



## **Unemployment Rate, Population Density and Crime Rate in Punjab (Pakistan): An Empirical Analysis**

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### **Abstract**

This article has examined the impact of unemployment, population density and amount of remittances, industrialization on crime rate among the districts of Punjab, Pakistan. The data has been composed from Pakistan Bureau of Statistics, the Multiple Indicator Cluster survey (MICS), Punjab Development Statistics (2018). The Johansen cointegration method has been applied for examining the relationship among variables. The results show that unemployment and population density have a positive impact on crime rate among the districts of Punjab, Pakistan. The outcomes reveal that the amount of remittances, industrialization and social infrastructure have a negative and significant impact on crime rate among the districts of Punjab. This study recommends that for reduction in crimes, the government of Punjab should control unemployment and population density and the same time enhance industrialization, social infrastructure with the amount of remittances. On the basis of previous literature and our findings, it has been concluded that unemployment is the mother of crime.

**Keywords:** unemployment rate, population density, crime rate, industrialization

**JEL Codes:** E24, Q56, Z21

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## **I Introduction**

Crimes are the main problems as civilization begins, its scale has been enlarged over time. Crimes have become worldwide main sources of the human unhappiness; these are widely and endlessly dispersed in developing as well as in developed countries. Throughout the human history, crimes are recognized as the main factor to disable quiet and healthy society, it leaves the imitations of insecurity, anxiety and mental distress among the masses. There are a number of crimes which have different definitions in different areas and time periods. Generally, "A crime is an act of human behavior damaging to others, which the nation is bound to stop. It reduces the different person accountable to punishment as a result of happening initiated by the state structures allocated to determine the environment, the degree and the lawful values of the person's unfairness" (Fajnzlber et al. 2002). The economic theory of crime is based on the definition of Becker (1968) which perceived crime as a kind of job and related the costs and welfares of obligating a crime. According to this definition the cost of obligating a crime is: punishment, custody, fine, physical agony and psychological fault. While psychological desire and monetary improvements were measured to be the profits of promising the crime. Due to an increase in criminal activities in the mainstream of western and eastern countries, the new doors have been unlocked in the economics of crime to explore the reasons, significances and socioeconomic causes of the crimes. Extensive amount of empirical studies has examined the causes of crimes in developed countries (Ehrlich 1973, Lochner 2004, Wolpin, 1978, Machin and Mukhopadhyay, 2011). A rising number of empirical studies are concentrating on socioeconomic factors of crimes for European countries like, Italy (Marselli and Vannini 1997, Buonanno and Leonida 2005) and Germany (Entorf and Spenger, 2000), for Latin American countries Colombia (Gaviria, 2000) and Argentina (Buonanno and Montolio, 2005), for Pakistan (Gillani and Rehman, 2009, Jalil and Iqbal, 2010, Aurangzeb, 2012).

Economists are customarily using the unemployment level as a measure of the total of real employment chances accessible to the persons. Consequently, a high unemployment level proposes that there are rarer employment chances accessible and the opportunity cost of selecting crime over genuine work is small (Becker, 1968; Cornwell and Trumbull, 1994; Ehrlich, 1996; Myers, 1984; Witte, 1980). However, sociologists consider the unemployment level as being an index of the "supply of proper targets" as well as the traditional economic viewpoint (Britt, 1994; Cantor and Land, 1985). As the employment level increases, there is a relative decrease in the supply of appropriate targets because people have less to snip. Unemployment and its extensive existence in an economy is the main reason of growth in crime rate. If unemployment rate increases, the chances for lawful incomes fall and crimes will increase because the real cost related to crimes for unemployed person is collapsed (Gillani et al. 2011). Unemployment abolishes the human happiness in countless pace and it has extensive standing influence on civilization (Ali, 2015). The concentration of population has also embedded influence in producing criminal actions. There is a high percentage of crimes in those regions where extensive people are inhabiting. Because extra commercial events fascinate criminals to obligate crimes as they have additional beating rooms. Industrialization may also help as an issue to rise the crime rate and its attentiveness in the urban surroundings. Education is possibly a significant component to avoid individuals from appealing in criminal events. Schooling assistances in educating youth and increases the revenues from genuine work as compared to the crimes. With the increase in schooling, certain kinds of street crimes decline, but other kinds of white-collar crimes like misappropriation, deceit and bankruptcy may increase (Lochner, 2004). The remittances increase the income of receivers, allowing them to increase consumption and investment, recover standard of existing. The remittances act as a fuel in order to start a business, buy up or expansion, invest more in education. As a consequence of remittances, the people have well contact to fulfill their wants. So, in that situation there are fewer probabilities to compel crimes when people have entree to more means. Pakistan is the sixth most populous country in the world. It has been witnessed that crime rate has been increasing in Pakistan since last three decades. The economics of crime in Pakistan are also connected to numerous arenas such as; sociology, criminology, psychology, demography and geography. Pakistan has rising unemployment, inflation rate, poverty rate, bad urbanization, population density, low industrialization, bad social infrastructure, low level of income, low literacy rare and health, cultural, psychological and low family background. These issues may motivate the people here to commit crimes, so Pakistan is an interesting case to study.

