Nexus Between Income Inequality, Crime, Inflation and Poverty: New Evidence from Structural Breaks for Pakistan

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- Crime function is applied for Pakistan.
- The combined approach is used for empirical purpose.
- Income inequality is positively linked with crimes.

Abstract:

Purpose: *Thispaper examines the relationship between income inequality, crime, poverty and inflation over the period of 1984-2012 for Pakistan.* ***Methodology:*** *Augmented Dickey-Fuller and Phillips-Perron unit root tests have been applied to test the stationarity of data. Perron structural break unit root test is used to test the stationary of data in the presence of single unknown structural break. The series are found to be stationary at first difference or I(1). The newly developed combine cointegration approach has been taken to test cointegration between variables. The problem of structural break is solved by using ARDL bound testing approach.* ***Findings:*** *Theirresults confirm the existence of the long run relationship between income inequality, crime, poverty and inflation. In long run, poverty, income inequality and inflation have found to be positive and significant impact on crime but, in short run, only income inequality has positive and significant impact on crime. The robustness of causal analysis is tested by Innovative Accounting Approach (IAA). The results explain that 23 percent of crime is explaining by shocks stimulating in income inequality and 42 percent of income inequality is explaining by shocks ruining in crime.* ***Recommendations:*** *This study opens up new insights for policy makers.*

Keywords: Income inequality, Crime, Poverty, Pakistan
JEL Classification: D63

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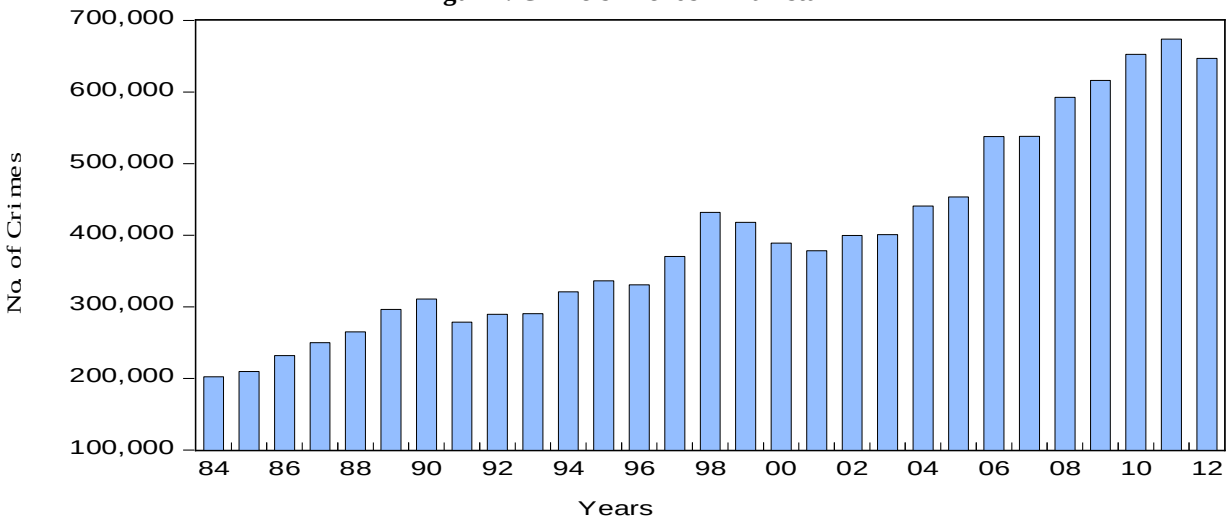
I. Introduction

Crime is the violation of laws and orders of a country. We cannot describe it by single definition because it varies from economy to economy. The history of crime is as old as human. First crime was committed when Cain (Son of Eve and Adam) killed his brother in jealousy. "A crime is an action of human conduct harmful to others which the state is bound to prevent. It renders the deviant person liable to punishment as a result of proceedings initiated by the state organs assigned to ascertain the nature, the extent and the legal consequences of that person's wrongness" (Gilqlani et al. 2009 and, Auolak and Ahmad, 1999). Crime creates insecurity for individuals and it has some psychological and monetary cost in every society (Gillani et al. 2009). There are many types of crimes that mostly exist in developing economies such as murders, kidnapping, child lifting, dacoits, robberies and burglaries etc. One hand, crime is major social evil and every society is trying to reduce its negativeimpacts. On the other hand, most economies are focusing to identify the reasons behind committing crime (Raja and Ullah, 2013).

