



**PUBLIC POLICIES, SOCIO-ECONOMIC ENVIRONMENT AND CRIMES IN PAKISTAN:
A TIME SERIES ANALYSIS**

AMJAD ALI¹, CHAN BIBI²

ABSTRACT

This article attempts to analyze the impact of public policies about taxes, defense expenditures, loans and grants on crimes in Pakistan over the period from 1980 to 2019. Autoregressive Distributed Lag (ARDL) approach has utilized to check cointegration among the variables of the model and Vector Error-Correction model is applied for estimating short run dynamics of the model. The outcomes of the analysis show that defense expenditures, loans and grants more taxes and rising economic misery have a positive and significant impact on crime rates in the case of Pakistan. For the reduction of crime rate government of Pakistan must reduce taxes, defense expenditures, loans and grants and economic misery in the country. For reducing unemployment, government of Pakistan must establish such economic environment which boost new jobs and stable inflation. Moreover, skill development programs must be initiated, so that youth can get self-employment rather than searching government and private jobs. Inflation can be controlled by putting checks on rising production costs.

Keyword: inflation, unemployment, crime rate, public policy

JEL Codes: E31, J64, J18

¹ Assistant Professor, Lahore School of Accountancy and Finance, City Campus, University of Lahore. chanamjadali@yahoo.com

² Advocate High Court Lahore, International Islamic University, Islamabad (LLM. Scholar in International Law)
chanali.lawyer@yahoo.com

I. INTRODUCTION

Simply, a crime is an unlawful or punishable act done by an individual under the jurisdiction of a state or other authority (Attenborough, 1922). A crime or offense (or criminal offense) is an act harmful not only to some individual, but also to a community, society, or the state ("a public wrong"). Such acts are forbidden and punishable by law (Martin, 2003). The notion that acts such as murder, rape, and theft are to be prohibited exists worldwide. The state (government) has the power to severely restrict one's liberty for committing a crime. In modern societies, there are procedures to which investigations and trials must adhere. If found guilty, an offender may be sentenced to a form of reparation such as a community sentence, or, depending on the nature of their offence, to undergo imprisonment, life imprisonment or, in some jurisdictions, execution. Usually, to be classified as a crime, the "act of doing something criminal" (*actus reus*) must – with certain exceptions – be accompanied by the "intention to do something criminal". While every crime violates the law, not every violation of the law counts as a crime. Breaches of private law (torts and breaches of contract) are not automatically punished by the state, but can be enforced through civil procedure. Protection against any crime is an essential condition to obtain macroeconomic stability in the economy and every sector of the economy grows if there is sufficient law & order present. Since defense is a public good, then it is not interest of the private sector to spend on it. For the sake of peace, the government makes defense expenditures, which leads to increase in number and efficiency of army and police forces. This increases the chances of being punished for criminals far more than a return from crime which leads to reduce the crime rate (Anwar et al., 2015). Having the personal and social cost, crime is unwanted for every society. The personal cost is lawful punishment bear by criminal if caught. While the society takes the loss of property and personnel (Arshad et al., 2016). So, it is in the best interest of policy makers to analyze and devise methods to reduce the crime in the society. There are a number of economists mention that poverty, income inequality, unemployment and lower education are some of the main determinants of crime (Neumayer, 2005; Buonanno and Leonida, 2005; Arshad et al., 2016).

Public policies related to taxes, subsidies, government expenditures, foreign loans, grants and debt financing have direct and indirect relation with the socioeconomic life of the masses. The direct impacts include provision of social goods like defense, subsidies and transportation in the cost of taxes. Taxes and subsidies decide the amount of productions of goods and services which imply an indirect effect on the labor market. The opportunities available in the labor market for the individuals reflect in the unemployment rate. The increase in unemployment means more jobless people and less earning opportunities available. The resources kept by individuals fell more rapidly if it is incorporated with increasing price levels in the economy. The poorest segment of the economy faces the similar problems (Gillani et al., 2009). These all factors give birth to psychological pressure for deprived people and they move towards criminal activities. Because most of them blame public policies and economic conditions of the country (Aurangzeb 2012). The period of hard economic days, motive people to turn towards criminal activities to compensate their income deficiencies. Economic misery creates low income and decreases the purchasing power of the people. With a low income and low purchasing power directly reduce the good and services for the individuals which urge them to do unfair acts to meet their fair needs. Unemployment combined with inflation has a deep rooted influence on crime (Wu and Wu, 2012; Fajnzylber et al., 2002). Those people who have less resources feel economic pressure, try to snatch wealth from those people having more resources which is reflected as an increase in the number of crimes (Kelly, 2000). Bureau of Crime Statistics and Research (2012) points out that economic well-being of society has a greater impact on crime levels than measures that influence the risk of arrest or the severity of punishment.

Crimes in Pakistan are present in various forms. Organized crime includes drug trafficking, money laundering, extortion, black marketeering, political violence, terrorism, abduction, etc. However, there are few studies on Pakistan, which describes the relationship of crime and economic indicators. According to statistics, the total of crimes reported in 1947 was 73,107 and it increased to 129,679 in 1971. Then, it became double from 152,782 to 403,078 during the 1980-1990 period. In 2007, the total number of crimes went to 538,048. These figures show only the reported crimes; however, there are almost 30-50 % crimes that are unreported in Pakistan (Gillani et al., 2008). The increasing trend in the crime rates over the country makes the people think about their security and safety. The overall crime rate in the country today is higher as compared to two years ago. Official statistics show that the overall crime rate, both at the Centre and in all the provinces, has increased despite all claims and policies made by the present federal or provincial rulers. It is a failure on the part of the law enforcement agencies that the crime rate has shot up in the past couple of years (Abbasi, 2010). Pakistan is spending too much money on its defense and security purpose, so these figures are very alarming for the government and security agencies. Security expenditures and crime rate are increasing both at the same time. So, authorities took serious steps to tackle crime down. From last few year's crime rate is showing a declining trend in Pakistan, but still it is very high as compare to other countries in the region. The crime rate in Pakistan in the year 2013 was 7.67 percent, which was a 1.45 % decline from the year 2012. During the year 2014, crime rate was 7.16 percent, which was 6.71 percent less as compare to the year 2013. During the year 2015 crime rate was 5.01 percent, which was 29.99

percent lower than the year 2014. During the year 2016, crime rate further declined to 4.41 percent, which was 11.99 percent lower than the year 2015 (Federal bureau of Statistics, 2019). Under such conditions Pakistan is an interesting case to study, so this study examining the impact of public policies, socioeconomic environment on crime rate in the case of Pakistan.

