To Battle Income Inequality, Focus on Military Expenditures: Lesson from Pakistan

Raza, Syed Ali and Shahbaz, Muhammad

IQRA University, Karachi-75300, Pakistan

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First Author

Syed Ali Raza
Lecturer,
IQRA University,
Karachi-75300, Pakistan
Email: syed_aliraza@hotmail.com
Tel: +92-333-344-8467
(Corresponding Author)

Second Author

Muhammad Shahbaz
Department of Management Sciences,
COMSATS Institute of Information Technology,
Lahore Campus, Pakistan
Email: shahbazmohd@live.com

(Preliminary Draft)

Abstract

This study investigates the impact of military expenditures on income inequality in Pakistan using data over the period of 1972-2012. In doing so, we have applied the ARDL bounds testing cointegration approach which confirmed the presence of long run relationship between military expenditures and income inequality. Furthermore, empirical analysis indicates that military expenditures have positive impact on income inequality. The analysis of Granger causality, Toda and Yamamoto Modified Wald causality and variance decomposition approaches confirm the unidirectional causal relationship running from military expenditures to income inequality. The findings suggest that military expenditures would be a significant policy option to control income inequality and should be considered as a mean to improve income distribution in Pakistan.

Keywords: Military Expenditures, Income Inequality, Economic Growth
JEL Classification: H56, D30, F43

1.Introduction

In last two decades the increasing inequalities within and between countries due to high expenditures on military budgets across the world are the two serious issues among the researchers and economists. However, there are very few studies analyzed the relationship between military expenditures and income inequality which provide conflicting empirical findings. Researchers and economist have analyzed the consequences of high military expenditures on economic development of any country. The first influential study was conducted by Benoit (1973) who analyzed the relationship between military expenditures[1] and economic growth. Benoit (1973) in this study confirmed the positive association between military expenditures and economic growth. The positive effect of military expenditures on economic growth has been confirmed by many other researchers.[2] On the other hand, some researchers also found the negative association between military expenditures and economic growth.[3]

One of the major objectives of any welfare state is to redistribute the government revenues to public for improving the distribution of wealth. Government has to perform different social expenditures to improve the living standard and reduce the income inequality within the country. The size of the budget is the main hurdle in the way of government to distribute the government revenue for social activities. The size of budget plays a conflicting role to make trade-offs between different types of expenditures. Therefore, higher military expenditures results in the less fund available for education, health, welfare and other social expenditures which all contribute to improve income inequality (Gunluk-Senesen, 2002; Shahbaz, 2010, Elveren, 2012). Indeed, there are some studies which suggest the conflicting evidence on the trade-offs between social expenditures and military expenditures (Yildirim and Sezgin, 2002). It can be argued that

[1] We use military expenditure and defence expenditure interchangeably throughout the paper.
[2] Federicksen and Looney (1982), Weede (1986), Stewart (1991), Ward et al. (1991), Mueller and Atesoglu (1993), Murdoch et al. (1997), Sheih et al. (2002), Yildirim et al. (2005), Narayan and Singh (2007), Wijeweera and Webb (2011) and Tiwari and Shahbaz (2012)
[3] Grobar and Porter (1989), Alexander (1990), Chowdhury (1991), Madden and Haslehurst (1995), Mintz and Stevenson (1995), Lai *et al*. (2002), Gerace (2002) and Wilkins (2004), Shahbaz and Shabbir (2012), Shahbaz et al. (2013a) etc.

the relationship between military expenditures and income inequality varies between country to country and region to region. However, the elasticity and relationship between these two depends upon the historical, cultural, economic, political and institutional structure of the country.

1.1. Military Expenditures and Income Inequality in Pakistan

The military expenditures always have a high proportion in Pakistani budget due to high conflicts with India. There has been a steady increase in military expenditures of Pakistan since its independence in 1947. Table-1 shows the trends of military expenditures in Pakistan. In 1970's the average annual military expenditures was 10.17 billion rupees. These annual military expenditures were continuously increased in 1980's, 1990's and 2000's to 30.48, 100.48 and 222.27 billion rupees respectively. In last four years, military expenditures also showing rapid increasing trend from 2009 to 2012 of annual military expenditures of 311.30, 378.14, 450.62 and 507.16 billion rupees respectively.

Table -1: Trend of Military Expenditure and Income Inequality in Pakistan

Time Period	Military Expenditure*	Income Inequality
1970s	10.17	0.359
1980s	30.48	0.364
1990s	100.48	0.403
2000s	222.77	0.300
2009	311.30	0.321
2010	378.14	0.328
2011	450.62	0.332
2012	507.16	0.345

Source: Ministry of Finance, Pakistan

* indicates Billion Pakistani Rupees

There are several reasons that explain the high level of military expenditures in Pakistan. First of all, in Pakistan there has been implicit military intervention in the government, five military coups has had direct intervention in Pakistan and ruled for 32 years of total 66 years of independence. It would not be wrong to argue that political leaders in the form of military corps have a tendency to devote more resources to military in general. Second, the non-friendly and conflicting relationship with India is also the main reasons for higher military expenditures. Pakistan has three major wars with India since 1947 in the years of 1965, 1971 and 1999. Pakistan has a long border with India and for that reason the large size of military personnel in the country is become an essential.

