Does Population Enhance Military Expenditure?: Long-run Evidence from Turkey

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Abstract: This study attempts to reveal the short-run and long-run relationship between population and military expenditure in Turkey by employing an annual dataset covering the periods of 1960-2018 and ARDL estimation technique. Robustness of the results was checked by employing two different indicators of military expenditure. According to co-integration test results, population and military expenditure move together in the long-run. Long-run coefficient estimation findings identified a positive statistically significant association between population and military expenditure. More specifically, if population in Turkey jumps by 1% then military expenditure increases by either 3.99% or 1.91%. Also diagnostic test results show that estimated models do not contain autocorrelation, heteroskedasticity, model specification error, and parameter instability problems.

Key Words: Military Expenditure, Population, Co-integration Analysis, ARDL Model.

1. INTRODUCTION

The issue of military expenditure has been analyzed from several aspects in the literature. The study of Arezki and Brueckner (2021) show that military expenditures play significant role on the relationship between the risk of civil conflict outbreak and natural resources. The study indentifies a significant positive effect of natural resource rents on the risk of civil conflict outbreak for the countries with low military expenditures but not for the countries with high military expenditures. The research conducted by Syed (2021) attempts to verify how military expenditure fosters economic growth and industrial productivity in the context of Military Keynesianism postulate by using panel data of India, China, and Pakistan, covering the period between 1990 and 2018. By using NARDL method, the study displays that the positive and negative effect of military expenditure possesses a significant positive and negative long-run impact on economic growth for China and India; but only positive impact favors economic growth in the short-run. In other words, the study implies that there is an asymmetric effect in the long-run and a symmetric effect in the short-run. Saba and Ngepah (2020) in their study, by utilizing a balanced panel data of 35 African countries for the period of 1990-2015, examines the impact of military expenditure on industrialization. The results of the study suggest feedback causality between military expenditure and industrialization and identify a significant positive impact of military expenditure on industrialization. The article of Fan et al. (2018) investigates the association between health and military expenditures by utilizing pooled cross-sectional (197 countries) and time series (2000–2013) data. The results of the study strongly verify the validity of crowding-out hypothesis, and thus increased military expenditures have negative impact on health expenditures. Pacific et al.(2017) in their research examine the relationship among military expenditure, exports and foreign direct investment on economic growth in Cameroon for the period of 1996-2014 via VAR analysis. The findings of the study show that military expenditure and the exports have positive statistically significant effect on gross domestic product growth. The paper of Azam and Feng (2017) empirically examines the impact of military expenditure on external debt of ten Asian countries over a period of 1990-2011. According to the estimation findings, the influence of military expenditure on external debt is positive. Azam et al. (2016) in their study try to investigate the association between military expenditures and unemployment rate in the selected SAARC countries (namely India, Nepal, Pakistan and Sri Lanka) over the period ranging from 1990 to 2013. The estimated coefficient of military expenditure is negative and hence military expenditure reduces the unemployment rate. The article of Wolde-Rufael (2016) analyzes the long-run and the causality relationship between military expenditure and income distribution in South Korea for the period 1965–2011. The results of the study exhibit that military expenditure has a positive and statistically significant effect on income inequality and there is a unidirectional causality running from military expenditure to income inequality. Solarin and Sahu (2015) in their study explore the influence of military expenditure on stock market development in 36 countries over the period 1989-2010. The estimation findings disclose that military expenditure possesses a negative and statistically significant impact on stock market performance in the selected countries. The article of Paleologou (2013) analyzes the effect of military expenditure on general government debt in the enlarged European Union countries. The findings hint that military expenditures have a large positive effect on the share of general government debt in the EU.

In addition to existing studies in the literature, in this study we examine the long-run association between population and military expenditure in Turkey. Estimation results indicate that population and military expenditure are co-integrated and population has positive significant impact on military expenditure.