II. LITERATURE REVIEW

There are a number of empirical and theoretical studies which examine the determinants of crimes among the developed and developing countries. But here most relevant and recent have been selected as a literature review. Wilson and Cook (1985) mention that in the reports of USA Congress mentioned that a rise in unemployment is a major cause of the increase in crime throughout the USA. Afterwards, in next report 1984 highlight that the difference in employment and real income per person are main factors responsible for crimes in the country. Patterson (1991) analyzed the data of 57 small societies to discover the relation of crime and economic factors within the community. The study finds income inequality does not affect crime within societies. Moreover, population density and poverty were found crucial determinants of violent crime. Martinez (1991) observes the relationship of tax amnesty and crimes for US. The study finds that tax evasion work like a crime and after few years, it has negative impact on economic growth of the country. Zimring and Hawkins (1993) analyze that during 1980 unequal economic opportunities, promotes the crime rate in the case of the USA. The study emphasis that deregulation contributing in the financial losses and criminal activities are due to personal reasons or institutional failure.

Raphael and Winter-Ebmer (1998) find the strong negative relationship of unemployment and military spending with crime in US economy. The study finds that high level of unemployment becomes a cause of increasing crime. The increase in military expenditures and increasing job availability are found helpful in reducing the unemployment rate. Chamlin and Cochran (2000) analyse the same sample and conclude that unemployment for the long time becomes a cause of increasing crime. The unemployed for more than 15 weeks is found significant impact on property crime. Chamlin et al., (1999) investigate that tax policy impact on crime. The study concludes that increase in the tax deduction as causes highly increase in violent crime. Such effect is less in amount for property crime. The study finds that by promoting social altruism by taxes alteration leads to increasing crime rather decreasing it. The study suggests that by liberalizing taxes and introduction of charity decrease crime. Kelly (2000) finds that inequality becomes a reason for the individuals to commit violent crime far more than other economic aspects in urban areas. Demombynes and Ozler (2005) find that high inequality becomes a major cause of crime in South Africa. The boundary wall of colonies and wealthy neighbors have a positive impact on property crime. The study concludes that the decrease in poverty tends to a decrease in crime. Bourguignon (2001) points out that irregularity in the development process of the economy causes crime as a social cost. Relative poverty and inequalities in incomes give general rise to crime. Bourne (2011) analyzed the crime level in Jamaica. The study takes macroeconomic factors for explaining violent crime. Both unemployment and poverty revealed insignificant impact in explaining crime. Fajnzylber et al., (2002) estimate the relation and causality between crime and inequality. The study includes panel data of 30 economies. The empiric revealed that increasing inequality is a major cause of the increase in crime and this relationship is found strongly in inter and intra country analysis.

Levitt (2004) points out that hiring more police and increasing imprisoned played a vital role in decreasing crime. The study finds a decline in crime in US over the period from 1991 to 2001. The study does not find evidence of these factors influences on crime rate in the past and suggests that high recruitment in police will decrease the crime in the future. Neumayer (2005) investigates the relationship of crime and inequality considering many countries. The study finds insignificant role of inequality in determining crime. The study suggests inter economy variables influence both crime and income inequality. Mehlum et al., (2005) estimates the effect of poverty on crime in Germany. The study uses instrumental variable technique to estimate that relation. The study finds a moderate significant impact of poverty on crime. Later Traxler and Burhop (2010) revisit the same study and confirmed a direct impact of poverty on property crime. Both studies approved high inverse effect of poverty on violent crime. Mehlum et al., (2005) suggest that beer price could be reason to higher crime rate. Gillani et al., (2009) investigate the relation of crime with economic indicators in Pakistan over the period from 1975 to 2007. The study revealed that crime is caused by poverty, price instability and unemployment. Aurangzeb (2012) analyzes the crime Pakistan over the period from 1980 to 2010. The study revealed that increase in GDP and wage rate leads to decrease crime. Population and migration possess a significant and direct impact on crime. The study suggests decreasing the political influence for improving law and order situation will help in reducing crime in Pakistan. Jalil and Iqbal (2010) analyze the relationship of unemployment and urbanization with crime in Pakistan over the period from 1964 to 2008. Income inequality and inflation also found contributing factors to crime in Pakistan. The study revealed that urbanization impact is direct and strong with crime in long run analysis. While Shamenna et al., (2016) find crimes more in rural areas as compared to urban areas of Sidama Zone and nearby

economies. Gumus (2003) analyse the relationship of crime with urbanization considering cross sectional data from US. The study points out that income inequality, unemployment and population are main determinant of urban crime. Altindag (2012) analyze the effect of unemployment on crime for 33 European economies. The study used panel data and for the reliability of results both OLS and 2SLS is employed. Empiric provides that increasing relationship in unemployment and crime. The increase in unemployment shows higher increase in property and crime in 2SLS than OLS.