The behaviors of the criminals are rational. They commit crime when benefits of crimes are larger than its costs. A great change accrued in the way of thing of people when Becker published first model of criminal choice in his paper underlining that some people commit crime due to lack of finance and some go for it because it's benefits are greater than benefits of legal work. Mostly, people commit crime when they are unable to buy goods due to barriers by society on those goods (Merton, 1938). Some criminologists and economists indicated that unequal distribution of resources forces the individuals to commit a crime (Brush, 2007). Many researchers have described the relationship between crime and economic factors in which, income inequality has found effective for explaining the commitment of crime (Maddah, 2013). Ali (2015) considers income inequality big hurdle for socio-economic development. Adam Smith published his book in 1937 in which he said "Income inequality is the existence of disproportionate distribution of total national income and wealth among the households whereby the share going to rich persons in a country is far greater than that going to poorer persons". An increase in the income inequality leads a higher percentage of population towards poverty (Baharom and Habibullah, 2009). Pakistan as an emerging economy, facing high crime reports due to miserable economic conditions. Figure-1 shows the trend in total number of committed crime. In 1985, total number of committed crime was 378301 that increased to310779in 1990. Further, it declined to 278438in 1996 but increased to 431854 in 1998. The number of committed crime decreased to 378301 in 2001 but increased from 378301 to 673750 over the period of 2001-2011 (Bureau of Police Research & Development Ministry of Interior, Pakistan).

Figur-1. Crime's Trends in Pakistan



Source: Bureau of Police Research & Development Ministry of Interior, Pakistan

This paper contributes to existing applied economics literature in following ways: 1) It re-investigates the impact of income inequality on crimes by incorporating poverty and inflation as sporting variables in the presence of structural breaks;2) Perron, (1997) single unknown structural break unit root test is employed; 3) Newly invented Bayar-Hanck combined cointegration approach is used; 4) ARDL bound testing approach is applied with structural breaks; 5) For long run and short run relationship between variables is examined by OLS and ECM and finally, robustness of causality results is tested by using innovative accounting approach (IAA).

II. Review of Literature

There are many studies that have investigated the determinants of crime for both developed and developing countries such as Kapuscinski et al. (1998) investigated the impact of unemployment on crime in Australia over the period of 1921-1987. The results showed that unemployment and female employment have positive impact on crime rate.Rushton and Whitney, (2002) investigated the relationship between serious assault, rape, murder per 100 thousand population and GDP per person over the period 1993-1995 for 74 countries of African, European and Asian. They found that violent of crime is high in African countries, intermediate in European countries and lowest in East Asian countries. The wealth was positively correlated with crime in Africa but negatively correlated with crime in East Asia and Europe. Similarly, Cahill and Mulligan, (2003) investigated the factors behind violent of crime through neighborhoods of Arizona, South Tucson and Tucson for time spam 1995-1999. Their results investigated that racial and ethnic heterogeneity type problems cause high crime rate in neighborhood countries. Nilsson, (2004) probed the impact of this rise in income inequality on the crime rate over the period of 1973-2000. Their results concluded that unemployment and the population proportion living below the 10% of median income have positive impact on the crime rate. Similarly, Neumayer, (2005) investigated that better economic policy and better political governance can decrease the homicide rate using time period 1980-1997 for 117 countries. The fixed effect and GMM methodology concluded that economic growth, respect of human rights, higher income level and higher death penalty decrease the homicide rates. Buonanno and Montolio, (2008) checked the demographic and socioeconomic determinants of crimes over the period of 1993-1999. Their results predicted demographic factor including percentage of male are 15 to 29 years old and foreigners are negatively correlated with crime but population in provisional capital negatively correlated with crime. Baharom and Habibullah, (2008) explored the causality between unemployment, income and crime in the eleven European countries over the period of 1993-2001 Their results showed that income has positively related with all categories of crime except domestic burglary because it has negative significant relationship.

Habibullah and Baharom, (2008) explained the impact of economic condition on the criminal activities in Malaysia by using ARDL technique over the time spam 1973-2003. The results concluded that economic performance has long run positive impact on motorcycle theft, burglary, assault, rape, murder but negative impact on armed robbery. Baharom et al. (2008) analyzed the convergence of violent of crime in the 51 states of U.S. over the period 1960-2007. The results conclude on the basis of KSS-CHLL nonlinear unit-root test. Their results concluded that, out of fifty-one states, long run convergence in eight cases, catching up in two cases and diverging from national average in forty-one states accrue. Similarly, Dahlberg and Gustavsson, (2008) analyzed the region-specific, transitory and permanent income inequalities effect on crime for 20 countries over the period of 1974-2004. The results revealed that permanent income inequality has significant and positive impact on crime and transitory income inequality has insignificant effect on crime. Fougere et al. (2009) checked the impact of unemployment on violent crimes and property crimes in France for data period of 1990-2000. Their results showed that raise in unemployment causes to increase in crime rate. It further causes to increase in drug offenses, theft and burglaries. Hooghe et al. (2011) explored the deprivation indicator impact on crime for the Belgian Municipalities for 2001-2006-time period. Their results concluded that unemployment has significant impact on the crime. Income inequality has negative impact on violent crime. Wu and Wu, (2012) checked the effect of unemployment and inequality on crime for UK regions by using panel data from 2002-2007. Their results revealed that crime depends on unemployment and income inequality when economic gainaccrue and vice versa. Crime is economic phenomena and it rises when economic gain rises.