Third, Pakistan is the major partner with USA in fighting against war on terrorism since 2001. Pakistan has witnessed tremendous increase in the terrorist and violent incidents of amplified intensities since 2004. These attacks were intensive in terms of casualties as well. For instance, from 2008 to 2012 the total of 12020 civilians and 3611 armed forces personnel were killed in terrorist activities. In only 2013, 3,677 people were killed in terrorist activities on civilian and armed forces personnel (Shahbaz et al. 2013b). Table-2 represents the total number of fatalities in civilian and armed forces personnel from 2004 to 2014. All these incidents can be the reasons of increase in the military expenditures.

Table-2: Fatalities in Terrorist Violence in Pakistan 2003-2014

Year	Civilians	Security Force Personnel	Total
2003	140	24	164
2004	435	184	619
2005	430	81	511
2006	608	325	933
2007	1522	597	2119
2008	2155	654	2809
2009	2324	991	3315
2010	1796	469	2265
2011	2738	765	3503
2012	3007	732	3739
2013	3001	676	3677
2014	58	26	84
Total*	**18214**	**5524**	**23738**

Source: South Asia Terrorism Portal (www.satp.org)

* Data till January 12, 2014

Pakistan has a highly unequal income distribution compared with the other developing economy. The trend of income inequality shows very mix results in Pakistan. Table-2 shows the trends of income inequality in Pakistan. In 1970's the average annual value of Gini coefficient was 0.359. In 1980's the income inequality in Pakistan remained very steady and increased by only 0.005, the average annual value of Gini coefficient in 1980's was 0.364. Furthermore, in 1990's the income inequality in Pakistan is sharply increased and with an average value of Gini coefficient was 0.403. The year of 1992 was having the highest value of Gini coefficient i.e. 0.410. In the decade of 2000's the position of income inequality in Pakistan has better and the value of Gini coefficient is decreased by significantly 25 percent. The average annual value of Gini coefficient was 0.300 in 2000's. However, the income inequality in Pakistan has been increasing from last for years i.e. 2009 to 2012 with a Gini coefficient value of 0.321, 0.328, 0.332 and 0.345 respectively.

The paper makes a unique contribution to the literature with reference to Pakistan, being a pioneering attempt to investigate the impact of military expenditures on income inequality. The study uses the annual data for the period of 1972-2012 by applying more rigorous econometric techniques. We find that military expenditures add in income inequality. The causality analysis reveals that military expenditures Granger cause income inequality.

2. Literature Review

This section reviews some theoretical and selected cross country as well as time series empirical studies.

2.1 Theoretical Underpinnings

There is no such theory that discusses the relationship between military expenditures and income inequality. The possible mechanisms that show the relationship between military expenditures and income inequality are discussed in existing literature. For example, first, according to

Keynesian point of view, high budget allocation on military spending enhances income opportunities in defence related sectors which increase the aggregate demand, earnings and employment opportunities in these sectors. These availabilities of employment opportunities play a critical role in reducing income inequality (Meng et al. 2013). Second, the above mentioned channel may be different because, the detail composition of military spending is sometime very complex. If the high defence budget is used to create the employment or earning opportunities for less skilled labor then income inequality should be reduced. But, if the high defence budget is used to create the employment or earning opportunities for high skilled labor then income inequality would be increased. The actual effect is dependent on the specific structure and nature of military spending (Ali, 2007; Meng et al. 2013). Third, military expenditures are generally made at the expense of other public and social expenditures. These heavy expenses on military create the scarce resources for other social welfare expenditures and reduced the available resources for social and welfare programs. The less investment on social and welfare programs leads to increase in income inequality (Lin and Ali, 2009).

Fourth, the spillover of defence R&D and defence technology provides a positive externality. As a known, modern military weapons are all based on advanced technologies. These technologies are also a key factor for the improvement of industrial productivity. These technological advancement may also used in other industries. The development of industries through technological development increases the productivity of the entire country. The increase in total productivity leads to increase in financial income, which also leads to use these incomes so as to reduce the income inequality in the country (Meng et al. 2013).

2.2 Empirical Studies

There are very few studies which have been done to analyze the relationship between military expenditures and income inequality. Abell (1994) was the first to analyze the relationship in between military expenditures and income inequality in US by using the time series data from the period of 1972-1991. The empirical results indicate that military expenditures increase income inequality in the US society. Similarly, Seiglie (1997) also explored the US military expenditures by using the larger sample from the period of 1939-1989. The empirical results show that military expenditures are associated with budget deficit which is a source for income transfer among different social groups. Likewise, Ali and Galbraith (2003) also analyzed the relationship between military expenditures and income inequality by controlling the effects of size of armed forces, GDP growth and per capita income. Their results suggest the positive association between military expenditures and income inequality. Moreover, Ali (2007) determined the global panel data from the period of 1987-1997 and found the positive relationship between military expenditures and income inequality by controlling the effects of some major macroeconomic variables such as per capita income, economic growth and size of the armed forces.

