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MILITARY SPENDING, INEQUALITY AND ECONOMIC GROWTH: EVIDENCE FROM PAKISTAN

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Abstract. A broad strand of literature envisages military spending as a cogent factor for economic growth. A little effort has been made for finding this link for inequality. This study breaks the ice by exploring the link among military spending, inequality and economic growth applying the Generalized Method of Moments (GMM) technique over the period of 1972 to 2016. Using the augmented Solow growth model with Harrod-neutral technology, the study finds positive link between military spending and growth. Inequality turns out to be negatively associated with growth. The study also enlists some policy implications.

Keywords: Military spending, Inequality, Growth, Pakistan, GMM.

JEL classification: H560, O11, C22

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I. INTRODUCTION

In his seminal study, Benoit (1973,1978) has shown very astonishing and sparking results regarding the link between military expenditures and growth. According to Benoit, military expenditures enhance economic growth in developing countries. These provocative findings have motivated the economists to research on the economic influences of military spending. However, Deger & Sen (1983) have strongly criticized the methodology of this study criticized, and most of studies found results which were contrary to the earlier ones (Dunne, 1996); though depending on the level of their wealth or poverty, the direction and significance of the upshot of military spending on economic growth is likely to differ considerably from country to country and subsistence of an arms industry, etc. (See Frederiksen & Looney, 1983; Brauer 1991). A lot of studies have been conducted to address the issue but there is no consensus found among the economists. A debate is still in continuation on the military-growth relationship.

Keynesian School of thought considers that military spending stimulates the economic growth because it is a part of fiscal policy and government can use its discretion to stabilize the economy. There are some school of thoughts like Neo-classical, the Institutional etc. who believe that military spending impede the economic growth. They have an opinion that military expenditures can crowd out the private investment. Military expenditures can hinder economic growth due to less spending on infrastructure by the government. There is also a possibility that military spending is financed through internal and external borrowing that also puts adverse effects on the economy.

Therefore, there is diversity in the views of economists on the economic outcomes of military spending. The positive effects work through the conduit of security, aggregate demand, investment and labour while the negative effects show the crowding out effect, opportunity cost, increased taxation, inefficiency of resource allocation and increased political power of the [Obreja Brasoveanu,2010].

Inequality has long been the focus of researchers for determining its impact on growth. Kaldor (1960) and Kalecki (1971) were the first who discussed the relationship between inequality and growth. Establishing a non-linear saving and investment behaviors, they proposed that inequality

could positively influence the growth. A variety of channels also explains the negative association between inequality and growth as inequality through median, non-median voter models, differential savings rates, sociopolitical instability, fertility and education, factor shares and reforms argue that inequality badly affects the economic growth.

Since 1972-2016, Pakistan is on average spending almost Rs. 226672.2 million which accounts for 5.2% of GDP on military affairs and stood at 23 position regarding military spending in the world (SIPRI, 2016). So far as Gini coefficient is concerned Pakistan on average experienced the value 0.30 (Pakistan economic survey, various issues).

For Pakistan, both the military spending and inequality remained burning issues regarding their impact on growth but no serious efforts have been made to find the empirical relationship between them. It is contribution of this study to explore the association between them by using augmented Solow growth model primarily in Pakistan. Secondly, this work focuses to explain the military-growth nexus by incorporating the income inequality using Harrod-neutral technological progress.

The rest of chapter proceeds as: Section II describes channels of influence for military spending, inequality and growth. Section III reviews the empirical studies on military spending and economic growth along with inequality and growth. In section IV, model specification, data and methodology are explained. Section V exhibits the results and discussions while conclusion and policy implications are offered in Section VI.

II. MILITARY SPENDING, INEQUALITY AND GROWTH: CHANNELS OF INFLUENCE

In this section, the study describes the various channels that through which the military spending and inequality affect the economic growth.