The remaining part of the paper proceeds as follows: the next part explains data and methodology, estimation findings are obtained in the third part and the last part concludes.

2. Data and Methodology

This study attempts to find out how population in Turkey affects military expenditure in the long-run. For that purpose we utilize a time series dataset covering the years between 1960 and 2018 and ARDL estimation method. We employed two distinct measures of military expenditure (i.e., military expenditure in terms of current USD (MILEXP) and deflated military expenditure in terms of current LCU (DEFMILEXP)) to see robustness of the results we found. Population (POPUL) is total population and all data were collected from WDI of the World Bank. All variables are in logarithmic forms.

We used ARDL technique to perform ARDL boundary test by estimating the following models:

$$\Delta \text{MILEXP}_t = \beta_0 + \sum_{i=1}^{p} \delta_i \Delta \text{MILEXP}_{t-i} + \sum_{i=0}^{q} \phi_i \Delta \text{POPUL}_{t-i} + \theta_0 \text{MILEXP}_{t-1} + \theta_1 \text{POPUL}_{t-1} + \varepsilon_t \quad (1)$$

$$\Delta \mathit{DEF}\text{MILEXP}_t = \beta_0 + \sum_{i=1}^{p} \delta_i \Delta \mathit{DEF}\text{MILEXP}_{t-i} + \sum_{i=0}^{q} \phi_i \Delta \text{POPUL}_{t-i} + \theta_0 \text{DEFMILEXP}_{t-1} + \theta_1 \text{POPUL}_{t-1} + \varepsilon_t \quad (2)$$

In Equation 1 and 2 given above, θ_0 and θ_1 notations are long-term coefficients; δ_i and ϕ_i notations show short-term coefficients; Δ notation represents first degree difference operator; β_0 stands for intercept term of the models, and ε_t is white noise error term of the models.

The null hypothesis of ARDL boundary test asserting non-existence of co-integrating association between military expenditure and population is given by $H_0 : \theta_0 = \theta_1 = 0$ and the alternative hypothesis of ARDL boundary test claiming presence of co-integrating association between military expenditure and population is given by $H_1 : \theta_0 \neq \theta_1 \neq 0$. F-statistic value of ARDL boundary test exceeding the critical value of upper limit for a given significance level hints that there is co-integrating relationship between military expenditure and population. Also F-statistic value of ARDL boundary test smaller than the critical value of lower limit for a given significance level points out that there is no co-integrating relationship between military expenditure and population. Meantime it is impossible to make decision if F-statistic value of ARDL boundary test stays between the critical values of lower and upper limits.

Following models were estimated to obtain short-run and long-run coefficients:

$$MILEXP_t = \alpha_0 + \sum_{i=1}^{p} \delta_i \Delta MILEXP_{t-i} + \sum_{i=0}^{q} \phi_i \Delta \text{POPUL}_{t-i} + \gamma ECM_{t-1} + \varepsilon_t \quad (3)$$

$$DEFMILEXP_t = \alpha_0 + \sum_{i=1}^{p} \delta_i \Delta DEFMILEXP_{t-i} + \sum_{i=0}^{q} \phi_i \Delta \text{POPUL}_{t-i} + \gamma ECM_{t-1} + \varepsilon_t \quad (4)$$

In Equation 3 and 4 given above, δ_i and ϕ_i symbols represent dynamic coefficients which return the model back to the balance in the long run; ECM symbol shows error correction term of the model; γ symbol is the speed of adjustment at which the model goes back to long run path in response to a shock taken place in short-run. A negative and statistically significant coefficient for the speed of adjustment term is anticipated.

3. Estimation Results

Firstly Phillips-Perron (PP) unit root test was utilized to identify the integration order of each series. The null hypothesis of PP unit root test assumes the non-stationarity of series while the alternative hypothesis of PP unit root test supposes the stationary of series. Table 1 below reports the PP unit root test findings.

