

## Revisiting the Relationship between Military Expenditure and Economic Growth in Pakistan

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### Abstract

*This study aims to examine relationship of military expenditure and economic growth in different phases of military regimes in the context of Pakistan. This study uses two-state Markov switching models with Constant Transition Probability (CTP) and Time Varying Transition Probabilities (TVTP) for the time period: 1973-2014. This investigation analyses two sorts of relations between military expenditures and economic development through fixed transition probability Markov exchanging models. To begin with, there is negative connection between GDP growth and military expenditures during a high variance state (i.e. having low economic growth). Second, there is positive relation between both variables, during low variance state (i.e. having higher economic growth) which is also supported by idea of Keynesian income multiplier. Another, empirical test of time varying transition probability model was used to capture the switch through indicator variable. Results of the study suggest that chances of switching are increased from low to high economic growth. The chances of switching increase from lower to higher economic growth period (or high variance period) if non-military expenditure increases. The study concludes that military expenditure and economic growth are state dependent. If conditions of economy are stable then increase of expenditure results in positive outcomes, otherwise, it affects negatively. Empirical findings suggest that military spending should be planned in accordance to the economic performance of the country.*

**Key Words:** Military expenditure, Economic growth, Markov switching models, Keynesian income multiplier.

### Introduction

Literature suggests that government expenditure has positive impact on long run economic growth, nevertheless these effects on economic growth is mixed, depending on size and different component of government spending. The studies that found positive relationship between public goods (open foundations, innovative work and government funded instruction) and financial development incorporates (Ram, 1986; Aschauer, 1989; Barrow, 1990; Morrison and Schwartz, 1996). On the contrary, (Glomm, 1997) was of the view that

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government expenditure and economic growth are negatively related because of greater proportion of non-productive spending in government expenditure. However, the empirical findings of (Devarajan *et al.* 1996) did not support the theory that a higher steady-state growth rate of the economy is achieved through productive government spending.

The military expenditure share of government spending also has important implications for determining long run economic growth. The endogenous growth theory is the basis for the connection between military consumption and economic development, anticipating that the relationship remain positive for optimal defence spending (Shieh *et al.* 2002). Theory argues that whether military spending has positive or negative effect on economic development depends on the comparison between its direct and indirect cost and benefits. The benefit is expected to be greater than the cost if the share of military spending is small as compare to aggregate government spending and hence have a positive impact on economic growth (Deger & Sen, 1995).

However, it is important to discuss here that modelling the relationship between military expenditure and economic growth linearly is mis-specified and hence the empirical analysis might be biased (Stroup & Heckelman, 2001; Cuaresma & Reitschuler, 2003; Aizenman & Glick 2006; Dunne & Perlo-Freeman, 2003; Collier & Hoeffler, 2004). The reason for nonlinearity in military expenditure stems from the fact that military expenditure provide security, prompting theory that the impact of each extra unit change in military spending isn't steady crosswise over factors and economies which brings about a few development administrations in extraordinary cases.

In Military Keynesianism, military expenditure is part of government expenditure and is utilized as a fiscal apparatus to cure macroeconomic fluctuation. In the defence spending-Growth nexus literature, different relationship are established but the interesting one is that pointed out by (Benoit, 1978) that defence spending and economic growth are directly related. Although economist discussed the relationship between military spending and economic growth extensively, even then they did not find specific bearing of causality between these two factors.

The role of military expenditure is different in different types of theoretical model. Though different theories might be right at different times, it depends on the asymmetric response of GDP growth to military spending as a result of whether the economy is in boom or recession periods. This is identified in the prevailing literature that military expenditure effect economic growth through many channels. Military spending increase aggregate demand by inducing output and employment through Keynesian multiplier tool particularly in the season of high unemployment. Military consumption may influence economic development negatively by moving without end resources from private sector which has the effect of crowding out private investment and impede

economic growth (Sandler & Hartley, 1995; Benoit, 1978). Some studies conclude that the two series are not related significantly (Galvin, 2003; Yildirim et al. 2006).

It is moreover fought that higher military spending implies better security and peace circumstance in home nation which advance exchange and speculation and along these lines beneficial outcome on development. Military division in any economy got significant consideration by dedicating substantial measure of spending plan to this part. There exist high positive relationship between military spending and monetary development over the long haul (Ram, 1995), on the other hand a few has the view that it will prompt war. The negative result of military use on monetary development is likewise supported on the ground that it requires higher duty gathering to back higher military spending and will in this way hinder the economic development.

Keeping in view the above contrasting opinion about the connection between economic development and military spending, the contribution of the proposed study to the existing literature is based on the examination of the relationship in these two variables. This study uses the regime switching framework for Pakistan analysing the periods 1973 to 2014. The association between military spending and economic growth got much care in recent years (Anwar et al, 2012; Shahbaz et al, 2012; Haseeb et al. 2014). It is noteworthy that most of the studies relating to Pakistan assumed linear relationship and constant parameters. But the case is different in Pakistan as the economic system in Pakistan experienced different policies during different political and autocratic regimes. The high growth periods were the military periods (6% growth on average) while the democratic periods show relatively lower growth (on average 4%) which can have serious implications for the estimation results.

Late investigations built up that the impacts of military consumption on total financial movement are absent after some time but rather advance in a stochastic way (Ali & Dimitraki, 2014). This investigation will add to the writing by experimentally break down the effect of military spending on financial development of Pakistan, utilizing the Markov administration exchanging model. The upside of the chose econometric model is that, it will endogenously distinguish the high and low development periods from watched information, without forcing any from the earlier data. Specifically this system will distinguish the low and quick development states and furthermore the low and high instability of development rate as military spending plan may not be the same in the midst of recessionary and expansionary periods. In this way the genuine effect of military spending on financial development can be expose that will help in better approach making for what's to come.

Whatever is left of the investigation is sorted out as takes after. Segment 2 talks about the economic development and defence spending in Pakistan, area 3 surveys the writing comprising of both the hypothetical and experimental

investigations. The fourth segment plans procedure embraced in the examination. Graphic investigations and elucidation of results is given in section five. At long last, part 6 finishes up the examination.

## **Macroeconomic Performance of Pakistan during Military Regimes**

Political regimes in Pakistan remain dominant to influence the economic outcomes significantly. Among these regimes the autocratic regimes shows good economic performance characterized by healthy growth than in democratic regimes and controls on public expenditure. On the other hand democratic regimes were characterized as macroeconomic instability and the result is slow economic growth.

Table 1 outlines the relative execution of chose macroeconomic factors crosswise over various political administrations. The autocratic regimes witnessed 6 percent growth rate per annum on average, which is approximately 2 rate focuses higher than the normal development rate seen amid democratic administrations. In every dictatorial administration, normal financial development stayed over 5 percent, while this average economic growth rate remained in the range of 2 and 5 percent during democratic regimes. Similarly, growth in Per capita income during autocratic regimes outperformed the same in democratic eras: average annual growth of GDP per capita remains high as 3.4 percent as compared to democratic regimes which is 1.2.

