run elasticities. Our main finding was that external debt, military expenditure and income were cointegrated for the panel of six Middle Eastern countries. In the long-run all three estimators suggest military expenditure has a statistically significant positive effect on external debt, while DOLS and FMOLS suggest income has a statistically significant negative effect on external debt. In the short-run, we found that military expenditure continues to have a statistically significant positive effect on external debt, although the elasticity switches from greater than one to less than one, and the effect of income on external debt becomes statistically insignificant. One important limitation on our finding is that, from an econometric perspective, the small panel (T=15, N=6) is only sufficient to accommodate two explanatory variables without a substantial loss in power. Future studies for the Middle East as well as other regions in the world could include more potential determinants of external debt within a panel cointegration framework subject to an increase in data availability.

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Table I. Panel Unit Root Tests

Panel A: Breitung (2000) test		
Variables (in logs)	test statistic	Probability
$\ln ED$	1.9907	0.9767
$\Delta \ln ED$	-3.1409***	0.0008
$\ln ME$	-0.2954	0.3838
$\Delta \ln ME$	-2.8189***	0.0024
$\ln Y$	0.0059	0.5024
$\Delta \ln Y$	-1.3061*	0.0958
Panel B: Im, Pesaran & Shin (2003) test		
Variables (in logs)	test statistic	Probability
$\ln ED$	0.2514	0.5992
$\Delta \ln ED$	-2.1458**	0.0159
$\ln ME$	-1.2699	0.1020
$\Delta \ln ME$	-3.2009***	0.0007
$\ln Y$	-0.3884	0.3489
$\Delta \ln Y$	-4.3783***	0.0000
Panel C: Maddala and Wu (1999) test		
Variables (in logs)	test statistic	Probability
$\ln ED$	9.2918	0.6778
$\Delta \ln ED$	22.5355**	0.0319
$\ln ME$	18.4110	0.1038
$\Delta \ln ME$	31.5325***	0.0016
$\ln Y$	12.7331	0.3887
$\Delta \ln Y$	41.7068***	0.0000

Figures in parenthesis are p values. *** (*) denote statistical significance at the 1 % and 1o % levels, respectively.

Table II. Panel Long-run Elasticities

	$\ln ME$	$\ln Y$
DOLS	1.05***	-0.59**
	(4.31)	(-2.00)
FMOLS	1.34***	-0.81***
	(14.92)	(-4.33)
DFE	1.61***	-0.78
	(2.76)	(-1.22)

Figures in parenthesis are t-statistics. *** (**) denote statistical significance at the 1 % and 5 % levels, respectively.

Table III. Short-run Elasticities

Variable	Coefficient	t-statistics
Constant	0.2765	2.9950
$\Delta \ln \mathrm{ME}_t$	0.2426**	2.0949
$\Delta \ln \mathrm{Y}_t$	-0.2912	-0.5481
ECT_{t-1}	-0.0417***	-3.3937
Goodness of fit: $\mathrm{R}^2 = 0.20$	$\overline{\mathrm{R}}^2 = 0.17$	

Figures in parenthesis are t-statistics. *** (**) denote statistical significance at the 1 % and 5 % levels, respectively.

