THE NEXUS OF MILITARY EXPENDITURE AND ECONOMIC GROWTH IN VISEGRAD GROUP COUNTRIES

Tereza Ambler
University of Defence, Czech Republic
intedo@seznam.cz

Jiri Neubauer
University of Defence, Czech Republic
jiri.neubauer@unob.cz

ABSTRACT

The relationship between military expenditures and economic growth has been investigated through many aspects. Even though this interrelationship is discussed frequently in defence economics studies, not many studies are examining this topic on case of Visegrad group countries (namely Czech Republic, Slovak Republic, Hungary and Poland). Our focus is to examine military expenditure and economic growth nexus for Visegrad group countries (V4) using economic variables and considering an external threat. Cross sectional dynamic analysis is used for time-period 1998 – 2015.

Keywords: *Dynamic panel data, Economic growth, Military expenditure, Threat*

1. INTRODUCTION

The relationship between military expenditures and economic growth is one of the most popular subjects of research in the defence literature. Benoit (1973, 1978) began to consider the impact of military spending on economic growth. Harris (1986) examined the endogenous impact of the domestic economy on the development of military expenditure by five East Asian countries - Malaysia, Thailand, Indonesia, the Philippines and Singapore. His conclusions discovered positive relationship between military expenditure in the current year and defense spending and the overall government budget in the previous year. Military expenditures in the current year show a slight inverse correlation with the inflation of the previous year. The balance of payments affects military spending through government spending. Harris research was followed by Looney and Fredericksen (1990) considering economic variables and the availability of resources as the key determinant of military spending. All the countries surveyed increased military budgets in anticipation of economic growth, but the time lag was different in each country. Surplus resources may lead to stabilization in Singapore (Singapore), growth (Malaysia) and distribution delay (Philippines). Uk Heo and Karl DeRouen Jr. (1998) are exploring the impact of economic and technological developments on the growth of military spending. If technological progress is part of the production function, it is possible to trace the negative effect of military spending on growth. Abu-Bader and Abu-Qarn (2003) take into consideration the relationship between the components of government spending. They investigated the direct relationship between these variables in the case of Israel, Egypt and Syria, as these countries most often appear in the Israeli-Arab conflict. In all three states, there was a negative relationship between military spending and economic growth. In Israel and Syria, there was a positive impact of civilian spending on the growth of the economy. Dunne, Smith and Willenbockel (2004) solve the impact of military spending through the Feder-Ram model. It critically evaluates the model, its limits and problems, and recommends not using the model. For research in the defense economy, in their opinion, Sollow's growth model or Barro models are more appropriate. The authors present the reason for this research as a fragmentation of the opinion on the establishment of an appropriate econometric procedure for examining the relationship between military expenditures and economic growth. Pieroni (2009) based the

research on the assumption that the influence of military spending on growth is influenced both by endogenous and external threats. The extension of the model captures the impact of civilian and military government spending on economic growth, thus predicting a positive correlation between the size of military spending and the "effectiveness" of civilian spending in military spending and growth. This effect is captured as a conditional variable in the growth equation and can alleviate the original negative relationship. Dunne and Nikolaidou (2012) used the augmented Solow model employing panel and time series methods to investigate defence spending and economic growth in EU15 over the period 1961-2007. Results of both approaches showed a negative or no effect of military burdens on economic growth. Topcu and Aras (2017) investigated the relationship between military expenditure and other variables in Central and Eastern European countries. They found out the influence of economic growth on military expenditure in the sample of selected countries. George and Sandler (2017) applied two-step GMM (generalized method of moments) model of demand for defense spending of NATO allies. They investigated NATO's demand for defense spending in three times periods 1968 – 2015, 1991 – 2015 and 1999 – 2015. This distribution of time line could help to describe NATO's response of geopolitical change better. Interesting features for NATO's defense spending appeared after the end of the cold war. The reducing of a percentage of military output to GDP was caused by perceiving Russia as a minor threat. In the post-Cold War era military expenditures of NATO members are driven more by transnational terrorist attacks then Russia´s military expenditures.

2. PANEL DATA MODELS

There are several approaches to analyze link between military spending and some economic or socioeconomic variables. Some authors prefer Barro and Sollow growth's models (Dune et al., 2004), others tend to use vector autoregressive models or vector error correction models (Odehnal, Neubauer, 2015). In recent years, a number of authors have used panel data models to study development and relationships between macroeconomic indicators (Roubalova and Hampel, 2016, Paleologou, 2013, George and Sandler, 2017). According to Odehnal and Sedlačík (2015), one can find differences between NATO member countries in terms of economic, political and military factors. The authors of this contribution have decided to analyze link between military expenditure and selected economic variables only in a part of NATO countries, in Visegrad group countries. For this purpose, a dynamic panel data model was employed.

