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MILITARY SPENDING AND INCOME INEQUALITY IN THE UNITED STATES

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Abstract

This paper examines relationship between income inequality and military spending for the United States using the DOLS technique for the period running from 1960 through 2012. The study uses real GDP per capita (PRGDP) and the level of real research and development (R&D) as control variables. The results indicate that the military spending, income inequality, PRGDP and R&D variables are cointegrated. The results from the DOLS show that while the PRGDP changes bring about a reduction in the degree of income inequality, increases in the level of real R&D expenditure and military spending lead to higher degree of income inequality in the United States for the period under study. These empirical findings support the conventional wisdom, which posits that increases in military spending increases the degree of income inequality. The empirical findings suggest that authorities should take military spending into consideration when developing policies aimed at reducing income inequality.

Keywords: Military spending, Income Inequality, DOLS, United States, R&D

INTRODUCTION

Growth in military spending is a worldwide phenomenon and exploring its relationship has drawn much attention from economists and other social scientists. Both developed and less-developed countries have experienced growing military expenditures as a share of GDP as well as a share of federal budgets. For rich and poor countries alike, resources spent on military have constrained spending on other programs. In some cases, the opportunity cost of such spending can be highly significant since these resources can alternatively be spent on education, health care, infrastructure, environment and other social programs. Military spending, therefore, has been the subject of numerous studies in the literature. The literature although inconclusive in many aspects, is rich. While economists have focused on exploring the relationship between military spending and macroeconomic variables, such as economic growth, taxes, inflation, interest rates and budget deficits; political scientist have investigated its impact on poverty, environment, income distribution and institutions.

Economic studies, in general, have followed the Keynesian argument in their model building. According to this approach, since military spending increases total government spending, it increases aggregate demand. Increased aggregate demand leads to increases in output, consumption and investment. Through the Keynesian multipliers it further leads to higher spending and higher GDP growth. Using this approach, most studies have found positive relationships between military spending and output. (Kidron 1970; Benoit 1973; Joerding 1980; Degos 1986; Chowdhury 1991; Chen 1993; Dakurah and Sampath 2001; Feridun 2007).

This finding of positive impact of military spending on income inequality, however, has been challenged by a number of studies that find a negative relationship (Faini et al. 1984; Senghaas 1977; Wolpin 1977; Chan 1989; Sawhney, DiPietro and Anoruo 2007; Hou and Chen 2012; Shahbaz 2013). The main theoretical argument for the negative effect is based on possible misallocation of resources from the civilian to military production and a “crowding out” effect on investment in research and development spending.

The focus of this paper however is to investigate the impact of military spending on income inequality. The topic of income inequality has received only scant attention in the literature. There are only a few studies that explore relationship between military spending and its impact on income inequality. The theoretical argument for such studies, in general, is that the defense sector of the economy uses relatively higher skilled personnel who command higher wages. Increased demand for these services as a result of higher military spending leads to higher pay differentials for workers in the defense versus non-defense sector of the economy, resulting in higher income inequality. Further, the minorities and women are traditionally engaged in lower paying jobs and the capital-intensive expenditures in military sectors do not favor the lower income and lower skilled workers in the economy.

The remainder of the paper is organized as follows. Following the present introduction, section 2 reviews the relevant literature. Section 3 presents the methodologies of the study. Section 4 describes the data and the summary statistics. Section 5 discusses empirical results. Section 6 offers the conclusions of the study.

LITERATURE REVIEW

Empirical research to investigate the impact of military spending on income inequality, using statistical methods, started with the seminal paper by Abel (1994). Abel employs OLS methods to the post-Vietnam war period for the United States. He controls for macroeconomic variables such as, taxes, economic growth, interest rates, inflation and non-military expenditures and finds a positive association between military spending and income inequality. He claims that the results are robust to alternative definitions of military spending and income distribution measures. Ali (2007) using global panel data examined the relationship between income inequality and military spending for the time running from 1987 through 1997. Ali finds a positive relationship between income inequality and military spending, after controlling for the size of the armed forces, GDP growth and per capita income. He concluded that increases in military spending could promote income inequality.