Furthermore, Vadlamannati (2008) examined the military expenditures and income inequality in four South Asian countries by using the panel data from the period of 1975-2005.[4] The empirical findings show that higher military expenditures lead to higher income inequality after controlling the major macroeconomic and institutional variables. In addition, Lin and Ali (2009) also verified the relationship between military expenditures and income inequality by using the larger

[4] These countries were Pakistan, Bangladesh, India and Sri Lanka.

sample of 58 countries from the period of 1987-1999. Their findings also show the positive relationship between income inequality and military expenditures. Another study conducted by Hirnissa et al. (2009) who analyze the causal relationship between military expenditures and income inequality in Malaysia, Indonesia, Singapore, Philippines, South Korea and India by using the time series data for the period of 1970-2005. They noted that the unidirectional causality exists running from military spending to income inequality in Malaysia while bidirectional causality is found between both variables for Singapore. There is no causality exists between military spending and income inequality in Indonesia, India, Philippines and South Korea. Kentor et al. (2012) analyzed the panel data of 82 developed and less developed countries to analyze the relationship between military expenditures and income inequality. Their results demonstrate the positive relationship between considered variables. Similarly, Elveren (2012) investigated the relationship between military expenditures and income inequality in Turkey by using the time series data for the period of 1963-2007. The findings validate the presence of cointegration between the series. Elveren also notes the unidirectional causal relationship between military expenditures and income inequality running from military expenditures to income inequality. Meng et al. (2013) also analyzed the long run cointegration and causal relationship between military expenditures and income inequality in China by using data over the period of 1989-2012. Their empirical findings confirm that the unidirectional causality is found running from military expenditures to income inequality.

There are very rare studies available in existing literature which shows the negative relationship between military expenditures and income inequality. For example, Comton (2005) claimed the negative relationship between military expenditures and income inequality in United States. He argued that increase in military expenditures generates more jobs for unskilled workers which lead to improve income distribution. Ali (2012) investigated the relationship between military spending and income inequality in Middle East and North African (MENA) countries by using the panel data over the period of 1987-2005. The results show the nonconventional significant negative relationship of military expenditures with income inequality in MENA countries. Besides, Shahbaz et al. (2012) also analyzed the cointegration and causal relationship between military expenditures and income inequality in Iran by using the time series data from the period of 1969-2011. The ARDL bounds testing approach suggests the valid long run relationship. Their results confirm the significant negative relationship between military expenditures and income inequality and military spending Granger causes income inequality in Iran.

3. Empirical Framework

After reviewing the theoretical and empirical work, the model to examine the relationship between military expenditures and income inequality is modeled as given below framework:

$$IIQ_t = \beta_0 + \beta_1 MEX_t + \beta_2 GDP_t + \beta_3 PCI_t + \varepsilon_t \qquad (1)$$

Where, ε_t is the error term, *IIQ* is the income inequality which is measured by Gini coefficient, MEX is the military expenditures as percentage of GDP, GDP is real gross domestic product and *PCI* is real per capita income. The expected signs for *GDP* and *PCI* are negative while, the sign of *MEX* is to be determined. In basic model researcher also considered GDP and PCI to control the effects of economic growth and income level. The annual time series data over the period of

1972-2012 is used for empirical analysis. All data are gathered from DataStream and different issues of economic surveys of Pakistan.

3.1 Unit Root Test

Augmented Dickey Fuller (*ADF*) and Phillip Perron (*PP*) unit root tests are used to examine the stationary properties for long run relationship of time series variables. Augmented Dickey Fuller (*ADF*)[5] test is based on equation given below:

$$\Delta Y_t = \alpha_0 + \alpha_1 Y_{t-1} + \sum_{j=1}^{k} d_j \Delta Y_{t-j} + \varepsilon_t \qquad (2)$$

Where ε_t is pure white noise error term, Δ is first difference operator, Y_t is a time series, α_0 is the constant and k is the optimum numbers of lags of the dependent variable. Augmented Dickey Fuller (*ADF*) test determines whether the estimates of coefficients are equal to zero. ADF test provide cumulative distribution of ADF statistics. The variable is said to stationary, if the value of the coefficient δ is less than critical values from fuller table. Phillip and Perron (PP)[6] unit root test equation is given below:

$$\Delta Y_t = \alpha + \rho^* Y_{t-1} + \varepsilon_t \qquad (3)$$

The Phillip and Perron unit root test is also based on t-statistics that is associated with estimated coefficients of ρ^*.

