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4 September 2017

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Abstract

Understanding the effect of military expenditures on profit rates can provide important insights on the use of government spending. We utilize the panel dynamic ordinary least square method to examine that relationship for 32 major countries from the period of 1963-2008. We find that while military expenditures increase profit rates in arm-exporting countries, the opposite occurs in the case of arms-importing countries.

Key Words: Military expenditures, profit rates, panel data

JEL Classifications: C33, E11, H50

Introduction

Whether military expenditures, a part of government spending, stimulate the economy by offsetting the decline in consumer demand is a crucial topic. Some early studies (Ram 1995; Dunne 1996; Smith, 2000) as well as recent ones (Dunne and Uye 2010; Alptekin and Levin 2012) review the extensive literature on the effect of military expenditures on economic growth. These empirical works provide three major tendencies (Dunne and Uye 2010): i) both negative and ambiguous effects of military expenditures on economic growth are more commonly found than positive effect, ii) recent studies with advanced methods are likely to find negative effect, iii) positive effect is more pronounced in the case of developed countries.

How military expenditures effect profit rates, major indicator of a healthy capitalist economy, on the other hand, has been examined in a few studies. To the best of our knowledge, there are four time-series studies, Georgiou (1992), Kollias and Maniatis (2003), Dunne et al. (2013), Elveren and Özgür (forthcoming) and only one panel study, Elveren and Hsu (2016), which this study departs from.

Georgiou (1992) employs an OLS methodology to investigate the effect of military expenditures on profit rates in the UK, US and the former West Germany during 1958-1987 period with respect to Luxemburg's and Mandel's views. The study suggests positive significant effect of military expenditures on profit rates for the US, and insignificant effects for other two countries. In the second work, Kollias and Maniatis (2003) use the autoregressive distributed lag approach to cointegration (ARDL). The authors found that while military expenditures have a positive short run effect on the profit rate, they have an inverse relationship in the long run in the case of Greece for the period of 1962-1994. Dunne et al. (2013) analyzes the case of the US during 1959-2010. Employing OLS and ARDL methods, the authors provide some evidence on

the positive long run relationship between the military burden and the profit rate. Employing a Markov switching model for Turkey for the 1950-2008 period, Elveren and Özgür (forthcoming) found that the effect of military expenditure on profit rates is nonlinear, negative during the turbulent years and positive in more tranquil years. The negative effects are larger than positive effects, but the probability of positive effects to prevail is larger.

Covering 24 OECD countries for the period of 1963-2008, Elveren and Hsu (2016), in a Marxist framework like previous studies, employ a panel ARDL lag model to find that while for the whole period there is positive linkage between military expenditures and profit rates, in the post-1980 era the impact of military expenditures is negative. The authors also find weak evidence that while for arms-exporting countries, there is positive linkage between military expenditures and profit rates, the linkage is negative for non-arms-exporter countries.

Adopting a panel data model, we examine if the impact of military expenditures on profit rates changes with respect to the role of countries in arms-trade, focusing on 32 countries[1] for the 1963-2008 period. This study contributes to the literature by examining an extended set of countries with a different method, supporting and strengthening the early findings that while military expenditures increase profit rates in arm-exporting countries such as the US, the effect is opposite in the case of arms-importing countries such as Greece. This work also suggests that it is more likely that while military expenditures Granger causes profit rates in arms-exporting countries, in the case of arms-importer countries causality is running from profit rates to military expenditure.

[1] Argentina, Australia, Austria, Belgium, Brazil, Canada, Chile, China, Denmark, Finland, France, Germany, Greece, India, Ireland, Israel, Italy, Japan, Luxembourg, Mexico, Netherlands, New Zealand, Norway, Portugal, South Africa, South Korea, Spain, Sweden, Switzerland, Turkey, UK, and US.

The following section introduces methodology and data. The third section presents and discusses the results. The final section summarizes the findings.

2. Methodology and Data

We employ a dynamic ordinary least square method to examine the effect of military expenditures on profit rates. Since domestic product is the main variable that has an effect both on military expenditures and profit rates real GDP is incorporated to control for nonstationary omitted variables[2].

$$profit_{it} = a_i + \delta_{it} + \beta_{1i}\log(income)_{it} + \beta_{2i}milex_{it} + \varepsilon_{it}$$

(1)

where a_i are country-specific fixed effects and δ_{it} are country-specific time trends. They account for any country-specific omitted factors.

Our dependent variable, *profit,* is the gross profit rate (the ratio of surplus value to invested capital) taken from the Extended Penn World Tables[3] v. 4.0 (EPWT). It is calculated as

profit=100*(1-*wage share*)**productivity of capital*

where *wage share* is the share of the employee compensation in the Gross Domestic Product, calculated in current prices of the local currency; *productivity of capital* is the output-capital ratio calculated using real Gross Domestic Product in 2005 purchasing power parity (Chain Index) divided by the estimated capital stock.