Ali and Galbraith (2003) develop a panel data study and using data for 1987-1997 find that military spending has a positive effect on pay- inequality. They also look at evidence that suggests that military spending allocates resources away from spending and health programs. Eleven (2012), use data for 1963-2007 for the Turkish economy and reaches similar conclusions. In a more comprehensive study, Lin and Ali (2009), develop a cross-sectional model of 58 countries. They reach a rather startling conclusion that does not support a positive or a negative relationship between military spending and economic inequality (most studies thus far found either a positive or negative relation). They claim that their Granger non-causality test provides no support to the causal relationship between the two variables. According to them their study uses more refined data from alternative sources and applies more refined techniques. Lin and Ali also argue that the findings of earlier studies are not reliable since they have not adequately addressed the possibility of non-stationarity in the variables used. (They also claim that in their study, when they ignore the problem of non-stationarity their results change in that they find causal relationships in both directions.

This brief survey points to the mixed results reached in several studies on the relationship between military spending and income inequality. Some studies point to a positive impact of military spending on income inequality, while others disagree and uncover a negative relationship. Yet another study (Lin and Ali, 2009) claims to have found no evidence in either direction. This inconclusive evidence in literature calls for more empirical work in this area and the present study contributes to the literature by using theoretical consistent econometric techniques. In particular, the study uses recent unit root tests and the Dynamic Ordinary Least Squares (DOLS) cointegration method to empirically examine the impact of military spending (MLY) on income inequality (GINIF) in the United States. The DOLS technique is applied because the parameter estimates from this technique have been shown in the econometric literature to be consistent, efficient and normally distributed.

RESEARCH METHODOLOGY

Model Specification

Based on the theoretical discussion presented above, the availability of the relevant data and earlier studies, the following econometric model is specified:

$$GINIF_t = \beta_0 + \beta_1 PRGDP_t + \beta_2 MLTY_t + \beta_3 RD_t + \varepsilon_t \qquad (1)$$

Where, GINIF is the Gini ratio of income of families, PRGDP is the level of real GDP per capita, MLTY is the percentage of military expenditure as a percentage of GDP and RD is the real Research and Development expenditure. The expected signs of the regression coefficients are $\beta_1 < 0$, β_2 and $\beta_3 > 0$. The stochastic term, ε_t is expected to be normally distributed with N (0,1).

A priori, we expect that as the economy experience growth in PRGDP, it should favorably affect all sections of the population, including the poor families. As the percentage of the military expenditure to GDP increases, in light of fixed available resources, fewer amounts will be spent on transfer payments and some items of the budget meant for income maintenance will be slashed. Finally, as Research and Development expenditure increases, the ensuing technological progress and the digitalization of the economy would displace many unskilled workers leading to an increase in the Gini ratio.

Upon testing whether the variables included in modeling are stationary or non-stationary in levels(the integration order) included in the Model (1), we employ the Dynamic Ordinary Least Squares (here after, DOLS), cointegration estimator proposed by Stock and Watson (1993) and Saikkonen(1991). As, the Johansen Cointegration technique (1988) has many shortcomings, the main reason being that the estimator is highly sensitive to the specified lag order and the inclusion of various deterministic terms, we apply the DOLS method. The DOLS method besides being robust to the presence of residual correlation, simultaneity, heteroscedasticity, misspecification and non-normality, controls for the presence of both the small sample and dynamic sources of bias. The DOLS is an asymptotically efficient estimator by adding lags and leads thus making the cointegration equation error terms orthogonal to the entire history of the stochastic regressor innovations (See, Stock and Watson, 1993).

Data and Summary Statistics

The required data for analysis and estimation of the model (1), for the period of the study, 1960-2012, are gathered from various sources. The data on the military expenditure as a percentage of the gross domestic product (GDP), MLY, are obtained from *SIPRI: Stockholm Military Expenditure Data Base*[http://www.SIPRI/.Databases/milex]. The data on PRGDP in 2010 U.S. constant dollars, and GINIF, Gini income ratio of families are obtained from the Federal Reserve Bank of St. Louis's *Economic Data* [http://Fred.stlouisfed.org]. The data on Industrial R&D (Research and Development) in millions in 2005 U.S. constant dollars are taken from the National Science Foundation's National *Patterns of R&D Resources* (Annual,2013). The selection of the sample period (1960-2012) was influenced by the availability of consistent data on the relevant four variables used in the study.

