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The effect of defence expenditure on income inequality: empirical evidence from Pakistan

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Abstract:

Every government needs sustainable economic development, and the degree of income inequality (later INE) significantly impacts how the economy develops. Furthermore, the defence expenditure (later DE) has always been a significant part of the government's budget, especially in developing countries like Pakistan, significantly affecting income inequality. This study was carried out to determine how Pakistan's income inequality is affected by defence spending. The time series data from 1972 to 2021 were used in this investigation and used the ARDL technique to estimate the data and other diagnostics. According to this study, income inequality and defence spending are positively correlated. Like how GDP, FDI, and the unemployment rate hurt income inequality in Pakistan, the inflation rate also has a beneficial impact on it. Furthermore, there is no causality between defence expenditure and income inequality. This study recommended that policymakers adapt their strategies by prioritising the basic and primary sectors to lessen this imbalance and concentrate on measures to boost the nation's economic activity and ultimately lower income inequality.

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1. Introduction

Every nation's government needs sustainable economic development and growth. However, developing countries have been confronting major macroeconomic issues like inflation, unemployment, income inequality, defence expenditure, and GDP growth. All of these variables are linked to one another in some way. But to have sustainable economic growth, the government and policymakers must always deal with these issues to stabilize the economy. Both a positive and negative relationship exists between INE and sustainable GDP growth. GDP growth and INE have an inverse relationship, according to previous studies; thus, when growth is high, income inequality will be low (Luan & Zhou, 2017; Rehman et al., 2023). GDP growth and INE are correlated, and the link is positive for countries with high income per capita and negative for countries with low income (Dorofeev, 2022). Nowadays, countries are spending more on defence, which is the type of expenditure that is required for the maintenance of military or different methods and defence equipment for defence purposes (Raju & Ahmed, 2019). However, it is believed that DE has a negative and adverse effect on long-term GDP growth. Using cross-sectional and time-series data, researchers have examined the effects of rising DE on GDP growth. The majority of studies confirmed that defence expenditures have adversely affected GDP growth (Dunne et al., 2002), while a few confirmed the positive relationship between growth and defence expenditures (Feridun et al., 2011).

Notwithstanding, income inequality has emerged as a preliminary problem all around the world, and every day, the income gap between rich and poor extends. Inequality of income causes unemployment and poverty. Additionally, it affects groups, cultures, families, etc. (Muhibbullah & Das, 2019). The biggest problem in the modern world is the trade-off between DE and INE. However, the relationship between defence expenditure and income inequality varies by country. According to Hirnissa et al. (2009), in Malaysia and Singapore, the relation between the two variables is positive, which means that if defence expenditure increases, it will increase income inequality in these countries, but they found no relationship between the two variables in Thailand, the Philippines, South Korea, and India, which means that defence expenditure has nothing to do with income inequality in these countries. Every country's government wants to redistribute the government's revenue in such a way as to raise everyone's standard of living and lessen income inequality. The largest impediment to the government's ability to distribute revenue and spend more on socioeconomic activities is the size of the budget. The volume of the budget can determine the distribution of revenue among different economic activities within the country (Raza et al., 2017).

Further, he says that if a government increases its defence expenditure, then it will have less money to spend on other things socio-economic activities such as health, education, and other activities that help to decrease income inequality. The government is always forced to choose between defence and non-defence spending. It is interesting to discuss here that, due to a vast variety of socio-monetary and political issues in South Asia, the effects of defence expenditure on income inequality are of great importance. According to Vadlamannati (2008), a cut in

defence expenditure may reduce income inequality. The researchers are divided into groups concerning the suggestion between DE and INE. Some accept that the more a country spends on defence, the more income inequality it will face, whereas others believe that the more a country spends on defence, the less income inequality there will be. However, in the case of Pakistan, the relation between DE and INE is significant, which shows that with more spending on defence, there will be more income inequality (Raza et al., 2017).