CHANNELS OF MILITARY SPENDING AND GROWTH

Deger (1986a) explained the three possible ways through which military spending can affect growth:

Spin-off Effects

Spin off effects are relating to effects of military spending on physical and social infrastructure. These effects positively influence economic growth and can be sub-divided into direct spin off and indirect spin off. The direct spin off effects of military spending on growth accounts for additional aggregate demand creation i.e. military spending upsurges the aggregate demand which ultimately influence growth via increase in investment. The indirect spin off effect realizes growth through modernization effect *i.e*. research and development made in defense sector can transfuse into civilian sector and enhances social infrastructure especially in developing countries. Similarly, military human capital investments (trainings and skills) sprinkle their benefits to the civilian sector.

Reallocation of Resources

The channel of reallocation of resources suggests the negative connotation between defense spending and growth. Given the stock of savings, an increase in military spending crowds out private investment and worsens growth. Similarly, increase in arms imports badly affect balance of payments and growth. Moreover, the negative correlation between military spending and growth is due to diversion of resources from exports sector to military sector in the presence of resource constraints. Inefficient bureaucratic system and resulting excess burden of taxes as of high military spending dampen the growth.

Creation of New Resources

Finally, the creation of new resources channel proposes the positive bearings of defense outlays on growth. High military spending promotes investment opportunities and growth because of increased security and law and order.

CHANNELS OF INEQUALITY AND GROWTH

Inequality favors or worsen growth depends upon the channels through which it operates. Different models in the literature explain these channels.

Median and Non-Median Voter Models

Median Voter Models suggest that there is trade-off between benefits and costs of voter due to redistribution. The more disadvantaged people have to face higher costs of redistributive transfers in the form of taxes that results in lower level of capital accumulation and growth. Non-Median Voter Models explains that inequality is harmful for growth as it leads to concentration of resources in the hands of a few politically influential people. Financial corruptions in this process deviates the process from productive to non-productive resources and hampers growth.

Differential Savings Rates

This model is based on the premises that inequality is good for growth due to savings differential as MPS of the capitalists is higher than that of workers. However, modern interpretation assumes higher savings of workers when human capital is incorporated.

Sociopolitical Instability

This channel assumes that socio-political rifts leads to uncertainty for investors and hamper growth.

Fertility and Human Capital

Perotti (1994) emphasized the role of fertility and human capital in determining the growth. There is negative association between fertility and inequality. It works through the mechanism, as the poor income increases through redistribution, will lead to high human capital formation and economic growth by lowering fertility i.e. increasing opportunity cost of more children

Factor Shares

Pineda and Rodríguez (1999) found negative association between capital share and growth. The capitalists' societies have low level of investment in education and health that ultimately hinders growth. Hence, inequality due to high capital share is bad for growth whereas if human capital channel is ignored, the capital share and growth link becomes positive through investment and physical capital formation.

Reforms

Inequality generates polarized societies that make fundamental economic reforms untenable. So, inequality dampens down the economic growth in the long-run by frustrating economic reforms.

III. REVIEW OF EMPIRICAL STUDIES

A broad stream of empirical writings has been conducted for estimating the connection military spending, inequality and growth. We are dividing this section into two parts: one is dealing with empirical studies on military-growth relationship while the other relates with inequality-growth relationship.

STUDIES ON MILITARY SPENDING AND GROWTH

An extensive literature is available that uses assorted models and techniques to find out the military-growth relationship i.e. the Emile Benoit study, ad-hoc models, demand-side models, supply-side models, demand and supply-side models, causality analysis and Barro model. However, a very few attempts have been made to explore this relationship by using augmented Solow Model. The researchers found the association between defense outlays and growth with and without income inequality. Following studies used the augmented Solow Model to explore military-growth nexus without considering income inequality.

