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The impact of military expenditure on external debt in Armenia

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Abstract. The paper explores the impact of military expenditure on external debt in Armenia using time series for 1994-2020. The purpose of this study was to verify the initial hypothesis that the main factor in the rise of Armenia's external debt is the increase in military spending directed at paying for the import of military products. The study was conducted using Johansen's cointegration and Granger's causality tests. The results of Johansen's cointegration test showed that there are long-term interdependencies between military expenditure and external debt, as well as between trade balance and external debt; meanwhile the long-term interdependence between non-military expenditures and external debt was not found. The results of Granger's causality test showed that the military expenditure caused an increase in external debt with a two-year time lag, and a similar causal relationship was also found between the current account balance and external debt. But more remarkable is the fact that the current account balance also caused a change in military expenditure, while the reverse causality has not been established.

Keywords: military expenditure, external debt, defense industry, Johansen's cointegration test, Granger's causality test, Armenia.

JEL Classification: H56, H63, C51

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1. INTRODUCTION

Issues related to the development of defense industry always imply a certain moral and ethical conflict with universal human values and human development priorities. Actually, social structures created by humanity throughout its history – army, military-industrial complex, research institutes, etc.– are more conductive to the culture of war rather than of peace. No matter how paradoxical it may sound, however, humanity has spent more resources on the destruction of life than on its preservation (Ursul & Marushevskij, 2013). For these and many other reasons, economists will never stop arguing about whether, ultimately, the development of the defense industry has a positive or negative impact on the economy. Certainly, as for any industrial sector, the development of defense industry also could be viewed

positively on its own, if only the need for comparison with opportunity costs were not so important in economic analysis. That is, the "effects" of the defense industry development can be assessed only in the framework of possible development of different branches and industries which society has abandoned in favor of it. On the other hand, for belligerent countries, the priorities of both human development and moral-ethical values of society are stretched out to the country's security, and it becomes the main unit of measurement of opportunity costs of all other industries. Furthermore, if the defense industry obviously plays backbone role in the economy and therefore has great potential for cooperation with civilian manufacturing sectors, it can also act as a critical industrial basis for economic development, as happened in Israel (Broud et al, 2013). However, based on the need to ensure security, the expansion of the defense sector often occurs not through the expansion of the military-industrial complex in the country (or sometimes its formation), but through an increase in military spending, which, in the case of a weak indigenous military-industrial base, is mainly spent on imports of military products, putting significant pressure on the state budget deficit and increasing external debt.

Such a situation has developed, for example, in Armenia, which is the only country in the world that, having a huge share of military spending in the state budget (20.9% in 2018), in conditions of relative peace for almost three decades, continued to remain a backward country in terms of the military-industrial development, despite the potential for the development of the sector, inherited from the Soviet Union (Harutyunyan, 2018). By the way, military spending became a significant deterrent to the economy, while even with very low rates of the defense industry development this influence could be diametrically opposite.

In this study we assessed the real (manifested) side effects (externalities) of defense sector expansion in the Armenian economy. In particular, considering the government external debt as a transmission mechanism for negative impact of military expenditures on economic growth, the effect of military expenditures on the country's external debt was assessed.

2. LITERATURE REVIEW

Since we have considered external debt as the main channel for the negative impact of military expenditures on economic development, from the large number of studies on military spending – economic growth interactions, we will focus only on the research papers that addresses the impact of military spending on government debt. Such papers are quite successfully systematized and presented by Esener and Ipek in their study (Esener & Ipek, 2015). Of particular interesting to us is that in this study the sample countries included Armenia as a country with a developing economy. By the way, according to the results of the research, there is a significant positive correlation between military spending and external debt in developing countries.