Similarly, Cerro and Ortega, (2012) explored the persistence regional crime rate in Argentina and its typologies by using GMM techniques for time spam 1980-2008. The persistence of the time shocks, unemployment and inequalities have significant and positive impact on all types of crime and GDP per capita have negative impact on all types of crime. Durante and Naples, (2012) investigated the relationship between crime and income equality in different U.S. states by using panel data from 1981-1999. Violent and property crime, Gini coefficient, unemployment, age 18 to 24, poverty, age over 65, female and population density have used. The results revealed that Gini coefficient age 18 to 24 and age over 65 have negative relationship with crimes. However, poverty and unemployment have positive impact on crime. Maddah, (2013) analyzed the relationship between crime, unemployment and income inequality in Iran by using structural VAR model and co-integration analysis. They used data from 1979 to 2007. The results show that there is positive co-integration between these variables and the coefficient of unemployment is 9.3 is more than coefficient of income inequality that is 2.14. They conclude that unemployment rise crime rate in Iran while crime is not affected by income inequality.

In case of Pakistan, there are few studies that have identify the factors behind high crime rate such as Khan et al. (2015) recently explored the multiple factors such as economic growth, poverty, unemployment and education have impact on the crime rate in Pakistan over the period of 1972-2011. Their results confirm the existence of long run relationship between crime, GDP, poverty and unemployment. Similarly, Raja and Ullah, (2013) analyzed the relationship between criminal activities and economic condition in case of Pakistan over the time spam 1990-2011. Johanson cointegration has been used to analysis the long run relationship between inflation, income inequality and rise in female labor employment. Their results concluded that the rise in the income inequality, female employment and inflation have positive and significant impact on crime. Similarly, Gillani et al. (2009) examined the long run relationship between inflation, poverty, unemployment and crime rate by using Johansen cointegration and Toda-Yamamoto ganger causality technique over the period of 1975-2007 for Pakistan. Their results predicted that inflation, poverty and unemployment are causing crime and there is significant long run relationship between them. Haider and Ali (2015) investigate the socio-economic determinants of crimes across the district of Punjab in case of Pakistan.The results show that population density and unemployment have positive and significant impact on crimes. Level of education and amount of remittances are inversely related to crimes in all districtsof Punjab. The results indicate that the most dense and populated areas provide more chances forcriminals to commit crimes.

III. Model Construction, Methodology and Data Collection

The crime data is a sum of different types of crime like murders, kidnapping, child lifting, dacoits, robberies, burglaries that is reported by bureau of police research and development in Pakistan. Gini coefficient is used as a proxy of income inequality, Head Count Ratio (HCR) as a proxy of poverty and Consumer Price Index (CPI) as a proxy of inflation rate have taken as independent variables. This study has taken time series data from 1984-2012. The data for this study are taken from World Development Indicators (WDI), Bureau of Police Research & Development Ministry of Interior, Pakistan and state Bank of Pakistan (SBP). A functional form of model is given bellow:

$$C_t = f\,(Gini_t, Pov_t, Inf_t) \tag{1}$$

$$C_t = \beta_1 + \beta_2 Gini_t + \beta_3 Pov_t + \beta_4 Inf_t + \mu_t \tag{2}$$

We have transformed all the series into logarithm to reduce sharpness, persistent and reliable resultsand to make the model estimable. The estimable empirical equation is modeled as following:

$$\ln C_t = \beta_1 + \beta_2 \ln Gini_t + \beta_3 \ln Pov_t + \beta_4 \ln Inf_t + \mu_t \tag{3}$$

Where, ln is natural log-form, G_t is income inequality, Pov_t is poverty, Inf_t is inflation rate and μ_t is error term having zero mean and constant error term.

III.I. Augmented Dickey-Fuller (ADF) Test

For time series analysis, it is necessary to test the stationarity of data first. For this purpose, Dickey and Fuller (1979) have developed a test known as "Augmented Dickey-Fuller" test. This test is conducted by "augmenting" the equations by adding the lagged values of the dependent variable. The ADF tests the null hypothesis that a time series is *I(1)* against the alternative hypothesis that is *I(0).* The ADF test here consists of estimating the following regression:

$$\Delta Y_t = \beta_1 + \beta_2 t + \delta Y_{t-1} + \alpha \sum_{i=1}^{m} \Delta Y_{t-i} + \varepsilon_t \tag{4}$$

The hypothesis of Augmented Dickey-Fuller test is following:

H_0: $\varphi = 0$: variables are not stationary at level. However, variables are stationary at their first difference.

H_1: $\varphi \neq 0$: variables are stationary at level.

If the calculated t-statistics is greater than critical t-statistics, we may reject H_0. If the null hypothesis is rejected, it means that variable is stationary. Whereas, if the calculated t-statistics is less than critical t-statistics, we may reject H_1. If alternative hypothesis is rejected, it means that variable is not stationary at level and need to be differenced to make it stationary.