The pooled panel data model is given by

$$y_{it} = \alpha + \beta' X_{it} + u_{it},$$

where $i = 1,2, \dots, n$ is the individual index (group, country, …), $t = 1,2, \dots, T$ is the time index and u_{it} is a random zero mean disturbance term, X_{it} is a $k \times 1$ vector of independent variables, β_{it} is a $k \times 1$ vector of parameters. This is a standard linear model *pooling* all data across i and t.

If one needs to model individual heterogeneity, it can be assumed that the error term has two separate components $u_{it} = \mu_i + \varepsilon_{it}$, where μ_i is specific to the individual and does not change over time. We get the model

$$y_{it} = \alpha + \beta' X_{it} + \mu_i + \varepsilon_{it}$$

The error term ε_{it} is usually assumed independent of both the regressors X_{it} and the individual component μ_i. If the individual component is correlated with the regressors, it is customary to treat the μ_i as next n parameters to be estimated. This is called the *fixed effect* model (Hsiao 2014, Wooldridge 2002). Let us denote $\alpha_i = \alpha + \mu_i$, we obtain the model

$$y_{it} = \alpha_i + \beta' X_{it} + \varepsilon_{it}.$$

If the individual component μ_i is uncorrelated with the regressors, the model is termed *random effect*, μ_i are not treated as fixed parameters, but as random drawings from a given probability distribution.

When analyzing panel data, we often encounter the problem of autocorrelation in residuals. One possible solution is the application of dynamic models. A *dynamic* linear panel data model can be written in the form

$$y_{it} = \rho y_{i,t-1} + \beta' X_{it} + \mu_i + \varepsilon_{it}.$$

The main idea on which the difference estimator is based is to get rid of the individual effect via differencing. First-differencing yields

$$\Delta y_{it} = \rho \Delta y_{i,t-1} + \beta' \Delta X_{it} + \Delta \varepsilon_{it}.$$

The error term $\Delta\varepsilon_{it}$ is autocorrelated and also correlated with lagged dependent variable $\Delta y_{i,t-1}$. Generalized method of moments (GMM) approach is used to get estimates of given equation, see Arellano and Bond (1991).

2.1. Empirical results

Analysis of determinants of military expenditure in the Visegrad group countries (Czech Republic, Slovakia, Poland and Hungary are based on time series of predominantly macroeconomic variables in time period 1998–2015 (the database SIPRI, The World Bank). To describe military expenditure – MILEX [% of a gross domestic product (GDP)], we use following variables:

- government debt – DEBT [% of GDP],
- economic growth – EC. GROWTH [%],
- inflation – INFLATION [%],
- Russian military expenditure [% of GDP]
- net trade – NET TRADE [in billions $]
- population of country [in millions]
- tax revenue – TAX REVENUE [% of GDP]

Firstly, the fixed and random effect models were applied. The estimated model suffers from the presence of autocorrelation in residuals. Breusch-Godfrey/Wooldridge and Durbin-Watson test for serial correlation in panel models reject the null hypothesis of no autocorrelation. Based on these results, we have decided to employ a dynamic panel to model military spending. The parameter estimates of the model containing all explanatory variables (the full model) and estimates of the final model (with estimates which are statistically significant at least at the significance level 0.10) are summarized in Table 1. The final model using the approach of generalized method of moment estimated contains lagged value of military expenditure with positive coefficient, government debt with a negative coefficient (increase in DEBT causes decrease in MILEX), military expenditure in Russia with positive sign (increase in Russian

military spending means increase military spending in V4), population size with a negative coefficient (the increase in POPULATION causes decrease in MILEX) and finally tax revenues again with a negative sign. Residuals of the estimated dynamic model are not auto-correlated (p-values of Arellano-Bond test for zero autocorrelation for order 1 and 2 are 0.0696 and 0.7017), instrumental variables used in the model are valid (p-value of Sargan test is 0.4318). The quality of the fit is graphically displayed in Figure 1.

Table 1: Parameter estimates of dynamic panel of V4 countries

Full model				*Final model*		
Variable	*Coeffcient*	*Std. Error*	*p-value*	*Coeffcient*	*Std. Error*	*p-value*
const	-0.03959	0.00596	0	-0.03348	0.00309	0
MILEX(-1)	0.42709	0.05669	0	0.48666	0.02459	0
DEBT	-0.00329	0.00017	0	-0.00212	0.00100	0.033
EC. GROWTH	0.00049	0.00306	0.8732			
INFLATION	-0.00713	0.00510	0.1619			
MILEX Russia	0.15179	0.04290	0.0004	0.15964	0.04072	0.0001
NET TRADE	0.00266	0.00175	0.1273			
POPULATION	-0.20941	0.05569	0.0002	-0.18148	0.10854	0.0945
TAX REVENUE	-0.01001	0.00488	0.0403	-0.01349	0.00596	0.0236