Therefore, these interesting as well as contrasting results of different studies compelled us to conduct a comprehensive study that included all these variables, in particular to investigate the long-term correlation between Pakistan's income inequality and defence spending. Additionally, this study's goal is to determine how defence spending affects income inequality. The study also looked at Granger causality between numerous factors, especially defence spending and income disparity.

2. Literature review

Ali and Galbraith (2007) investigated the link between DE and INE. They used data from 1987 to 1997. They obtained consistent results indicating that defence expenditure has a favourable effect on INE. In his empirical investigation of the link between DE and INE, Ali (2007) did a panel regression along with nation-level models and controlled defence force, GDP, consistency with income per capita, and other potential factors. They made use of the 1987–1997 data. They discovered a beneficial impact of DE on INE. Vadlamannati (2008) explored the relationship between defence spending and economic inequality. The four South Asian countries were studied, and the data ranged from 1975 to 2005. The models Pooled OLS and 2-SLS were used in the study. They discovered that defence expenditure had a positive effect on income disparity.

Lin and Ali (2009) contend that the relationship between defence spending and economic inequality is underappreciated in the empirical research. There is no connection between DE and INE. The utilization of BVC and SIPRI data across 58 countries from 1987 to 1999 revealed a direct link between defence spending and inequality. In addition to that, Hirnissa et al. (2009), using annual data from 1970 to 2005, examine the link between defence expenditure and INE. According to their findings, the relationship between DE and INE in Malaysia and Singapore is long-term, implying that growing military spending would increase income inequality in both countries. There is no co-integration between these variables for the other nations in the sample; hence defence expenditure has no effect on INE. Their findings, which are highly fascinating, demonstrate a unidirectional link between defence spending and income disparity in Malaysia, and a bidirectional relationship in Singapore. The lack of major links between the remaining states might be seen as evidence of good governance in these countries. Ali (2012) empirically examined the connection between defence expenditure and inequality inside the MENA nations by using a panel regression and tokenizing the data from 1987 to 2005. DE has a noteworthy and inverse effect on inequality. Elveren (2012) studied the link

between defence expenditure and INE for Turkey and used data from 1963 to 2007. They founded co-integration in the model. Furthermore, the empirical result of causality test verified the one-sided causality running from defence expenditure to INE.

Töngür and Elveren (2013) analyse data from 1963 to 2008 to show that, while income disparity has a favourable influence on economic development, military spending has no effect. Guo et al. (2013) investigate the link between defence spending, budget deficits, and economic redistribution in India from 1970 to 2009. Their approach is based on the widely used autoregressive distributed lag model (ARDL). They discovered that military spending in India is related to economic redistribution. Furthermore, their empirical methodology suggests that in India, there is a long-run link between transfer payments as a percentage of GDP, defence spending as a percentage of GDP, and budget deficits as a percentage of GDP. Raza and Shahbaz (2014) examine the influence of military spending on income inequality in Pakistan using data from 1972 to 2012. For estimate, they used the ARDL bounds testing cointegration and the Granger causality technique. They discovered that military spending had a beneficial influence on income disparity. Furthermore, results demonstrate the unidirectional causal link that exists between military spending and economic disparity.

Meng et al. (2015) found that China's defence spending has had an influence on income disparity. They identified a one-way causal relationship between income disparity and defence spending. Töngür and Elveren (2015) examined connections that may exist among defence expenditure, income inequality and the various political and welfare systems. The data for thirty-seven states, from 1988 to 2003, show that the influence of DE on INE is positive. Wolde-Rufael (2016) investigate the connection between defence expenditure and the INE in Taiwan. The findings suggest that defence expenditure led to the growth in income inequality in Taiwan from 1976-2011. Shahbaz et al. (2016) investigate the effect of DE on INE in the case of Iran. They used statistics from 1971 to 2011 and employed ARDL, VECM, and OLS strategies for estimation. They observed that defence expenditure improves income sharing in Iran. A U-shaped link among defence expenditure and income inequality was observed. Zhang et al. (2017) analyse the relation between inequality in income and defence expenditure using data from 1997 to 2012 for 31 provinces of China and seven defence areas. Additionally, there was a short-term and strong effect of DE on INE. In China, there is a positive correlation in the north and a negative correlation in the south.