III.II Bayer-Hanck Combine Cointegration

There are many cointegration approaches have been introduced in existing literature such as Engle and Granger (1987) cointegration approach, *Johansen maximum eigenvalue test* by Johansen (1991), *Phillips–Ouliaris cointegration test* by Phillips and Ouliaris (1990), Error Correction Model (ECM) based F-test of Peter Boswijk (1994) and the ECM based *t*-test of Banerjee et al (1998). However, different tests provide different results. Later, Bayer and Hanck introduced combined cointegration to increase the power of cointegration test. This test provides joint test-statistic based on Engle and Granger, Johansen, Peter Boswijk, and Banerjee tests for the null of no cointegration. It allows us to combine these cointegration tests results to provide a more conclusive finding. It is also applied in this paper to check the existence of cointegration between crime, income inequality, poverty and inflation. The Fisher's formulas for significance level (p-value) of individual cointegration test are as follow:

$$EG - JOH = -2\,[\ln(P_{EG}) + (P_{JOH})] \tag{5}$$

$$EG - JOH - BO - BDM = -2[\ln(P_{EG}) + (P_{JOH}) + (P_{BO}) + (P_{BDM})] \tag{6}$$

Where P_{EG}, P_{JOH}, P_{BO} and P_{BDM} represent P-statistics of various individual cointegration tests respectively. If calculated Fisher statistics exceed the critical values provided by Bayer and Hanck (2013), we may reject the null hypothesis of no cointegration.

III.III ARDL Bound Testing Approach

The traditional cointegration test lack to accommodate structural breaks stimulating into series. To check the robustness of our results, we rely on structural break ARDL bound testing approach. This approach takes care of the structural break present in the series. One side, tt is also flexible regarding the integrating properties of variables. Once, variables is found to be stationary at I(0), I(1), I(0)/I(1), we may apply this technique to investigate long run relationship between variables. On the other side, it is more appropriate for a small sample set. We are following the unrestricted error correction model (UECM) and the models for estimations are given below:

$$\begin{aligned}\Delta \ln C_t = {} & \alpha_1 + \alpha_T T + \alpha_c \ln C_{t-1} + \alpha_{Gini} \ln Gini_{t-1} + \alpha_{Pov} \ln Pov_{t-1} + \alpha_{Inf} \ln Inf_{t-1} \\ & + \sum_{j=0}^{q} \alpha_j \Delta \ln Gini_{t-j} + \sum_{k=0}^{r} \alpha_k \Delta \ln Pov_{t-k} + \sum_{l=0}^{s} \alpha_l \Delta \ln Inf_{t-l} + \mu_t \end{aligned} \tag{7}$$

$$\begin{aligned}\Delta \ln Gini_t = {} & \beta_1 + \beta_T T + \beta_{Gini} \ln Gini_{t-1} + \beta_C \ln C_{t-1} + \beta_{Pov} \ln Pov_{t-1} + \beta_{EC} \ln Inf_{t-1} \\ & + \sum_{j=0}^{q} \beta_j \Delta \ln C_{t-j} + \sum_{k=0}^{r} \beta_k \Delta \ln Pov_{t-k} + \sum_{l=0}^{s} \beta_l \Delta \ln Inf_{t-l} + \mu_t \end{aligned} \tag{8}$$

$$\begin{aligned}\Delta \ln Pov_t = {} & \gamma_1 + \gamma_T T + \gamma_{Pov} \ln Pov_{t-1} + \gamma_C \ln C_{t-1} + \gamma_{Gini} \ln Gini_{t-1} + \gamma_{Inf} \ln Inf_{t-1} \\ & + \sum_{j=0}^{q} \gamma_j \Delta \ln C_{t-j} + \sum_{k=0}^{r} \gamma_k \Delta \ln Gini_{t-k} + \sum_{l=0}^{s} \gamma_l \Delta \ln Inf_{t-l} + \mu_t \end{aligned} \tag{9}$$

$$\begin{aligned}\Delta \ln Inf_t = {} & \delta_1 + \delta_T T + \delta_{Inf} \ln Inf_{t-1} + \delta_{Gini} \ln Gini_{t-1} + \delta_C \ln C_{t-1} + \delta_{Pov} \ln Pov_{t-1} \\ & + \sum_{j=0}^{q} \delta_j \Delta \ln Gini_{t-j} + \sum_{k=0}^{r} \delta_k \Delta \ln C_{t-k} + \sum_{l=0}^{s} \delta_l \Delta \ln Pov_{t-l} + \mu_t \end{aligned} \tag{10}$$

The ARDL bound testing approach depends on the tabulated critical values by Peraran *et al.* (2001). They developed Upper Critical Bound (UCB) and Lower Critical Bound (LCB). The null hypothesis of no cointegration of UECM models is $\alpha_C = \beta_C = \gamma_C = \delta_C = 0$, $\alpha_{Gini} = \beta_{Gini} = \gamma_{Gini} = \delta_{Gini} = 0$, $\alpha_{Pov} = \beta_{Pov} = \gamma_{Pov} = \delta_{Pov} = 0$ and $\alpha_{Inf} = \beta_{Inf} = \gamma_{Inf} = \delta_{Inf} = 0$. The Alternative hypothesis of cointegration of UECM models is $\alpha_C \neq \beta_C \neq \gamma_C \neq \delta_C \neq 0$, $\alpha_{Gini} \neq \beta_{Gini} \neq \gamma_{Gini} \neq \delta_{Gini} \neq 0$, $\alpha_{Pov} \neq \beta \neq \gamma \neq \delta_{Pov} \neq 0$ and $\alpha_{Inf} \neq \beta_{Inf} \neq \gamma_{Inf} \neq \delta_{Inf} \neq 0$.If the calculated F-statistics exceeds the UCB, we may reject the null hypothesis of no cointegration. Similarly, acceptance of null hypothesis depends on small value of calculated F-statistics compare to

lower critical bound (LCB). When F-statistics will lie between lower critical bound (LCB) and upper critical bound (UCB),our results for cointegration are inconclusive and uncertain.