3.2 ARDL Bound Testing Approach

The Auto Regressive Distributed Lag (ARDL) method of cointegration developed by Pesaran and Pesaran (1997), Pesaran and Shin (1999) Pesaran *et al.* (2000, 2001) has been used with the help of unrestricted vector error correction model to investigate the long run relationship between military expenditures and income inequality. The ARDL bounds testing approach has several advantages over other cointegration methods. The ARDL approach may apply irrespective of whether underlying variables are purely *I(0)*, *I(1)* or mutually co-integrated.[7] The bounds testing approach has estimated better small sample properties.[8] In the ARDL procedure the estimations of results is even possible if the explanatory variable are endogenous.[9] The ARDL model is developed for estimations as follow:

$$\Delta \mathrm{IIQ}_t = \psi_0 + \psi_1 \sum_{i=1}^{p} \Delta \mathrm{IIQ}_{t-1} + \psi_2 \sum_{i=1}^{p} \Delta \mathrm{MEX}_{t-1} + \psi_3 \sum_{i=1}^{p} \Delta \mathrm{GDP}_{t-1}$$
$$+ \psi_4 \sum_{i=1}^{p} \Delta \mathrm{PCI}_{t-1} + \gamma_1 \mathrm{IIQ}_{t-1} + \gamma_2 \mathrm{MEX}_{t-1} + \gamma_3 \mathrm{GDP}_{t-1} + \gamma_4 \mathrm{PCI}_{t-1} + \mu_t \qquad (4)$$

[5] See, Dickey and Fuller (1979)
[6] See, Phillips and Perron (1988)
[7] Pesaran and Shin (1999)
[8] Haug (2002)
[9] Pesaran and Shin (1999) and Pesaran et al. (2001)

Where ψ_0 is constant and μ_t is white noise error term, the error correction dynamics is denoted by summation sign while the second part of the equation corresponds to long run relationship. Schwarz Bayesian Criteria (*SBC*) has been used to identify the optimum lag of model and each series. In the ARDL model, we first estimate the *F*-statistic value by using the appropriate ARDL models. Secondly, the Wald (*F*-statistic) test is used to investigate the long run relationship among the series. The null hypothesis of no cointegration is rejected if the calculated *F*-test statistic exceeds the upper critical bound (UCB) value. The results are said to be inconclusive if the *F*-test statistic falls between the upper and lower critical bound. Lastly, the null hypothesis of no cointegration is accepted if the *F*-statistic is below the lower critical bound. If long run relationship between military expenditures and income inequality is found then we estimate the long run coefficients. The following model will be use to estimate the long run coefficients:

$$\mathrm{IIQ}_t = \zeta_0 + \zeta_1 \sum_{i=1}^{p} \mathrm{IIQ}_{t-1} + \zeta_2 \sum_{i=1}^{p} \mathrm{MEX}_{t-1} + \zeta_3 \sum_{i=1}^{p} \mathrm{GDP}_{t-1} + \zeta_4 \sum_{i=1}^{p} \mathrm{PCI}_{t-1} + \mu_t \qquad (5)$$

If we find evidence of long run relationship between military expenditure and income inequality then we estimate the short run coefficients by employing the following model:

$$\Delta\mathrm{IIQ}_t = \varphi_0 + \varphi_1 \sum_{i=1}^{p} \Delta\mathrm{IIQ}_{t-1} + \varphi_2 \sum_{i=1}^{p} \Delta\mathrm{MEX}_{t-1} + \varphi_3 \sum_{i=1}^{p} \Delta\mathrm{GDP}_{t-1} + \varphi_4 \sum_{i=1}^{p} \Delta\mathrm{PCI}_{t-1} + \mathrm{nECT}_{t-1} + \mu_t \qquad (6)$$

The error correction model shows the speed of adjustment needed to restore the long run equilibrium following a short run shock. The n is the coefficient of error correction term in the model that indicates the speed of adjustment.

3.3. Granger Causality Analysis

The direction of causality between dependent and independent variables is firstly analyzed by Granger, (1969) causality test. The researcher performed the causality analysis of income inequality model on lag one. Jones, (1989) favors the ad-hoc selection method for lag length in Granger causality test over some of other statistical method to determine optimal lag. The equation of Granger causality model is given below:

$$Y = \sum_{i=1}^{t} \alpha_i X_{t-i} + \sum_{i=1}^{t} \beta_i Y_{t-i} + \mu \qquad (7)$$

$$X = \sum_{i=1}^{t} \lambda_i X_{t-i} + \sum_{i=1}^{t} \delta_i Y_{t-i} + v \qquad (8)$$

It is assumed that μ and v are uncorrelated. There are two variables which dealt with bilateral causality. Above equation states that Y is related to its lag values and X is related to its lag values.