Table 1. PP Unit Root Test

Variable	Model	Test Stat.	Prob.	Result
MILEXP	Constant	*-0.8669*	*0.7918*	-

1st. Diff. of MILEXP	Constant	*-7.2092*	*0.0000*	I(1)
DEFMILEXP	Constant	*-1.0764*	*0.7194*	-
1st. Diff. of DEFMILEXP	Constant	*-5.9914*	*0.0000*	I(1)
POPUL	Constant	*-7.6017*	*0.0000*	I(0)

As seen from the results in Table 1, MILEXP and DEFMILEXP variables are not stationary at level but stationary at first difference whereas POPUL variable is stationary at level. In other words MILEXP and DEFMILEXP variables are integrated order one and POPUL variable is integrated order zero. Since none of our variables are integrated order no more than one, we are eligible to conduct ARDL boundary test for co-integration analysis.

After checking stationarity status of each series, the AIC criterion was used to determine the optimal leg length of each model given in Equation 1 and 2. Figure 1 and 2 indicate that the best models are ARDL(4,0) and ARDL(2,0) for MILEXP and DEFMILEXP models respectively.

Figure 1: Optimal Lag Length Selection for MILEXP Model

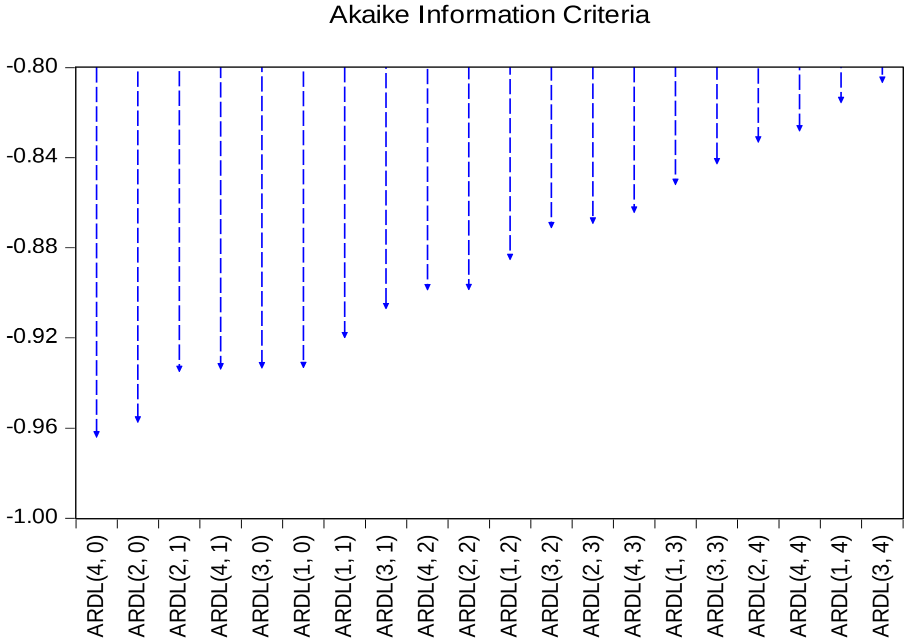
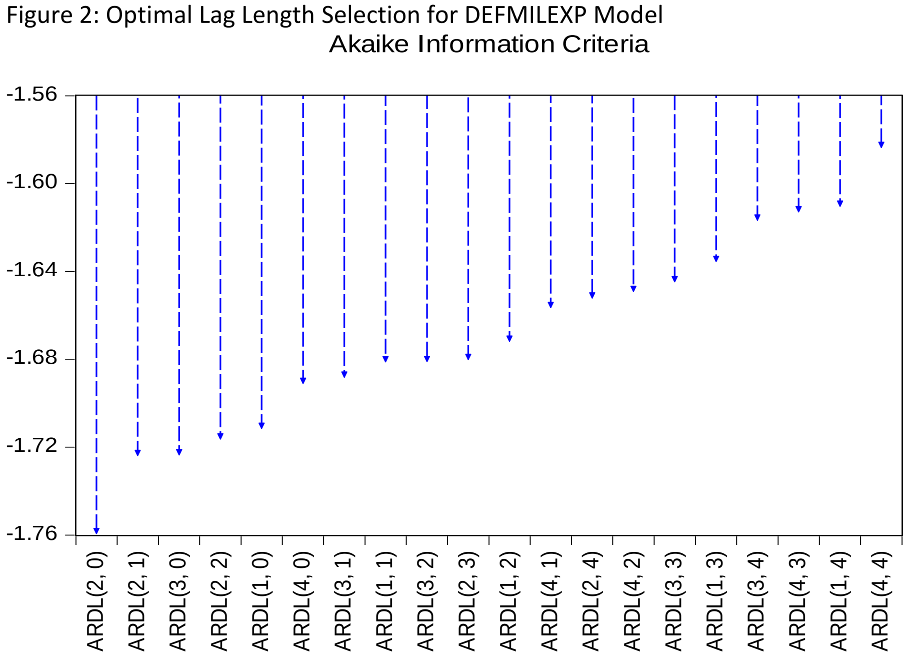