Sharif and Sharif and Afshan (2017) took data from 1980 to 2014 on an annual basis. They discovered that defence expenditure significantly and favourably effect INE in Pakistan and India. Furthermore, the same long-period link between DE and INE was found by Çenberci (2019), who used panel estimation for fifteen countries belonging to the EU for the period 2005–2016. Following the co-integration test, it was proven that there is a long-period link between defence spending and economic disparity. The results obtained from the casual test show that there is no causal linkage between defence expenditure and income inequality. Moreover, defence expenditure’s effect on INE for the 14 NATO countries between 1977 and

2007 was examined by Michael and Stelios (2020), it was possible to determine the long-period linkage between DE and INE. They showed that the relationship between defence expenditure and INE is positive. Biscione and Caruso (2021) examine the link between DE and INE in a sample of transition economies between 1990 and 2015. The results show that there is a positive correlation between defence expenditure and INE. Similarly, Using data from 1990 to 2015, Ghosh (2022) empirically investigates the link between INE and defence expenditure in the top ten defence expenditure nations. They found a adverse effect of defence expenditure on the INE.

Maesza et al. (2022) used data from 2000 to 2019 and employ OLS technique to estimate the influence of the defence budget on income disparity in Indonesia. They discovered that the defence budget, economic growth, and investment all had an impact on income disparity. Digdowiseiso et al. (2022) empirically investigate the link between fiscal-decentralization, vertical-, and horizontal-inequality. They examined how institutional-quality and DE impact the fiscal decentralization-inequality nexus in thirty-three (33) developing countries from 1990-2014. Their findings show that different types of fiscal power have a major impact on income distribution and ethnic disparity. This is dependent on the institutions and military spending levels attained by these emerging nations. Gillani et al. (2022) used the 51 developing countries data from 2000-2020 and employ 3SLS techniques for estimation. They found that the DE shows that higher level of DE reduces the INE and economic growth. Moreover, GDP has a negative impact on income disparity and military spending. The disaggregate analysis in this study is done on the basis of democracy level, by separating the nations into two categories, democratic countries and authoritarian countries. The findings of democratic nations are identical to the results of combined data analysis, but the results of authoritarian countries are identical to aggregate data analysis, with the exception of economic development, which has a negligible influence.

Biyase et al. (2022) use ARDL and limits test for cointegration approach to study the link between DE and INE in South Africa, shedding some light on the empirical conundrum. The empirical findings demonstrated a long-run link between South African DE and economic inequality. Military spending increases result in a high degree of inequality. Eita et al. (2022) explore the DE-INE nexus in South Africa using data from 1980-2017 and an NARDL model. They discovered evidence of an asymmetric link between military spending and INE. Furthermore, Chakravarthi (2023) found that the defence expenditure has no effect on income inequality. Thomas et al. (2023) investigate the link between military spending and wealth inequality in the BRICS countries. They employed the PMG or PARDL technique for the BRICS states from 1990 to 2017. They discovered an adverse link between DE and INE. When the data was disaggregated to represent the BRICS nations with military expenditures of less than 2% of the national budget (Russia, China, and India), they discovered that DE had a negative effect on income inequality in the long-term equation.

In short, the effect of the defence expenditure on inequality is still ambiguous and controversial

among the researchers. Like, the one group argues that defence expenditure expand the income inequality (Sharif & Afshan, 2017), Biscione and Caruso (2021), (Michael & Stelios, 2020), (Maesza et al., 2022) while, the other group claim that defence expenditure shrink the income inequality (Ghosh, 2022). However, some researcher argues that defence expenditure have like with income inequalityÇenberci (2019), and Chakravarthi (2023). A substantial literature on the impact of DE on GDP produces contradictory conclusions. The potential impact of inequality is a critical problem that has not been studied in this context (Töngür & Elveren, 2013). There are conflicting perspectives on the relationship between a country's military budget and its wealth disparity. Military spending is an important component of the government budget, and it can easily swamp out transfer payments, which are required to reduce economic disparity. However, these payments can also increase demand, which can improve low-income people' income prospects. Therefore, the link between DE and INE is more essential issue (Thomas et al., 2023). Therefore, this study was conducted to minimize the gap and tried to make the link between defence outlay and INE clear in the Pakistan as well as in the other developing countries.