Knight et al. (1996) analyzed the effects of military spending on economic growth by applying the augmented Solow growth model for 79 countries over the period 1971-1985. The study found significant inverse link between defense burden and growth. Moreover, military spending crowded out the investment levels. Murdoch and Sandler (2002b) adopted the augmented Solow growth model to investigate the effects of civil wars on the short-run and long-run growth of home and neighboring countries of four groups of countries. The study estimated the results through panel data procedure using the data from 1961-1995. In both periods, the effects of civil war on economic growth were negative in all regions.

Yakovlev (2007) investigated the effects of military spending and net arms exports on economic growth using the augmented Solow growth model for twenty-eight countries over the period 1965-2000. The study

used GMM and panel estimation techniques with fixed and random effects. The results of the empirical study indicated that military spending and net arms exports had negative effects on growth.

Two studies examined the relationship among military spending, inequality and growth simultaneously of which one applied augmented Solow growth model. Aksogan and Elveren (2012) analyzed the impact of health and education expenditures along with defence spending on income inequality in Turkey for the period 1970-2008. The study found that growth and social transfers exhibited improved effects in income inequality while defense spending results in increasing inequality. The study used indirect channel to explore the link defense spending and growth. In a recent study, Tongur and Elveren (2014) applied the augmented Solow growth model to explore the relationship among military spending, inequality and growth for the period 1963-2008. Based on structural model for Turkey, the study found that income inequality is positively associated with growth but military expenditures do not show the significant relationship with growth.

From the ongoing, it is evident that the studies used augmented Solow growth model exhibited negative association between military spending and growth but the studies used Feder, Deger and Benoit type models found mostly positive defense-growth relationship.

STUDIES ON INEQUALITY AND GROWTH

There is a wide range of studies regarding the link between inequality and growth. Forbes (1997) using panel data study found positive association between inequality and growth. Li and Zou (1998) validated the findings of Forbes (1997). Barro and Martin (1995) explored a non-linear relationship between inequality and growth i.e. for high levels of incomes, inequality promotes growth but for low levels of income, it makes growth sluggish. In another study, Barro (1999) showed the positive inequality-growth relationship.

Alesina and Drazen (1991) and Fernandez and Rodrik (1993) present the link between inequality and growth through reforms. Alesina and Rodrik (1994) and Persson and Tabellini (1994) showed the inverse relationship between inequality and growth by validating the models of Median voter. The Non-Median Voter Models which justifies negative association between inequality and growth were proposed by Benabou

(1996) and Rodríguez (1999b). Perotti (1994), Alesina and Perotti (1993) and Alesina et al. (1992) provided the negative empirical evidence between inequality and growth.

Castello-Climent (2010) proposed the inverse relationship between inequality and growth for middle-income countries. Kanbur (2000) exhibited that inequality lowers economic growth because of uncertainty arising from socio-political instability. Nissanke and Thorbecke (2010) pointed out that anti-social activities such as corruption, hoarding and mounting threats to property rights due to political and social polarization enhances inequality that ultimately reduces economic growth.

The above reviewed studies on inequality and growth show diversifying results suggesting there is a need to explore the relationship by using comprehensive data and modern econometric techniques.

IV. MODEL SPECIFICATION, DATA AND METHODOLOGY

MODEL

Based on the theoretical foundations of augmented Solow growth model presented by Manikiw, Romer and Weil (1992), this study has extended the model by incorporating the inequality to find the link among military spending, inequality and economic growth. None of the earlier studies has applied augmented Solow growth model with military expenditures and inequality constraints for Pakistan. The study added a new dimension of inequality to the model earlier developed by Dunne et al. (2005) based on augmented Solow growth model for finding the link between military spending and economic growth.

The model specification starts with neoclassical production function characterizing labor augmenting technology as:

$$Y(t) = K(t)^{\alpha}\left[A(t)L(t)\right]^{1-\alpha} \qquad (0 < \alpha < 1) \tag{1}$$

where Y(t) is aggregate income, K(t) is capital stock, L(t) is labor and A(t) is efficiency parameter representing technological progress. A(t)L(t) or AL refers to the effective labor that grows at the rate of $(n+g)$. α is capital share of income while $(1-\alpha)$ is effective labor share of income.