**Table 1: Regime Wise Economic Performance in Different Sector**

	1971-1977	1977-1988	1988-1999	1999-2007	2008-2013
Real GDP growth	3.9	6.6	4.5	5.2	3.3
GDP per capita(MP growth rate)	0.98	3.93	1.32	2.9	1.4
Expenditure(% of GDP)	25.1	24.9	24.1	19	20.11
Economic aid, US\$(million)	3755.5	4417.7	1555.1	4264.8	1998.55
Military Aid, US\$(million)	5.1	2935.4	612.5	3786.34	3344.8
Per Capita Aid, US\$(million)	56.81	78.29	19.13	49.9	21.2*

Source: The statistics on first 3 variables are taken from different economic survey of Pakistan, while the figures on remaining three variables are taken from U.S. Overseas Loans and Grants [Green book] and US Assistance per Capita by year.

\* The figure is calculated from economic survey of Pakistan from 2008 to 2012.

In short all economic indicator show better performance during autocratic regimes as compare to democratic. It is also evident from the table that the flow

of economic aid, military aid and per capita aid is greater in autocratic regimes.

## **Literature Review**

In late decades the association between safeguard utilize and money related improvement is talked about broadly both hypothetically and empirically. This examination explores the impact of military utilizations on pay unevenness in Pakistan using data over the season of 1972– 2012. Consequently, we associated as far as possible testing co-reconciliation approach which avowed the proximity of long-run concordance association between military utilize and wage difference. In addition, observational examination shows that military spending decidedly influences compensation uniqueness. The examination of Granger causality, Toda– Yamamoto Modified Wald test and distinction disintegration approaches attest the closeness of unidirectional causality running from military use to wage dissimilarity. The revelations of our examination suggest that higher military utilization prompts higher wage lop-sidedness in Pakistan. In this way, we provoke the system makers to focus more on the methodologies which can assemble the money related activities in the country and definitely lessen pay irregularity (Reddy, Shahbaz, & Raza). This article precisely researches the effect of military spending on outside commitment, using a case of ten Asian countries during the time from 1990 to 2011. The Hausmann's test suggests that the unpredictable effects show is perfect; regardless, both sporadic effects and settled effects models are used as a piece of this investigation. The observational results exhibit that the effect of military spending on external commitment is sure, while the effects of remote exchange holds and of fiscal advancement on external commitment are negative. For making countries got in security bind, military utilize consistently requires a development in external commitment, which may impact money related headway conflictingly (Azam & Feng). There exist a few restricting speculations clarifying the connection between military consumption and financial growth. From one perspective, the crowding out impact comes about when assets are exchange from non-military faculty to the military part, and afterward once more, useful externalities are made in the casing establishment, human capital improvement (instruction, preparing) and mechanical degrees of progress (Ram, 1995) by military spending (especially in creating economies). A beneficial outcome of military utilization on money related development is in like manner elucidated by some other channel, as showed by which military experiencing renders a country with security (both inside and outside) which in this manner attracts remote examiners, particularly those of whole deal wander outlines (Benoit, 1973). Specifically in developing economies, the influential work of (Benoit's, 1978), find a positive relationship between military expenditure and economic growth. This influential work is criticised in many empirical studies to challenge his findings. Diverse

hypothetical and methodological systems including, distinctive sample periods, different topographical territories and high-low development or non-conflict and conflict states were utilized to talk about the issue.

Military spending and aggregate economic activity in developing economies is observed to be not significant (Deger & Sen, 1995) while in advanced economies this relationship proves to be somewhat more grounded and negative (Kollias *et al.*, 2007). On the whole, there exist contrast view in evaluating the relationship between military expenditure and economic growth. Some studies find that military expenditure is positively related to growth (Chester, 1978; Weede, 1983; Chowdhury, 1991; Kusi, 1994) while the studies that find negative relationship between the two are (Sandler & Hartley, 1995; Knight *et al.*, 1996; Heo, 1999; Shieh *et al.*, 2002), others determine that there is no obvious relationship between the two variables (Wallace, 1980; Lindgren, 1984; Majeski, 1992; Mintz & Stevenson, 1995). The prevailing empirical findings with reference to Pakistan are also mixed and are reported in Table 3 below.

**Table 2: Review of the empirical Literature from Pakistan**

Author(s)	Period	Methodology	Findings
Reddy.S, Shahbaz.M & Raza.A	1972 to 2012	ARDL Bound Testing Co- integration Approach	1-ARDL limits testing co-integration approach which affirmed the nearness of long-run harmony connection between military use and wage disparity 2-Moreover, observational examination demonstrates that military spending positively affects salary disparity 3-The examination of Granger causality, Toda–Yamamoto Modified Wald test and difference deterioration approaches affirm the nearness of unidirectional causality running from military use to wage disparity.

Khilji and Mahmood (1997)	1972-1995	Granger Causality Test	1) Proof of bidirectional causality between military spending and financial improvement is found  (2) military spending has negative effect of financial improvement and Indian security spending has negative effect on Pakistan protection spending
Khan (2004)	1951-2003	Johansson Co-integration and Vector Error Correction Model (VECM)	There exist long-run relationship among variables (2) Military Keynesianism Hypothesis does not hold in Pakistan and long-run economic growth is not effected by defence spending
Shahbaz <i>et al.</i> (2012)	1972-2008	ARDL bound testing approach	There exist a stable long run connection between military spending and economic development
Anwar <i>et al.</i> (2012)	1980-2010	Johansson Co-integration and Granger Causality Test	(1) Long run relationship exist between defence spending and economic growth (2) Causality running from economic growth to defence spending
Haseeb <i>et al.</i> (2014)	1980-2013	ARDL bound testing approach	(1) Military expenditure and economic growth is positively related (2) Military Keynesian hypothesis does not hold in Pakistan
Nasir and Akhtar (1997)	1972 to 1995	Granger causality	Bi-directional causality exist between military consumption and financial development.

For the most part the previously mentioned investigations utilized direct models to review the association between military utilize and monetary improvement. In this manner, its changing outcomes might be a direct result of straight models and distinctive examples selected (Hendry and Ericsson, 1991). The exact discoveries of (Barro, 1990; Giavanni et al., 2000) set up with sureness that nonlinearity are connected with financial factors i.e. government spending, assesses, the general size of shortfall. Besides, the wrong conclusion could be drawn from the linkages between military spending and financial development, if the nonlinearity isn't considered while contemplating the connection between the two (Pieroni, 2009). The nonlinear relationship between military expenditure and economic growth

around the world is empirically analysed by a number of studies including (Kinsella, 1990; Landau, 1993; Hooker & Knetter, 1997; Heo, 1998; Stroup & Heckelman, 2001; Gerace, 2002; Lai *et al.* 2005; Aizenman & Glick, 2006; Cuaresma & Reitschuler, 2006; Yakovlev, 2007; Yang *et al.* 2011). The proposed study, is aimed to analyse the nonlinear relationship between the two factors in Pakistan utilizing the Markov-regime switching specification.

**Table 3: Review of the empirical Literature around the world**

Authors	Models	Time Span of Study and Region	Conclusion
Azam. M & Yi Feng 2016	Random Effect Model	1990 to 2011 Asian Countries	The Hausman's test recommends that the irregular impacts display is ideal; notwithstanding, both irregular impacts and settled impacts models are utilized as a part of this exploration. The observational outcomes demonstrate that the impact of military spending on outer obligation is certain, while the impacts of remote trade holds and of monetary development on outer obligation are negative.
Jording .W (1986)	Causality	1962 to 1977 DCs (57)	As compare to economic growth military expenditure is somewhat endogenous. The study suggest for a simultaneous equation model or more dynamic analyses to understand the relationship between the two variables.
Karagol, E. and Palaz S. (2004)	Causality	1955 to 2000 (Turkey)	The investigation inferred that the causal association between military spending and monetary advancement is either a result of misallocation of assets or the assets spent on protection use is ineffective.
Yildirim, J. and Ocal, N. (2006)	Causality	1949-2003 (India and Pakistan)	The study find the arms race between India and Pakistan for the given sample period. Since Pakistan is smaller in size that India, the responsible forces for slow growth in both the countries is arms race.