IV. Analysis and Results Description

Table-1 shows Descriptive statistics and pair-wise correlations. In descriptive analysis, we observe the detail analysis of the study such as mean values, maximum and minimum values and skewness. The values of Jarque-Bera show that our series are normal distributed with zero mean and constant variance. The covariance matrix explains that crime is positively correlated with income inequality, poverty and inflation. Income inequality is also positively correlating with poverty and inflation. Similarly, poverty is also correlating with inflation.

Table-1. Descriptive statistics and correlation matrix

Variables	$\ln C_t$	$\ln Gini_t$	$\ln Pov_t$	$\ln Inf_t$
Mean	12.8367	-0.9457	3.3424	1.9999
Median	12.8435	-0.9519	3.3707	2.0806
Maximum	13.4206	-0.8158	3.5026	2.8697
Minimum	12.2168	-1.0729	3.0612	0.8887
Std. Dev.	0.3469	0.0739	0.0871	0.5038
Skewness	0.0859	0.1087	-1.0847	-0.4795
Kurtosis	2.0909	1.9799	5.0014	2.2898
Jarque-Bera	1.0345	1.3143	10.5266	1.7209
Probability	0.5962	0.5283	0.0052	0.4229
$\ln C_t$	1.0000			
$\ln Gini_t$	0.8915	1.0000		
$\ln Pov_t$	0.3212	0.4888	1.0000	
$\ln Inf_t$	0.3258	0.2298	0.0404	1.0000

It is necessary to examine the integrating properties of the variables before going to apply any cointegration approach for examining the long run association between the series. There are many unit root tests such as ADF by Dicky and Fuller (1981), PP by Philips and Perron (1988), DF-GLS by Elliot et al. (1996) and NG-Perron (2001) unit root tests. This study has applied Augmented Dickey-Fuller and Phillips-Perron tests to check the stationary of data. The results of these testsare reported in Table-2. These tests identify the presence of unit root problem in the series at level with intercept and trend. But variables are found stationary at first difference with intercept and trend. It entails that variables are integrated at I(1). The following unit root tests fail to incorporate problem of structural breaks period. For this purpose, this study applies Perron, (1997) single unknown structural break test. The results of structural break unit root test are displayed in table-3. The empirical findings disclosed that our series have unit root problem at level i.e. *I(0)* but found stationary at first difference, i.e. *I(1)*. The series of crime, income inequality, poverty and inflation carry the structural break year of 1998, 1992, 2003 and 1999 respectively. So, unique level of integration leads us to apply combined cointegration suggested by Bayer and Hanck, (2013). Before applying combined cointegration, we need to analysis lag selection technique. Table-4 shows the results of VAR lag order selection criteria. AIC has used to select appropriate lag due to spurious property. The results show that 1 lag is suitable for our sample data.

The results of Bayer-Hanck combined cointegration are reported in Table-5. The computed Fisher-statistics of EG-JOH and EG-JOH-BO-BDM tests for models crime, income inequality and poverty exceed critical values at 1%, 5% and 10% level of significance. It rejects the hypothesis of no cointegration between variables. This shows that there is a long run relationship exists among the variables. Without any doubt, Bayer and Hanck, (2013) combine cointegration provides efficient, consistent and reliable results but it fails to incorporated structural break while investigating cointegration between variables. So, we solve this problem by applying ARDL bound testing approach in the presence of structural breaks. Table-6 explains the results of ARDL bound testing approach in the existence of structural break. The empirical results reveal that calculated F-statistics exceeds the upper critical bounds at 1 % level of significance when we use crime, income inequality and poverty as independent variable.This concludes that we may reject the null hypothesis of no cointegration. This confirms the presence of three cointegration vectors.

Table-2. Unit Root AnalysisWithout Structural Break

Variables	**ADF unit root test**			**PP unit root test**		
	T-statistics "Intercept and trend"	Prob. value	Decision	T-statistics "Intercept and trend"	Prob. value	Decision
ln C_t	-2.5555	0.3014	Non-Stationery	-2.6340	0.2693	Non-Stationery
ln$Gini_t$	-2.3471	0.3966	Non-Stationery	-1.0372	0.7256	Non-Stationery
ln Pov_t	-2.9451	0.1645	Non-Stationery	-2.8119	0.2049	Non-Stationery
ln Inf_t	-2.3733	0.3843	Non-Stationery	-2.3901	0.3762	Non-Stationery
ΔlnC_t	-4.7702*	0.0037	Stationery	-4.7722	0.0037	Stationery
Δln$Gini_t$	-8.8772*	0.0000	Stationery	-9.0601	0.0000	Stationery
Δln Pov_t	-7.6135*	0.0000	Stationery	-7.6135	0.0000	Stationery
Δln Inf_t	-6.5590*	0.0001	Stationery	-6.5590	0.0001	Stationery
Note: significance at 1%, 5% and 10% is shown by *, ** and *** respectively.						