FIGURE 1 Military Expenditure/ GDP 1988-2002 for Six Middle Eastern Countries

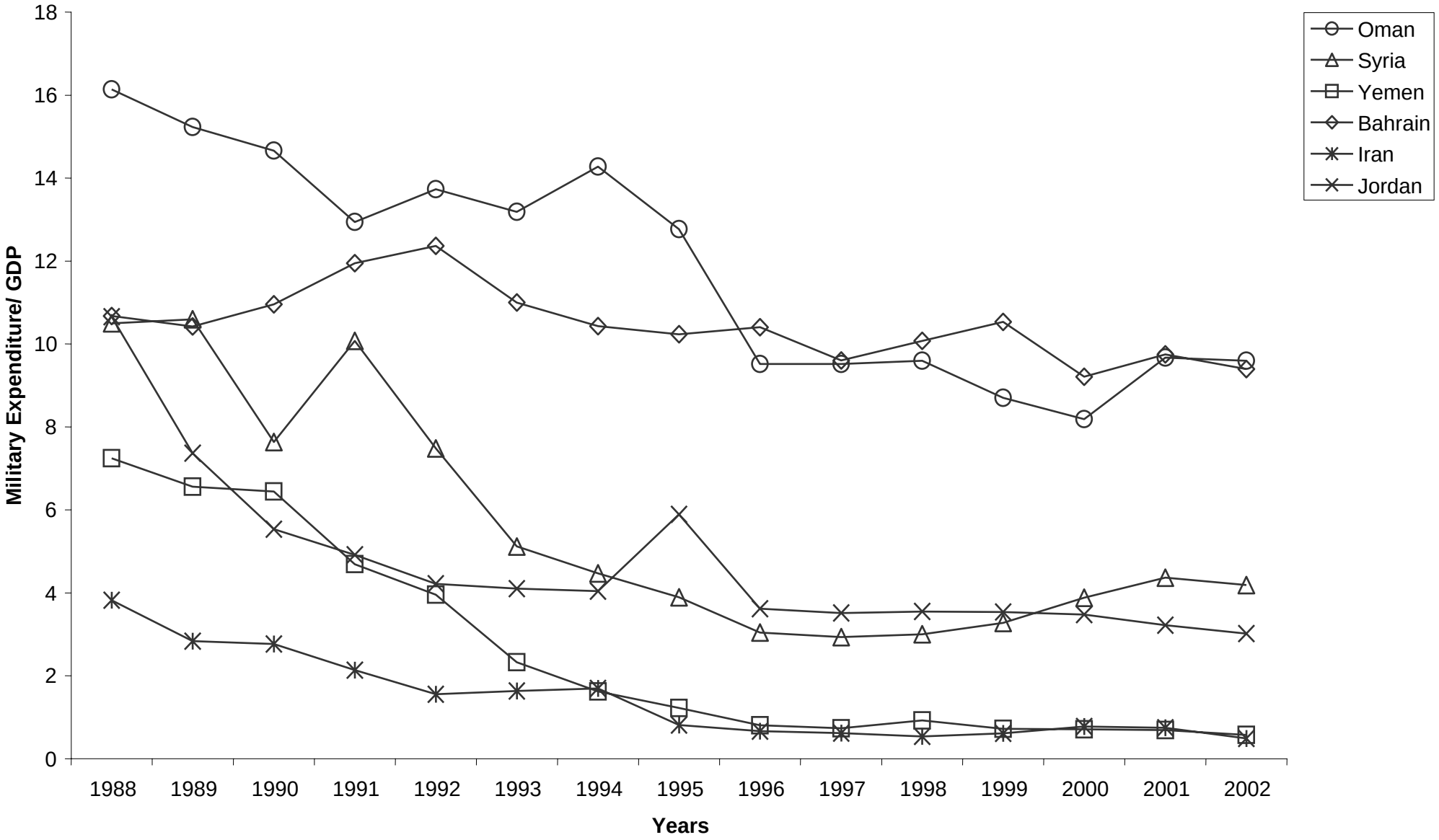
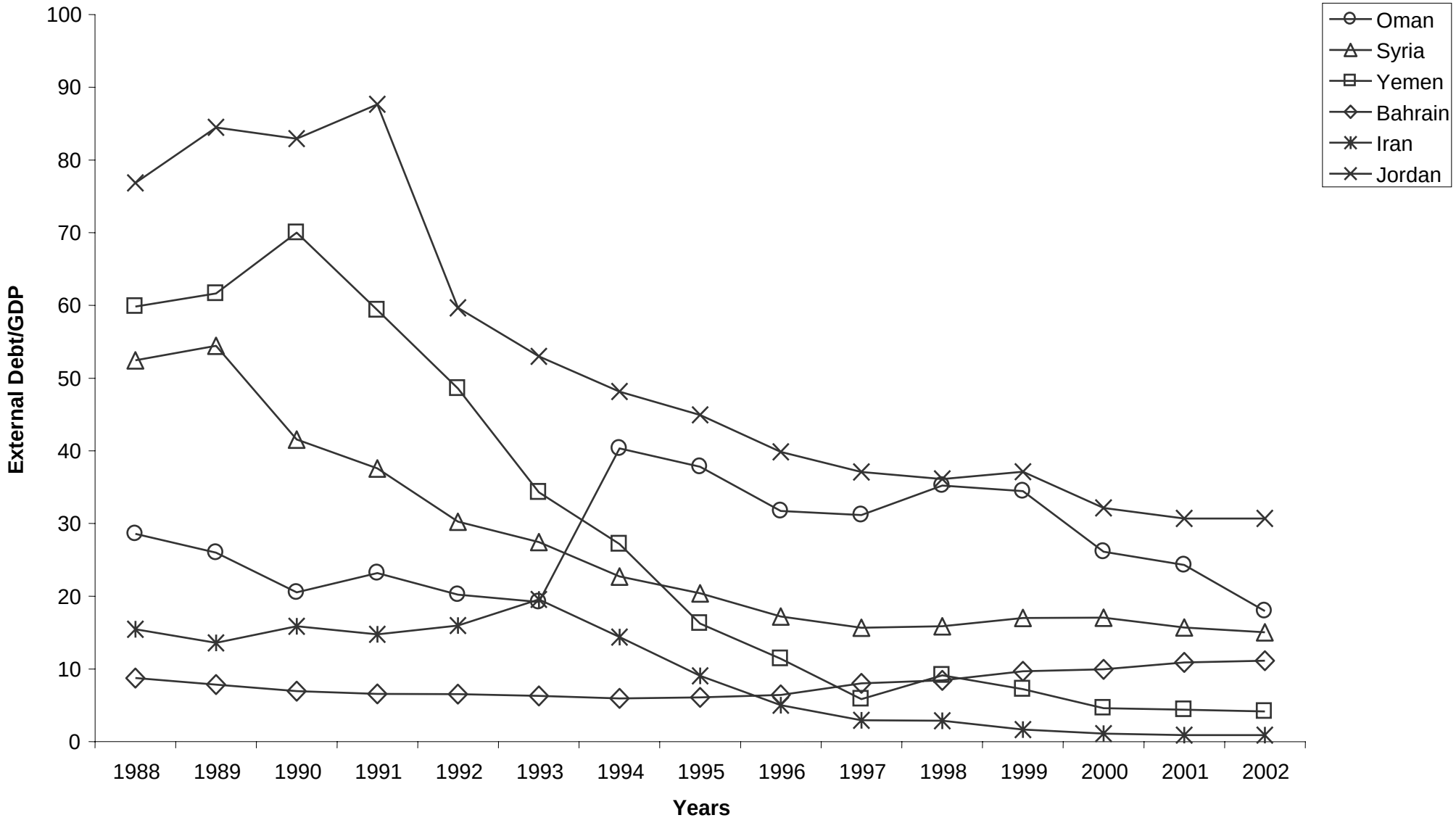


FIGURE 2 External Debt/ GDP 1988-2002 for Six Middle Eastern Countries



ENDNOTES

[1] Interested readers are referred to Pedroni (2004) for further details and mathematical representation of the tests.