3. Theoretical background

Lin and Ali (2009) found that there are a lot of expenses for defence. Income disparity rises as funding for social and welfare programs is cut. To begin, Keynesian theory explains how defence spending improves the income distribution of companies tied to defence. This leads to a rise in total demand and a higher level of employment in the country. During economic downturns, the ensuing inequality grows, whereas it falls during upturns. As a result, during economic upswings, low-income folks profit disproportionately more than wealthier individuals. As a result, such defence spending can help to reduce economic disparity. Second, the argument elaborates on how, due to the complexities of its composition, the relationship between defence spending and income disparity might change depending on the conditions. The difference should be recognized when defence money pays for a highly skilled workforce. Similarly, when defence spending pays for a lower-skilled workforce, inequalities must be addressed. As a result, the type and structure of defence spending determines the genuine impact (Ali, 2007). Third, according to microeconomic theory, increasing defence expenditures comes at the price of other government spending. As a result, defence spending depletes resources for social services (Ali, 2004). Finally, it is obvious that industrial inequality is being researched. According to this report, defence personnel are better rewarded than those in non-defence industries. In many cases, the military industry's labour revenue exceeds that of other industries. As a result, there is a significant income disparity between pay groups within a country's industries (Ali, 2007).

4. Methodology

This study used the data from 1972-2021 and extract from the World Development Indicators (WDI) (2022).

4.1. Model specification

The inequality was measured with Gini coefficient. These variables like FDI, INF, Edu and Umep, have a significant role in the influence of income inequality, which are not considered by prior studies. Therefore, an inclusive model, this study also includes FDI, GDP, defence-spending (DE), and Uemp in the model. Moreover, the model of this study came from the studies of Raza et al. (2017), Cysne et al. (2005), Abdullah et al. (2015), Carvalho and Di Guilmi (2020) and Chintrakarn et al. (2012). Following a review of the theoretical and empirical research, we suggest the empirical model below to investigate the connection between defence spending and income inequality.

$$INE_t = \beta_0 + \beta_1 DE_t + \beta_2 GDP_t + \beta_3 Unemp_t + \beta_4 FDI_t + \beta_5 INF_t + \beta_6 edu_t + \mu_t \ldots. (1)$$

where, INE is for the Gini coefficient's measure of income inequality, MEX stands for military spending as a proportion of GDP, GDP, Unemp stands for unemployment rate, FDI, INF stands for inflation rate, and Edu stands for education.

Table 1: Explanation of variables

S.#.	Variables	Measeurement	Period	Symble	Source
1	Gini index	Rank (0-100) perfect equality to inequality)	1972-2021	INE	----
2	Military expenditure	Percentage of GDP	1972-2021	DE	Meng et al. (2015), Raza et al. (2017), Ali (2007), Jorgenson (2005), Jayadev and Bowles (2006) and Biscione and Caruso (2021)
3	GDP growth	Percentage annual	1972-2021	GDP	Halmos (2011), Barro (2008), and (Wahiba & El Weriemmi, 2014)
4	Unemployment	Percentage of total labor force	1972-2021	Unemp	Carvalho and Di Guilmi (2020), and Esquivias et al. (2021)
5	Inflation, consumer prices	Percentage annual	1972-2021	INF	Deyshappriya (2017), Balcilar et al. (2018), and Siami-Namini and Hudson (2019)
6	Foreign direct investment, net inflows	Percentage of GDP	1972-2021	FDI	Chintrakarn et al. (2012), and Herzer and Nunnenkamp (2011)
7	School enrollment, secondary	Percentage of gross	1972-2021	Edu	Abdullah et al. (2015) and Gregorio and Lee (2002)