Figure 2: Optimal Lag Length Selection for DEFMILEXP Model



Co-integration test results gathered from ARDL bound tests are displayed in Table 2 and 3 and as can be deduced from the results, F-statistic values go beyond the upper limit critical values at least at 2.5% significance level. Based on those findings, it can be concluded that military expenditure and population are co-integrated in both models; and thus military expenditure and population move together in the long-run in Turkey.

Table 2. ARDL Bound Test Findings for MILEXP Model

F-statistic:	6.218523	*Critical Values*	
Significance		*Lower Limit*	*Upper Limit*
10%		3.02	3.51
5%		3.62	4.16
2.5%		4.18	4.79
1%		4.94	5.58

Table 3. ARDL Bound Test Findings for DEFMILEXP Model

F-statistic:	5.278376	*Critical Values*	
Significance		*Lower Limit*	*Upper Limit*
10%		3.02	3.51
5%		3.62	4.16
2.5%		4.18	4.79
1%		4.94	5.58

Long-run coefficient estimation findings of the MILEXP and DEFMILEXP models are shown in Table 4 and the long-run coefficient estimations reveal that population has positive and highly statistically significant impact on military expenditure in MILEXP and DEFMILEXP models. More specifically, if population in Turkey goes up one percent then military expenditure jumps by 3.99% and 1.91% for MILEXP and DEFMILEXP models respectively. Having coefficient estimations larger than one discloses that sensitivity of military expenditure to population (i.e., population elasticity of military expenditure) is quite high.

Table 4. Long-run Coefficients of MILEXP and DEFMILEXP

Model: ARDL(4,0) / Dependent Variable: MILEXP			
Variable	Coefficient	t-statistic	Prob.
POPUL	3.993643	17.49565	0.0000
Constant	-48.83664	-11.94119	0.0000
Model: ARDL(2,0) / Dependent Variable: DEFMILEXP			
Variable	Coefficient	t-statistic	Prob.
POPUL	1.913263	12.19619	0.0000
Constant	-10.39580	-3.723665	0.0005

In Table 5 we report the error correction estimation results for ARDL(4,0) model. Short-run coefficients of MILEXP variable are positive and statistically significant for first and third lags. As expected, we got negative and statistically significant coefficient estimation for error correction term. Moreover, Breusch-Godfrey Serial Correlation LM test for autocorrelation, ARCH test for heteroskedasticity, and Ramsey RESET test for model specification error were conducted for diagnostic check of the model. As indicated by diagnostic test results, ARDL(4,0) model does not have autocorrelation, heteroskedasticity, and model specification error problems.