3.4. Toda and Yamamoto Modified Wald Test Causality Analysis

The direction of causality between dependent and independent variables is also analyzed by using the causality test based on Toda and Yamamoto (1995) procedure. This test use a modified Wald (*MWALD*) test which can be applied irrespective of whether underlying variables are purely *I(0)*, *I(1)* or mutually cointegrated. Toda and Yamamoto (1995) augmented Granger causality test uses the Seemingly Unrelated Regression (*SUR*) technique through estimating a two equation system. The Wald test improves efficiency when *SUR* models are used in the estimation. So, the model can be specified as follows:

$$Y_t = \alpha_1 + \sum_{i=1}^{k+d} \gamma_{1i} Y_{t-i} + \sum_{t-i}^{k+d} \gamma_{2i} X_{t-i} + \varepsilon_{yt} \qquad (9)$$

$$X_t = \alpha_2 + \sum_{i=1}^{k+d} \delta_{1i} Y_{t-i} + \sum_{t-i}^{k+d} \delta_{2i} X_{t-i} + \varepsilon_{xt} \qquad (10)$$

Where k is the optimal lag order, d is the maximum order of integration of the series in the system, and ε_{yt} and ε_{xt} are error terms that are assumed to be white noise. Usual Wald tests are then applied to the first k coefficient matrices using the standard χ^2 – statistics.

4. Estimations and Results

To check the stationary properties, we use Augmented Dickey Fuller (*ADF*) and Phillip Perron (*PP*) unit root tests. Table-3 represents the results of stationary tests. First, these tests are applied on level of variables then on their first difference.

Table -3: Stationary Test Results

Variables	Augmented Dickey-Fuller				Phillips-Perron			
	I(0)		I(1)		I(0)		I(1)	
	C	C&T	C	C&T	C	C&T	C	C&T
IIQ	-2.17	-2.51	-3.90	-3.82	-1.52	-1.72	-4.00	-3.94
MEX	-2.36	-2.96	-4.46	-4.58	-2.04	-2.88	-4.48	-4.58
GDP	1.95	-0.66	-3.75	-3.57	1.26	-0.26	-3.75	-3.59
PCI	0.38	-1.67	-3.71	-3.71	0.03	-1.58	-3.72	-3.71

Note: The critical values for ADF and PP tests with constant (c) and with constant & trend (C&T) 1%, 5% and 10% level of significance are -3.711, -2.981, -2.629 and -4.394, -3.612, -3.243 respectively.

Results of Table-3 show that all variables are stationary and integrated at first difference. This implies that the series of variables may exhibit a valid long run relationship. The Autoregressive distributed lag method for cointegration is used to estimate the long run relationship between military expenditures and income inequality. The first step is to determine the optimal lag length of the variables. The order of optimal lag length is decided by using the Schwarz Bayesian Criterion. Table-4 shows the results of the ARDL cointegration method.

Table-4: Lag Length Selection & Bound Testing for Cointegration

Lags Order	AIC	HQ	SBC	F-test Statistics
0	0.925	0.986	1.108	33.256*
1	-12.061	-11.757	-11.145	
2	-13.656*	-13.110*	-12.007*	

Note: * 1% level of significant.

The ARDL results suggest the rejection of null hypothesis of no cointegration in model because the value of the *F*-statistic is greater than upper bound critical value at 1% level of significance in favor of alternative hypothesis that the valid long run relationship is existed between military spending and income inequality. Now the lag length order of all variables is estimated through unrestricted vector auto regression method. The decision criterion is based on minimum value of Schwarz Bayesian Criterion[10].

Table -6: Long Run Results using ARDL Approach

Variables	Coeff.	t-stats	Prob.
Constant	-0.226	-0.666	0.512
IIQ (-1)	0.868	6.537	0.000
MEX	0.139	2.369	0.027
MEX (-1)	-0.148	-1.862	0.076
GDP	-0.067	-3.060	0.005
GDP (-1)	-0.097	-1.713	0.099
GDP (-2)	-0.003	-0.516	0.610
PCI	-0.359	-2.109	0.045
PCI (-1)	-0.097	-0.752	0.460
PCI (-2)	0.001	0.170	0.867
Adj. R^2	0.888		
D.W stats	1.729		
F-stats (Prob.)	119.286 (0.000)		

Table-6 shows the results of long run ARDL estimations. The results of *GDP* and *PCI* are having expected negative and significant relationship with income inequality. We find that both

[10] Table-5 represents the results of lag length order of all variables. The results of Schwarz Bayesian Criterion indicate that the variables of income inequality and military expenditures should be included in model at 1st lag while gross domestic product and per capita income should be included in model at 2nd lag.

economic growth and increasing income level are the two major sources to reduce income inequality in Pakistan. The results indicate the positive and significant effect of military expenditures on income inequality. The coefficient of military expenditures is showing that a 1% increase in military expenditures cause to increase in income inequality by 0.139%. It is concluded that military expenditures is an important factor to deteriorate income inequality. The finding is consistent with the earlier available literature which is mostly showing the positive relationship between military expenditures and income inequality.