Wu and Wu (2012) investigate the validity of economic factors in explaining the crime. The study develops a model that relates inequalities in incomes and unemployment to crime. Empirics from UK are in strong support of the gains from crime are helpful for unemployed population. The study declares that crime phenomena driven by economic gains and it is highly valid for property crime less for others types of crimes. Explaining the same relationship Burdett et al., (2004) added on the job search in the analysis. Multiple equilibria are established that elaborates arising of different outcomes and quantitative methods is also employed. The study finds increase in insurances related to unemployment leads to increase unemployment and crime. The Unique equilibrium case is also discussed that identify nonmonotone relation of crime and inequality. Anwar et al., (2015) investigate the determinant factors to property and violent crimes, considering 25 districts of Punjab (Pakistan) over the period from 2005 to 2011. The study analyses that crime as a whole can split it into property and violent crime. The study found that population density and returns from crime as contributing factors to all types of crime.

Asghar et al., (2016) analyzed the determinants of crime in Pakistan over the period from 1984 to 2013. The study separately determines the effect of political, social and economic factors on crime. The study concludes that law and order increase the crime rate while government stability is helpful in decreasing crime. Poverty is found an increasing factor of crime. The study points out that income inequality contributes positively in crime rate. Unemployment and inflation increase the crime insignificantly. However, Omotor (2009) found that unemployment is a major cause of crime in Nigeria. Haider and Ali (2015) mention that increase in unemployment and population density lead to increase crime in Punjab (Pakistan) considering all districts. The study recommends the need of government policies, including police departments restructure, reducing poverty, controlling population and corruption to decrease in the crimes. Arshad et al., (2016) estimate the impact of economic factors on crime considering data from Punjab (Pakistan) over the period from 2005 to 2013. The study reveals that an increase in health and police expenditures have increasing relationship with the crime rate. The public expenditures also found lowering factor to crime. The study suggests increasing primary education expenditures instead of police expenditures to reduce crime in Punjab.

III. THE MODEL

Virtually all macro-social theories of crime causation, although they often specify alternative intervening processes, contend that temporal fluctuations in the level of unemployment are likely to affect the level of property crime. Rational choice theories of social action assume that individuals are somewhat cognizant of the costs and benefits associated with criminal activities within their immediate environment. The potential offenders take such information into account before deciding to engage in, or refrain from, illegal activities. Consequently, if the anticipated gains from criminal behavior exceed the costs (including the opportunity costs associated with activities forgone), then the aggregate level of crime is expected to increase (Becker, 1968; Cornish and Clark, 1986; Geerken and Gove, 1975; Gibbs, 1975; Ali (2011), Ali (2015), Ali (2018), Ali and Bibi (2017), Ali and Ahmad (2014), Ali and Audi (2016), Ali and Audi (2018), Ali and Rehman (2015), Ali and Zulfiqar (2018), Ali et al., (2016), Haider and Ali, 2015) and Kassem et al, (2019).

Following the previous methodologies, the model of this study becomes as;

$$Cr_t = f(LNGR_t, MI_t, DEF_t, INI_t, IT_t) \quad (1)$$

Where

Cr = all reported crimes

LNGR= loans and grants

MI = economic misery (unemployment rate + inflation rate)

DEF = defence expenditures

INI = income inequality

IT = taxes on income, profits and capital gains

The econometric model of the above functional form become as;

$$LCr_t = \alpha_0 + \alpha_1 LLNGR_t + \alpha_2 MI_t + \alpha_3 LDEF_t + \alpha_4 INI_t + \alpha_5 IT_t + e_t \quad (2)$$

e_t = white noise error term

For empirical analysis, this study uses data from 1980 to 2019. The data of selected variables have been taken from different issues of Economic Surveys of Pakistan, Statistical Year Book and World Development Indicators a data basis maintained by the World Bank.

IV. ECONOMETRIC METHODOLOGY

The econometric tools are helpful in quantifying the economic phenomena. They provide the base for quantitative analysis of economic theory. Most of macroeconomic factors include time trend which makes it non stationary which leads to unreliable regression results. Nelson and Plosser (1982) revealed that macroeconomic variables possess unit root problem when the data is time series. He concludes that existence or non-existence of unit root helps to check the authenticity of the data generating process. Stationary and non-stationary data have some different features. The stationary time series data have temporary shocks which disappear over the time series and move back to their long-run mean values. However, shocks are permanently in non-stationary time series data. As a result, the variance and mean of a nonstationary time series depend upon the time trend and the series has: (a) no long-run mean to which the series returns, and (b) variance will depend on time and approach infinity as time goes to infinity. In case if the time series data has only negative or positive shocks, the time series data is nonstationary (Dickey and Fuller, 1979). In the literature, several unit root tests are available for making data stationary. For this purpose, the study uses Augmented Dickey-Fuller (ADF) unit root test (1981).

IV.I. AUGMENTED DICKEY-FULLER (ADF) TEST

Dickey and Fuller (1981) propose the Augmented Dickey-Fuller (ADF). The general forms of the ADF can be written as:

$$\Delta X_t = \delta X_{t-1} + \sum_{j=1}^q \phi_j \Delta X_{t-j} + e_{1t} \quad (3)$$

$$\Delta X_t = \alpha + \delta X_{t-1} + \sum_{j=1}^q \phi_j \Delta X_{t-j} + e_{2t} \quad (4)$$

$$\Delta X_t = \alpha + \beta t + \delta X_{t-1} + \sum_{j=1}^q \phi_j \Delta X_{t-j} + e_{3t} \quad (5)$$

X_t is a time series for testing unit root problem, t is the time trend and e_t is error term having white noise properties. If $j = 0$, it represents the simple DF test. The lagged dependent variables in the ADF regression equation are included until the error term becomes white noise. For checking the serial correlation of error terms LM test is used. The null and alternative hypotheses of ADF unit roots are:

H_0 : $\delta = 0$ non-stationary time series; so it has unit root problem.

H_a : $\delta < 0$ stationary time series.