Table 1: Summary Statistics

Variable	GINIF	PRGDP*	MLY	R&D**
Mean	0.39	33,695.00	5.43	7,664.75
Maximum	0.45	49,979.53	9.10	13,593.20
Minimum	0.35	17,036.89	2.90	2,828.50
St.Deviation	0.03	10,441.42	1.83	3,414.01
Skewness	0.18	0.10	0.53	0.34
Kurtosis	1.43	1.73	2.25	1.78
Jarque-Bera	5.7***	3.66	3.69	4.31
P-value	(0.06)	(0.16)	(0.15)	(0.12)

Notes: The asterisk, *, denotes the variable in 2010 constant U.S. Dollars. ** are in constant U.S. millions of Dollars. The asterisk***, shows the statistical significance at the 10% level.

The summary statistics on all the variables incorporated in Model(1) are reported in Table 1. With the exception of the GINIF variable, from the results of the Jarque-Bera(JB) test, we find that all the other variables are normally distributed. Strictly speaking, even the distribution of the GINIF is normally distributed at the 10% significance level, indicating that there seem to be no outliers and we can apply most of the tests that require normality. We fail to observe any excess

Kurtosis and skewness indicating that the distributions of the variables in the model appear to be normal, echoing the results of the JB tests. The observed standard deviation of PRGDP and R&D variables reveal that these variables have experienced significant increases during the period under study.

EMPIRICAL RESULTS

Table 2 presents the results of some widely used traditional unit root tests such as the Augmented Dickey Fuller (ADF) test, the KPSS test and the Ng-PerronMZ_a and MZ_t tests. While the ADF, $MZ_a$and MZ_tunit root tests maintain the hull hypothesis as non-stationarity (presence of a unit root), the KPSS test states the null as stationarity. As these tests have become standard tools of determining the integration order of the data generating process (DGP) , no attempt has been made in this paper to explain them(For details, see Choi, 2015; Patterson, 2011). The results of the ADF and the MZ_a and MZ_ttests indicate that we fail to reject the null hypothesis of a presence of a unit root in all the variables at the 5 % level of significance. The outcome of the KPSS unit root tests show that while we reject the null hypothesis of stationarity for the variables of PRGDP and MLY at the 10% level, for the series –GINIF and RD, we reject the null at the 5% level.

Thus, the overwhelming empirical findings from Table 2 clearly indicate that all the variables included in the specified model (1) are non-stationary in levels and thus they are integrated of order one, I (1).

Table 2: Results of Conventional Unit Root Tests

Series	KPSS	MZa	MZ_t	ADF
GINIF	0.158	-5.31	-1.61	-2.74
PRGDP	0.137	-16.90	-2.86	-2.77
MLY	0.134	16.85	-2.89	-2.77
RD	0.225	-4.459	-1.458	-1.80

NOTE: The critical values for the ADF procedure at the 1, 5, and 10 percent level are -4.14, -3.498, and -3.179, respectively. The critical values for the KPSS procedure at the 1, 5, and 10 percent level are 0.216, 0.146, and 0.119, respectively. The lags were determined by the SBC. The null hypothesis of the KPSS unit root test is stationarity. For MZ□ and MZ_ttests, the 1, 5 and 10 percent level are respectively -23.8, -17.30, -14.20 and -3.42, -2.91 and -2.62 (Critical values from EVIEWS9.5, 2016).