Table-3.Perron, (1997)Single Structural Break Unit Root Test

Variables	**At level**		**At 1st difference**	
	T-statistics	Time Break	T-statistics	Time Break
ln C_t	-3.5998	1998	-5.3316***	1998
ln$Gini_t$	-5.0492	1992	-11.197*	1990
ln Pov_t	-5.0856	2003	-9.9229*	1990
ln Inf_t	-4.5839	1999	-7.5071*	2004
Note: * and *** represent level of significance at 1 % and 10 % respectively.				

Table-4.Lag Length Criteria

VAR Lag Order Selection Criteria						
Lag	LogL	LR	FPE	AIC	SC	HQ
0	71.96883	NA	7.65e-08	-5.034728	-4.842752	-4.977643
1	130.6540	95.63507*	3.30e-09*	-8.196591*	-7.236712*	-7.911169
2	142.4052	15.66827	4.93e-09	-7.881866	-6.154083	-7.368105
* indicates lag order selected by the criterion.						
LR represents sequential modified LR test statistic (each test at 5% level), FPE describes final prediction error, AIC identify Akaike information criterion, SC denotes Schwarz information criterion and HQ shows Hannan-Quinn information criterion						

Table-5. Bayer and Hanck Combine Cointegration Test

Estimated model	EG-JOH-BO-BDM	EG-JOH	Cointegration
$C_t = f(\text{Gini}_t, \text{Pov}_t, \text{Inf}_t)$	112.16*	56.90*	Yes
$Gini_t = f(C_t, \text{Pov}_t, \text{Inf}_t)$	19.23***	13.41**	Yes
$Pov_t = f(\text{Gini}_t, C_t, \text{Inf}_t)$	19.44***	8.84***	Yes
$Inf_t = f(\text{Gini}_t, \text{Pov}_t, C_t)$	6.61	5.59	No
Significance Level	**EG-JOH-BO-BDM**		**EG-JOH**
1%	31.169		16.259
5%	20.486		10.637
10%	16.097		8.363
Note: * represents significant at 1%, 5% and 10% level of significance respectively.			

Table-6. ARDL Approach to Cointegration

Bound testing to cointegration			Diagnostic tests				
Estimated Models	Optimal lag length	Structural Break	F- Statistics	χ^2_{Normal}	χ^2_{ARCH}	χ^2_{RESET}	χ^2_{SERIAL}
ln C_t	(4,4,4,4)	1998	14.7033*	0.6583	0.9383[1]	0.2584[1]	0.6014[1]
ln$Gini_t$	(4,4,4,4)	1992	11.9848*	0.8178	0.8447[1]	0.4396[1]	0.3449[1]
ln Pov_t	(3,2,4,2)	1999	6.4738*	0.8386	0.2368[2]	0.8782[1]	0.1254[4]
ln Inf_t	(2,4,4,1)	2003	4.1309	0.4606	0.1218[1]	0.2665[1]	0.8538[1]
Critical values[#] Narayan, (2005)[1]							
Significance level.		Lower bounds $I(0)$		Upper Bounds $I(1)$			
1 %		5.17		6.36			
5 %		4.01		5.07			
10 %		3.47		4.45			
Note: * shows the significance at 1 percent level of significance. The optimal lag length is determined by AIC. [] is the order of diagnostic tests. # shows that critical values are collected from Narayan, (2005).							

Table-7 shows long run relationship among crime, poverty, income inequality and inflation. The results predict that income inequality, poverty and inflation has positive and significant impact on crime. The result of income inequality shows that 1 % increase in income inequality will cause to 3.9 % increase in crime remaining other things constant. The value of poverty predicts that 1% increase in poverty will lead to 1.09% increase in crime else hold constant. Similarly, 0.08 % increase in crime will exist due to 1 % increase in inflation. Income inequality is a major component to predict crime in Pakistan. Value of Durbin Watson has confirmed that there is no auto-correlation. R-squared shows that 88 % independent variable in explaining by dependent variables. The diagnostic test such as LM test for serial correlation, normality of residual term, white heteroscedisticity provided no evidence of serial correlation, autoregressive conditional heteroscedisticity and white heteroscedisticity. The residual terms are normally distributed and the functional form of the model appears well specified. Figure-2 and 3 represent the results of CUSUM and CUSUM of Square that lie within the critical boundaries. It confirms the stability of parameters for over the period of time.

Table-7. Long Run Analysis

Dependent Variable: lnC_t			
Constant	Coefficient	Std. error	T-statistics
Ln$Gini_t$	3.9905*	0.3264	12.2222
ln Pov_t	1.0950*	0.2701	4.0535
ln *Inft*	0.0820***	0.0479	1.7126
R-squared	0.8855		
Diagnostic Test			
	Statistics	Prob.	
F-statistic	64.4322	0.0000	
Breusch-Godfrey LM test	1.4334	0.2590	
ARCH Test	0.1550	0.8572	
Heteroscedisticity Test	0.7906	0.6285	
Ramsey RESET Test	2.3627	0.1166	
Normality test	0.9271	0.6290	
Note: significance at 1%, 5% and 10% is shown by *, ** and *** respectively.			