Applying OLS and computing τ statistic of the estimated coefficient of X_{t-1} and comparing it with the Dickey Fuller (1979) critical τ values, if the calculated value of τ statistic is greater than the critical value then reject the H_0 . In this case the time series data is stationary. On the other hand, if we fail to reject H_0 , the series is non-stationary. In this way by applying this procedure on all variables, we can easily find their respective orders of integration.

IV.II. AUTO REGRESSIVE DISTRIBUTED LAG MODEL (ARDL) APPROACH TO COINTEGRATION

In literature, a number of cointegration tests are available for econometric analysis. Most famous and traditional cointegration tests are the residual based Engle-Granger (1987) test, Maximum Likelihood based on Johansen (1991/1992) and Johansen-Juselius (1990) tests. One thing is common in these tests is that they require same order of integration for their analysis. These cointegration tests become invalid and inefficient when the variables of the model have different level of integration. Moreover, the analysis based on these tests of cointegration does not provide information about the structural breaks of time series data and also have low power of prediction. With the passage of time structural changes have occurred in time series such as economic crises, new institutional arrangements and changes in the policy regime. The problem with these traditional methods is that the testing of the null hypothesis of structural stability against the alternative of a one-time structural breaks only. If such structural changes are present in the data generating process, but not allowed for in the specification of an econometric model, results may be biased. The ARDL bound testing approach presented by Pesaran and Pesaran (1997), Pesaran and Shin (1999), and Pesaran, Shin and Smith (2001) has numerous advantages over traditional methods of cointegration. Firstly, ARDL can be applied regardless of the order of integration. Secondly, ARDL bounds testing approach to cointegration can be used for small sample size (Mah, 2000). Thirdly, this approach allows taking a sufficient number of lags for capturing the data generating process in a general to the specific modelling framework (Laurenceson et al., 2003). Lastly, ARDL gives efficient and valid detailed information about the structural breaks in the data. This technique is based on Unrestricted Vector Error Correction Model (UVECM) which have better properties for short and long-run equilibrium as compared to traditional techniques (Pattichis, 1999). Pesaran and Shin (1999) and later on Pesaran et al. (2001) mention that under certain environment long-run correlation among macroeconomic variables can be found with the help of the Autoregressive Distributive Lag Model (ARDL). After lag order selection for ARDL procedure, simply OLS can be used for identification and estimation. Valid estimates and inferences can be drawn through the presence of unique long-run alliance that is crucial for cointegration.

$$\Delta \ln Y_t = \beta_1 + \beta_2 t + \beta_3 \ln Y_{t-1} + \beta_4 \ln X_{t-1} + \beta_5 \ln Z_{t-1} + \dots + \sum_{h=1}^p \beta_h \Delta \ln Y_{t-h} + \sum_{j=0}^p \gamma_j \Delta \ln X_{t-j} + \sum_{k=0}^p \phi_k \Delta \ln Z_{t-k} + \dots + u_{it} \quad (6)$$

First this study will find the direction of relationship among the variables in case of Pakistan by applying the bounds test using F-Test test.

H0: $\beta_3 = \beta_4 = \beta_5 = 0$ (no cointegration among the variables)

HA: $\beta_3 \neq \beta_4 \neq \beta_5 \neq 0$ (cointegration among variables)

If there exists long-run cointegration relationship among the variables, then for finding short-run relationship the study uses the Vector Error Correction Model (VECM). The VECM is explained as under:

$$\Delta \ln Y_{it} = \beta_1 + \beta_2 t + \sum_{h=1}^p \beta_h \Delta \ln Y_{it-h} + \sum_{j=0}^p \gamma_j \Delta \ln X_{t-j} + \sum_{k=0}^p \phi_k \Delta \ln Z_{it-k} + \omega ECT_{t-1} + u_t \quad (7)$$

V. EMPIRICAL RESULTS AND DISCUSSION

This section of the article is presenting the estimated results and discussion. The descriptive statistic of the model has been given in the table 1. The results indicate the presence of positive skewness in a dataset of taxes on income and profits and economic misery whereas defense expenditures, loans and grants, crime and income inequality provide negative skewness. The probability value of Jarque-Bera estimates show that selected data for the variables is normally distributed over the selected time period.

Table 1: Descriptive Statistic

	LCr	IT	LLNGR	LDEF	INI	MI
Mean	5.543344	25.01077	3.338118	4.996783	35.71495	14.39956
Median	5.573225	26.12381	3.390309	5.083482	36.31940	13.31099
Maximum	5.828499	38.54076	3.670988	5.732872	41.67880	32.71115
Minimum	5.210618	12.76359	2.987666	4.102255	22.22250	4.312005
Std. Dev.	0.184317	8.752796	0.167697	0.444332	4.418699	6.268075
Skewness	-0.167505	0.145737	-0.348629	-0.245886	-0.842304	0.905759
Kurtosis	2.061033	1.708119	2.345653	2.194198	3.671506	3.853542
Jarque-Bera	1.408012	2.484713	1.295316	1.262472	4.659169	5.681017
Probability	0.494600	0.288703	0.523270	0.531934	0.097336	0.058396
Sum	188.4737	850.3662	113.4960	169.8906	1214.308	489.5850
Sum Sq. Dev.	1.121106	2528.178	0.928031	6.515210	644.3218	1296.529
Observations	41	41	41	41	41	41

The estimated results of correlation have been given in the table 2. These results provide evidence that the crime rate possesses positive and significant correlation with loans and grants, economic misery, defense expenditures and taxes on incomes and profits whereas it has a negative and insignificant correlation with income inequality. Loans and grants have positive and significant correlation with economic misery, defense expenditures and taxes on income and profits while it has negative correlation with income inequality. The empirics provide evidence of a positive correlation of economic misery with defense expenditures and taxes on income and profits, but economic misery has negative and insignificant correlation with income inequality. Defense expenditures provide positive and significant correlation with taxes on income and profits while it has a negative and insignificant correlation with income inequality. The empirics provide negative and insignificant correlation between income inequality and taxes on income and profits. The overall results show that most of the selected variables have significant correlation with the crime rate. Moreover, selected variables have not much higher correlation which becomes an issue of multicollinearity among the explanatory variables.