Chen (1993)	Co-integration and Causality	1950–1991 (China)	The examination neither one of the founds long run connection between the two factors through co-integration nor causal relationship through Granger causality test.
Dimitraki and Menla Ali (2013)	Co integration and weak exogeneity tests	1952–2010 (China)	The investigation discovered long run connection amongst military and economic development alongside some control factors. Encourage it is gotten from the investigation that expansion in military consumption is caused by economic improvement.
Dimitraki and Menla Ali (2014)	Markov switching model	1953 to 2010 (China)	The study uses the Markov regime switching technique and conclude that military spending effect economic growth nonlinearly i.e. positive effect in faster growth (lower variance state) and negative effect in slower growth (high variance state).
Frederiksen and Looney (1983)	Benoit's sample and model with breakup in sub-samples	24 resource-abundant countries, and group of 9 resource constrained countries.	The asset rich nations has positive effect on financial development while asset compelled nations has negative impact on monetary development.
Alexander (1990)	Feder-type 4-sector model	9 DCs, 1974-1985.	Economic growth and military expenditure are related.

## Methodology

### The Markov-Switching Model

The point of this examination is to break down the connection between military spending and financial development in a nonlinear way for Pakistani data covering the period from 1973 to 2014. The (Hamilton, 1989) technique of Markov regime switching is likely to be an appropriate technique to look at the economic development in various administrations. This technique assumes that the time series switches from one regime to another regime randomly and the

parameters are estimated through maximum likelihood methods. This technique assumes the likelihood of changing starting with one administration then onto the next administration as constant. Linear dependency and constant parameters are assumed by a large portion of the current exact examinations (Chen, 1993; Masih et al., 1997; Wolde-Rufael, 2001) however this is not the situation in Pakistan, as economic framework in Pakistan experienced auxiliary changes in the light of strategy upgrades. The non-linear relationship between military spending and economic growth are investigated by a number of studies (Stroup & Heckelman 2001; Aizenman & Glick, 2006; Kalaitdakis & Tzouvelekas, 2011).

Particularly with reference to Pakistan the non-direct reliance between these two factors got less consideration. Consequently the organization trading association between growth related improvement and military spending will add to the present writing. This consider exhibited that the effect of military utilization on improvement in yield can be better depicted through time moving change probabilities (TVTP) Markov organization trading model displayed by (Filardo, 1994). This model represents the extra data about when a specific administration has happened by joining the money related time arrangement information to the customary MS model.

In particular this model has the characteristic that it systematically identifies the variation in the transition probabilities before and after the happening of the inflection point. Since the effect of military spending on economic activity is different during different phases of business cycle so it is necessary to monitor the country's economic activity by a leading indicator. Now which variable contain sufficient information to explain time varying transition probabilities (TVTP) as opposed to constant transition probabilities (CTP) is a theoretical question. Different studies used different indicator variables. The informational variables suggested in the growth literature by (Barrow 1990) is explicitly changes in non-military expenditure, changes in government investment, growth in population and human capital.

If the observed series (military expenditure and GDP growth) in Markov-switching model is generated through nonlinear process then the economy is in different state depending on whether military spending effect aggregate economic activity positive or negative. If military expenditure affect aggregate economic activity positively then it means the economy is in high growth period and the low growth period is when aggregate economic activity are negatively affected by the military spending. Therefore this research consider model with only two regime i.e. the low development administration and the high development administration.

In order to capture these low and high growth periods the regime switching models then needs a law which is responsible to control the transition from one regime prevailing at time  $t$  to another regime occurring in next period. If there is evidence of persistence in regime, once a regime changes then these

transition probabilities depends on past values of itself. This type of data generating process assumes that the unobservable variable  $s_t$  follows a Markov chain process. The basic assumption in Markov regime switching model is that the transition probabilities at any time are related to the past only through the most recent realization of regime at time  $t - 1$ .

The unobservable variable  $s_t$  in the framework of Hamilton takes after a first request two-state Markov handle with move probabilities given underneath

$$\Pr(s_{t+1} = 0/s_t = 0) = P^{00} \tag{1}$$

$$\Pr(s_{t+1} = 1/s_t = 0) = 1 - P^{00} = P^{01} \tag{2}$$

$$\Pr(s_{t+1} = 1/s_t = 1) = P^{11} \tag{3}$$

$$\Pr(s_{t+1} = 0/s_t = 1) = 1 - P^{11} = P^{10} \tag{4}$$

Where

$$\sum_{j=1}^M p_{ij} = 1 \text{ for all } j \in \{1 \dots M\} \tag{5}$$

i.e.  $P^{00} + P^{01} = 1$  and  $P^{11} + P^{10} = 1$

The above 2-state Markov process is written in matrix notation as follows:

$$P = \begin{bmatrix} P^{00} & P^{10} \\ P^{01} & P^{11} \end{bmatrix}$$

It is assumed here that each element of this matrix i.e.  $p_{ij}$  is less than one so that the regime is persistent rather absorbent. Equation (1) through (5) records the probabilities of being in either of the two regimes conditioning on the previous period. For example,  $P(s_{t+1} = 1/s_t = 1)$  is the probability of high growth regime in time  $t$  given that economy was in a high growth regime in the previous period ( $s_t = 1$ ) is a constant  $P^{11}$ . Likewise, the probability of a high growth regime on date  $t$ , given a low growth in the previous period is a constant  $P^{01}$ .

### Transition Probabilities: constant or Time-Varying

If the effect of military spending on aggregate output growth is subject to regime change then the transition probabilities is time variant rather than time invariant. In other words the transition probabilities are associated with some informational variables which contain sufficient information as to anticipate shift in regime and hence worked as leading indicator for the unobserved regimes. This leading indicator will endogenize the Markov regime switching process (Kim, 2003). The application of Expectation Maximization (EM) algorithm to the TVTP case is perceived by the choice of leading indicator. It is shown by (Filardo, 1998) that the conditional exogeneity between the informational variables and the stochastic regime induce that EM algorithm is the valid technique to estimate the parameters in Markov switching model with time varying transition probabilities (TVTP).

It is assumed here that the conversion from one regime to other depends on informational variable  $z_t$  such that  $P\{s_t/s_{t-1}\} = P\{s_t/s_{t-1}, z_t\}$ . Therefore the transition probabilities in the Markov process might be time dependent and is modelled as logistic function of the informational variable.

$$S_t = \begin{cases} 0, & \text{low growth} \\ 1, & \text{high growth} \end{cases} \quad (6)$$

$$\begin{cases} P_{00}(z_t) = \frac{\exp(a_0+b_0z_t)}{1+\exp(a_0+b_0z_t)}, & P_{11}(z_t) = \frac{\exp(a_1+b_1z_t)}{1+\exp(a_1+b_1z_t)} \\ P_{01}(z_t) = 1 - P_{00}(z_t), & P_{10}(z_t) = 1 - P_{11}(z_t) \end{cases} \quad (7)$$

Where  $P_{ij}(z_t)$  is the probability of switching from state I to state j conditional on the dynamics of the transition variables. The likelihood of a transition from regime one to two may increase or decrease depending on the positive or negative coefficient of the variable  $z_t$  i.e.  $b_1 > 0 (< 0)$ . A similar interpretation applies to the coefficient  $b_2 > 0 (< 0)$  when there is a transition from regime 2 to 1. The advantage of the above illustration over the conventional Markov switching model is that the transition probability varies over time with respect to  $z_t$ . By enabling the progress probabilities to change extra time, we can show the mechanics fundamental move from low development periods to high development administration unequivocally.