Perhaps, Loony was one of the first who was endeavored to assess the impact of military spending (Looney, 1987), as well as weapons imports (Looney, 1989) on external debt. The first study was conducted based on year 1982 for 77 developing countries, which were separated into two groups: "largely undynamic", also characterized as resource constrained, and "dynamic', less constrained in terms of local savings and foreign exchange reserves. The study found that military spending in the first group of countries had a significant impact on foreign debt growth, while in countries where foreign exchange reserves were not limited, no such effect was observed. In addition to military spending, Looney's regression model also includes GDP, current account balance, imports, exports, government spending on education and health care, as well as foreign exchange reserves as variables that determine external debt. The 1989 study confirms the results of previous study, moreover, the author concludes that in some developing countries, the external debt accumulated in 1982 was the result of arms imports in 1970-1982,

with the fact that countries not constrained by foreign exchange reserves (including Greece, India, Egypt, Turkey, Brazil, Kuwait, Saudi Arabia and 16 other countries) were enabled to develop local defense industry and to substitute some imports by endogenous production. As a result, the impact of military spending on external debt in these countries is not noticeable.

On the basis of a model proposed by Looney – with the same set of variables – Günlük-Senesen and Sezgin (Günlük-Senesen and Sezgin, 2002) assessed the impact of military expenditure on Turkey's external debt and concluded that military expenditure did not have a significant impact on external debt, while the growth of arms imports emerges as a significant determinant. The same conclusion was reached by Dunne et al. (Dunne et al., 2003) in the analysis based on 1960-2000 panel data for 11 small industrialized countries. In this case, the number of variables explaining the estimation model was also larger, in particular, the indicators of external debt servicing and tax revenues were added compared to previous models.

From the relatively recent studies, those of Zaman et al. (2013), Ahmed and Kamran (2016), Abbas and Wizarat (2018), Dunne et al. (2018) are particularly interesting. Zaman et al. (2013) conducted study for 9 countries of the South Asian Association for Regional Cooperation (SAARC) based on 1988-2008 data, using Pedroni's test for panel cointegration (Pedroni, 1999, 2004).

A simple regression equation (with logarithm expressions) was used for the estimation, where the external debt as a dependent variable is conditioned by changes in GDP and military spending. The results show that external debt is elastic with respect to these two variables in the long run (1% increase in military spending led to an increase in external debt between 1.18% and 1.24%), while I the short run it's not like that – 1% increase in military spending increases external debt by 0.15%.

Ahmed and Kamran (Ahmed and Kamran, 2016) used a Pooled OLS model for estimates:

$$ED_{it} = \alpha + \beta MB_{it} + \pi EX_{it} + \Omega GR_{it} + \prod TRES_{it} + \delta TR_{it} + \mu_{it}, \quad (1)$$

where, in subscript, *i* and *t* are used for cross-sectional and time series respectiely,

ED is External Debt as percentage of GNI,

MB is Military Spending as percentage of GDP,

EX is Export of goods and services as percentage of GDP,

GR is Annual Growth of GDP (%),

TRES is Total International Reserves as percentage of GDP,

TR is Tax Revenues as percentage of GDP.

The study was conducted for four developing countries with high level of external debt and low incomes – India, Pakistan, Brazil and the Philippines. In order to assess the impact of the «military burden» separately for each country, a further assumption was made that there is a cross-section variation in slope coefficient of military spending for each country. Accordingly, dummy variables characterizing the peculiarities of the countries have been added to the regression model. The assessment revealed an obvious positive correlation between military spending and external debt, in particular, the 1% increase in military spending led to a 1.34% increase in external debt. However, the results obtained for individual countries differed significantly from each other. For example, in the case of Brazil, it turned out that military spending has a minor negative impact on external debt, but a significant negative impact in the case of India, and in the case of Pakistan and Philippines, the impact of military spending on external debt can be described as significant positive. The main conclusion of this study is that although military spending has a significant impact on external debt, it is mainly reflected in unfavorable economic conditions, and in the case of growing economies, tax revenues, exports and international reserves, this impact is negligible.

Abbas and Wizarat (2018) also carried out a study using a fixed effect regression model (adopting dummy variables for individual country analysis) based on data from 1990 to 2015 for five countries in South Asia (Pakistan, Bangladesh, India, Nepal and Sri Lanka). In the estimation model GDP per capita, domestic investment (as a percentage of GDP), trade balance (as a percentage of GDP), military spending, and the share of military spending in GDP were selected as explanatory variables. Of the above, only the impact of military spending was assessed as a significant positive (an increase in military spending by US $ 1 billion increased the external debt in the countries under consideration by US $ 7.7204 billion); although the share of military spending in GDP also had a positive impact on the growth of external debt, but this influence was insignificant. With regard to GDP per capita and investment, the impact of both was negative, but in the case of GDP per capita the influence was not significant, and in the case of investment – very significant.