Table 2: Pairwise Correlation

LCr	1.000000					
IT	0.874065 (10.17778)***	1.000000				
LLNGR	0.833697 (8.540213)***	0.683518 (5.297141)***	1.000000			
LDEF	0.987213 (35.03286)***	0.874224 (10.18562)***	0.805751 (7.696036)***	1.000000		
INI	-0.245570 (-1.433033)	-0.357398 (-2.164727)**	-0.202623 (-1.170485)	-0.216543 (-1.254720)	1.000000	
MI	0.554142 (3.765761)***	0.557835 (3.802141)***	0.482232 (3.113901)***	0.558961 (3.813291)***	-0.029804 (-0.168669)	1.000000
	LCr	IT	LLNGR	LDEF	INI	MI

NOTE: The asterisks ***, **and * indicates the significant at 1%, 5% and 10% levels, respectively.

The results of unit root tests of all variables in the model are given in table 3. The results of Augmented Dickey-Fuller test reveal that economic misery is stationary at level. But all other selected variables are not stationary at level. Hence their order of integration is mixed. Since variable possess different orders of integration and no variable have I (2) order of integration so, ARDL technique could be used effectively to estimate the cointegration among the variables of the model.

Table 3: Unit Root Estimation

Variables	At level	At First Difference
	T-Statistic (Prob. *)	T-Statistic(Prob.*)
LCr	-1.218443 (0.6546)	-6.248138 (0.000)
LLNGR	-2.385692(0.1540)	-7.116333(0.0000)
MI	-4.148284 (0.0028)	-7.384122 (0.0000)
LDEF	-2.143966 (0.2297)	-4.244937(0.0022)
IT	-0.385626 (0.9004)	-5.403447 (0.0001)
INI	0.082729(0.9595)	-5.256601(0.0001)

*MacKinnon (1996) one-sided p-values.

To find the cointegration among crime rate, loans and grants, economic misery, defense expenditures, taxes on income and profits and income inequality ARDL bounds testing is utilized. The estimated results are presented in the table 4, The estimated F-statistic (4.188) is greater than upper bound at 5 percent significance level, which provides the rejection of the null hypothesis of no cointegration among variables. Hence, we can conclude that there is cointegration among the variables of the model, when we have crime rate is dependent variable.

Table 4 : ARDL Bound Testing Approach

Dependent Variable: Log Crime ARDL (1, 1, 2, 0, 2, 0)		
Critical values	F-Statistics (4.188331)**	
	Lower Bound	Upper bond
99%	3.41	4.68
95%	2.62	3.79
90%	2.26	3.35

NOTE: The asterisks ** and * represents significance at 5% and 10% levels respectively.

Table 5: Estimated Long Run Coefficients ARDL Approach

Dependent Variable: Log Crime ARDL (1, 1, 2, 0, 2, 0) Time Period 1980-2019			
Regressor	Coefficient	Standard- Error	T-Ratio(Prob.)
LLNGR	-0.386904	0.110210	3.510595(0.0022)
IT	0.005955	0.002560	2.325684(0.0307)
LDEF	0.271625	0.059055	4.599550(0.0002)
MI	0.008825	0.003662	2.409761(0.0257)
INI	0.002270	0.001762	1.288295(0.2123)
C	2.804786	0.232957	12.039921(0.0000)

Estimated long run results have been given in the table 5. The coefficient of loans and grants reveals that there is negative and significant relationship between crime rate and loans and grants in the case of Pakistan. The estimated coefficient indicates that 1 percent increase in loans and grants will decrease crime rate by (0.389) percent. Imposition of taxes on income and profits has a positive and significant impact on crime rates in the case of Pakistan. The estimated results show that a one percent increase in taxes on income and profit advocates (0.006) percent increase has been occurred in crime rate in case of Pakistan. Our findings are consistent with the findings of Aurangzeb (2012). Defense expenditures have a positive and significant impact on crime rates in the case of Pakistan after the selected time period. The outcomes reveal that 1 percent increase in defense expenditures (0.27) percent increase has been occurred in crime rate in the case of Pakistan. These findings are similar to Arshad et al., (2016), however, it is reversed from Levitt (2004) study of the US economy, which could be due to institutions quality difference in Pakistan and US or may be an inefficient use of defense expenditures in Pakistan. The coefficient of economic misery provides the positive and significant relationship with the crime rate in Pakistan.

The estimated coefficient reveals that 1 percent increase in economic misery (0.009) increase has been occurred in crime rate in the case of Pakistan. These findings are consistent with the findings of Haider and Ali (2015). The estimated results show that income inequality has a positive, but insignificant impact on crime rates in the case of Pakistan over the selected time period. The overall long run results of this article show that most of the selected explanatory variables have significant relationship with the crime rate in Pakistan.

Vector Error-Correction Model has been used for examining the short run relationship among the variables of the model, the outcomes of short run dynamic are shown in table 6. The estimates show that loans and grants have a positive and significant relationship with the crime rate. Defense expenditures have a significantly positive impact on crime rate which is similar to long run analysis. The coefficient of economic misery is positive and significant indicates that the increase in either unemployment rate or inflation leads to increase the crime rate. Taxes on income and profit cause negative and significant short run impact on crime rates. The impact of income inequality is insignificant on crime rates. The coefficient (-0.693) of ECM has a negative sign and is highly significant which is theoretically correct. ECM estimate indicates the speed of adjustment or convergence from short run to the long run equilibrium. This coefficient reveals that deviations from short-run to long-run is corrected by 69.3 percent, approximately each year and short run equilibrium takes one year and five months approximately to converge to long run equilibrium.