## **II. Literature Review**

There are a number of studies which examine the determinants of crime, but here most recent and relevant are selected as a literature review. Freeman (1991) examines the magnitude of criminal activity among disadvantaged youths in the 1980's. It reveals that a large proportion of youths who drop out of high school become the reason of criminal records in the decades. The fall in real earnings reduced the opportunity cost of crime, and may have conceived many youths that they have no future in the legitimate job market. The long-term decline in the employment of less educated

is likely to have had a similar impact, inducing youths into crime. The more money in the hands of wealthy means more demand by the wealthy for the illegal items such as drugs. Ajimotokin et al., (2015) examine the effects of unemployment on crime rates in the case of the USA. The results show that the crime rate has positive correlation with unemployment. The results reveal that the unemployment rate inversely related to property and violent crime. Barenboim and Campante (2008) study the crime and inequality are positively correlated. The study finds evidence that for the case of Faveals in Rio de Janeiro, it is the savings mechanism rather than location choice that is heading crime to breed inequality. Melick (2003) studies the connection between crime and unemployment with an aim to get which aspect has the supreme result at government level. The effects of this article indicate that emphasis on the economics of crime. This paper gives an indirect connection of unemployment and crime. General idea about public policy making suggest that more crimes generates in result of more unemployment. It also gives attention about the individual action. Sometimes an individual's action completely differently. The effects review the future research thoughts. One of the absolute ways that will be studied is fixed impacts of each government.

Cantor and Land (1985) review the crime rate theories with the help of annual data in the case of the USA. The first theory presents a conceptual model that recognizes the criminal opportunity and the second theory is based on criminal motivation. The study identifies that the unemployment with crime have positive effects. The results explain that the kind of crime either criminal opportunity or criminal motivation are affected by the level of unemployment. Falk et al., (2011) mention that unemployment plays a vital role in the phenomena of right-wing extremist crimes. The study finds a positive relation between state unemployment and militant criminal activities. The authors mention that the gap in unemployment rates between East and West Germany can completely describe the considerable distinction in REC between the two regions. Entorf and Sieger (2014) study the association between unemployment and crime rate on pre-existing local crime levels in German. The mention that the size of unemployment impact crime rate among different regions of Germany. The results do not establish quantile type relationship among variables. Gillani et al., (2015) study the relationship between unemployment and crimes in Pakistan during 1975 to 2008. The estimates show that unemployment has a long run relationship with property crimes. The employment plan and internship schedule for unemployed individuals may be a favorable tool for reducing the property crime. The estimates describe that unemployment in Pakistan causes dacoity, burglary, theft and cattle theft in Pakistan.

Dahlberg and Gustavsson (2005) discuss the impact of income inequality on crime rate, the study mention it is the total income or total earnings which decide the level of crimes in the economy. The estimates show that an increase in the disparity in permanent income gives a significant rise in total crimes as well as property crimes particular. Baron (2008) examines the role of unemployment in criminal action. The estimates disclose that the impact of unemployment on crime is moderate as compare to other explanatory variables. The study mentions that the shortage of adequate money and restricted job opportunities instantly influence the unemployment rate and boost crime rates in the economy. Champan et al., (2002) examine the hypothetical dispute behind the relationship between unemployment and crime rate. In actual, the longer a person is jobless the higher the relative charm of crime. Chamblin and Cochran (2000) also mention that long term unemployment amongst young males has an important impact on property crime. The possible profits in terms of crime failure that might follow from the institutional policies that are operative in the reduction of long-term unemployment and encourage young population educational success.