Dunne et al. (2018) studied the impact of military spending on external debt using data over the period 1960 – 2016 for 47 countries in Sub-Saharan Africa, where annual external debt averaged 75% of GDP (albeit with a fairly large standard deviation). Particular attention was paid to the fact whether the state under study was involved in the conflict or not (a dummy variable was included in the model to assess the influence of this factor). Nevertheless, the study found that the estimates obtained for the dummy variable describing conflict involvement were not significant, and the authors simply repeated the study without countries involved in military conflicts. The results obtained demonstrate that although there is indeed a positive relationship between military spending and the growth of external debt, this effect is more obvious in countries involved in military conflicts.

3. DATA AND RESEARCH METHOD

Considering that the main factors influencing the external debt of the state are GDP and current account balance, the regression model chosen for the study, in addition to military and non-military expenditures, also included variables characterizing these indicators as explanatory variables. Accordingly, we will estimate the impact of military expenditures on external debt using the following regression model:

$$\ln EXTD_t = \alpha_0 + \alpha_1 \ln Y_t + \alpha_2 \ln MExp_t + \alpha_3 \ln NMExp_t + \alpha_4 \ln TB_t + \varepsilon_t \quad (2)$$

where *EXTD* is an indicator of external debt,
Y is GDP index,
MExp is military expenditure,
NMExp is non-military expenditure,
TB is an indicator of foreign trade balance.

The natural logarithms of the variables were used in the model because they assume monotonic changes and the main characteristics of time series are preserved. Our estimation model differs from other similar models (for example, Sezgin, 2004) in that it also includes the indicator of non-military expenditure as an explanatory variable. This is attributable to the fact that Armenia is generally characterized as a "consumer" rather than a "productive" economy, and as a consequence non-military expenditure, such as expenditure on social protection –which, by the way, have the largest share in the state budget – can also have a large impact on external debt. For instance, in 2021, social protection accounted for 29.2% of general government spending, while military spending accounted for only about 16%. Another notable difference from other model estimating the relationship between military spending and external debt is that this model does not include a variable describing international reserves, such as in the following proceedings: Looney (1987, 1989), Dunne et al. (2003, 2004), Ahmed and Kamran (2016). This is

preconditioned by the fact that international reserves do not directly affect external debt in the sense that they do not create demand for external financing. If countries have stable sources for replenishment of the international reserves, for example, exports of strategic raw materials or high value-added exports, then they tend to reduce external debt. Considering that both sources were not available in Armenia, international reserves were not considered as a factor influencing external debt.

From the point of view of comprehensive analysis, the main drawback of our proposed model lies in the fact that the import of weapons is not included as an important variable, as for example in the works of Looney (1989) or Sezgin (2004). Reason for that is the lack of statistical data on the arms trade for Armenia, which made it meaningless to include such a variable in the model.

The model will be evaluated using the Johansen cointegration and Granger causality tests (applying the standard least squares method). The cointegration test shows the existence of a long-term relationship between variables under study, but does not show the direction of this relationship, so a second (causality) test was also carried out (Wolde-Rufael, 2014). The study will have the following sequence of steps:

- ✓ The stationarity in time series data selected for study will be detected using the Dickey-Fuller unit root test (Dickey and Fuller, 1979).
- ✓ In case of non-stationarity, we will check the stationarity of the time series and their first-order differences or the time series integration of order one – I(1), because in the case of integration of a higher order, the application of the Johansen's cointegration test is not appropriate.
- ✓ Then the existence of long-run relationship between time series will be revealed using Johansen's cointegration test.
- ✓ In case of positive result, error correction will be performed using the Engel-Granger method (Engle & Granger, 1987).
- ✓ The Granger causality test (Granger, 1969) will be performed only after the error correction coefficient shows negative and significant results, which would indicate that there is convergence between short-run and long-run series.

A similar sequence of steps can be found in the works of Karagol and Turhan (2008), Das et al. (2015) and with some differences in the Wolde-Rufael's work (2014).