[2] We use real GDP in line with Herzer and Vollmer (2012) and Elveren and Hsu (2016).
[3] The data is constructed based on the Penn World Tables by Duncan Foley and Adalmir Marquetti.

For a small number of missing countries and years, we utilize the profit rate sets calculated with the same method in EPWT, provided by Michael Roberts and Esteban Ezequiel Maito.

Our key explanatory variable is the military burden. We use military expenditures as a share of GDP recently provided by Stockholm International Peace Research Institute (SIPRI). Depending on the assumptions (i.e. full employment, structure of military expenditures in terms of R&D or personnel expenditures etc.) military expenditures may have positive or negative effect on the profit rate. There are several positive and negative channels that military spending affects economic growth and profit rates (Kollias and Mantias 2003; Elveren and Hsu 2016). Increase in spending stimulates aggregate demand, avoids the rise in organic composition of capital and accompanying fall in the profit rate, and increases the rate of surplus value by increasing labor productivity. On the other hand, increasing military expenditures may cause crowding out of investment, and decline in productivity through purchase of "unreproductive" goods, and reduce the profit rates by increasing the organic composition of capital through expanding a capital-intensive sector, and taxing capital income.

Real GDP is taken from the World Development Indicator set provided by the World Bank. Increase in national income leads to higher capital accumulation. That is, it is expected that higher growth is associated with higher rates of profit.

3. Results and Discussion

To test the stationarity, in addition to main panel unit root tests, we also employ the cross sectionally augmented IPS or CIPS panel unit root test proposed by Pesaran (2007). The results

(not provided here to save space) show that variables are integrated of order one, allowing one to pursue cointegration analysis.

To investigate the existence of cointegration two main panel cointegration tests suggested by Pedroni (1999, 2004) and Kao (1999) are utilized. The most of tests reject the null hypothesis of no cointegration, suggesting that there exists a long-run relationship between profit rates, military expenditures, and income.

Table 1: Panel Cointegration Tests

	Full	Exporters	Importers
Pedroni			
Panel PP t-stat	-1.984**	-1.067	-1.448*
Panel ADF stat	-1.562*	-1.516*	-0.825
Group PP t-stat	-1.669**	-0.828	-1.478*
Group ADF t-stat	-2.333***	-1.628*	-1.893**
Kao	-1.984**	-2.440***	-1.111

Notes: The number of lags is determined automatically by the Schwarz Info Criterion. Pedroni test with no deterministic intercept or trend, Kao test with individual intercept. *, ** and *** refer to significance at the 10%, 5% and 1% levels, respectively.

The long-run relationship between variables are analyzed with the standard dynamic ordinary least square (DOLS) method and its Mark and Sul (2003) extensions, in which estimation accounts for heterogeneity, weighting the data using cross-section specific.

$$profit_{it} = a_i + \delta_{it} + \beta_{1i}\log(income)_{it} + \beta_{2i}milex_{it} +$$

$$\sum_{j=-k_i}^{k_i} \emptyset_{1ij}\, \Delta\log(income)_{it-j} + \sum_{j=-k_i}^{k_i} \emptyset_{2ij}\Delta milex_{it-j} + \varepsilon_{it} \qquad (2)$$

Where $\emptyset_{1ij}$ and $\emptyset_{2ij}$ are coefficients of lead and lag differences that account for possible serial correlation and endogeneity of the regressors. The DOLS technique has some advantageous against conventional panel methods in that it does not require exogeneity assumptions nor does it require the use of instruments. The estimator is super-consistent under cointegration, not effected by the omission of variables that do not form part of the cointegrating relationship.

Tables 2 and 3 report DOLS estimation results for all countries, and arms-exporter countries and arms-importer countries, respectively.

Table 2: DOLS Estimations (All countries)

	Pooled	Pooled (Weighted)	Grouped
Log(GDP)	-4.235*** [0.680]	-3.449*** [0.415]	-1.444* [0.790]
Milex	-0.193 [0.194]	0.105 [0.105]	-1.963* [1.118]

Notes: The number of lags is determined automatically by the Schwarz Info Criterion. Estimations include constant trend. *, ** and *** refer to significance at the 10%, 5% and 1% levels, respectively.

The negative GDP coefficient in Table 2 suggests that profits are countercyclical. This might be the case if workers can increase their share in the boom and the capital output ratio is constant. The results show no significant impact of military expenditures on profit rate. In fact, the table reports both positive and negative sings. In fact, recalling possible positive and negative channels mentioned earlier, this should not be unexpected. In line with Elveren and Hsu (2016) we argue that countries' role in arms-trade should be taken into account. Because not just the size of the military burden but also their structure matters. The negative consequences of production of an armament system are more likely to be realized in the arms-importing countries than those in arms-producing (exporting) countries. To test this hypothesis, we categorize countries as arms-exporters[4] and arms-importers[5] according to arms trade data provided by SIPRI. Table 3 reports those findings that differ significantly with respect to country groups. Accordingly, while profit rates are countercyclical in the case of arms-importing countries as showed in Table 2 for all countries, they are procyclical for the arms-exporting countries. More importantly, the results suggest that while military expenditures boost profit rates in arms-exporter countries, they reduce profit rates in the case of importers. This finding strengthens that of Elveren and Hsu (2016) in the case of different set of countries.