Scorcu and Cellini (1998) study the economic situations on crime rates in Italy from 1951 to 1994. The study finds that unemployment encourages crime rate among different parts of Italy. Lee and Holoviak (2006) also find a long - run relationship between youth unemployment and several crime series in the case of Asian countries. Arshad and Ali (2016) examine the interconnection of unemployment rate, interest rate in Pakistan from 1974 to 2013. The study mention that unemployment generates many types of social evils in the economy. Armengol et al., (2007) examine the relationship between social structure and information exchange on crime rates. The study finds that good salary jobs have an inverse impact on criminal activities, whereas to stay unemployed encourages property crimes. The reason behind is that property crimes are strongly bothered with shortage of that is basically akin with an unemployment rate in the economy. Rapheal and Winter-Ebmer (2001) analyze the impact of employment on seven convicted crimes in the USA. The study mentions that all seven types of crime have a negative relationship with an employment rate in the case of the USA. Edmark (2003), Rapheal and Winter-Ember (2001) also find a powerful positive effect of unemployment on property crime. A poor generative relationship is although finds comparative to violent crimes. Tang (2006) examines the connection between inflation, unemployment and crime rates in Malaysia during the period of 1970 to 2006. The study mentions that inflation and unemployment are two important criminal inspiration elements in Malaysia.

Boyatzis (1982) examines the impact of criminal authorization on crime. The study finds that labor market-crime not link to authorized crime rate. The rise in crime recent years does not focus because of the increase in labor market. There is a cyclical pattern in crime rate, with crime advancing over the cycle with unemployment. Lynch (2013) identify an affirm relationship between unemployment and crime rates specifying that unemployment links with burglary, robbery, assault and homicide. The findings show a weak or negative association between unemployment and crime as compare to other studies. Papps and Winkelmann (1998) examines the relationship of unemployment and a range of classes of crime in New Zealand over the period 1984 to 1996. Results show that total rate of crime is not remarkably affected by the unemployment rate. This paper reveals, the unemployment, crime relationship in an old issue. Perhaps the inspection by Webb (1998) has a certain relevance to this area of study that this is an “urge to achieve a validity which supply does not exist.” Batu (2016) examines that youth unemployment is one of the most favorable population to indulge in criminal activities. The results show that the unemployment rate among region, sex, marital status and education level decide the level of crime rate in the society. Khamis et al., (2014) investigates the impact of socioeconomic, demographic, and health indicators on crime rate in the case of developed countries. The study finds that the socioeconomic and demographic structure decides the level of crime rate in the society. Lauridsen et al., (2013) study the factors affecting crime rates in the EU-15 countries during the years 2000 to 2007. The study focuses on inflation rate, level of education, income and employment. The results show that economic capacity and education affect crime negatively while inflation rate, employment capacity and urban population have positive effects on crime rates. Cinar and Cubucku (2012) study the relation between personal and property crime and social, economic and physical environmental issues. The findings provide that individual and property crimes were absolutely correlated. The result of physical, environmental issues was more marked for property crimes than personal crime. Bhowmik and Chaliha (2011) examines the belongings of the sex and crimes. The children should be raised with solid principles and it should be trained to these cleared minds that the self-respect of a woman is to be valued. At the school level, sex education should be compulsory. A sexual attack on male is an understated crime. The essential for a new rule on sexual attack is touching as the present rule does not describe and reproduce the various kinds of sexual attack that women and children are unprotected in our country.

### III. The Model

There are several social and economic factors which may because of existing crimes among the districts of Punjab, Pakistan. This study has examined the determinants of crimes in all thirty-five districts of Punjab for the year 2018. Unemployment may increase crimes (Coomer 2003, Gillani et al. 2009, and Gillani et al. 2011). Remittances may assist in decreasing crimes by affecting education, investment, consumption and standard of living. Crimes are high in most crowded regions (Ahmad, 2012; Brito et al., 2014). Population density may raise the probabilities of crimes (Nolan, 2004). Industrialization, on one side approves incomes of persons, job potentials and workmanship while on the further side, it may promote crimes (Rout, 2013). It may help in reducing crimes (Lochner and Moretti 2004, Dutta and Husain 2009 and Machin et al., 2011). The main objective of this paper is to explore the association between crime and unemployment for the period 1981-2017. Following the methodologies of Dahlberg and Gustavsson (2005), Lochner and Moretti (2004), Dutta and Husain (2009), Ali (2011), Rout, (2013), Ali (2015), Khamis et al., (2014), Ali (2018), Webb (1998), Ali and Bibi (2017), Papps and Winkelmann (1998), Ali and Ahmad (2014), Bhowmik and Chaliha (2011), Ali and Audi (2016), Scorcu and Cellini (1998), Ali and Audi (2018), Ali and Rehman (2015), Champan et al., (2002), Ali and Zulfiqar (2018), Haider and Ali (2015) and Ali et al., (2016), the functional form of the model becomes as:

$$CRM_t=f(UNEMP_t,IND_t,REM_t,PD_t,SI_t) \quad (1)$$

Here CRM=crime rate among the district of the Punjab

UNEMP=unemployment rate in Punjab

REM=amount of remittances received in these district of the Punjab

IND=industrialization (industrial output)

PD=population density

SI=social infrastructure (index has been constructed with the help of principle component analysis, based on number of schools, colleges, university, registered students, family structure etc.)

t=time period (1981 to 2017)

The data of selected variables has been taken from Multiple Indicator Cluster survey (MICS, 2018) and Punjab Development Statistics various issues.