4.2. Estimation strategy

In order to avoid any econometric issues that could lead to biased, contradictory, or false results, it is essential to examine the time series' stationarity properties. Therefore, we implement the ADF test, one of the commonly used tests created by Dickey and Fuller (1979),

which is a frequently used unit root test. This study used ARDL technique for estimation initiated by Pesaran et al. (2001) because its allow mixed order of integration for regression or proof of the equilibrium link between the variables When there is a mixed order of integration, the traditional Granger cointegration analysis is inappropriate.

In ARDL form

$$\mathrm{INE}_t = \beta_0 + \sum_{i=1}^{n} \beta_{1i}\mathrm{INE}_{t-i} + \sum_{i=0}^{n} \beta_{2i}\mathrm{DE}_{t-i} + \sum_{i=0}^{n} \beta_{3i}\mathrm{Uemp}_{t-i} + \sum_{i=0}^{n} \beta_{4i}\mathrm{FDI}_{t-i} + \sum_{i=0}^{n} \beta_{5i}\mathrm{INF}_{t-i} + \sum_{i=0}^{n} \beta_{6i}\mathrm{Edu}_{t-i} + \mu_t \quad \ldots\ldots (2)$$

In ARDL bond form

$$\Delta\mathrm{INE}_t = \beta_0 + \sum_{i=1}^{n} \beta_{1i}\Delta\mathrm{INE}_{t-i} + \sum_{i=0}^{n} \beta_{2i}\Delta\mathrm{DE}_{t-i} + \sum_{i=0}^{n} \beta_{3i}\Delta\mathrm{Uemp}_{t-i} + \sum_{i=0}^{n} \beta_{4i}\Delta\mathrm{FDI}_{t-i} + \sum_{i=0}^{n} \beta_{5i}\Delta\mathrm{INF}_{t-i} + \sum_{i=0}^{n} \beta_{6i}\Delta\mathrm{Edu}_{t-i} + \gamma_1\,\mathrm{DE}_t + \gamma_2\mathrm{GDP}_t + \gamma_3\mathrm{Unemp}_t + \gamma_4\mathrm{FDI}_t + \gamma_5\mathrm{INF}_t + \gamma_6\mathrm{Edu}_t + \mu_t \quad \ldots\ldots (3)$$

Where μ is the error term, t in the subscript of each variable represents the time, while β_0 is a constant, and other $\beta_{'s}$ are coefficients of the variables.

5. Results and discussion

5.1. Descriptive Statistics

Table 2 presents descriptive statistics, demonstrating that the series income inequality has the greatest average when the mean value of the series FDI is lowest. Similar to this, the series FDI has the lowest standard deviation, the series education has the highest standard deviation, and the series means has the highest variation. The Jarque-Bera test shows that the series income inequality, GDP, Education, and unemployment are ordinarily distributed while the series FDI, defence expenditure, and inflation rate are not ordinarily distributed.

Table 2: Summary of Descriptive Statistics

	INE_t	GDP_t	FDI_t	Edu_t	DE_t	INF_t	$UEMP_t$
Mean	31.0108	4.7070	0.7612	26.7468	5.1200	9.0341	3.7555
Median	30.7300	4.7820	0.5975	25.4533	5.4783	8.0941	3.9700
Maximum	33.5000	10.2157	3.6683	44.8682	6.9917	26.6630	7.8300
Minimum	28.6500	-1.3295	-0.0627	16.5387	3.2652	2.5293	0.4000
Std. Dev.	1.4810	2.1956	0.7635	8.5817	1.3008	5.1010	2.0453
Skewness	0.2764	-0.1570	2.3466	0.6154	-0.0485	1.5136	0.1511
Kurtosis	1.8152	3.2532	8.6499	2.2001	1.4045	5.6199	2.2187
Jarque-Bera	3.5613	0.3391	112.3893*	4.4892	5.3233***	33.3905*	1.4620
Probability	0.1685	0.8440	0.0000	0.1060	0.0698	0.0000	0.4814