A(t) develops in line with:

$$A(t) = A_o e^{gt} ms(t)^{\eta} ineq(t)^{\lambda} \qquad (2)$$

where *g* indicates the exogenous rate of labor augmenting technological progress (or Harrod-neutral that keep the capital output ratio constant). *ms* represents the military spending burden calculated by ratio of military spending to GDP. η shows elasticity of steady state income in relation to military spending burden. *ineq* exhibits income inequality measured by Gini coefficient while λ demonstrates elasticity of steady state income with respect to income inequality.

Evolving through this arrangement, an enduring change in *ms* can bring about change in the per-capita income in the short-run leading to new steady state equilibrium along the steady state growth path but it does not distress long-run steady state. (Dunne,2005; Tongur and Elveren 2014). This premise is based on the hypothesis that military expenditures affect factor productivity through level effects on efficiency parameter with labor augmenting technology. Dunne and Nikolaidou, 2011).

The study has contributed by adding the variable of inequality in the constraint with the assumption that redistribution of resources reduces inequality that enhances factor efficiency and ultimately growth. Using specification, long-run steady state growth rate would not be changed due to a permanent change in *ineq.* Therefore, a new steady state equilibrium would be observed by an enduring effect on PCI along the steady state growth path.

Using the assumptions of Solow growth model, *s* is exogenous savings rate, *n* is constant growth rate of labor force and δ is the capital depreciation. The dynamics of physical capital per effective labor is k = K/AL is depicted by:

$$k^o = sk(t)^{\alpha} - (n + g + \delta)k \Leftrightarrow \frac{\partial \ln k}{\partial t} = se^{(\alpha-1)\ln k(t)-(n+g+\delta)} \qquad (3)$$

The steady state levels of physical capital and output per effective labor units are:

$$k^*(t) = \left[\frac{s}{n+g+\delta}\right]^{1/(1-\alpha)} \quad y^*(t) = \left[\frac{s}{n+g+\delta}\right]^{\alpha/(1-\alpha)} \tag{4}$$

By applying truncated Taylor series expansion around the steady state linearizing the equation (3) by substituting the equation (4), we have:

$$\frac{\partial \ln k}{\partial t} = (\alpha - 1)(n+g+\delta)\left[\ln k(t) - \ln k^*(t)\right] \tag{5}$$

$$\frac{\partial \ln y}{\partial t} = (\alpha - 1)(n+g+\delta)\left[\ln k(t) - \ln y^*(t)\right] \tag{6}$$

Equation (6) estimates the transitory dynamics of output per effective labor unit in a vicinity of the steady state. For empirical analysis, we assimilate the equation (6) forward from t-1 to t and find:

$$\ln y(t) = e^{\psi} \ln(t-1) + (1 - e^{\psi}) \ln y^*(t) \tag{7}$$

where $\psi \equiv (\alpha - 1)(n+g+\delta)$

By the use of equations (2), (4) and (7), y is observable per-capita income y =Y/AL via:

$$\ln y(t) = e^{\psi} \ln y(t-1) + (1 - e^{\psi})\left[\ln A_o + \frac{\alpha}{1-\alpha}\ln s - \frac{\alpha}{1-\alpha}\ln(n+g+\delta)\right]$$

$$+\eta \ln ms(t) + e^{\psi}\eta \ln ms(t-1) + (t - (t-1)e^{\psi})g + \lambda \ln ineq(t) \tag{8}$$

It is worth mentioning that in the steady state per-capita income changes in accordance with:

$$\ln y^*(t) = \ln y^* + \ln A_o + \eta \ln ms^* + \lambda \ln ineq^* + gt \tag{9}$$