Table 6: Vector Error-Correction Model (VCEM)

Dependent Variable: Log Crime			
ARDL (1, 1, 2, 0, 2, 0)			
Time Period 1980-2019			
Regressor	Coefficients	Standard- Error	T-Ratio(Prob.)
LLNGR	0.151874	0.056481	2.688937(0.0141)
IT	-0.005535	0.002318	-2.388283(0.0269)
LDEF	0.188234	0.074982	2.510384(0.0208)
MI	0.002307	0.001010	2.284860(0.0334)
INI	0.001573	0.001152	1.365655(0.1872)
ECM(-1)	-0.692993	0.169827	-4.080594(0.0006)
R-squared	0.988921	Adjusted R-squared	0.982827
S.E. of Regression	0.022391	F-statistic	162.2897
Mean of Dependent Variable	5.563255	Prob(F-statistic)	0.00000
Residual Sum of Squares	0.010027	S.D. of Dependent Variable	0.170865
Akaike Info. Criterion	-4.480326	Equation Log-likelihood	83.68521
Durbin-Watson statistic	2.525061	Schwarz Criterion	-3.930675

The reliability of the estimates can be checked using diagnostic tests which include tests for heteroskedasticity and serial correlation. The calculated results of the present study are provided in table 7. White test is applied to find out if the problem of heteroskedasticity exists in the model. The estimated F-statistic approved the null hypothesis of homoskedasticity. Breusch-Godfrey LM test is used to detect serial correlation. Its estimate provides empirical evidence of no serial correlation in the model. So, the model does not suffer from heteroskedasticity or autocorrelation.

Table 7: Heteroskedasticity Test: White

F-statistic	1.001154	Prob. F(5,28)	0.4352
Obs*R-squared	5.156557	Prob. Chi-Square(5)	0.3971
Scaled explained SS	2.448592	Prob. Chi-Square(5)	0.7842
Breusch-Godfrey Serial Correlation LM Test			
F-statistic	2.390215	Prob. F(2,26)	0.1115
Obs*R-squared	5.280454	Prob. Chi-Square(2)	0.0713

The stability of the model can be verified by using different tests. The present study has used Cumulative Sum (CUSUM) test for this purpose, which is shown in figure 1. The figure provides no evidence of structural break in the model. Hence this model gives reliable estimates to the crime rate over time. Jarque-Bera test is applied to check the normality in residuals distribution and its results ensures the normality.