5.2. Matrix of correlation

Table 3 presents the correlation between the variables, which shows that the series income inequality is negatively correlated with GDP, FDI, Education, and unemployment while positively correlated with defence expenditure and inflation rate. Similarly, the series GDP is positively correlated with the series FDI, and education while negatively correlated with the series defence expenditure, inflation rate and unemployment rate. Furthermore, the series FDI is positively correlated with education, inflation rate, and unemployment while negatively correlated with negatively correlated with defence expenditure. Similarly, the series education is negatively correlated with defence expenditure, inflation rate and unemployment rate. However, the series defence expenditure is positively correlated with inflation rate and unemployment rate. There is a negative correlation between unemployment and inflation rate.

Table 3: Correlation Matrix

Variables	INE_t	GDP_t	FDI_t	Edu_t	DE_t	INF_t	$UEMP_t$
INE_t	1	-0.0134	-0.0630	-0.4234	0.2041	0.1189	-0.2040
GDP_t		1	0.1679	0.3418	-0.2816	-0.1210	-0.1336
FDI_t			1	0.3665	-0.4753	0.0707	0.2035
Edu_t				1	-0.6883	-0.1166	-0.0438
DE_t					1	0.1065	0.0396
INF_t						1	-0.4257
$UEMP_t$							1

5.3. Unit Root test findings

The results of the ADF test are presented in Table 4, and they demonstrate that while the series of income inequality, GDP, FDI, and inflation rate are stationary at level, the series of education, defence spending, and unemployment rate are stationary at 1st difference. The ARDL procedures are more appropriate for estimate in this situation since the results of the ADF test demonstrate that the variables have various orders of integration.

Table 4: ADF test Results

Variables	Level		1st difference		Decision
	t-statistics	p-value	t-statistics	p-value	
INE_t	-4.7395*	0.0003	----	----	1(0)
GDP_t	-5.6115*	0.0000	----	----	1(0)
FDI_t	-3.1598**	0.0288	----	----	1(0)
Edu_t	0.3878	0.9805	-6.3626*	0.0000	1(1)
DE_t	-1.0661	0.7217	-5.0566*	0.0001	1(1)
INF_t	-3.4723**	0.0130	----	----	1(0)
$UEMP_t$	-2.2180	0.2027	-6.8880*	0.0000	1(1)

Note: *,**,& *** indicated the consequence level at 1, 5 and 10%.

5.4. Regression results

The ARDL long-run results are presented in Table 5, which demonstrates that the GDP has a negative and large impact on income disparity. Income disparity will reduce by 0.2453 points for every percentage point increase in GDP growth. Halmos (2011), Choi (2006), Barro (2008), Mo (2000), and (Wahiba & El Weriemmi, 2014) reported comparable results, but Kentor (2001) reported the contrary. Similar to this, FDI significantly and negatively affects income inequality. A percentage increase in FDI inflow will result in 1.3626 points decline in income inequality. Chintrakarn et al. (2012), and Herzer and Nunnenkamp (2011) reported similar results, but Herzer et al. (2014), and Kaulihowa and Adjasi (2018) reported the contrary. Income inequality is negatively and significantly impacted by education. Income inequality will go down by 0.2327 points for every percentage point rise in secondary school attendance. Education raises the number of poor earners while lowering the income share of the richest earners. The elimination of inequality in Pakistan has benefited greatly from education. Abdullah et al. (2015) and Gregorio and Lee (2002) reported comparable results, but Glomm and Ravikumar (2003) reported the opposite. The cost of the military, however, has a positive and large impact on income disparity. A percentage rise in defence spending will result in 0.4440 points increase in income inequality.