The research was conducted using data over the period 1994-2020. The main source of data for constructing the time series was the World Bank's World Development Indicators website, expect for the time series of non-military expenditures, the data for which were calculated on the basis of statistical yearbooks published by the Statistical Committee of the Republic of Armenia by simple subtraction operation between gross government spending and expenditure allocated for defense sector. With that, some data that were missing in the time series generated from the World Development Indicators website were also filled with comparable indicators (in particular, the external debt indicators of 2020 and the military expenditure indicator for 1994) using the publications of the Statistical Committee of the RA. As an indicator characterizing the external debt External Debt Stocks (% of Gross National Income) was chosen; as an indicator of GDP – the GDP in constant 2010 US $; as an indicator for military expenditure – the military expenditure in current LCU; as an indicator of non-military expenditures – the non-military expenditure in current LCU; and as an indicator characterizing foreign trade current account balance (current US $) was chosen. This difference in the measurement units of the explanatory variables aims to mitigate the possible correlation between the variables.

4. EMPIRICAL RESULTS AND DISCUSSION

Tests for the stationarity of the studied time series showed that the first-order differences of all series are stationary. The results of the Dickey-Fuller test for stationarity for all times series are presented in Table 1.

Table 1

Dickey-Fuller test's results for all the time series used in the study

Null Hypothesis:	Test critical values:	t-Statistic	Prob.
D(EDEB, 1) has a unit root	1% level -3.769597	-6.089215	0.0001
D(GDP,1) has a unit root	2% level -3.004861 3% level -2.642242	-5.89 4188	0.0001
D(MEXP,1) has a unit root	1% level -3.808546 2% level -3.020686 3% level -2.650413	-4.858156	0.0000
D(NMEXP,1) has a unit root	1% level -3.769597	-5.068233	0.0003
D(TB,1) has a unit root	2% level -3.004861 3% level -2.642242	-5.927294	0.0001

Source: own calculations

The obtained results show that the time series are integrated of order one I (1), so the Johansen cointegration test can be applied to them. The test was not applied using only one general equation, but it was carried out for each individual pairs of variables (*EDEB* and *MEXP, EDEB* and *GDP, EDEB* and *NMEXP, EDEB* and *TB*). The results are presented in the Table 2.

Table 2

The results of the Johansen cointegration test

Series: EDEB, MEXP
Lags interval (in first differences): 1 to 1
Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.579700	20.64593	15.49471	0.0076
At most 1	0.030391	0.709831	3.841466	0.3995

Trace test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.579700	19.93610	14.26460	0.0057
At most 1	0.030391	0.709831	3.841466	0.3995

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Series: EDEB, GDP
Lags interval (in first differences): 1 to 1
Unrestricted Cointegration Rank Test (Trace)

Hypothesized		Trace	0.05	

No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None	0.267323	14.01556	15.49471	0.0825
At most 1	0.257938	6.861411	3.841466	0.0088

Trace test indicates no cointegration at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None	0.267323	7.154150	14.26460	0.4711
At most 1	0.257938	6.861411	3.841466	0.0088

Max-eigenvalue test indicates no cointegration at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Series: EDEB, NMEXP
Lags interval (in first differences): 1 to 1
Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None	0.386010	13.78716	15.49471	0.0890
At most 1 *	0.105656	2.568293	3.841466	0.1090

Trace test indicates no cointegration at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None	0.386010	11.21887	14.26460	0.1436
At most 1 *	0.105656	2.568293	3.841466	0.1090

Max-eigenvalue test indicates no cointegration at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Series: EDEB, TB
Lags interval (in first differences): 1 to 1
Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.533386	20.53878	15.49471	0.0080
At most 1	0.122552	3.006963	3.841466	0.0829

Trace test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized		Max-Eigen	0.05	

No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.533386	17.53182	14.26460	0.0147
At most 1	0.122552	3.006963	3.841466	0.0829

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Source: own calculations

The results of Johansen's cointegration test show that among the observed variables, there are long-term interdependencies only between military expenditure and external debt, and also between trade balance and external debt. Withal, the absence of a long-term interdependence between non-military expenditures and external debt is noteworthy. The change in GDP also did not have a noticeable effect on external debt. Such a state of affairs reflects a weak interdependence between external debt formation process and real economy functioning and this basically corresponds to our initial hypothesis that the main factor in the growth of Armenia's external debt is not the growth of military spending per se, but rather the increase in such military spending, which is directed to pay for the import of military products.