Table-7: Short Run Results using ARDL Approach

Variables	Coeff.	t-stats	Prob.
Constant	-0.340	-1.306	0.204
ΔIIQ (-1)	0.238	3.136	0.004
ΔMEX	0.122	3.633	0.001
ΔMEX (-1)	-0.104	-0.303	0.764
ΔGDP	-0.337	-3.091	0.005
ΔGDP (-1)	-0.011	-0.309	0.760
ΔGDP (-2)	0.009	1.073	0.294
ΔPCI	-0.245	-2.104	0.046
ΔPCI (-1)	-0.166	-0.186	0.854
ΔPCI (-2)	0.143	0.407	0.407
ECM(-1)	-0.096	-3.819	0.001
Adj. R^2	0.670		
D.W stats	1.699		
F-stats (Prob.)	94.167 (0.000)		

Table-7 represents the short run relationship between military spending and income inequality. The results indicate the lagged error correction term for the estimated income inequality equation which is negative and statistically significant. This confirms a valid short run relationship between military expenditures and income inequality. The coefficient of error term is showing the value of -0.096 that suggests about 10 % of disequilibrium which is corrected in current year. Interestingly, results indicate the positive and significant effect of military expenditures on income inequality.

Stability of Long run Model: A Rolling Window Analysis

The stability of coefficients of the long run model in the sample size is evaluated by using the rolling window estimation method. Figure-1 and Table-8 represent the coefficients of each year of military expenditure throughout the sample by using the rolling window estimation method. Two standard deviation bands show the upper and lower bounds.

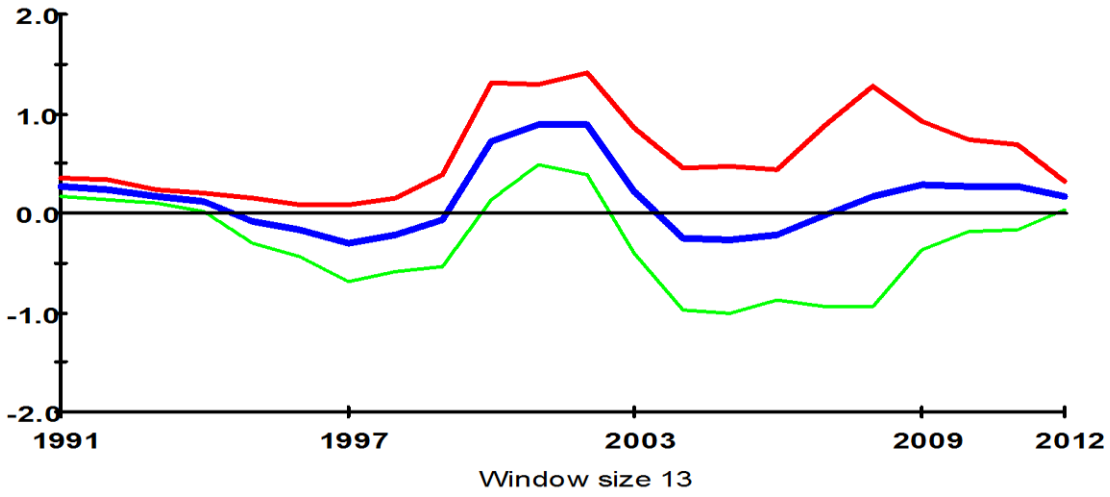

Figure-1 Coefficient of MEX and its two S.E. bands based on rolling OLS (Dependent Variable: IIQ)

Table-8: Long run Coefficients of Military Expenditures

Year	Coeff.	Year	Coeff.
1991	0.267	2002	0.895
1992	0.236	2003	0.224
1993	0.162	2004	-0.260
1994	0.114	2005	-0.270
1995	-0.078	2006	-0.219
1996	-0.175	2007	-0.019
1997	-0.301	2008	0.168
1998	-0.217	2009	0.277
1999	-0.072	2010	0.271
2000	0.725	2011	0.263
2001	0.893	2012	0.175

Our results verify that the military expenditures is having very mix coefficients throughout the sample period. The results of figure-1 and Table-8 show that the coefficient of military expenditures shows positive values from 1991 to 1994, 2000 to 2003 and 2008 to 2012. Conversely, the coefficient of military expenditures shows negative values from 1995 to 1999 and 2004 to 2006. From 2000 to 2002 the coefficient has increased significantly while from 2003 to 2005 the coefficient has declined very sharply.

The stability of short run model in the sample size is evaluated by using the cumulative sum (CUSUM) and CUSUM of square test on the recursive residuals. The CUSUM test detects systematic changes from the coefficients of regression, while, CUSUM of square test is able to detect the sudden changes from constancy of regression coefficients [Brown et al. (1975)]. Figure-3 and 4 represent the results of CUSUM and CUSUM of square tests respectively. Results indicate that the statistics of both CUSUM and CUSUM of square test are located within

the interval bands at 5% confidence interval. Consequently, results suggest that there is no structural instability in the residuals of equation of income inequality.