[4] France, Sweden, Switzerland, UK and US

[5] Argentina, Australia, Belgium, Brazil, Chile, Greece, India, Japan, Mexico, New Zealand, Norway, Portugal, South Africa, South Korea, Spain, Turkey.

Table 3: DOLS Estimations (Exporters vs Importers)

	Exporters			Importers		
	Pooled	Pooled (Weighted)	Grouped	Pooled	Pooled (Weighted)	Grouped
Log(GDP)	4.773** [2.196]	2.821 [1.973]	6.701** [3.241]	-9.055*** [1.121]	-7.861*** [1.509]	-5.332*** [0.706]
Milex	1.731** [0.726]	1.420** [0.621]	2.983** [1.486]	-2.277*** [0.712]	-1.374* [0.836]	-3.531* [1.998]

Notes: The number of lags is determined automatically by the Schwarz Info Criterion. Estimations include deterministic trend. *, ** and *** refer to significance at the 10%, 5% and 1% levels, respectively.

Finally, we investigate the direction of causality between profit rates and military expenditures by employing a non-causality test for heterogeneous balanced panel data suggested by Dumitrescu and Hurlin (D-H) (2012) in following form:

$$\Delta Profit_{i,t} = \alpha_i + \sum_{k=1}^{p} \gamma_i^k \Delta\, Profit_{i,t-k} + \sum_{k=1}^{p} \gamma_i^k \Delta\, Milex_{i,t-k} + v_{i,t} \quad (3)$$

$$\Delta Milex_{i,t} = \alpha_i + \sum_{k=1}^{p} \gamma_i^k \Delta\, Milex_{i,t-k} + \sum_{k=1}^{p} \gamma_i^k \Delta\, Profit_{i,t-k} + v_{i,t} \quad (4)$$

where, α_i are assumed be fixed in the time dimension. The D-H test is the average of the test statistics of standard Granger Causality regressions for each cross-section individually. There are two main findings. First, there exist bidirectional panel Granger causality between military burden and profit rates in one-third of the countries. Second, it is more likely that while profit

rates Granger causes military expenditures in importer countries, in the case of exporter countries causality is running from military expenditure to profit rates.

Table 4: Granger-causality test results

	Milex →Profit		Profit→Milex	
Panels	Panel P-values			
	Lags: 1	Lags: 2	Lags: 1	Lags: 2
All countries (32)	0.0000	0.0000	0.0003	0.0007
Exporters (5)	0.0001	0.0203	0.3271	0.9605
Importers (16)	0.0399	0.0883	0.0019	0.0000
	Number of countries with P-value<0.10			
	Lags: 1	Lags: 2	Lags: 1	Lags: 2
All countries (32)	10	11	10	9
Exporters (5)	3	3	2	0
Importers (16)	3	3	5	6

Notes: Both variables in first differences. → means "does Granger cause". Null hypothesis is no causality.

4. Conclusion

The main finding of this study is that while the impact of military expenditures on profit rates is ambiguous, there is a clear distinction with respect to countries' role in arms trade. While military expenditures increase profit rates in arm-exporting countries, their effect is opposite in the case of arms-importing countries. The study also suggests that although bidirectional

causality exist only one-third of the countries, there is a clear distinction between country groups in that while profit rates Granger causes military expenditures in importer countries, in the case of exporter countries causality is running from military expenditure to profit rates.

The findings of the study underscore an important issue that has not been received enough attention in the nexus of military expenditures and economic growth, the countries' role in arms trade. It matters because the size of military burden does not tell about the structure of the armament industry itself. One may expect a different effect of the military expenditures on the economy between in countries like Greece and Turkey, which are mainly arms importers, and arms exporter countries of the US and the UK with much larger armaments industry. In fact, it is not possible to capture this heterogeneity fully in panel estimation models. Therefore, such a distinction is both empirically and theoretically plausible (Elveren and Hsu 2016). It is more likely that military expenditures can create positive effect via R&D and by generating employment. One may also expect that positive effect can occur by "establishing international dominance along with cheap raw materials and favorable terms of trade and increasing the productivity of labor through the boost of technological innovations" (Elveren and Hsu 2016, 571). These possible positive effects are not likely to occur in the case of arms importing countries. On the contrary, expenditures on arms import may decrease productivity by diverting resources to purchase ''unreproductive'' articles.

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