Table 5. Error Correction Estimation Results of ARDL(4,0) Model

	Dependent Variable: MILEXP		
	Coefficient	*t-Statistic*	*Prob.*
$\Delta MILEXP(-1)$	0.285170	2.423101	0.0191
$\Delta MILEXP(-2)$	0.123444	1.022142	0.3117
$\Delta MILEXP(-3)$	0.233669	2.098469	0.0410
ECM_{t-1}	-0.318394	-4.406475	0.0001
EC = MILEXP - (3.9936*POPUL - 48.8366)			

Diagnostic Tests	
Tests	Test Stat. / Prob.
Breusch-Godfrey Serial Correlation LM Test	0.497966 (0.6109)
ARCH Heteroskedasticity Test	0.099658 (0.7535)
Ramsey RESET Test	1.616337 (0.2097)

In Table 6 we display the error correction estimation results for ARDL(2,0) model. Short-run coefficient of DEFMILEXP is positive and statistically significant. A negative and statistically significant coefficient for error correction term was estimated. Meanwhile the results of Breusch-Godfrey Serial Correlation LM test, ARCH test, and Ramsey RESET test exhibit that ARDL(2,0) model does not contain autocorrelation, heteroskedasticity, and model specification error problems.

Table 6. Error Correction Estimation Results of ARDL(2,0) Model

	Dependent Variable: DEFMILEXP		
	Coefficient	*t-Statistic*	*Prob.*
ΔDEFMILEXP(−1)	0.287481	2.454798	0.0174
ECM_{t-1}	-0.267157	-4.053724	0.0002
EC = DEFMILEXP - (1.9133*POPUL -10.3958)			

Diagnostic Tests	
Tests	Test Stat. / Prob.
Breusch-Godfrey Serial Correlation LM Test	0.195785 (0.8228)
ARCH Heteroskedasticity Test	0.143377 (0.7064)
Ramsey RESET Test	0.737760 (0.3943)

Finally, as seen from the CUSUM test results given by the graphs in Figure 3 and 4, parameters of MILEXP and DEFMILEXP models are stable and hence neither MILEXP model nor DEFMILEXP model suffer from parameter instability problem.