3. DISCUSSION

This paper examined the relationship between military expenditures and economic growth and other determinants of military expenditures such as government debt, inflation, net trade, tax revenue, population and Russian military expenditures. To investigate the determinants of military expenditures we focused on Visegrad group countries (V4) Czech Republic, Slovak Republic, Hungary and Poland. We focus on variables such as military expenditures of V4, economic growth, government debt, inflation, Russian military expenditure, net trade and tax revenue. We have not found any statistical significant link between military expenditures and economic growth, inflation and net trade. Our empirical results indicate that negative tax revenue coefficient had a negative impact on military expenditures. We used Russian military expenditures as an indicator for an external threat. Contrary to expectations George and Sandler discovered a negative effect of growing military expenditures of Russia in their empirical model of NATO's defense spending (George, Sandler, 2017). Russia´s military expenditures are associated with a positive influence in our analysis. A 1% increase in Russia's military expenditure leads almost to 0.16% increase of military expenditure in our selected group. It seems that military expenditures of V4 countries are driven by Russia's military expenditures. So, the growing defense spending of Russia is perceived as a potential threat for the whole group of V4.

Figure following on the next page

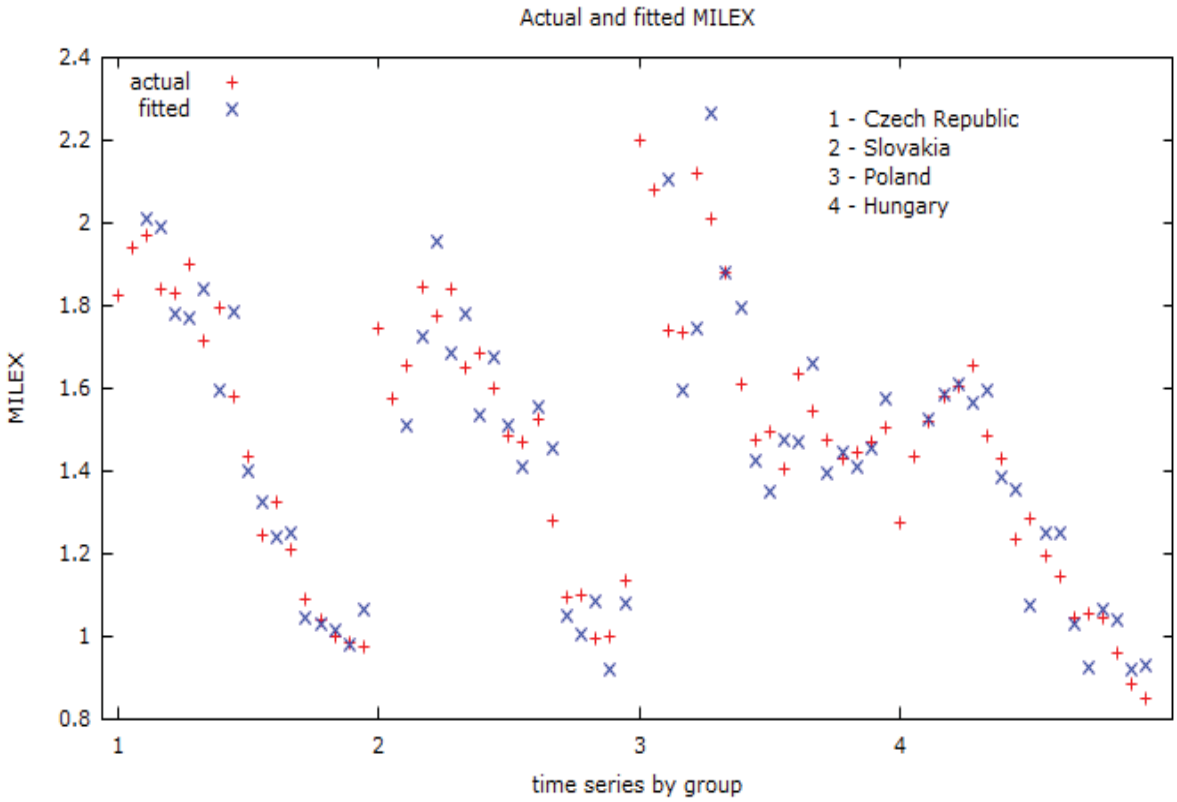

Figure 1: Actual a fitted values of military expenditure of V4 countries 1998 - 2015

A positive change of population size of 1 million inhabitants generates a 0.18% decrease of military expenditures in the V4 countries group. This result is not in accordance with some authors who are associating the population grow with the rising demand for defence and an increase of military expenditures. The negative impact of population on military expenditure could be connected with the perception of internal security, optimization of defense costs or preferring civil consumption needs to security needs (Dunne, Perlo-Freeman, 2003). The negative effect of the population increase could be also associated with positive or negative effect on military expenditure (Ambler, Neubauer, 2017). The role of government debt in military expenditures has showed a negative sign. This is inconsistent with the findings of Paleologou (2013). The results of Paleologou's study came to a conclusion that decreasing of military spending could help to decrease government debt.

