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A Panel Data Analysis of the Military Expenditure-External Debt Nexus: Evidence from six Middle Eastern Countries

Focus: the nexus between military expenditure and external debt

- Large military expenditure can result in large external debt
- Potential adverse economic effects of external debt
 - Deterioration in terms of trade
 - Overvaluation of domestic currency
 - Slower economic growth, especially if constraints on external borrowing: "Guns-Butter trade-off"
- Relatively few studies considering the effect of military expenditure on external debt
- First study to use a panel cointegration framework to examine the effect

How does military expenditure effect external debt?

- Military expenditure is a **budget item** that needs to be financed: if tax receipts < expenditure, need to fund through borrowing
- Where **arms are imported**, the purchase requires foreign exchange – which is limited by reserves/price of foreign currency
- Indigenous arms production: demand for foreign exchange to purchase **intermediate inputs** from abroad

Existing Literature – global perspective

- Brzoska (1983) – one of the first to emphasise the effect of *ME* on *ED*: 1979 – found *ME* = 20-30% of *ED* in developing countries
- Several authors found the relationship to be ambiguous for South American Countries
- Dunne, Perlo-Freeman and Soyden (2004) found *ME* had a positive impact on *ED* for a panel of 11 small industrialising countries over 1960-2000
- Generally, results are mixed:
 - South America is ambiguous
 - Smaller industrialising countries – stronger link

Existing Literature – Middle Eastern focus

- Effect of *ME* on *ED* for the Middle-Eastern countries has not been statistically analysed
- Yet, *ME/GDP* in the Middle-East = 6.3% in 2001, compared to 3% in North America and a global average of 2.3%
- Middle-East continues to be one of the most indebted regions in the world (Aalami 2002, 2003)
- Alami (2002) – descriptive analysis:
 - Military debts = 40% of total debt and around 66% of external debt for Arab/Middle-Eastern countries in 1989-90.

Six country panel

- Sample comprises only Oman, Syria, Yemen, Bahrain, Iran and Jordan due to data constraints using annual data over the period 1988 - 2002
- World Bank classification
 - Resource-rich labour-importing: Bahrain and Oman
 - Resource-rich labour-abundant: Iran, Syria and Yemen
 - Resource-poor labour-abundant: Jordan
- All except Jordan are major oil exporters
- Middle-Eastern six: mostly downward trend in *ED/GDP* (Oman slightly higher at end of 1990s), mainly due to *GDP* growth

Analytical framework

- *ME* contributes to *ED* through 3 channels:
 1. Budget item that needs to be financed
 2. Where arms are imported – require FX
 3. Local production may require imported inputs
- Following existing studies, to account for effects of *ME* on *ED*, we have used variables to capture a country's capacity to borrow internationally
- Proxy used: real *GDP*

Relationship between GDP and External Debt

- Increase in *Y* might increase *ED*
 - * Theories of constrained access to international credit markets.
 - * The existence of repudiation risk
- Increase in *Y* might decrease *ED*
 - Richer countries might have more capacity to repay external debt

Empirical specification

- The following model is estimated:

$$\ln ED_{it} = \beta_{0i} + \beta_1 \ln ME_{it} + \beta_2 \ln Y_{it} + \varepsilon_{it}$$

- Where
 - ED is real external debt,
 - Y is real GDP,
 - ME is real military expenditure and
 - ε is the stochastic error term

Data

- Six countries: Oman, Syria, Yemen, Bahrain, Iran and Jordan
- Annual data for the six country panel are available for the period 1988 – 2002
- Data for CPI and ED are from the World Bank *World Tables* and data for ME is from the *Stockholm International Peace Research Institute (SIPRI)*.

Econometric methodology

- The above equation is estimated using a panel unit root and panel cointegration framework
- This ensures that the problem of spurious regression is avoided and allows us to distinguish between short run and long run impacts of *ME* on *ED*
- Long run estimates are calculated using the DFE, DOLS and FMOLS estimators

Econometric methodology – Panel Unit Root

- We apply standard 'first generation' panel unit root tests (available in E-views)
 - Breitung (2000)
 - Im, Pesaran and Shin (2003)
 - Maddala & Wu (1999)
- Advantages and drawbacks of these tests are well-known and discussed in the paper

Econometric methodology – Panel Cointegration

- Addressing the question of whether there is a long-run equilibrium relationship
- Pedroni (2004) provides 'within dimension' (panel tests) and 'between dimension' (group tests) for the test of the null of no cointegration.
- We use the 'within dimension' and 'between dimension' rho-statistic recommended by Pedroni.
- These statistics are based on the residuals from the following regression:

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

- Where $\xi_{i,t} = \eta_i \xi_{i(t-1)} + \mu_{i,t}$ are the estimated residuals from the panel regression

Econometric methodology – Panel Long-Run Estimators

- The long-run estimates of the variables are calculated using the estimators and the results compared:
 - **DFE** – where intercepts are allowed to differ across groups while coefficients and error variances are not. Also best at capturing dynamic relationships among variables)
 - **DOLS** – corrects for simultaneity bias
 - **FMOLS** – corrects for endogeneity and serial correlation as well as asymptotically eliminating sample bias

Empirical results: Panel unit root tests

- Panel unit root tests are first conducted
- Results in Table I:
 - Panel A Breitung test
 - Panel B Im, Pesaran & Shin test
 - Panel C Maddala and Wu test
- 2 sets of results:
 - Based on log-levels of the variables
 - Based on first differences of the log-levels
- All tests suggest that *ED*, *ME* and *Y* contain a panel unit root.