However, as shown by Perron(1989) that the traditional tests do not consider the presence of any structural breaks in the data generating process and thus render the ADF tests to over reject the unit root hypothesis. Therefore, in light of his criticism, we conduct unit root tests that consider the presence of structural breaks in the presence structural breaks in the data generating process (DGP). While there are many unit root tests that take into account the presence of structural breaks, in this paper we apply the Lee and Strazicich's Minimum Lagrange Multiplier unit root tests (Lee and Strazicich, 2003;2004) that endogenously determines structural breaks in the deterministic terms of an intercept and a trend in the data generating process. While Lee and Strazicich have developed both one and two breaks Minimum Lagrange Multiplier unit root tests(LM test hereafter), in this paper we apply the one break test because the results of the two break tests in many of the variables indicate the presence of a statistically significant break. Furthermore, as noted by Lee and Strazicich (2004), an endogenous one-break LM unit root test exhibits better statistical power and no size distortions in the presence of a structural break in a under the null hypothesis. Moreover, as they have demonstrated the one-structural break unit root test is invariant to the magnitude of a structural break under both the null and alternative hypothesis. As they state in the case of Lee and Strazicich's LM unit root tests, the rejection of the null hypothesis unambiguously implies that the time series is a trend stationary process.

Table 3: Results of the Lee and Strazicich Unit Root Tests for One Structural Break[a]

Variable	TB1	t-Statistics (D)	LM Test Statistics (S_{t-1})	
Panel 1: ***Model A -*** *Crash Model*				
GINIF	1982	5.89*	-1.538	
PRGDP	1984	-0.572	-2.098	
MLY	1982	-2.928*	-2.700	
RD	1984	-0.565	-1.204	
Panel 2: ***Model C –****Breaks in Intercept and Trend*			*B(t)*	*D(t)*
GINIF	1982	2.792*	-0020	-2.600
PRGDP	1997	2.529*	-0.240	-2.098
MLY	1971	-0.761	-0.416	-2.100
RD	1995	3.299*	-0.458	-2.767

Lags=2 . TB1 and TB2 are the time periods of break1 and 2, respectively. The critical values are from Lee and Strazicich(2003, 2004). The critical values depend on the location of the breaks in the DGPs.k=lags=3. a The L&S unit root tests are executed using RATS 8.3. For Model A, the critical values at the 1%,5% and 10% significance levels, respectively are -4.239,-3.566 and -3.211(Lee & Strazicich,2004).The critical values for λ1=0.5 at the 1%,5% and 10% levels are respectively, -5.11,-4.51 and -4.17. The critical values for λ1=0.3 at the 1%,5% and 10% levels are respectively, -5.15,-4.45 and -4.18(Lee & Strazicich,2004).

The results of the LM unit root tests are shown in Panel 1 and 2 of Table 3. Panel 1 shows the results of the LM test that incorporates a structural break in the intercept (the Crash Model). As the observed LM test statistics that for all the variables are less than (in absolute value) the critical values even at the 10 % significance level, we fail to reject the null hypothesis of the presence of a unit root with a break in the intercept. or GINIF and MLY. For the series, GINIF and MLY, GINIF and MLY, we note the statistically significant breaks in 1982. In Panel 2, we notice that for GINIF, PRGDP and RD, the LM unit root tests that incorporate a single break in the intercept and the trend, also fail to reject the null hypothesis of the presence of a unit root with a statistically significant break in both the intercept and trend. Thus, the overall LM unit root test results indicate that the variables included in the Model (1) are non-stationary. Applying the L& S minimum LM unit root two break-tests also resulted in consistent results, in variably yielding a single statistically significant break. Therefore, in light of the results shown in Table 3, we need to apply a cointegrating estimator for an estimation and analysis of the Model (1).

Table 4: Gregory-Hansen Cointegration Tests (Variables: GINIF, PRGDP, MLY, RD)

Deterministic Term	ADF[b]	Structural Break
C	-4.895	1982
C/T	-5.042	1982
C/S	-6.643*	1982

Notes: [α]Lag length was chosen using the BIC/SBC criterion. b Modified ADF statistics. *Indicates significant at the 1% level.

As a majority of the variable has experienced structural breaks during the period under investigation, before estimating the Model (1), we have to find out if the variables are cointegrated despite experiencing breaks. Therefore, we perform the Gregory-Hansen (1996) cointegration tests in the presence of various deterministic terms of a constant (C), a constant and a trend(C/T) and a regime shift(C/S). The Gregory-Hansen tests results are presented in Table 4. The results show that we reject the null of no cointegration in a full break(C/T) or a regime shift model with a structural break in 1982.