We can estimate the following model based on equation (8):

$$\ln y(t) = \beta_0 + \beta_1 \ln y(t-1) + \beta_2 \ln s + \beta_3 \ln(n+g+\delta) + \beta_4 \ln ms(t) + \beta_5 \ln ms(t-1) + \beta_6 ineq + \mu \tag{10}$$

where:

ln y(t) = ln of GDP per-capita (dependent variable)

ln s = ln of saving ratio (using gross fixed capital formation to GDP as a proxy)

ln(n+g+δ)= ln of labor force growth rate + 0.05

ln(*ms*) = ln of share of military spending in GDP (Military Burden)

ineq= inequality index (measured by Gini coefficient)

DATA AND METHODOLOGY

The data used for this study ranging from 1972 to 2016 have been acquired from two sources. The data on GDP, gross capital formation, military spending are obtained from World Development Indicatorswhile the data of labor force, Gini coefficient and population are taken from Pakistan economic survey (various issues). The study employs the methodology of Generalized method of Moments (GMM) to estimate the equation (10) in order to resolve the issue of endogeneity which is evident in the model.

V. RESULTS AND DISCUSSIONS

Table 1 presents the results of Durbin Wu Hausman (DWH) endogeneity test.

TABLE 1

Durbin Wu Hausman (DWH) Test

Variable	Chi-Sq. Statistic	d.f	Prob.
$COV(X,\mu)\neq 0$	0.4970	2	0.7799

Source: Authors' own calculation

The results of Durbin Wu Hausman (DWH) Test indicate that we fail to reject null hypothesis of OLS estimators are consistent and efficient as compared to instrumental variables.

Table 2 presents the results of the estimates of equation (10) which shows the influence of defense outlays and income inequality on economic growth in the framework of augmented Solow growth model with Harrod-neutral technology. Variables of interest for the study are

inequality and military expenditures whereas as other mediating variables are also used to interpret this relationship.

It is evident from the table that the coefficient of $Y_{(t-1)}$ i.e. one period lag of log GDP per-capita is positive and high significant. It means that the impact of previous GDP per capita has a positive bearing on current level of GDP. It is based on the theory of multiplier accelerator interaction which postulates that increasing GDP in one period proceed on its effects to the next period based on the interaction of multiplier and accelerator up to a certain time. But this result is in contrast with the earlier findings of (Dunne and Nikolaidou, 2011;Tongur and Elveren 2014).

TABLE 2

GMM based Results of Military Spending and Inequality

Explanatory Variables	Dependent Variable: ln(Y)			
	Coefficient	Std. Error	t-Statistic	Prob.
C	2.042510	1.282971	1.592015	0.1209
ln $Y_{(t-1)}$	0.950966***	0.074167	12.82193	0.0000
ln s	0.073255	0.166636	0.439614	0.6631
ln(n+g+δ)	-0.484160*	0.263010	-1.840846	0.0747
ln ms	0.874147*	0.488591	1.789119	0.0828
ln $ms_{(t-1)}$	0.669174*	0.396330	1.688426	0.1008
Ineq	-0.482215	0.250780	-1.922855	0.0751
R-squared	0.994925	Mean dependent var		9.435503
Adjusted R-squared	0.994002	S.D. dependent var		1.310389
S.E. of regression	0.101483	Sum squared resid		0.339859
Durbin-Watson stat	1.907810	J-statistic		0.029779

Source: Authors' calculations

*Level of significance represented: 1 % by ***, 5% by **, 10% by **

The gross fixed capital formation to GDP ratio shown as lns is having positive sign although insignificant hence can be ignored. The coefficient of (n+g+δ) representing augmented labor-force growth rate appears with negative sign at 10 percent significant level. The result of this coefficient is in consonance with the findings of the Dunne and Nikolaidou, 2011; Tongur and Elveren 2014. The negative correlation explains that physical capital per worker falls because of increasing population that hinders growth (Mankiw et al., 1992).