However, positive results of cointegration test are not enough to identify causal relationships between time series. Therefore, after error correction operations (using the Engel-Granger method), the Granger causality test was also performed for the variables in case of which the Johansen cointegration test gave a positive result. Since the coefficient of error correction is negative and significant (See Table 3) we can conclude that the time series converges in the long-run after short-term deviations from equilibrium.

Table 3

Error Correction results

Error correction model: (U is residual of model)
Dependent Variable: D(EDEB)
Method: Least Squares
Sample (adjusted): 2 27
Included observations: 27 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.154232	0.026872	5.739437	0.0000
D(MEXP)	-0.881419	0.183646	-4.799568	0.0001
D(TB)	-0.094461	0.050283	-1.878574	0.0050
U(-1)	-0.401688	0.063546	-6.321204	0.0000
R-squared	0.824788	Mean dependent var		0.050587
Adjusted R-squared	0.798506	S.D. dependent var		0.233556
S.E. of regression	0.104839	Akaike info criterion		-1.521769
Sum squared resid	0.219825	Schwarz criterion		-1.325427
Log likelihood	22.26123	Hannan-Quinn criter.		-1.469679
F-statistic	31.38242	Durbin-Watson stat		2.331319
Prob(F-statistic)	0.000000			

Source: own calculations

The Granger causality for a one-year time lag was first examined. As a result, it was found that none of the studied variables was Granger-causal for the other (we do not present the results of this test). The causality hypothesis was then tested for a two-year time lag. The results are presented in the Table 4.

Table 4

Results of the Granger Causality Test

Pairwise Granger Causality Tests Sample: 1 27 Lags: 2			
Null Hypothesis:	Obs	F-Statistic	Prob.
MEXP does not Granger Cause EDEB	25	2.22717	0.0067
EDEB does not Granger Cause MEXP		0.83116	0.8416
TB does not Granger Cause EDEB	25	5.89925	0.0107
EDEB does not Granger Cause TB		0.08023	0.9232
TB does not Granger Cause MEXP	25	5.10491	0.0175
MEXP does not Granger Cause TB		2.30199	0.1288

Source: own calculations

The results show that in Armenia, the military expenditure caused an increase in external debt with a two-year time lag, and a similar causal relationship was also found between the current account balance and external debt. But more remarkable is the fact that the current account balance also caused a change in military expenditure, while the revers causality – that is, military expenditure caused a change in the current account balance – has not been established.

5. SUMMARY OBSERVATIONS

Although statistical data on the import of military products of Armenia are nor publicly available, nevertheless, juxtaposing the information obtained from official reports on the import of weapons and loans received for it – receiving a 200 million US$ export loan from Russia in 2015 (Yerevan Today I&A website, 2015) for purchase of Russian-made military products, or receiving a 100 million US$ loan from the same country for the same purpose in 2017 (Razminfo military analytical website, 2017) – we can conclude that the results of our empirical study fully reflect the existing realities. In other words, a significant part of Armenia's external debt was due to the need for military spending, which was mainly directed to the weapons import, and that mainly from only one country – Russia. Military expenditure by itself, without affecting the negative balance of foreign trade, could not influence on external debt, because the long-term relationship between non-military expenditures and external debt was generally not discovered, despite the fact that there are categories in non-military expenditures (for example, expenditure on social security), which outweighs military expenditure. On the other hand, the lack of cointegration between GDP and external debt indicates a week relationship between the functioning of real economy and external debt which makes the upward trend in external debt dangerous in the long term. In conditions of the undeveloped local defense industry, actually, the negative externalities of increasing military spending are manifested not only in a reduction in government spending directed to other sectors, but also in increase in the external debt burden and in gradual decrease in the possibilities of its repayment. This reaffirms once again that the development of defense industry in Armenia has no alternative.

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