Now that the variables are found to be non-stationary, we estimate Model (1) using a cointegration estimator. In Table 5, the results of the DOLS estimation of the Model (1) are reported. At the outset, we note that the coefficients of all the variables are statistically significant at the 1 % level indicating that they impact the degree of inequality in the United States as measured by GINIF. The magnitude of the coefficient of PRGDP, although small, shows that as the economy grows, the degree of income inequality decreases implying that the transfer payments and anti-poverty programs are to some extent effective. The coefficients of MLY is small in magnitude but positive in direction conveying that as the percentage of military expenditure increases, less GDP will be allocated to income-inequality programs. The regression coefficient of RD, despite being small indicates that as technological progress in the form of computerization, diffusion of the internet and automation take place in the economy, the demand for unskilled labor decreases resulting in higher rate of structural unemployment, ultimately leading to increased degree of income inequality. In Model (1), changes in the variables, PRGDP, MLY and RD together explain about 98% of the variation in the dependent variable of GINIF, as shown by a high adjusted R^2. Regarding the post- regression diagnostics of the DOLS procedure in estimating the model, the result of the Hansen Parameter Instability test shows that the parameter estimate is stable and we cannot reject the null hypothesis of cointegration. Although the Greg-Hansen shows the presence of a structural break in the relationship in 1982, in the DOLS estimation of the Model (1), the dummy variable, D1982 is found to be statistically not significant. Furthermore, the ADF test and Ng-Perron'sMZ$_a$ and MZ$_t$unit root tests on the residual series of Model(1) from the DOLS estimation is stationary at the 5% level, further reinforcing that GINIF, PRGDP, MLY and RD together form a long-run equilibrium economic relationship and thus, they are cointegrated.

Table 5: The Dynamic Ordinary Least Squares Estimation (DOLS)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CONSTANT	0.349*	0.029	11.881	0.000
PRGDP	-6.47E-06*	2.06-E06	-3.117	0.004
MLY	0.0065*	0.0031	2.100	0.018
RD	1.49E-05*	4.33-E06	3.443	0.001
Trend	0.003**	0.001	3.00	0.027
D1982	0.001	0.007	0.143	0. 896

Adj. R^2 =0.98; Hansen-Parameter Instability L_C =0.063 (0.2)[a]; ADF =-6.140[a];
MZ_a= 21.00[b]; MZ_t=3.25[b]

[a]P-value in parentheses.[*]and [**] show significance at the 1% and 5% levels, respectively. [b] indicates significance at the 5% level. We have added 2 lags and 2 leads given the length of the series of the variables in the system. For pre-whitening with lags for long-run variance, the SIC criterion (Schwartz Information Criterion) determined the lag length, with Bartlett kernel, Newey-West fixed bandwidth of 4.

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SUMMARY AND POLICY IMPLICATIONS

This paper has examined the relationship between income inequality and military spending for the United States. In particular, the paper performed the KPSS, Philip-Perron, and the ADF unit root tests to empirically ascertain the time series properties of the income inequality, military spending, real GDP per capita and R&D variables. In addition, the study implemented the Lee and Strazicich's LM unit root tests to account for possible structural break(s) that might be present in the data generating process. The study applied the Gregory-Hansen integration (1996) procedures to test for long run relationship, in the presence of a structural break in the incorporated variables, between the GINIF and PRGDP, MLY and RD in the model. The DOLS cointegration method was employed to obtain parameter estimates. The results from the various unit root tests indicate that the income inequality, military spending, real GDP per capita and R&D variables are first difference stationary. The results from the DOLS show that military spending has significantly positive effect on income inequality suggesting that increases in military spending raise, although moderately, income inequality. The finding of positive relationship between military spending and income inequality is consistent with the results found in Ali (2007). The empirical findings presented in this paper imply that countries should take the problem of growing income inequality into consideration, when making decisions regarding military outlays. Depending on the availability of relevant data, further research on this topic can be undertaken using panel data approach to underpin the extent to which the results from this study can be generalized.

REFERENCES

Abell, J. D. (1994) Military Spending and Income Inequality. Journal of Peace Research 31 (1) 35-43.

Ali, H. (2007) Military expenditures and income inequality: Evidence from global data. Journal of Defense and Peace Economics 18(6) 519–535.