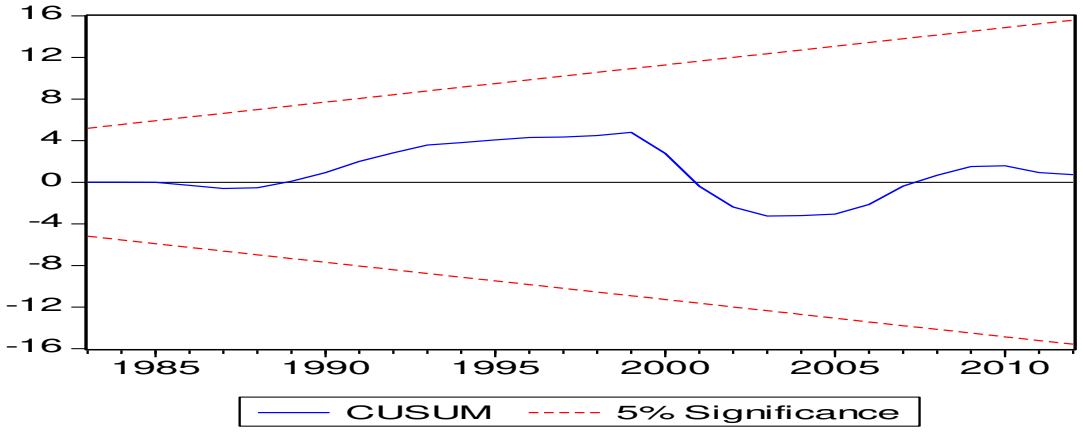

Figure-2. Plot of cumulative sum of recursive residuals. The straight lines represent critical bounds at 5% significance level.

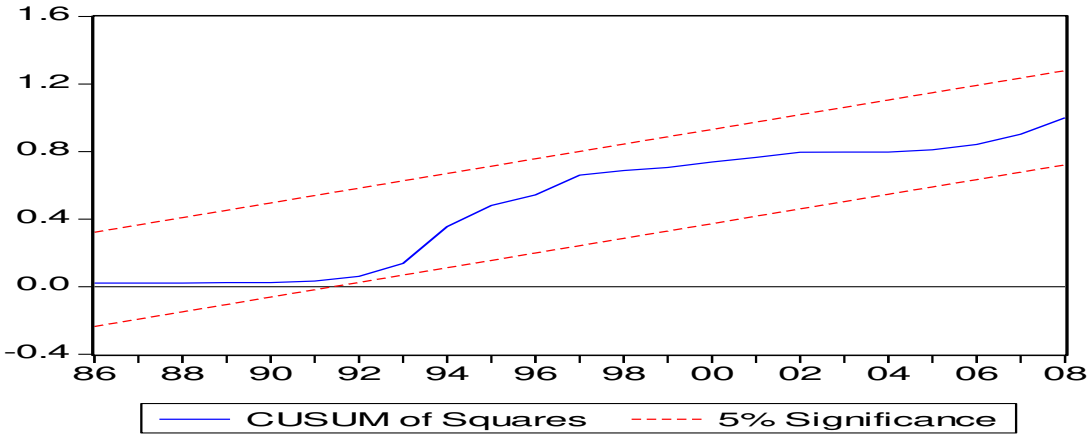

Figure 6.2. Plot of cumulative sum of squares of recursive residuals. The straight lines represent critical bounds at 5% significance level.

The Causality Analysis

In this section three different techniques of causality analysis namely, Granger causality analysis[11], Toda and Yamamoto modified Wald test causality analysis[12] and variance decomposition method[13] have been used to analyze the robustness of causal relationship between military expenditures and income inequality in Pakistan. The results of Granger causality test are reported in Table-9. The results show the unidirectional causal relationship between military expenditures and income inequality which runs from military expenditures to income inequality.

[11] See, Granger (1969)

[12] See, Toda and Yamamoto (1995)

[13] The Variance Decomposition method is estimated through VAR framework, it shows the proportion contribution in one variable caused by the shocks in other variables, Pesaran and Shin (1998).

The bidirectional causal relation exists between income per capita and income inequality. Economic growth Granger causes income inequality.

Table-9: Results of Granger Causality Test

Variables	F-Statistic	Probability
IIQ does not Granger Cause MEX	0.210	0.650
MEX does not Granger Cause IIQ	8.807	0.006
IIQ does not Granger Cause GDP	0.017	0.898
GDP does not Granger Cause IIQ	10.224	0.003
IIQ does not Granger Cause PCI	6.071	0.020
PCI does not Granger Cause IIQ	8.826	0.006

Note: The lag length is 1.

The results of Toda and Yamamoto (1995) procedure based causality test are reported in Table-10. We find that the unidirectional causal relationship between military expenditures and income inequality which runs from military expenditures to income inequality. Income inequality is also Granger cause of economic growth and income per capita. The results of Granger causality and Toda and Yamamoto Causality test are consistent. Both tests confirm that income inequality is Granger cause of military expenditures.