The coefficient of the military spending i.e. lnms is the main variable of interest for this study. It also represents the military burden of a

country. The coefficient is positive and significant which means that military spending is casting positive impact on growth of the country like Pakistan. There is a sound theoretical reasoning for such findings in the literature of defense economics. There are two types of spin off effects of military spending on growth (Deger, 1986a): one is direct and the other one is indirect. The direct spin off work through the effects of military spending on physical and social infrastructure and it ultimately accelerates growth. Military is so resourceful in case of Pakistan that it is serving in almost all sectors in parallel with civilian sector. For example, CMH, army welfare trust, Askari bank, fouji foundation, NLC and FWO for road constructions. The indirect path of spin off operates through modernization effect. Military sector is highly engaged in research and development activities through investing in human capital. It is also providing technical support to civilian sector. These modernization effects are made operational through educational institutions working under military sector for example, National University of Science and Technology (NUST), Military colleges, Army Public School and Federal colleges etc.

Deger (1995) further supported the positive bearing of defense outlays on economic growth through creation of new resources which thrives on the bed rock of security. It means higher defense spending result in peace and security that may invite foreign and domestic investment resulting in new resource creation and growth.

The socio-politico and religious services provided by military sector to civilian sector in Pakistan is an additional contribution for enhancing growth such as duties in election, Muharram, de-silting operations, census, natural disasters, rehabilitation of IDPs and monitoring of various departments (WAPDA, Railways).

The positive finding of military spending and growth of this study is in line with the findings of the other researchers i.e. Benoit,1973; Ram, 1986; Atesoglu and Mueller,1990; Ward et al., 1991; Biswas, 1993; Macnair et al., 1995; Alexander,1995; Murdoch et al, 1997; Ramos, 2004; Sachin and Cetinkaya, 2010; Sheikh, 2014 and Sheikh and Chaudhry,2016.

It should not be mistakenly assumed that military spending should be focused only to enhance growth in developing countries but it is specially

in Pakistan where military has been dominant in economic process and acquired so much skills and resources which resulted in it economic growth over time. The other important variable of the study is inequality. It appears in the model with negative sign suggesting that inequality is dampening down Pakistan economic growth due to the reasons given in Non-Median Voter Models, sociopolitical instability, factor shares and reforms arguments. The result for this coefficient is in line with the findings of the earlier studies.

VI. CONCLUSIONS AND POLICY IMPLICATIONS

The study is an attempt to explore the relationship among military spending, income inequality and economic growth. The newness of this study is that it incorporates inequality in the constraints of the augmented Solow growth model with Harrod-neutral technology which is applied primarily in Pakistan. Secondly, this study develops the framework for inequality and growth in the presence of defense spending and its economic outcomes. Hence, the triangle of defense, inequality and growth has been estimated for the first time in Pakistan and rarely in defense economics internationally.

The findings of this study are focused on two variables i.e. military spending and inequality. The result for military spending is according to the hypothesis of the study. The findings are consistent with the findings of the earlier studies. Inequality is found to be significant and negative.

Augmented Solow growth model for defense expenditures supports the hypothesis that defense expenditures enhance the economic growth through technological spin offs, positive externalities and infrastructural facilities for Pakistan. Hence, the suggestion from the findings of the study is that Pakistan should continue to spend more on defense sector to make its complementary effects on growth. Pakistan has noteworthy defense industrial base for example, Heavy Industries Taxila (HIT), Pakistan Ordinance Factories (POF), Pakistan Aeronautical Complex (PAC) Kamra, Pakistan Navy Dockyard (PND), Karachi Shipyard and Engineering Works (KSEW). The industrial base of Pakistan is substantial, growing and inclined to technologically advance production. It has spillover effects on the growth through provision of the infrastructural base, research and development initiative and implanting of sophisticated technology in production sectors. In addition, the defense

sector also provides health, education, transport and communication and other social sector related services in Pakistan that lead to economic growth. On the basis of above mentioned grounds, the governments have the justifications to spend more on defense sector. The findings of this study has also supported the hypothesis of new resource creation which suggests that defense expenditures through inflationary process enhances economic growth especially in a resource constrained economies like Pakistan.

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