Figure 3: CUSUM Test for Parameter Stability of MILEXP Model

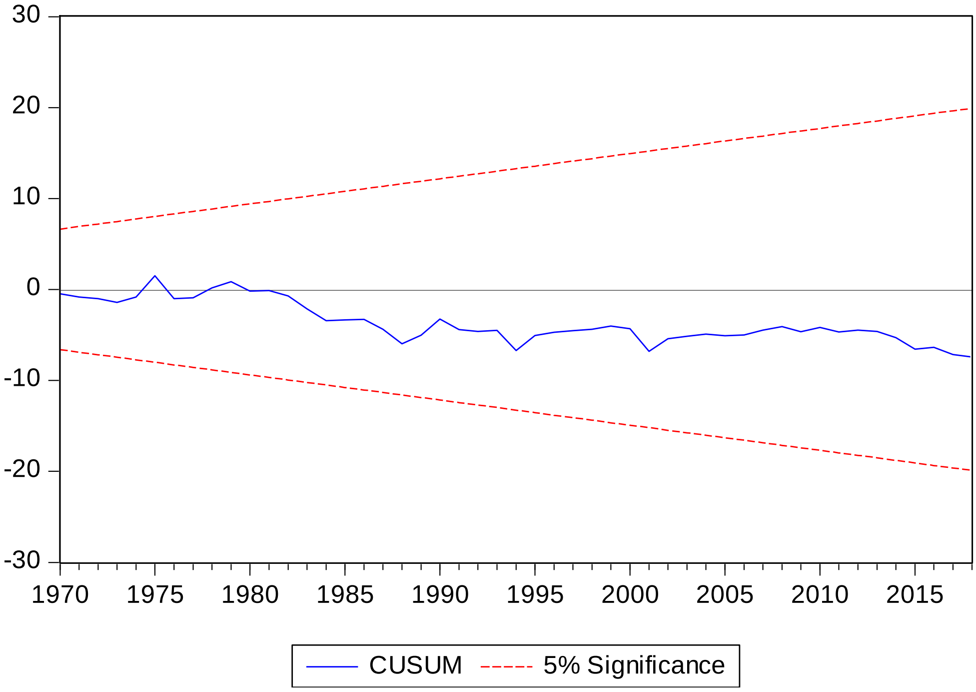
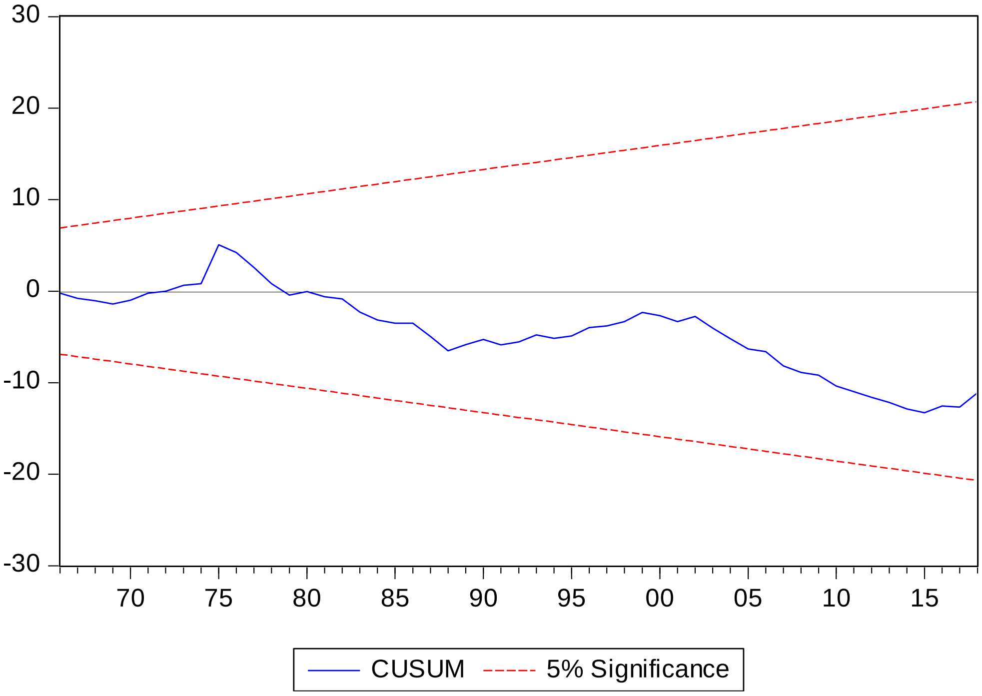


Figure 4: CUSUM Test for Parameter Stability of DEFMILEXP Model



4. CONCLUSION

In this study we examine the short-run and long-run association between population and military expenditure in Turkey. For that purpose we use an annual dataset covering the periods of 1960-2018 and ARDL estimation technique. Robustness of the results was checked by employing two different indicators of military expenditure. We firstly conducted PP unit root test to find out the integration order of population and military expenditure variables. Having variables with integration order less than two allowed us to use ARDL boundary test for co-integration analysis. Co-integration test findings implied that population and military expenditure are co-integrated. Thus they have a co-movement in the long-run in Turkey. Based on the long-run coefficient estimation results, we identified a positive statistically significant relationship between population and military expenditure. In other words, if population in Turkey increases one percent then military expenditure goes up by 3.99% and 1.91% for MILEXP and DEFMILEXP models respectively. Since long-run coefficients are bigger than one, we can say that population elasticity of military expenditure is quite high in both models. Moreover diagnostic test results disclose that the both models do not contain autocorrelation, heteroskedasticity, model specification error, and parameter instability problems.

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