Table-10: Results of Toda and Yamamoto Causality Test

Dependent Variable	Modified Wald – Statistics			
	IIQ	MEX	GDP	PCI
IIQ	–	13.294 (0.001)	6.404 (0.018)	7.534 (0.011)
MEX	0.429 (0.518)	–	2.102 (0.159)	2.416 (0.132)

Note: The lag length for IIQ is 1, MEX is 1, GDP is 2 and PCI is 2 as per Schwartz Bayesian Criteria (SBC).

Variance Decomposition Approach

Generalized forecast error variance decomposition method under vector autoregressive (VAR) system has also been used to analyze the strength of the causal relationship of military expenditures and income inequality. The variance decomposition method provides the magnitude of the predicted error variance for a series accounted for by innovations from each of the independent variable over different time period. Wong (2010), and Raza and Jawaid (2013) have used this approach to find causal relationship among considered variables. Table-11 represents the results of variance decomposition analysis.

Table-11: Results of Variance Decomposition Approach

Period	IIQ	MEX	GDP	PCI
Variance Decomposition of IIQ				
1	100.000	0.000	0.000	0.000
2	95.881	1.439	0.652	2.029
3	82.431	1.454	10.475	5.641
4	72.048	6.726	10.988	10.238
5	58.152	14.572	12.442	14.835
6	40.231	20.794	20.176	18.800
7	31.201	24.352	22.639	21.808
8	27.891	25.738	22.597	23.775
9	26.433	25.699	23.052	24.817
10	23.841	24.888	26.125	25.146
Variance Decomposition of MEX				
1	6.806	93.195	0.000	0.000
2	4.186	94.412	0.251	1.150
3	4.639	92.190	0.406	2.765
4	1.398	94.312	0.322	3.968
5	8.063	87.231	0.223	4.483
6	5.746	89.446	0.191	4.618
7	4.286	90.818	0.251	4.645
8	3.366	91.585	0.394	4.655
9	2.794	91.953	0.588	4.666
10	2.466	92.051	0.799	4.684

The results of Table-11 show that in the first round the change in income inequality is explained completely 100% by its own innovations. In the second period 95.88% explain by own innovation, 1.44% by military expenditure, 0.65% by gross domestic product and 2.03% by per capita income. In period five the shocks in income inequality explain 58.15% by own innovation, 14.57% by innovations of military expenditures, 12.44% by innovations of gross domestic product and 14.84% by innovations of per capita income. In tenth period the shocks in income inequality explain 23.84% by own shocks, while, 24.89% explain by innovations of military expenditures, 26.13% explain by innovations of gross domestic product and 25.15% explain by innovations of per capita income. The shocks in military expenditures explain 93.20%, 94.41%, 87.23% and 92.05% by its own innovations in period 1, 2, 5 and 10 respectively. The shocks in military expenditures explain 6.81%, 4.19%, 8.06% and 2.47% by innovation of income inequality in period 1, 2, 5 and 10 respectively. These findings also suggest the unidirectional causal relationship between military expenditures and income inequality which runs from military expenditures to income inequality.

5. Conclusion and Policy Recommendations

The current study investigates the impact of military expenditures on income inequality in Pakistan by using the annual time series data for the period of 1972-2012. The ARDL bounds testing cointegration approach confirms the valid long run relationship between military expenditures and income inequality. The results indicate that military expenditures have positive

relationship with the income inequality. The findings of CUSUM and CUSUM of square test suggest that there is no structural instability in the residuals of equation of income inequality.

The results of rolling window estimation method indicate that the military expenditure is having very mix coefficients throughout the sample period. Our findings also indicate that the coefficient of military expenditures is showing positive from 1991 to 1994, 2000 to 2003 and 2008 to 2012. Conversely, the coefficient of military expenditures is showing negative values from 1995 to 1999 and 2004 to 2006. The Granger causality, Toda and Yamamoto Modified Wald causality and variance decomposition analysis confirm the unidirectional causal relationship between military expenditures and income inequality which runs from military expenditure to income inequality in Pakistan.

The findings of this study suggested that military expenditures would be a significant policy option to control the income inequality and should be considered as a mean to improving income distribution in Pakistan. Policy makers should critically analyze the reasons of negative association of military expenditures with income inequality in years from 1995 to 1999 and from 2004 to 2006 to formulate favorable policies to improve income distribution in Pakistan. Policy makers should focus on diversifying their budget expenditures on more developing, social and welfare expenditures instead of high military expenditure to enhance the living standard and decrease the income inequality in Pakistan.

At this stage it can be suggested that the mutual relationship between Pakistan and India is very important for the global peace and especially for South Asian region. Therefore, it is highly demanded that both Pakistan and India should initiate bilateral talks to develop mutual consensus to fight against income inequality, poverty and terrorism instead of fighting with each other. The economic condition and standard of living of both countries do not permit them to invest such a huge amount of their annual budgets on their defence spending. It is highly recommended that both countries should start dialogues to build a consensus for the peace by reducing their military budgets. This step may reduce the arm race in between Pakistan and India which will shift the huge chunk of their budget expenditures on more developing, social and welfare expenditures instead of high military expenditures to enhance the living standard and decrease the income inequality in Pakistan.

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