The non-linear impact of military spending changes on economic growth is investigated in this study for Pakistan covering the period 1973 to 2014. In particular, the Markov regime economic growth in different regimes, i.e. the mean and variance of economic growth is allowed to vary in different states (periods of contraction and expansion). The determination of the model is as per the following:

$$y_t = \mu_{st} + \sum_{i=1}^2 \phi_i y_{t-1} + \beta_{st} x_{t-1} + \lambda' z_{t-1} + \varepsilon_t \quad (8)$$

$$\varepsilon_t \sim N(0, \sigma_{st}^2)$$

Where  $y_t$  is economic growth and  $x_{t-1}$  is the military spending changes, while  $\varepsilon_t$  is white noise term. The informational variables suggested in the growth literature is represented by  $z_{t-1}$ , explicitly changes in non-military expenditure, changes in government investment, growth in population and human capital, the coefficient of which is  $\lambda_1, \lambda_2, \lambda_3$  and  $\lambda_4$  respectively. We also took two lags of Auto regressive terms in order to capture the possible persistence in conditional mean of economic growth.

Generally in Markov regime switching models the parameters (i.e.  $\mu_{st}, \sigma_{st}^2$  and  $\beta_{st}$  in our case) is a function of unobservable state variable  $s_t \in$

$\{1, \dots, M\}$ , which signify the probability of presence in a specific state of the world. The constant transition probabilities related with each regime that follows a first order Markov process is defined as follows.

$$\Pr(s_t = j / s_{t-1} = i) = p_{ij} \quad (9)$$

The smoothed probability of the random variable  $s_t$  is the likelihood of being in state  $j$  in light of the data contain in the entire perceptible arrangement i.e.  $\Pr(s_t = j / y_1, \dots, y_T)$ . We estimate different specification of Equation 1, specifically the transition probabilities were allowed to depend on the informational variables  $z_{t-1}$ . This time varying transition probabilities (Filardo, 1994) in particular examine that regardless of whether military spending changes convey any proposal about the move probabilities related with exchanging between development states. In this case the growth transition probabilities are modified as follows.

$$p_t^{11} = \frac{\exp(a_0 + b_1 z_{t-1})}{1 + \exp(a_0 + b_1 z_{t-1})} \quad (10)$$

$$p_t^{22} = \frac{\exp(\gamma_0 + \gamma_1 z_{t-1})}{1 + \exp(\gamma_0 + \gamma_1 z_{t-1})} \quad (11)$$

Where  $P_{ij}(z_{t-1})$  is the probability of switching from state  $I$  to state  $j$  conditional on the dynamics of the transition variables. The likelihood of being staying in state 1 is increasing if  $b_1 > 0$ . Similarly the probability of being staying in state 2 is decreasing if  $\gamma_1 < 0$ .

A few steady parameter models for examination designs are assessed utilizing OLS which is frequently find in literature is written as follows.

Without exogenous variable model:

$$y_t = \mu + \sum_{i=1}^2 \phi_i y_{t-i} + \varepsilon_t \varepsilon_t \sim N(0, \sigma^2) \quad (12)$$

A model in which growth depends only on military spending changes:

$$y_t = \mu + \sum_{i=1}^2 \phi_i y_{t-i} + \beta x_{t-1} + \varepsilon_t \varepsilon_t \sim N(0, \sigma^2) \quad (13)$$

A model which include both military spending changes and information variables:

$$y_t = \mu + \sum_{i=1}^2 \phi_i y_{t-i} + \beta x_{t-1} + \lambda' z_{t-1} + \varepsilon_t \varepsilon_t \sim N(0, \sigma^2) \quad (14)$$

The details about estimation and data are given in next section.

The most extreme probability gauge of the model parameter will be acquired by the desire expansion (EM) algorithmic govern, proposed by (Hamilton, 1990) after (Diebold et al., 1994). This technique begins with the underlying assessments of the shrouded data and iteratively produces a joint dissemination that will expand the likelihood of watched data. When all is said in done, the EM calculation boosts the deficient information log probability by means of the iterative augmentation of the normal finish information log probability, contingent upon the detectable information. Given the watched information and some underlying assessment of the parameters in the model, the EM calculation starts by ascertaining the smoothed state probabilities. With the evaluated smoothed state and move probabilities, the normal finish information log

probability work is developed. This is the "E", desire some portion of the calculation. The normal finish information log probability work is then expanded to get a refreshed parameter appraise. This is the "M", enhancement part of the calculation. Using this refreshed gauge, and the smoothed probabilities are computed again and substituted into the normal probability work, which is amplified once more. This method is rehashed until the point that union (in the parameter gauges or the probability work) is acquired.

### **Empirical Results**

For display estimation yearly information of Pakistan over the period 1973 to 2014 is utilized. The information are gotten from the accompanying sources. The genuine GDP development rate is gotten from financial review of Pakistan different issues. The information on Population development, government venture and file of human capital is gotten from pen world tables, while military spending information is gathered from financial study of Pakistan different issues.

The descriptive states of the data are provided in table 4 below. The lowest average is of military expenditure (4.09) followed by economic growth (5.03). The fourth column of the table 4 report absolute variation of the series in which military expenditure has the lowest absolute variation (1.55) while economic growth has absolute variation of (2.17). The relative variation is given in last column of the table 4 in which the less volatile series is military spending (0.37) as compare to economic growth (0.43). The military expenditure series is not normal because the null hypothesis of normality is rejected for the series while the economic growth series is normally distributed. Military spending has relatively right tail (positively skewed) as well as lower degree of kurtosis (platykurtic) as compare to economic growth.

**Table 4: Descriptive Statistics**

Variables	Mean	Median	Std. Dev.	Skewness	Kurtosis	Jarque-Bera	prob	$(\sigma)/(\mu)$
Military spending	4.09	3.48	1.55	0.81	2.32	5.29	0.07	0.37
Economic growth	5.03	4.80	2.17	-0.58	3.37	2.56	0.27	0.43

The standard unit root test is applied on each series and the result is reported in table 5. Before proceeding for further analysis of time series a standard unit root test is conduct for each series. The standard Augmented Dickey Fuller unit root test results is given in table 5 which reject the null hypothesis of unit root. Hence, it is evident that all the series are integrated of order zero,  $I(0)$ . In all series, correlation in residuals vanish at lag one of the equation under consideration.