Table I. Panel Unit Root Tests

Panel A: Breitung (2000) test

<i>Variables (logs)</i>	<i>Test statistic</i>	<i>Probability</i>
In ED	1.99	0.97
Δ In ED	-3.14***	0.00
In ME	-0.30	0.38
Δ In Y	-2.82***	0.00
In Y	0.01	0.50
Δ In Y	-1.31*	0.10

Panel B: Im, Pesaran & Shin (2003) test

<i>Variables (logs)</i>	<i>Test statistic</i>	<i>Probability</i>
In ED	0.25	0.60
Δ In ED	-2.15**	0.02
In ME	-1.27	0.10
Δ In ME	-3.20***	0.00
In Y	-0.39	0.35
Δ In Y	-4.38***	0.00

Panel C: Maddala and Wu (1999) test

<i>Variables (logs)</i>	<i>Test statistic</i>	<i>Probability</i>
In ED	9.29	0.68
Δ In ED	22.54**	0.03
In ME	18.41	0.10
Δ In ME	31.53***	0.00
In Y	12.73	0.39
Δ In Y	41.71***	0.00

***significant at the 1% level; **significant at the % level; *significant at the 10% level.

Empirical results: Cointegration and LR effect of ME and Y on ED

- Phillips and Perron (1988) type group rho-statistic: **2.5**
- Pedroni (2004) type panel rho-statistic: **2.1**
- Suggests panel cointegration at the 1% level of significance.
- Long run effect of Y and ME on ED is estimated using FMOLS, DOLS and DFE.
- Results in Table II:

Empirical results: Long-run elasticities

Table II. Panel Long-Run Elasticities

	<i>Ln ME</i>	<i>Ln Y</i>
DOLS	1.05*** (4.31)	-0.59** (-2.00)
FMOLS	1.34*** (14.92)	-0.81*** (-4.33)
DFE	1.61*** (2.76)	-0.78 (-1.22)

Figures in parentheses are *t*-statistics.

*** significant at the 1% level; **significant at the 5% level.

- Results suggest that:
 - an increase in ME by 1% results in an increase in ED by between 1.05 and 1.61%
 - An increase in Y by 1% results in a reduction in ED by between 0.59 and 0.81%

Empirical results: Short-run elasticities

Table III. Short-Run Elasticities

<i>Variable</i>	<i>Coefficient</i>	<i>t-statistics</i>
Constant	0.28	3.00
$\Delta \ln ME_t$	0.24**	2.09
$\Delta \ln Y_t$	-0.29	-0.55
ECT_{t-1}	-0.04***	-3.39

Goodness of fit: $R^2 = 0.20$; $\bar{R}^2 = 0.17$.

***significant at the 1% level; **significant at the 5% level.

- Results:
 - *ME* has a +ve and significant effect on *ED*:
1% increase in *ME* → 0.24% increase in *ED* in the SR
 - *Y* has a negative and insignificant effect on *ED*
 - While *ED* is likely to converge to equilibrium following shocks, the speed of adjustment is likely to be slow.

Summary of empirical results

- *ME* statistically significant and positive effect on *ED* in the short-run and long-run,
- The results for *ME* are more economically significant than those of studies for other countries
- This reflects the large *ME/GDP* ratio in many Middle Eastern countries
- The DOLS and FMOLS estimates suggest *Y* has a significant negative inelastic effect on *ED* in the long-run, while in the short-run it is not a significant determinant of *ED*.
- This result is consistent with the argument that high debt levels in some countries in the late 1980s were not sustainable and the better performing economies have been better placed to reduce debt.

Conclusion ...

- While *ED/GDP* ratios have fallen in many Middle Eastern countries primarily because of higher oil prices, they remain high.
- *ME* is an important contributor to this debt
- This study finds that *ME* has a statistically and economically positive relationship with *ED* for Oman, Syria, Yemen, Bahrain, Iran and Jordan

... Conclusion.

- Results suggest that reducing *ME* by 1% can reduce *ED* by 0.2% in the SR and between 1-1.6% in the LR
- Increasing real income by 1% reduces *ED* between 0.6-0.8% in the LR and has no effect on *ED* in the SR.
- Thus ...economic growth will contribute to lower *ED* levels, but the effect of economic growth will not be as strong as cutting *ME*.

Limitations

- Panel is restricted to six countries so need to be cautious about drawing conclusions for the Middle East as a whole.
- Only consider two determinants of *ED*.
- Effects of *ME* could be 'swamped' by other macroeconomic variables if these were considered in a larger panel.

Future research

- Include more determinants of *ED*.
- Quantify the 'causal' relationship between external debt, military expenditure and oil revenue in a panel Granger causality framework.
- More descriptive work on the different aspects of military debt. 'Pure military debt' is likely to be the tip of the iceberg.