4. CONCLUSION

This study examines the relationship between economic growth and military expenditures using the date Czech Republic, Slovak Republic, Hungary and Poland of the period 1998 – 2015. To explore the interaction between military expenditure and economic growth we focused on following variables such as military expenditure, economic growth, government debt, inflation, net trade, population, tax revenue and military expenditures of Russia. Our results are based on a dynamic GMM model and we have reached the following findings. First, our findings do not indicate any impact of military expenditures on economic growth, inflation and net trade. Second, the growth of the military expenditures of Russia could be considered as a potential threat for V4 countries and they are trying to follow the trend of military expenditure of Russia as their potential rival. Third, results of our model show the negative effect of an increase in population size on military expenditures in V4 countries. Fourth, our findings suggested negative influence of government debt and tax revenue on military expenditures.

LITERATURE:

1. Abu-Bader, S. Abu-Qarn, A. S. (2003) Government expenditures, military spending and economic growth: causality evidence from Egypt, Israel, and Syria. *Journal of Policy Modeling*. 25, 567–583.
2. Ambler, T. Neubauer, J. (2017). Defense Expenditure and Economic Growth in Visegrad Group Countries: A Panel Data Analysis. In *35th International Conference Mathematical Methods in Economics (MME 2017)*. 6–11.
3. Arellano, M., Bond, S. (1990). *Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations*. The Review of Economic Studies. 58, 277–297.
4. Benoit, É. (1973). *Defense and Economic Growth in Developing Countries*. Boston: Lexington Books.
5. Benoit, E. (1978). Growth and Defense in Developing Countries. *Economic Development and Cultural Change*. 26(2), 271–280.
6. Dunne, J. P., Nikolaidou, E. (2012). Defense spending and economic growth in the EU15. *Defense and Peace Economics*. 23(6), 537–548.
7. Dunne, J. P., Perlo-Freeman, S. (2003). The Demand for Military Spending in Developing Countries. *International Review of Applied Economics*. 17(1), 23–48.
8. Dunne, J. P., Smith, R. P., Willenbockel, D. (2004). Models of military expenditure and growth: A critical review. *Defence and Peace Economics*. 16(6), 449–461.
9. George, J., Sandler, T. (2017). Demand for Military Spending in NATO, 1968–2015: A Spatial Panel Approach. *European Journal of Political Economy*. Retrieved 19.11.2017 from https://doi.org/10.1016/j.ejpoleco.2017.09.002.
10. Harris, G. (1986). The Determinants of Defence Expenditure in the ASEAN Region. *Journal of Peace Research*. 23(1), 41–49.
11. Heo, U. DeRouen, K. (1998). Military Expenditures, Technological Change, and Economic Growth in the East Asian NICs. *The Journal of Politics*. 60(3), 830–846.
12. Hsiao, Ch. (2014). *Analysis of Panel Data.* 3rd edition. Cambridge University Press.
13. Looney, R. E., Fredericksen, P. C. (1990) The Economic Determinants of Military Expenditure in Selected East Asian Countries. *Contemporary Southeast Asia*. 11(4), 265–277.
14. Odehnal, J., Neubauer, J. (2015). Economic Determinants of Military Spending – Causal Analysis. *Ekonomický časopis*. 63(10), 1019–1032.
15. Odehnal, J. Sedlačík, M. (2015). The Demand for Military Spending in NATO Member Countries. In: *Proceedings of the International Conference on Numerical Analysis and Applied Mathematics 2014 (ICNAAM-2014), AIP Conference Proceedings, 1648*. American Institute of Physics, Melville, New York.
16. Paleologou, SM. (2013). A Dynamic Panel Data Model for Analyzing the Relationship between Military Expenditure and Government Debt in EU. *Defence and Peace Economics*. 24(5), 419–428.
17. Pieroni, L. (2009). Military Expenditure and Economic Growth. *Defence and Peace Economics*. 20(4), 327–339.
18. Roubalová, L., Hampel, D. (2016). The main inflationary factors in the Visegrad Four. In *34th International Conference Mathematical Methods in Economics (MME 2016)*. 741–746.
19. Topcu, M., Aras, İ. (2017). Military Expenditures and Economic Growth in Central and Eastern EU Countries: Evidence from the Post-Cold War Era. *European Review*. 25(3), 453–462.
20. Wooldridge, J. M. (2002). *Econometric Analysis of Cross Section and Panel Data*. Cambridge, Massachusetts: The MIT Press.