[1]The critical values of bounds provided by Pesaran *et al.* (2001) are more appropriate for large sample size i.e. T = 500 to T = 40, 000. So, Narayan's (2005) values are more appropriate for small samples of size T = 30 to T = 80.

Table-8 shows short run relationship between dependent variable and independent variables. In our analysis income inequality has positive and significant impact on crime but poverty has negative and insignificant impact on crime. Similarly, inflation has positive and insignificant impact on crime. It is concluded that in short run crime can be control by only income inequality rather than focusing on poverty and inflation. The estimation of $ECM_{t-1}$is negative but statistically significance at 5% level which indicates speed of adjustment from short run to long run.The statistically significance of ECM_{t-1} also indicates the rate of convergence from short run to long run equilibrium. This implies that deviations from short run towards long run are corrected by 6% in each year and will take 16 years and 6 months approximately to reach equilibrium level. The diagnostic tests have confirmed that there is no autocorrelation, no heteroscedisticity, white heteroscedisticity, no serial correlation and residual is normal distributed in short run. Similarly, the CUSUM and CUSUM of Square explain that parameters are stable for short run (see Figure-2 and 3).

Table-8. Short Run Analysis

Dependent Variable: lnC_t			
Constant	Coefficient	Std. error	T-statistics
Ln$Gini_t$	0.7746**	0.2865	2.5220
ln Pov_t	-0.0108	0.2462	-0.0439
ln *Inft*	0.0226	0.0281	0.8060
ECM_{t-1}	-0.06928**	0.0277	2.5037
R-squared	0.4029		
Diagnostic Test			
	Statistics	Prob.	
F-statistic	3.532	0.0233	
Breusch-Godfrey LM test	0.2810	0.7581	
ARCH Test	0.2007	0.8197	
Heteroscedisticity Test	0.3407	0.9693	
Ramsey RESET Test	1.0623	0.3653	
Normality test	0.6856	0.7097	
CUSUM	Stable at 5%		
CUSUM of Squ.	Stable at 5%		
Note: significance at 1%, 5% and 10% is shown by *, ** and *** respectively.			

To determine the causality relationship between sample periods, innovative accounting approach is better than VECM Granger causality method because VECM Granger causality tells us only direction of causality by ignoring the effect of shocks and magnitude of causality. The innovative accounting approach includes variance decomposition and impulse response function. The variance decomposition approach indicates the magnitude of predicted error variance for a series accounted for by innovations from each of the independent variable over different time-horizons beyond the selected time period. It is pointed by Pesaran and Shin, (1999) that generalized forecast error variance decomposition method shows the proportional contribution in one variable due to innovative shocks stemming in other variables. Further, the generalized forecast error variance decomposition approach estimates the simultaneous shock effects. Engle and Granger, (1987) and Ibrahim, (2005) argued that with VAR framework, variance decomposition approach produces better results as compared to other traditional approaches. The results of variance decomposition approach are labeled in Table-9. The results indicate that 59.53 percent portion of crime is explaining by its own innovative shocks and 23.90 percent is explaining by income inequality which is higher proportion comparing to others. Poverty and inflation is explaining crime by 8.09 percent and 8.46 percent respectively. The contribution of crime to income inequality is 42.39 percent. 43.54 percent Income inequality is explaining by its own shocks. Poverty and inflation are explaining income inequality by 3.27 percent and 10.78 percent respectively. Inflation has major contribution to explain poverty by 27.38 percent. Poverty is explaining by 46.30 percent its own shocks, 18.13 percent by income inequality shocks and 8.17 percent by crime shocks. The contribution of crime to inflation is 11.69 percent, income inequality to inflation is 4.07 percent and poverty to inflation is 9.96b percent, similarly, 74.26 percent inflation in explaining by itself.

Table-9. Variance decomposition Approach

Variance decomposition of LC_t:					
Period	S.E	L C_t	L $Gini_t$	L Pov_t	L Inf_t
1	0.060585	100.0000	0.000000	0.000000	0.000000
8	0.221862	62.59676	22.64132	8.775117	5.986799
9	0.232290	60.86434	23.36239	8.409171	7.364098
10	0.240673	59.53231	23.90418	8.097854	8.465663
Variance decomposition of L$Gini_t$					
Period	S.E	L C_t	L $Gini_t$	L Pov_t	L Inf_t
1	0.034375	10.70780	89.29220	0.000000	0.000000
8	0.054563	41.67571	45.78742	3.138945	9.397929
9	0.056705	42.12341	44.45760	3.217592	10.20140
10	0.058554	42.39664	43.54514	3.278046	10.78018
Variance decomposition of LPov_t					
Period	S.E	L C_t	L $Gini_t$	L Pov_t	L Inf_t
1	0.054789	1.407177	22.44142	76.15140	0.000000
8	0.073878	8.119984	18.06457	46.34117	27.47427
9	0.074035	8.175663	18.10117	46.31542	27.40775
10	0.074080	8.179707	18.13455	46.30570	27.38004
Variance decomposition of L Inf_t					
Period	S.E	L C_t	L $Gini_t$	L Pov_t	L Inf_t
1	0.426729	0.058945	0.029098	2.539012	97.37295
8	0.620531	11.79349	3.959275	10.04594	74.20130
9	0.622298	11.73078	4.057306	9.989877	74.22204
10	0.623370	11.69082	4.074414	9.967866	74.26690