#### IV. Econometric Methodology

This study is based on data from 1981 to 2017, Nelson and Plosser (1982) mention that mostly time series data have a unit root problem. They conclude 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 are disappearing over the time series and move back to their long run mean values. Whereas, shocks are permanently in non-stationary time series data. As a result, the variance and mean of a non-stationary time series is depended upon the time trend and the series follow; (a) no long run mean to which the series returns (b) variance will depend on time and will 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 non-stationary (Dickey and Fuller, 1979). There are different unit root tests available for making data stationary. For our analysis we use Augmented Dickey-Fuller (ADF) unit root test (1981), for ADF we have to follow this procedure:

$$X_t = \phi X_{t-1} + e_t \quad \text{AR (1)} \quad (2)$$

If

$$|\phi| \geq 1 \text{ non-stationary}$$

and

$$|\phi| < 1 \text{ stationary}$$

If unit root exists the variable is non-stationary;

$$X_t = \phi_1 X_{t-1} + \phi_2 X_{t-2} + e_t$$

$$X_t = \phi_1 L X_t + \phi_2 L^2 X_t + e_t$$

where  $L$  is lag operator

Taking  $X_t$  common we get;

$$X_t = X_t (\phi_1 L + \phi_2 L^2) + e_t$$

Letting

$$\phi L = \phi_1 L + \phi_2 L^2$$

We get

$$X_t = \phi L X_t + e_t$$

Solving for  $e_t$  we get;

$$X_t - \phi L X_t = e_t$$

$$X_t = \phi L X_t + e_t$$

Let

$$1 - \phi L = 0$$

$$L = 1 / \phi$$

If  $L > 1$  Time series will be stationary

$$-1 < \phi < 1$$

$$X_t - X_{t-1} = \phi X_{t-1} - X_{t-1} + e_t \quad \text{AR (2)} \quad (3)$$

$$\Delta X_t = X_{t-1} (\phi - 1) + e_t$$

$$\Delta X_t = \delta X_{t-1} + e_t \quad (4)$$

Where

$$\delta = \phi - 1$$

$$\delta = 0 \text{ non-stationary}$$

$$\delta < 0 \text{ stationary}$$

#### IV.I Augmented Dickey-Fuller (ADF) Test

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

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

$$\Delta X_t = \alpha + \delta X_{t-1} + \sum_{j=1}^q \phi_j \Delta X_{t-j} + e_{2t} \quad (6)$$

$$\Delta X_t = \alpha + \beta t + \delta X_{t-1} + \sum_{j=1}^q \phi_j \Delta X_{t-j} + e_{3t} \quad (7)$$

$X_t$  is a time series for testing unit roots,  $t$  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

Apply OLS and compute  $\tau$  statistic of the estimated co-efficient of  $X_{t-1}$  and compare with the Dickey Fuller (1979) critical  $\tau$  values. If the calculated value of  $\tau$  statistic is greater than the critical value then rejects the  $H_0$ . In this case the time series data is stationary. On the other hand, if we do not reject the  $H_0$ . In this case the time 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. Johansen Cointegration

Johansen (1988) proposed Johansen Co-integration test and Johansen and Juselius (1990) extended it for finding the long run relationship of the variables when they are stationary at some order of integration. Originally, the co-integration concept was developed by Engle and Granger (1987). Engle and Granger (1987) proposed two step estimation for only one co-integrating vector, but Johansen (1988) and Johansen and Juselius (1990) proposed maximum likelihood test for finding the number of co-integrating vectors in demonstration of Vector Autoregressive (VAR). The common method of VAR is as below:

$$X_t = \alpha_0 + \alpha_1 X_{t-1} + \dots + \alpha_k X_{t-k} + \varepsilon_t \quad (8)$$

Where  $X_t$  is a  $(n \times 1)$  vector of variables that are integrated at same order,  $\alpha_0$  is a  $(n \times 1)$  vector of constant terms,  $\alpha_1 \dots \alpha_{t-k}$  are parameters and  $\varepsilon_t$  is the residual term, for Vector Error Correction Model (VECM) the VAR can be written in following form.