Table 5: ARDL long-run results

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
GDP_t	-0.2453**	0.0979	-2.5048	0.0177
FDI_t	-1.3626*	0.3255	-4.1867	0.0002
Edu_t	-0.2327*	0.0660	-3.5246	0.0013
DE_t	0.4440*	0.0693	6.4053	0.0000
INF_t	0.1209**	0.0444	2.7209	0.0106
$UEMP_t$	-0.2441*	0.0606	-4.0291	0.0003
C	23.6015*	2.1998	10.7292	0.0000
F-Bounds Test		Null hypothesis: no levels relationship		
Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	4.8088*	10%	1.9900	2.9400
K	6	5%	2.2700	3.2800
		2.5%	2.5500	3.6100
		1%	2.8800	3.9900

Note: *, **, & *** indicated the consequence level at 1, 5 and 10%.

Meng et al. (2015), Raza et al. (2017), Ali (2007), Jorgenson (2005), Jayadev and Bowles (2006) and Biscione and Caruso (2021) reported comparable results, while Ali (2012), and Michael and Stelios (2020) reported the opposite findings. The rate of inflation significantly and favourably impacts income inequality. The income disparity will rise by 0.1209 percentage

points for every percent increase in the inflation rate. Cysne et al. (2005), Nantob (2015), Deyshappriya (2017), Balcilar et al. (2018), and Siami-Namini and Hudson (2019), and others provided comparable results; Monnin (2014), Maestri and Roventini (2012), and Coibion et al. (2012) provided the opposite results. On the other hand, the unemployment rate significantly and negatively affects income inequality. The income inequality will drop by 0.2441 points for every percentage point increase in the unemployment rate. Carvalho and Di Guilmi (2020), and Esquivias et al. (2021), and Sheng (2011) all presented comparable results, while Sheng (2011) presented the opposite results. The ARDL-Bound test and F-statistic values are above the 1% upper bound, indicating that there is long-term cointegration between the variables.

The ARDL short run results are shown in Table 6, which demonstrates that the GDP has a negative and considerable impact on income disparity. A percentage increase in FDI inflow will result in 0.0475 points reduction in income inequality. Similar to this, FDI significantly and negatively affects income disparity. A percentage increase in FDI inflow will result in 0.3399 points reduction in income inequality. However, the impact of education on income disparity is minimally negative. Income inequality is positively and significantly impacted by defence spending. The income discrepancy will rise by 0.5706 percentage points for every percentage point increase in defence spending. Similar to this, the rate of inflation significantly and favourably affects income inequality. The income inequality will rise by 0.1170 percentage points for every percent increase in the inflation rate. On the other hand, the unemployment rate significantly and negatively affects income disparity. Income disparity will fall by 0.2784 points for every percentage point increase in the unemployment rate. This study also discovered that the ECM value is negative and substantial, indicating that the spread of adjustment at 53% indicates convergence of the short-run equilibrium to the long-run equilibrium.

Table 6: ARDL short-run results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
$D(GDP_t)$	-0.0475**	0.0228	-2.0811	0.0439
$D(FDI_t)$	-0.3399***	0.1753	-1.9385	0.0596
$D(Edu_t)$	-0.0703	0.0549	-1.2814	0.2074
$D(DE_t)$	0.5706**	0.2484	2.2970	0.0269
$D(INF_t)$	0.1170*	0.0306	3.8209	0.0005
$D(UEMP_t)$	-0.2784*	0.0670	-4.1585	0.0002
ECM_{t-1}	-0.5297*	0.0161	-32.8684	0.0000
C	0.0045	0.0724	0.0618	0.9510

Note: *, **, & *** indicated the consequence level at 1, 5 and 10%.

5.5. Results of causality tests

The results of the Granger causality test are presented in Table 7, which demonstrates that there is a one-way causal relationship between GDP and INE, income inequality and FDI, education

and INE, INF and INE, FDI and GDP, education and GDP, GDP and unemployment, and FDI and unemployment. However, there is no correlation between defence outlay and INE, unemployment rates, GDP, inflation rates, unemployment rates and education, inflation rates and education, unemployment rates and education, inflation rates and defence expenditure, or between inflation rates and defence expenditure, unemployment rates and inflation, or between defence expenditure and unemployment rates.