Figure-4 incorporates the results of Impulse response function which is alternative to variance decomposition method. It shows how long and to what extent dependent variable reacts to shock stemming in the independent variables. The results indicate that response in crime due to income inequality and poverty is negative initially decreasing and then increasing after 6th and 5th time zone respectively. Crime responds positive inverse u-shape and then negative decline after 4th time zone.Similarly, response in income inequality due to crime, poverty and inflation is positive, negative and negative respectively. Response in poverty due to crime is negative decreasing and then increasing after 2nd time zone and it is positive after 4th time zone. Response of poverty to income inequality is negative and increasing then constant after 4th time zone. Similarly, the response in poverty due to inflation is negative than positive inverse u-shape after 2nd time zone. The response of inflation due to crime, income inequality and poverty is positive, positive than negative after 3rd time zone and negative respectively.

V. Conclusion and Recommendations

The aim of this study is to estimate the factors that push crime up in Pakistan over the period of 1984-2012 in the presence of structural break. The conclusion brings positive relationship between crime and income inequality in short run as well as in long run. Hence, income inequality is one of the major contributing factors of high crime ratein Pakistan. When the income inequality increases, people go for crime to fulfill their necessities by snatching instead of using legal way (Raja and Ullah, 2013). Similarly, poverty and inflation have positive and significant impact on crime only in long run. Poverty can lead people to high level of stress and mental illness which causes individuals to adopt the criminal behavior. The significance of ECM_{t-1} at 5 percent level of significance indicatesdeviations from short run towards long run are improved by 6 percent in each year and will take 16 years and 6 months approximately to reach equilibrium level.

For cointegration relationship, combine cointegration shows three cointegration vectors once we take crime, income inequality and poverty as dependent variables. Same findings are concluded by ARDL bound testing approach in the presence of structural breaks that explains the existence long run relationship between variables for Pakistan. The variance decomposition approach indicates that income inequality is a main determinants of crime in Pakistan. It shows that 23.90 percent portion of crime is explaining by shocks stimulating in income inequality that is higher proportion comparing to other's shares. Similarly, crime also causes income inequality and its share is 42 percent. 27 percent portion of poverty is also explaining by shocks stimulating in inflation. These results have also confirmed by impulse response function. Policy makers should focus on reduction of income inequality via redistribution through taxes and other benefits. Minimum wage level should be increase by government to reduce income inequality and poverty. Government should focus on policies that encourage higher saving rates and lower the cost of building assets for working and middle class households to eliminate income inequality.

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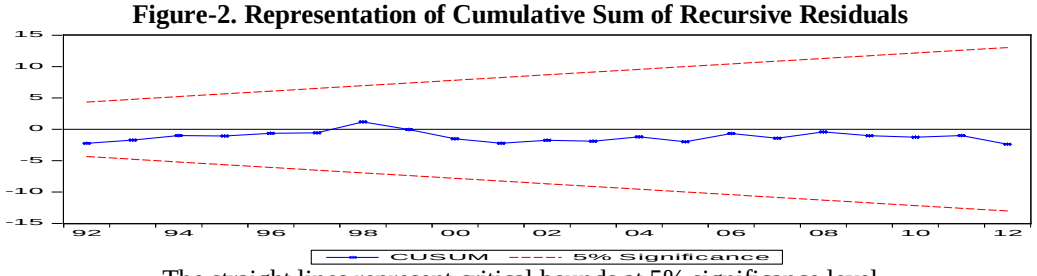
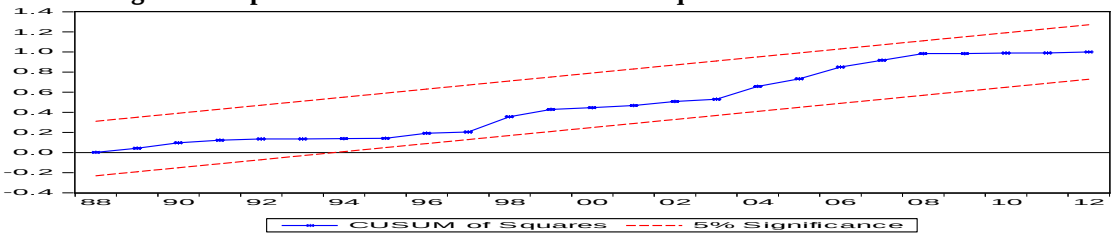
Appendix:

Figure-2. Representation of Cumulative Sum of Recursive Residuals



The straight lines represent critical bounds at 5% significance level

Figure-3. Representation of Cumulative Sum of Squares of Recursive Residuals



The straight lines represent critical bounds at 5% significance level

Figure-4. Impulse response function

Response to Cholesky One S.D. Innovations ± 2 S.E.