Ali, H. and Galbraith, J. (2003) Military Expenditures and Inequality: Empirical Evidence from Global Data, UTIP Working Paper 24, October 2003.

Benoit, E. Defense and Economic Growth in Developing Countries, 1973, D. C. Heath, Lexington Books, Boston.

Chan, S. (1989) Income Inequality Among LDC's: A Comparative Analysis of Alternative Perspectives, International Studies Quarterly 33 (1) 45-65.

Chen, C. (1993) Causality Between Defense Spending and Economic Growth: The Case of Mainland China, Journal of Economic Studies 20 (6) 37-44.

Choi,I. Almost all about unit root tests- Foundations, developments and applications, 2015, Cambridge University Press, New York.

Chowdhury, A.R. (1991) A Causal Analysis of Defense Spending and Economic Growth, The Journal of Conflict Resolution 35 (1) 80-97.

Deger, S. (1985) Human Resources, Government Education Expenditures and the Military Burden in Less Developed Countries. Journal of Developing Access 20 (1) 37-48.

Elveren, A. (2012) Military Spending and Income Inequality: Evidence on Co-Integration and Causality for Turkey, 1963-2007. Defence and Peace Economics 23 (3) 289-301.

Hamid, A. (2007) Military Expenditures and Inequality: Empirical Evidence from Global Data. Defence and Peace Economics 18 (6) 519-535

Hou, N. and Chen B. Military Expenditure and Economic growth in Developing Countries: Evidence from System GMM Estimates. Defence and Peace Economics 24 (3) 183-193.

Faini,R., Arnez,p. Taylor,L.(1984) Defence Spending, Economic Structure and Growth: Evidence Among Countries and Over Time. Economic Development and Cultural Change 32(3)487-498.

Federal Reserve Bank of St. Louis, Economic Data, [http://Fred.stlouisfed.org].

Gregory, A. W. and Hansen, B. E. ,Residual-Based Tests for Cointegration in Models with Regime Shifts, 1996, Journal of Econometrics, 70, 99-126.

Joerding, W. (1986) Economic Growth and Defence Spending: Granger Causality. Journal of Development Economics (21) 35-40.

Johansen, S. Statistical analysis of cointegration vectors, 1988, Journal of Economic Dynamics and Control, 12, 231-254.

Kidron, M. Western Capitalism Since the War, 1970, Harmondsworth: Penguin

Lin, E. S. and Hamid E. Ali (2009). Military Spending and Inequality: Panel Granger Causality Test. Journal of Peace Research 46 (5) 671-685.

Lee, J. and Strazicich, M.C., Minimum LM unit root test with one structural break," Working Papers, 2004, 04-17, 2004, Department of Economics, Appalachian State University.

Lee, J. and Strazicich, M. C., Minimum LM unit root test with two structural breaks, 2003, Review of Economics and Statistics 85: 1082–1089.

National Science Foundation, National patterns of R & D Resources(Annual 2013).

Patterson, K., Unit root tests in time series, Vol.1, Key concepts and problems, 2011, Basingstoke, Palgrave-Macmillan.

Perron, P., The great crash, the oil price shock and the unit root hypothesis, 1989, Econometrica, 57,1361-1401.

Saikkonen, P., Asymptotically efficient estimation of cointegration regressions", 1991, Econometric Theory, 7, 1-21.

Sawhney, B. Dipietro, W. and Anoruo, E. The Effects of World Military Power on the Output of Nations. Southern Business and Economic Journal 30 (3) 75-86.

Senghaas, D. (1977) Militarism Dynamics in the Contemporary Context of Peripheral Capitalism. Bulletin of Peace Proposals 8 (1) 103-109.

Shahbaz, M. Talat, A. and Muhammad, S. (2013) Defence and Peace Economics 24 (2) 105-120.

SIPRI: Stockholm Military Expenditure Data Base [www.SIPRI/Data bases/milex. 2017.

Stock, J.H. and Watson, M. W., "A Simple estimator of cointegrating vectors in higher order integrated systems," 1993, Econometrica, Econometric Society, 61(4), 783-820.

Wolping, M. (1977) Military Dependency Versus Mortality Correlates of Economic Development, Population Review 19 (1-2) 46-50.