Table 7: Results of the granger causality test

Variables	INE_t	GDP_t	FDI_t	Edu_t	DE_t	INF_t	$UEMP_t$
INE_t	---	0.6830 (0.5105)	3.4322** (0.0414)	1.1814 (0.3166)	0.9498 (0.3948)	3.0548*** (0.0575)	0.8134 (0.4500)
GDP_t	2.6445*** (0.0826)	----	1.2076 (0.3088)	0.9325 (0.4014)	0.8832 (0.4208)	0.4742 (0.6256)	2.6920*** (0.0792)
FDI_t	1.6827 (0.1979)	3.0664*** (0.0569)	----	0.3198 (0.7280)	1.0620 (0.3547)	1.0620 (0.3547)	1.8156 (0.1750)
Edu_t	2.4107*** (0.1000)	3.0193*** (0.0593)	0.0204 (0.9799)	----	1.1462 (0.3274)	0.0665 (0.9358)	1.1913 (0.3137)
DE_t	0.1112 (0.8950)	0.6663 (0.5188)	2.6309*** (0.0836)	2.1179 (0.1327)	----	0.3141 (0.7321)	0.0361 (0.9646)
INF_t	1.5377 (0.2265)	0.6240 (0.5406)	0.8927 (0.4170)	0.0168 (0.9834)	0.4445 (0.6441)	----	0.7282 (0.4886)
$UEMP_t$	1.5312 (0.2278)	0.5152 (0.6010)	4.1615** (0.0223)	0.3190 (0.7286)	0.5204 (0.5980)	1.3818 (0.2621)	----

Note: *, **, & *** indicated the consequence level at 1, 5 and 10%.

6. Conclusion and recommendations

In order to determine how Pakistan's income inequality is affected by defence spending, this study was carried out. The time series data from 1972 to 2021 were used in this investigation and used the ARDL technique to estimate the data and other diagnostic. According to the empirical data, the GDP, FDI, education, and unemployment rate all have a considerable negative impact on income inequality, whereas defence spending and inflation have a significant long-term positive impact. In the short term, income disparity is significantly and negatively impacted by the GDP, foreign direct investment, and unemployment rate, while positively impacted by defence spending and inflation. The ECM value was likewise found to be negative and significant in this study, showing that the spread of adjustment at 53% suggests convergence of the short-run equilibrium to the long-run equilibrium. GDP and income inequality, income inequality and FDI, education and income inequality, inflation and income inequality, FDI and GDP, education and GDP, unemployment and FDI, and GDP and unemployment all have a one-way causal relationship. However, there is no correlation between defence spending and income inequality, unemployment, GDP, inflation rate, education, unemployment rate, and any of these variables. Nor is there any correlation between inflation and defence spending, unemployment rate and defence spending, and inflation and unemployment rate. Additionally, the ARDL-bound test and F-statistic values are above the

1% upper bound value, thus indicating that the variables' long-term co-integration is present. This study also discovered that the ECM value is negative and substantial, thus indicating that the spread of adjustment at 53% indicates convergence of the short-run equilibrium to the long-run equilibrium.

Overall, the study's findings suggest that rising defence spending is a primary cause of Pakistan's income inequality. Decreased funds for social spending like welfare, health care, and education as a result of higher defence spending, all of which have a positive impact on how money is divided. Policymakers should rearrange their plans by putting more emphasis on the primary and basic sectors to minimize income inequality in Pakistan since, as was already shown, higher defence spending causes larger income inequality in that country. Raising living standards and decreasing income disparity in Pakistan will also be accomplished by focusing on social and welfare spending rather than excessive defence spending. According to the study's findings, Pakistan's income inequality increases as defence spending rises. To improve living conditions and reduce income inequality across the country, the government must implement a number of social welfare programs.

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