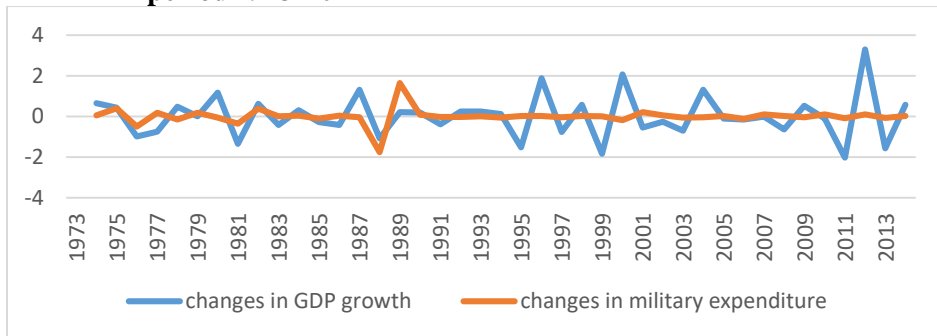
**Table 5: Unit root test result**

Military spending changes	Economic Growth
Without trend -4.83 (0.00)	-6.73(0.00)
With trend -6.38 (0.00)	-6.60 (0.00)

Note: The p-values are given in parenthesis which is highly significant and rejecting the null of unit root in each case.

The yearly pattern in economic development and military spending changes is shown in Figure 1 amid the investigation time frame. It is evident in this assume both the arrangement coming back to their mean esteem affirming that the arrangement are covariance stationary.

**Figure 01: Economic growth and military spending in Pakistan over the period 1973-2014**



Source: Economic survey of Pakistan various issues

In modelling Markov switching models the initial step is to test non-linearity in the regression in order to confirm whether Markov regime switching model is appropriate or not. The likelihood ratio test is not valid because of the nearness of annoyance parameters when testing the invalid theory of linearity against the nonlinearity. This problem was recognized by (Hamilton, 1998) in his influential work on Markov switching models however (Hansen, 1992) cured this problem

in detail. Hansen pointed out that the nuisance parameters  $P_{00}$  and  $P_{11}$  is not identified under the null hypothesis. These nuisance unidentified parameters make the quasi-log-likelihood function flat and so there is no unique maximum. Also when there are aggravation parameters under the invalid then the invalid speculation delivers a neighbourhood ideal or emphasis point. In these conditions, the asymptotic conveyances of the typical tests (probability proportion, Lagrange multiplier, Wald tests) are non-standard. Therefore (Hansen, 1992) proposed a standardized likelihood ratio test which account for such problems. The Hansen standardized LR is applied in this research to military expenditure and economic growth to test for nonlinearity. The results (see Table 6) indicate that the null of one state is rejected in all cases against two states. Thus the Hansen test provide evidence for the two-regime shifting representation in modelling the relationship between these two variables.

**Table 6: Standardized LR test for MSI(2) against null of linearity**

Variables	Hansen's LR Test	P-Value				
		M=0	M=1	M=2	M=3	M=4
Military spending	2.5342	0.016	0.015	0.014	0.011	0.003
Economic growth	2.6534	0.088	0.082	0.067	0.081	0.057

The results of linear models are given in Table 7, where in column 1 the results of (Equation 12) OLS without exogenous variables are given. The second and third column in table 7 gives the results of equation 13 and 14 by including military spending and control variables respectively.

The OLS brings about section 3 are translated as a one unit change in military consumption conversely impacts money related improvement in Pakistan. By including the control factors the aftereffects of the expanded development condition is given in segment 4 of Table 7. It is seen that the impact of control factors (non-military consumption, changes in government speculation, development in populace and human capital) is likewise negative with bring down noteworthiness (huge at around 12%). The consequences of this direct models is reliable with (Anwar et al. 2012; Shahbaz et al. 2010) who found negative association between military spending and monetary improvement, while opposing to (Khilji and Mahmood, 1997; Haseeb et al. 2014) in the event of Pakistan who viewed a positive association between military utilize and



monetary advancement. The impact of just human capital among control factors is certain on financial development.

**Table 7: Results of Linear models**

Parameters	OLS	Extended OLS (MS only)	Extended OLS (MS & CV)
$\mu_1$	0.35**(0.09)	0.17**(0.084)	12.9*** (4.89)
$\phi_1$	0.189**(0.05)	0.39*** (0.095)	0.193**(0.16)
$\beta_1$		-0.39** (0.17)	-0.33(0.27)
$\lambda_1$			-0.61**(0.27)
$\lambda_2$			-8.09(5.54)
$\lambda_3$			-3.4(3.67)
$\lambda_4$			3.80**(2.1)
$\sigma_1$	0.16	0.47	0.36

Notes: In parentheses (..) the Standard errors values are given. \*\*\* denotes significance at 1%, \*\* at 5%, and \* at 10%.

### Results of Markov Regime Switching

The after-effects of the Markov-administration exchanging models with settled progress probabilities, with FTP including control factors and the most broadened show with time changing advancement probabilities are given in column 2, 3 and 4 respectively in table 9. We estimate different specification of Markov-switching models with TVTP and CTP and the results of only best fit on the basis of maximum value of likelihood is given in table 8 is discussed for analyses. Since in Markov switching model mean and variance are subject to regime shift, therefore the relationship between military spending and economic growth is state dependent. The times of quick/moderate development and of high/low development unpredictability is recognised correctly through smoothed probability. The identification of this high and low growth periods is also confirm since the parameters of mean and variance and other coefficient is significant. It is evident from the results of Markov switching models with CTP and TVTP column 3 and 4 of table 9 that state one is considered to be slow growth regime and state two considered to be high growth regime with respect to business cycles dynamics. The associated smoothed and filtered probabilities which are used to obtain forecast about the regime for future periods for different specification is displayed in figure (3 to 5). The smoothed probabilities is based upon all sample period information for a regime at time t while the filtered probabilities are conditional on information up to time t. It is evident from the

plot of the smooth regime probabilities that frequent swings to high and low growth regimes are observed in almost all specification.

Specifically it is obvious from the results of Markov switching model with fixed transition probability column 3 military expenditure affect economic growth negatively in regime one which may be positive in regime 2 imposing the nonlinear relationship between the two variables in Pakistan. The adverse effect of military expenditure on economic growth in high variance state (low growth period) is consistent with crowding out effects, while the positive effect of military spending on economic growth in low variance state (high growth period) is predictable with Keynesian income multiplier mostly developing countries uses this later structure for analyses. The crowding out effect asserts that the higher military spending is funded either by expanding current charges or borrowing, the latter funding worsen the balance of payments. However, financing the military spending in both the cases cuts the after expense form on beneficial capital as well as the stream of saving which boost the productive capital the result is the low economic growth (Knight *et al.*, 1996). On the other hand, the Keynesian income multiplier suggests that a rise in military expenditure increase aggregate demand capacity (Dunne, 1996), in particular the growth of current production as compared to full capacity production.

With respect to as control factors are concerned, the impact of non-military consumption on financial development stay negative while utilizing settled change probabilities. Likewise, populace has positive and huge effect on financial growth supporting the discoveries of (Mintz and Stevenson, 1995) that expanded work compel has positive effect on monetary development. Ultimately, Government venture and human capital has immaterial effect on financial development.

The after-effects of time varying probability model column 4 of table 9 suggest that the switch from high variance state (low growth regimes) to low variance state (high growth regimes) is also detected by the positive and significant estimate of the  $\gamma_1$ . If the estimate of this parameter is positive and significant then it means that the probability of being staying in the high variance state (low growth periods) is increasing. By considering control variables, only population has significant impact on economic growth.