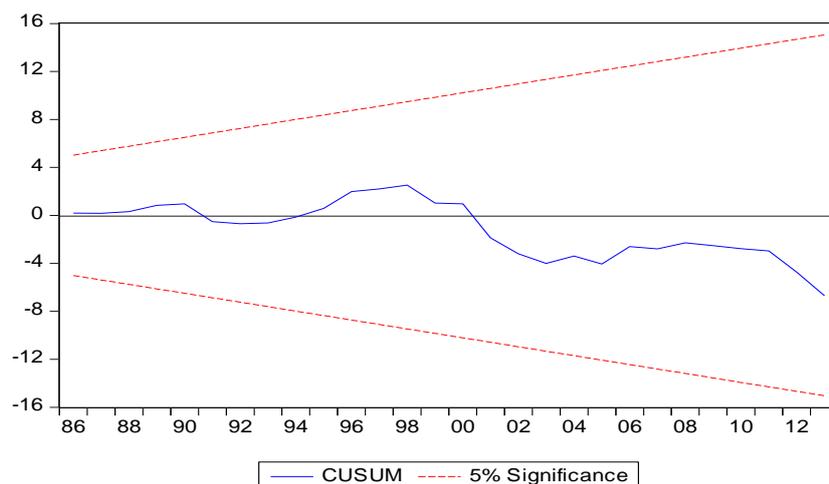


Figure 1: Plot of Cumulative Sum of Recursive Residuals

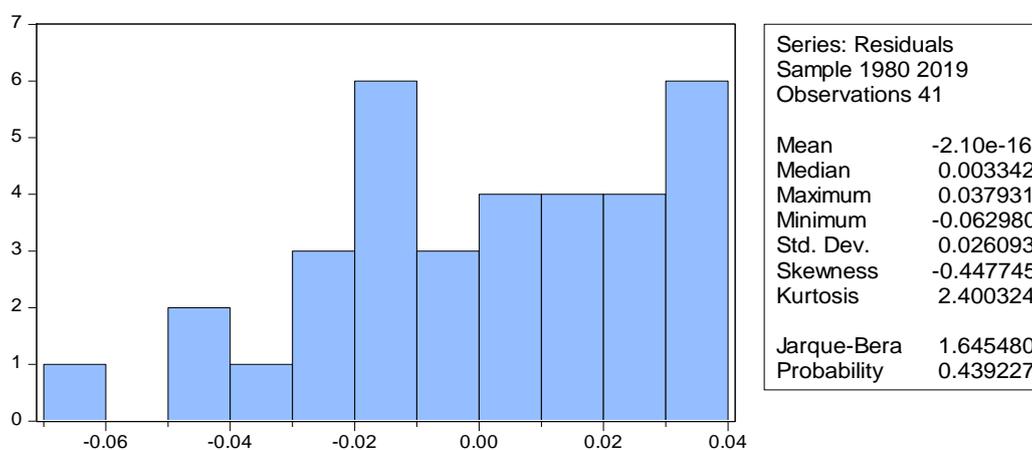


Figure 2

VI. CONCLUSIONS AND SUGGESTIONS

This study has analyzed the impact of public policy and socioeconomic environment on crime rate in Pakistan over the period of 1980 to 2019. The results reveal that loans and grants, defense expenditures, economic misery, taxes on income have a positive impact on crime rates in Pakistan. In this study public policy is represented by taxes, defense expenditures and loans and grants. Whereas as the socioeconomic environment has been measured with the help of economic misery. On the basis of estimated results, the study finds that rising inflation and unemployment is one of the major reasons for the rising crime rate in Pakistan. So, for the reduction of crime rate, the government of Pakistan must reduce and unemployment and control inflation at the same time. For reducing unemployment, government of Pakistan must establish such economic environment which boost new jobs and stable inflation. Moreover, skill development programs must be initiated, so that youth can get self-employment rather than searching government and private jobs. Inflation can be controlled by putting checks on rising production costs. Most of the public policy indicators have a positive and significant impact on the rising crime rate in the case of Pakistan. Pakistan is a developing country and following its geographic situations it needs higher defense expenditures. But higher defense expenditures force the government to reduce development and investment expenditures. So, for higher investment and development expenditures, government of Pakistan must reduce its defense expenditures, which ultimately reduce crime rate in the country. A rising tax rate reduces the purchasing power of people and most of the needs of the people remain unfulfilled which urge them to do criminal activities. So, government of should reduce indirect taxes and focus on direct taxes, so that burden can be shifted towards rich people and crime activities can be minimized. This study recommends that public policies and socioeconomic environment have a detrimental impact on crime rates in the case of Pakistan.

REFERENCES

- Ali, A. (2011). Disaggregated import demand functions of Pakistan; An empirical Analysis. M-Phil Thesis, NCBA&E, Lahore, Pakistan, 1-70.
- Ali, A. (2015). *The impact of macroeconomic instability on social progress: an empirical analysis of Pakistan*. (Doctoral dissertation, National College of Business Administration & Economics Lahore).

- Ali, A. (2018). Issue of Income Inequality Under the Perceptive of Macroeconomic Instability: An Empirical Analysis of Pakistan. *Pakistan Economic and Social Review*, 56(1), 121-155.
- Ali, A. and Bibi, C. (2017). Determinants of Social Progress and its Scenarios under the role of Macroeconomic Instability: Empirics from Pakistan. *Pakistan Economic and Social Review* 55 (2), 505-540.
- Ali, A., & Ahmad, K. (2014). The Impact of Socio-Economic Factors on Life Expectancy in Sultanate of Oman: An Empirical Analysis. *Middle-East Journal of Scientific Research*, 22(2), 218-224.
- Ali, A., & Audi, M. (2016). The Impact of Income Inequality, Environmental Degradation and Globalization on Life Expectancy in Pakistan: An Empirical Analysis. *International Journal of Economics and Empirical Research*, 4 (4), 182-193.
- Ali, A., & Audi, M. (2018). Macroeconomic Environment and Taxes Revenues in Pakistan: An Application of ARDL Approach. *Bulletin of Business and Economics (BBE)*, 7(1), 30-39.
- Ali, A., & Rehman, H. U. (2015). Macroeconomic Instability and Its Impact on Gross Domestic Product: An Empirical Analysis of Pakistan. *Pakistan Economic and Social Review*, 53(2), 285.
- Ali, A., & Zulfiqar, K. (2018). An Assessment of Association between Natural Resources Agglomeration and Unemployment in Pakistan. *Pakistan Vision*, 19(1), 110-126.
- Ali, A., Ahmed, F., & Rahman, F. U. (2016). Impact of Government Borrowing on Financial Development (A case study of Pakistan). *Bulletin of Business and Economics (BBE)*, 5(3), 135-143.
- Ali, A., and Rehman, H. U. (2015). Macroeconomic Instability and Its Impact on Gross Domestic Product: An Empirical Analysis of Pakistan. *Pakistan Economic and Social Review*, 53(2), 285.
- Altindag, D. T. (2012). Crime and Unemployment: Evidence from Europe. *International Review of Law and Economics*, 32(1), 145-157.
- Anwar, M. A., Nasreen, S., and Shahzadi, A. (2015). Social and Demographic Determinants of Crime in Pakistan: A Panel Data Analysis of Province Punjab. *International Journal of Economics and Empirical Research*, 3(9) , 440-447.
- Arshad, N., Anwar, A., and Sarwar, S. (2016). Role of Expenditures and Economic Factors in Determining the Incidence of Crime: Cross Districts Analysis of Punjab. *Caspian Journal of Applied Sciences Research*, 5(2) , 32-40.
- Arshad, S., & Ali, A. (2016). Trade-off between Inflation, Interest and Unemployment Rate of Pakistan: Revisited. *Bulletin of Business and Economics (BBE)*, 5(4), 193-209.
- Asghar, N., Qureshi, S., and Nadeem, M. (2016). Effects of Socio-Economic and Political Factors on the Crime Rate in Pakistan. *Journal of Political Studies*, 183-206.
- Aurangzeb, D. (2012). Determinants of Crime in Pakistan. *Universal Journal of Management and Social Sciences*, 2(9) , 9-18.
- Bourguignon, F. (2001). Crime as a Social Cost of Poverty and Inequality: A Review Focusing on Developing Countries. *Facets of Globalization*, 171-191.
- Bourne, Paul A. (2011). Re-Visiting the Crime-and-Poverty Paradigm: An Empirical Assessment with Alternative Perspectives, *Current Research Journal of Economic Theory* 3(4), 99-117
- Burdett, K., Lagos, R., and Wright, R. (2004). An On-The-Job Search Model of Crime, Inequality, and Unemployment. *International Economic Review*, 45(3), 681-706.
- Chamlin, M. B., and Cochran, J. K. (2000). Unemployment, Economic Theory, and Property Crime: A Note on Measurement. *Journal of Quantitative Criminology* 16 (4) , 443-455.
- Chamlin, M. B., Novak, K. J., Lowenkamp, C. T., and Cochran, J. K. (1999). Social Altruism, Tax Policy, and Crime: A Cautionary Tale. *Criminal Justice Policy Review*, 10(3), 429-446.
- Demombynes, G., and Ozler, B. (2005). Crime and Local Inequality in South Africa. *Journal of Development Economics* 76 , 265-292.
- Dickey, D. A., and Fuller, W. A. (1979). Distribution of the Estimators for Autoregressive Time Series With a Unit Root. *Journal of the American Statistical Association*, 74(366a), 427-431.
- Dickey, D. A., and Fuller, W. A. (1981). Likelihood Ratio Statistics for Autoregressive Time Series With a Unit Root. *Econometrica*, 49, 1057-1072.
- Fajnzylber, P., Lederman, D., and Loayza, N. (2002). Inequality and Violent Crime. *Journal of Law and Economics*, 1-40.
- Gali, J., and Gertler, M. (1999). Inflation Dynamics: A Structural Econometric Analysis. *Journal of Monetary Economics*, 44(2) , 195-222.
- Gillani, S. Y., Rehman, H. U., and Gill, A. R. (2009). Unemployment, Poverty, Inflation and Crime Nexus: Cointegration and Causality Analysis of Pakistan. *Pakistan Economic and Social Review*, 47(1) , 79-98.
- Gumus, E. (2004). Crime in Urban Areas: An Empirical Investigation. *Akdeniz I.I. B.F. Dergisi* , 98-109.
- Haider, A., and Ali, A. (2015). Socio-Economic Determinants of Crimes: A Cross-Sectional Study of Punjab Districts. *International Journal of Economics and Empirical Research*, 3(11) , 550-560.