**Table 8: Specification Selection for Markov Switching models**

Specification	Log Likelihood value
MSIAH(2) CTP	-363.58
MSIAH(2) with CV and CTP	-270.36
MSIAH(2) with TVTP	-2.21

**Table 9: Results of Two-state non-linear models**

parameters	FTP	Extended FTP (CV)	Extended TVTP
$\mu_1$	1.04** (0.51)	0.22**(0.09)	0.25**(0.093)
$\mu_2$	0.18*** (0.09)	-0.106(0.35)	0.031**(0.0094)
$\phi_1$	0.354* (0.13)	0.85(0.61)	-2.2**(0.246)
$\beta_1$		-0.09**(0.02)	
$\beta_2$		0.45**(0.11)	
$\lambda_1$		-1.13**(0.34)	-0.30**(0.080)
$\lambda_2$		1.99**(0.69)	-0.52(0.49)
$\lambda_3$		1.19**(0.56)	3.40(2.67)
$\lambda_4$		4.15(4.01)	-3.80**(2.1)
$b_0$			2.68**(1.11)
$b_1$			5.3**(2.33)
$\gamma_0$			1.48(0.93)
$\gamma_1$			3.37(7.26)
$\sigma_1$	0.15[0.05]	0.244(0.00)	0.013(0.04)
$\sigma_2$	0.51[0.00]	0.003(0.00)	0.029(0.00)

Notes: FTP and TVTP represent fixed and time-varying transition probability Markov switching models, correspondingly. In parentheses (..) the Standard errors values are given. \*\*\* denotes significance at 1%, \*\* at 5%, and \* at 10%.

### Transition Probabilities of Markov Switching Models

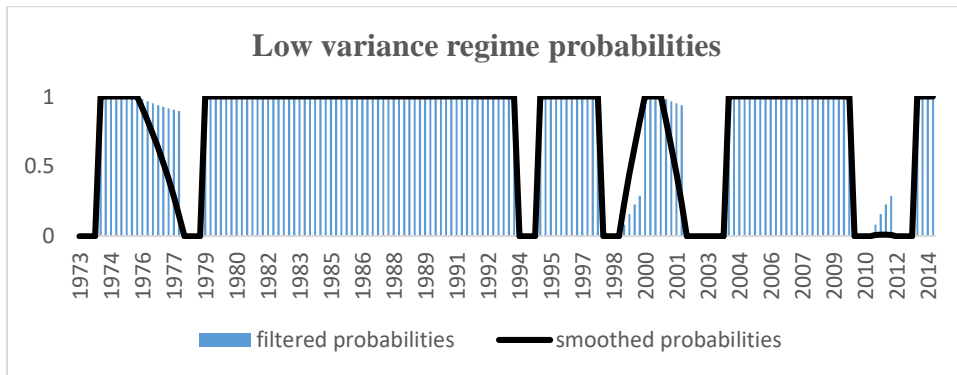
The move in administrations in various sorts of Markov exchanging models with TVTP and CTP takes after first demand Markov chain process which relies upon advance probability lattice. The probability that a particular organization will stay in period t or will travel to some other administration in period t+1 is given by transition probabilities. The principal diagonal element of the transition probability matrix tells us that the transition of macro economy (regime) remains the same. The Transition probability matrix for different specification of Markov switching models is given in table 11. In these transition probability matrix the first element is the probability that if the system is in state one in period t it will remain in the same state for next period t+1. The transition from one state to other is given by the off-diagonal elements of the transition probability matrix. In all the specification given in table 11 it can be seen that the probability of remaining within the same state is high, while the probability is very low for the transition from low growth regime to high growth regime (or from high growth regime to low growth regime. MSIAH(2) is the specification in which intercept,

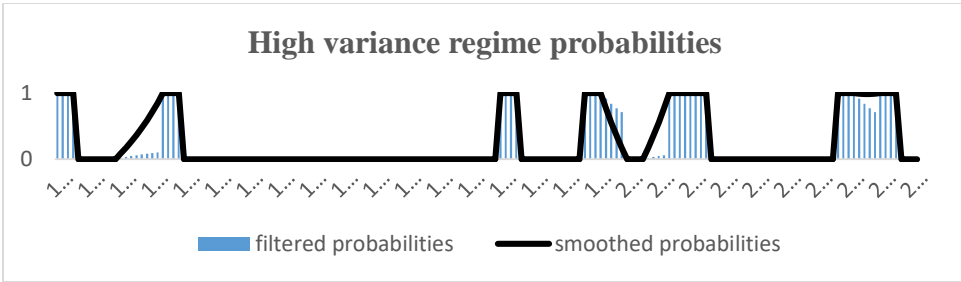
coefficients and error variances are subject to regime (i.e. two regime low variance regime and high variance regime) shifts. In MSIAH(2) specification all the parameters of the model are subject to regime shifts but we have now control variables in the model as well while in MSIAH(2) all the parameter are varying but the probability of switching from one regime to other is time varying not constant.

**Table 11: Transition Probability Matrix of different specification**

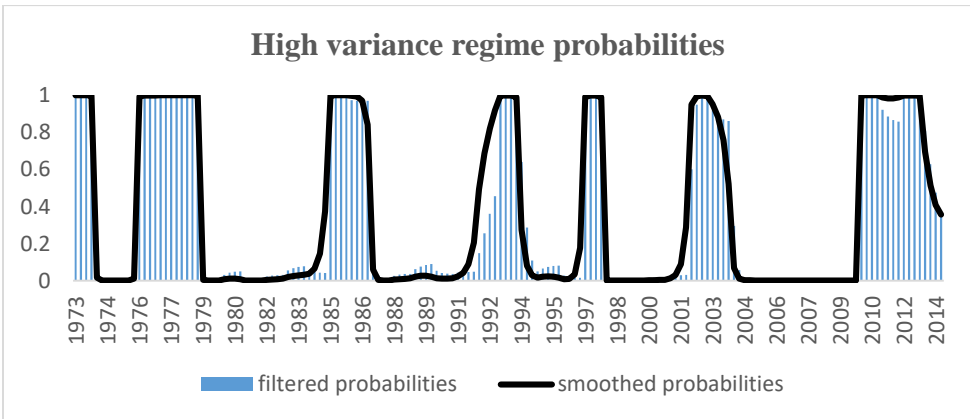
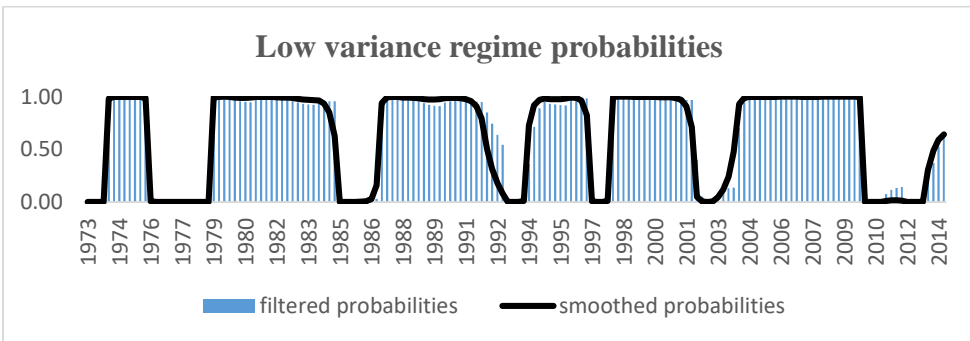
Transition Probability Matrix		Expected Duration of Regime	
		State 1	State 2
MSIAH(2)	$\begin{bmatrix} 0.97 & 0.17 \\ 0.03 & 0.83 \end{bmatrix}$	16.84	2.62
MSIAH(2) with CV	$\begin{bmatrix} 0.94 & 0.14 \\ 0.06 & 0.86 \end{bmatrix}$	16.12	6.98
MSIAH(2) with TVTP	$\begin{bmatrix} 0.94 & 0.12 \\ 0.06 & 0.88 \end{bmatrix}$	16.15	8.40

**Figure 02-03: All Parameters in the model are subjects to regime shift with CTP**

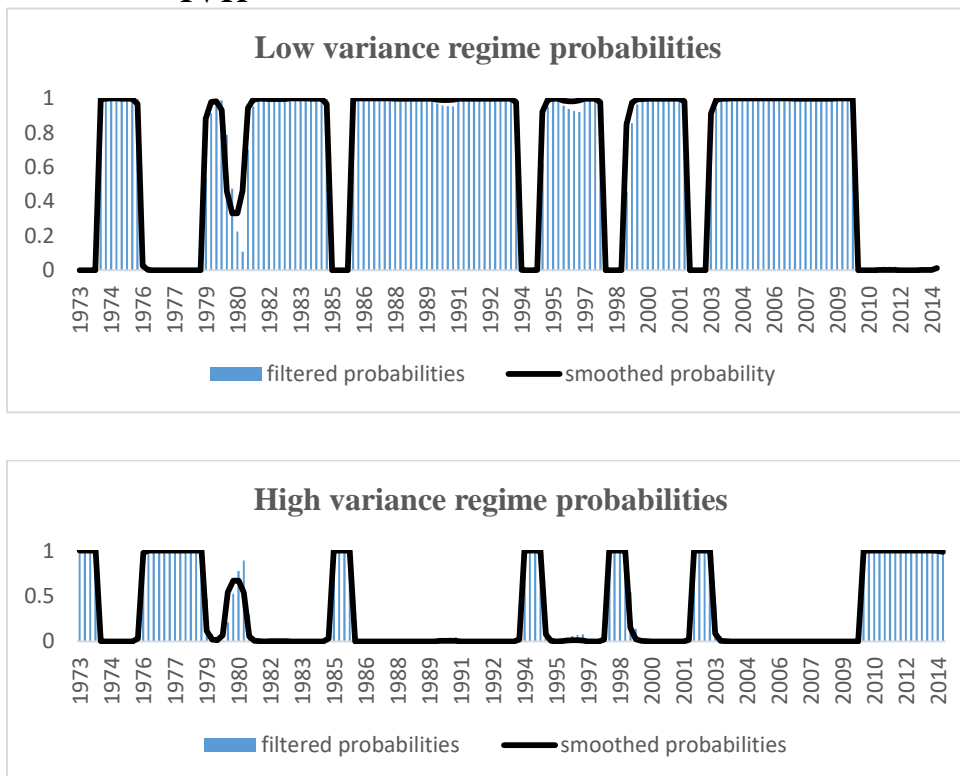




**Figure 04-05: All Parameters in the model are subject to regime shift with CTP and CV**



**Figure 06-07: All Parameters in the model are subject to regime shift with TVTP**



## Conclusion and Policy Outcomes

The subject of military spending growth nexus is explored widely around the globe and in Pakistan as well by means of various theoretical and empirical approaches and reached to different conclusion. The proper allocation of budget between military and non-military spending remain a policy issue for developing countries because the proper distribution of resources direct the speed of economic growth. Mostly studies relating to Pakistan uses models in which it is expected that the connection between the military spending and monetary development is direct and additionally steady parameters. Be that as it may, these experimental examinations overlook the potential basic changes happened after some time. Keeping in mind the end goal to recognize these basic changes endogenously (nonlinear reliance between military consumption and monetary development) the examination gauge distinctive particular of direct and nonlinear

(Markov exchanging) models with TVTP and CTP among which the best fit model based on most extreme probability esteem is decided for investigation.

Particularly the finding of the examination recommends that the military spending influence financial development contrastingly amid high fluctuation (low development administrations) and low change (high development administrations). Along these lines, the outcomes demonstrate that the military consumption development nexus is state subordinate. The results of the settled progress likelihood Markov exchanging models recommend that there is opposite connection between military use and economic development in high variance state (low growth regimes) consistent with crowding out affect while the two variables are positively related in low variance state (high growth regimes) steady with the Keynesian salary multiplier. All the more particularly, the consequences of time changing transition probability models propose that the switch from high variance state (low growth regimes) to low variance state (high growth regimes) is also detected by the positive and significant estimate of the  $\gamma_1$ . If the estimate of this parameter is positive and significant then it means that the probability of being staying in the high variance state (low growth periods) is increasing. Broadly, the result has important policy suggestion, as budget allocation will be different during high variance and low variance state.

## **References**

- Reddy, S, Shahbaz, M & Rzaz, A (2016). Dynamics of Military expenditure and income inequality in Pakistan. *Journal of Social Indicator Research* 131(03), 1035-1055.
- Azam, M & Feng Yi (2015). Military expenditure and external debt? Evidence from Asia. *Journal of Defense and Peace Economics* 1-18.
- Aizenman, J. and Glick, R. (2006). Military expenditure, threats, and growth. *Journal of*, 15(2), 129–155.
- Aizenman, J. and Glick, R. (2006). Military expenditure, threats, and growth,,. *Journal of International Trade & Economic Development*, 15,, 129-155.
- Anwar, M. A., Rafique, Z., & Joiya, S. A. (2012). Defense Spending-Economic Growth Nexus: A Case Study of Pakistan. *Pakistan Economic and Social Review*, vol. 50(2), 163-182.
- Aschauer, D. (1989). Is government spending productive? *Journal of Monetary Economics*, 23,, 177-200.
- Barro, R. (1990). Government Spending in a simple Model of Endogenous Growth. *Journal of Political Economy*, 98, , 103-125.
- Barro, R. J. (1990). Government spending in a simple model of endogeneous growth. *Journal of Political Economy*, vol. 98, 103-25.
- Benoit, E. (1978). Growth and defense in developing countries, *Economic Development and Cultural Change*. vol. 26, 271 –80.
- Chawla, Shalini. (2001). Pakistan's military spending: Socio-economic dimensions. *Strategic Analysis*. vol. 25(5), 703-716.
- Chen, C. H. (1993). Causality between defence spending and economic growth: the case of Mainland China. *Journal of Economic Studies*, vol. 20, 37–43.
- Chester, E. (1978). Military spending and capitalist stability,. *Cambridge Journal of Economics*,, 2,, 293-298.