- Jalil, H. H., and Iqbal, M. M. (2010). Urbanisation and Crime: A Case Study of Pakistan. *Pakistan Institute of Development Economics*, 741-755.
- Johansen, S. (1991). Estimation and Hypothesis Testing of Cointegration Vectors in Gaussian Vector Autoregressive Models. *Econometrica*, 59(6), 1551-1580.
- Johansen, S. (1992). Cointegration in Partial Systems and the Efficiency of Single-Equation Analysis. *Journal of Econometrics*, 52(3), 389-402.
- Johansen, S. and K. Juselius (1990). Maximum Likelihood Estimation and Inference on Cointegration — With Application of Demand for Money. *Oxford Bulletin of Economics and Statistics*, 52(2), 169-210.
- Kassem, M. Ali, A. and Audi, M. (2019). Unemployment Rate, Population Density and Crime Rate in Punjab (Pakistan): An Empirical Analysis. *Bulletin of Business and Economics*, 8(2), 92-104.
- Kelly, M. (2000). Inequality and Crime. *Review of Economics and Statistics*, 82(4), 530-539.
- Laurenceson, J., C. Joseph and H. Chai (2003), *Financial Reform and Economic Development in China*. Cheltenham, UK: Edward Elgar.
- Levitt, S. D. (2004). Understanding Why Crime Fell in the 1990s: Four Factors that Explain the Decline and Six that Do Not. *Journal of Economic Perspectives*, 18(1), 163-190.
- Mah, J. S. (2000). An Empirical Examination of the Disaggregated Import Demand of Korea The Case of Information Technology Products. *Journal of Asian Economics*, 11(2), 237-244.
- Martinez, L. P. (1991). Federal Tax Amnesty: Crime and Punishment Revisited. *Virginia Tax Review*, 10, 535-585.
- Mehlum, H., Miguel, E., and Torvik, R. (2006). Poverty and crime in 19th century Germany. *Journal of Urban Economics*, 59(3), 370-388.
- Omotor, D. G. (2009). Socio-Economic Determinants of Crime in Nigeria. *Pakistan Journal of Social Sciences*, 6(2), 54-59.
- Patterson, E. B. (1991). Poverty, Income Inequality, and Community Crime Rates. *Criminology*, 29(4), 755-776.
- Pattichis, C. A. (1999). Price and Income Elasticities of Disaggregated Import Demand: Results from UECMs and an Application. *Applied Economics*, 31(9), 1061-1071.
- Pesaran, M. H. and B. Pesaran (1997). *Working with Microfit 4.0: Interactive Econometric Analysis*. Oxford: Oxford University Press.
- Pesaran, M. H. and Y. Shin (1999). An Autoregressive Distributed Lag Modelling Approach to Cointegration Analysis. In Strom, S. (ED), *Econometrics and Economic Theory in the 20th Century: The Ragnar Frisch Centennial Symposium*, Cambridge: Cambridge
- Pesaran, M. Hashem, Yongcheol Shin and Richard J. Smith (2001). Bounds Testing Approaches to the Analysis of Level Relationships. *Journal of Applied Econometrics*, 16(3), 289-326.
- Raphael, S., and Winter-Ebmer, R. (2001). Identifying the Effect of Unemployment on Crime. *Journal of Law and Economics*, 44(1), 259-283.
- Shahbaz, M., Loganathan, N., Mujahid, N., Ali, A., and Nawaz, A. (2016). Determinants of Life Expectancy and its Prospects Under the Role of Economic Misery: A Case of Pakistan. *Social Indicators Research*, 126(3), 1299-1316.
- Shamenna, A. T. (2016). Statistical Modeling of Crime Severity in Sidama Zone and Its Neighbors, Ethiopia. *British Journal of Education, Society and Behavioural Science*, 16(4), 1-12.
- Tobin, J. (1965). Money and Economic Growth. *Econometrica: Journal of the Econometric Society*, 671-684.
- Traxler, C. and C. Burhop. 2010. *Poverty and Crime in 19th Century Germany: A Reassessment*. Max Planck Institute for Research on Collective Goods, Working Paper 2010- 35. University Press.
- Wilson, J. Q., and Cook, P. J. (1985). Unemployment and Crime—What is the Connection. *The Public Interest*, 79, 3-8.
- Wu, D., and Wu, Z. (2012). Crime, Inequality and Unemployment in England and Wales. *Applied Economics*, 44(29), 3765-3775.
- Zimring, F. E., and Hawkins, G. (1993). Crime, Justice, and the Savings and Loan Crisis. *Crime and Justice*, 18, 247-292.