- Chowdhury, A. R. (1991). A causal analysis of defence spending and economic growth., *Journal of Conflict Resolution*,, 35, , 80–97.
- Cuaresma, J. C. and Reitschuler, G. (2006). Guns or butter?’ revisited: robustness and nonlinearity issues in the defence-growth nexus., *Scottish Journal of Political Economy*, 53, , 523–542.
- Deger, S. (1990). Military Expenditure. *The Political Economy of International Security*.
- Deger, S. and Sen, S. (1995). Military expenditure and developing countries, in K. Hartley, and T. Sandler. *Handbook of Defence Economics: , Elsevier, Amsterdam,, Vol. 1*, pp. 275–307.
- Diebold, F., et al. (1994). Regime switching with time-varying transition probabilities.
- Dimitraki, O. and Menla Ali, F. (2013). The long-run causal relationship between military spending and economic growth in China: revisited. *Defence and Peace Economics*.
- Dunne, J. Paul, Eftychia Nikolaidou & Ron P. Smith. (1999). Arms Race Models and Econometric Applications. *mimeo Middlesex University Business School*.
- Faini, Ricardo, Patricia Annez, and Lance Taylor . (1984). Defence Spending Economic Structure, and Growth: Evidence Among Countries and Over Time. *Economic Development and Cultural Change*.
- Filardo, A. J. (1994). Business-cycle phases and their transitional dynamics., *Journal of Business and Economic Statistics*, vol. 12, 299–308.
- Frederiksen, P.C. and Looney, R. (1983). Defense Expenditures and Economic Growth in Developing Countries. *Armed Forces and Society*, 633-645.
- Galvin, H. (2013). The impact of defence spending on the economic growth of developing countries: A cross-section study. *Defence and Peace Economics*, vol.41(1), 51 -59.
- Gerace, M. P. (2002). US military expenditures and economic growth: some evidence from spectral methods., *Defence and Peace Economics*,, 13, , 1-11.

- Glomm G. and Ravikumar B. (1997). Productive government expenditure and long run growth. . *Journal of Economics Dynamics and Control*, 21, 183-204.
- Hamilton, J. D. (1989). A new approach to the economic analysis of nonstationary time series and the business cycle. *Econometrica: Journal of the Econometric Society*, 357-384.
- Haseeb, M., Abu, BNA., Azam, M., Hartani, NH., and Hassan, S. (2014). The macroeconomic impact of defense expenditure on economic growth of Pakistan: an econometric approach. *Asian Social Science* 10 (4), 203-213
- Heo, U. (1998). Modelling the defence-growth relationship around the globe., *Journal of Conflict Resolution*, 42, , 637–657.
- Heo, U. (1999). Defence spending and economic growth in South Korea: the indirect link. *Journal of Peace Research*,, 36, , 699-708.
- Hollist, W. L. (1997). Alternative explanations of competitive arms processes: Tests on four pairs of nations. *American Journal of Political Science*, vol. 21(2), pp.313-340.
- Hooker, M. and Knetter M. (1997). Unemployment effects of military spending: evidence from a panel of states, ,. *Journal of Money, Credit, and Banking*, 29, 400–421.
- Joerding, W. (1986). Economic growth and defense spending: Granger causality. *Journal of Development Economics*,, vol. 21(1), pp. 35-40.
- Kalaitzidakis, P. and Tzouvelekas, V. (2001). Military spending and the growth-maximizing allocation of public capital: a cross-country empirical analysis. *Economic Inquiry*.
- Karagol, E. and Palaz, S. (2004). Does defence expenditure deter economic growth in Turkey? A cointegration analysis *Defence and Peace Economics*. vol. 15(3), 289–298.
- Khan, M.-H. (2004). Defence expenditure and macroeconomic stabilization: Causality evidence from Pakistan. *SBP Working Paper Series*, vol.6, pp.1-17.
- Khilji, N.M. and Mahmood, A. (1997). Military expenditures and economic growth in Pakistan. *The Pakistan Development Review*, 36(4), 791 –808.

- Kinsella, D. (1990). Defence spending and economic performance in the United States: a causal analysis,. *Defence Economics*,, 1, , 295–309.
- Knight, M., Loayza, N. and Villanueva, D. (1996). The peace dividend: military spending cuts and economic growth,. *IMF Staff Papers*, , 43, 1-37.
- Kollias, C., Mylonidis, N. and Paleologou, S. M. (2007). A panel data analysis of the nexus between defence spending and growth in the European Union,. *Defence and Peace Economics*,, 18, , 75–85.
- Kusi, N. K. (1994). Economic growth and defence spending in developing countries: a causal analysis,. *Journal of Conflict Resolution*,, 38, , 152-159.
- Lai, C. L., Huang, B. N. and Yang, C. W. (2005). Defence spending and economic growth across the Taiwan straits: a threshold regression model,. *Defence and Peace Economics*, 16,, 45-57.
- Landau, D. (1993). The economic impact of military expenditure, . *The World Bank Working Paper Series. The World Bank, Washington, DC*.
- Levine, R. and Renelt, D. (1992). A sensitivity analysis of cross country growth regressions. *The American Economic Review*, 82: 942–63.
- Lindgren, G. (1984). Armaments and economic performance in industrialized market economies,. *Journal of Peace Research*,, 21, , 375-387.
- Majeski, S. J. (1992). Defence budgeting, fiscal policy, and economic performance, in A. Mintz (Ed), . *The Political Economy of Military Spending in the United States*, pp. 217–237.
- Menla Ali, and Dimitraki, O. (2014). Military spending and economic growth in China: A regime switching analysis.
- Mintz, A. and Stevenson, R. T. (1995). Defence expenditures, economic growth, and the “peace dividend”: a longitudinal analysis of 103 countries,. *The Journal of Conflict Resolution*,, 39,, 283-305.
- Morrison C.J.. and Schwartz A.E. (1996). State infrastructure and productive performance. *American Economic Review* ,, vol.86, pp.1095-1111.

- Nelson, M. A., and R. D. Singh. (1994). The Deficit-Growth Connection: Some Recent Evidence from Developing Countries. *Economic Development and Cultural Change*.
- Ram, R. (1986). Government size and economic growth: a new framework and some evidence from cross-section and time-series data. *American Economic Review*, 76,, 191-206.
- Ram, R. (1995). Defense expenditure and economic growth. *In Handbook of Defence Economics*, pp.251 –273.
- Sandler, T. and Hartley, K. (1995). *The Economics of Defence*, CUP, Cambridge, MA.
- Sandler, T. and Hartley, K. (1995). *The Economics of Defence*, CUP, Cambridge.
- Shahbaz, M., Afza, T., & Shabbir, M. S. (2012). Does defense spending impede economic growth? Cointegration and causality analysis for Pakistan. *MPRA*.
- Shieh, J., Lai, C. and Chang, W. (2002). The impact of military burden on long-run growth and welfare. *Journal of Development Economics*, vol.68,, pp. 443-454.
- Siddiqa-Agha, A. (2000). Defence a public good? A case study of Pakistan's military expenditure. *Regional Centre for Strategic Studies*.
- Stroup, M.D. and Heckelman, J.C. (2001). Size of the military sector and economic growth: A panel data analysis of Africa and Latin America. *Journal of Applied Economics*, vol.4(2), pp. 329-360.
- Wallace, M. D. (1980). Accounting for superpower arms spending, in P. McGowan, and C. W. Kegley. *Threats, Weapons, and Foreign Policy*, pp. 259–273.
- Weede, E. (1983). Military participation rations, human capital formation, and economic growth: a cross-national analysis. *Journal of Political and Military Sociology*, 11,, 11-19.
- Yakovlev, P. (2007). Arms trade military spending and economic growth, *Defence and Peace Economics*,, 18, 317-338.

Yang, A. J. F., Trumbull, W. N., Yang, C. W. and Huang, B. N. (2011). On the relationship between military expenditure, threat and economic growth: a non-linear approach. *Defence and Peace Economics*, 22, 449-457.

Yildirim, J. and Ocal, N. (2006). Arms Race and Economic Growth: The Case of India and Pakistan,. *Defence and Peace Economics*, 17: 37-45.