$$\Delta X_t = \mu + \sum_{i=0}^{p-1} \varphi_i \Delta X_{t-i} + \Upsilon X_{t-1} + \varepsilon_t \quad (9)$$

Where  $X_t$  is a  $(n \times 1)$  column vector of  $p$  variables,  $\mu$  is a  $(n \times 1)$  vector of constant terms,  $\varepsilon_t$  is  $(n \times 1)$  vector of usual error term,  $\Delta$  is difference operator and  $\varphi$  as well as  $\Upsilon$  represent coefficient matrices. The coefficient matrix  $\Upsilon$  is representing the long run equilibrium relationship for the matrix. In this analysis two types of likelihood ratio tests are utilized (trace test statistics and maximum eigenvalue test statistics) for finding co-integrating vectors. If there is long run co-integration relationship among the variables, then for finding short run relationship we use the Vector Error Correction Model (VECM). The VECM is explained as under:

$$\Delta \ln Y_{it} = \beta_1 + \beta_2 t + \sum_{h=1}^p \beta_h \Delta \ln Y_{it-h} + \sum_{j=0}^p \gamma_j \Delta \ln X_{t-j} + \sum_{k=0}^p \phi_k \Delta \ln Z_{it-k} + \omega ECT_{t-1} + u_t \quad (10)$$

All the variables above except  $ECT_{t-1}$  which is one time period lagged error correction term. The error correction model results indicate the speed of adjustment back towards long run equilibrium after a short run shock.

### V. Empirical Results and Discussion

This study examines the impact of unemployment, industrialization, population density, the amount of remittances and social infrastructure on crime rate among the provinces of Punjab, Pakistan. The results of unit root tests have been presented in the table 1. The estimated results of the study reveal that all the selected variables of the model are non-stationary at level. But at first difference all the variables of the model become stationary. This show that all the variables have the same order of integration which is suitable to apply Johansen method of cointegration.

**Table 1 Augmented Dickey-Fuller (ADF) Test for Unit Root**

Augmented Dickey-Fuller (ADF) Test at Level		
Variables	t –Statistic	p- Value
CRM	1.717956	0.9910
UNEMP	-1.315286	0.6140
IND	-1.991389	0.7480
PD	1.970863	0.2981
REM	0.149335	0.9577
SI	-1.091098	0.1349
Augmented Dickey-Fuller (ADF) Test at 1 <sup>st</sup> Difference		
Variables	t –Statistic	p- Value
dCRM	-3.669221	0.0887
dUNEMP	4.995631	0.0000
dIND	6.846525	0.0000
dPD	-4.680238	0.0000
dREM	-6.239947	0.0017
dSI	-6.877576	0.0048

**Table 2 VAR Lag Order Selection Criteria**

Endogenous variables: CRM UNEMP IND REM PD SI						
Sample: 1971 2014						
Included observations: 42						
Lag	LogL	LR	FPE	AIC	SC	HQ
0	-1186.460	NA	1.85e+17	56.78380	57.03204	56.87479
1	-833.2204	588.7324	5.17e+10	41.67716	43.41483	42.31409
2	-726.0485	147.9994*	1.94e+09*	38.28802*	41.51512*	39.47088*
<p>* indicates lag order selected by the criterion                      LR: sequential modified LR test statistic (each test at 5% level)                      FPE: Final prediction error                      AIC: Akaike information criterion                      SC: Schwarz information criterion                      HQ: Hannan-Quinn information criterion</p>						

Table 2 presents the results of lag length criteria. Generally, sequential modified LR test statistic (LR), Final prediction error (FPE), Akaike information criterion (AIC), Schwarz information criterion (SC) and Hannan-Quinn information criterion (HQ) are used for this purpose. So, following the above lag length criteria maximum 2 lag length is selected for long run empirical analysis.

The results of Johansen cointegration have been given in table 3. In deciding the level of cointegration among the variables of the model trace statistic and maximum eigen statistic are used. Johansen (1991) mentions that when the variables are cointegrated of the same order  $I(1)$ , then the maximum likelihood test based on max-eigenvalue and trace statistics should be used to define the long run relationship among variables. The estimated trace statistics is greater than the critical value till  $R \leq 3$ , so, the null hypothesis of no co-integration is rejected and conclude that there is 3 co-integrating relationship among the variables of the model. In the case of Maximum Eigen test statistic, the value of Max-Eigen is greater than the critical value till  $R \leq 2^*$ . So, Max-Eigen value also confirms the existence of 2 co-integrating relationship among the variables of the model. On the bases of Trace statistic and Max-Eigen statistic, it is concluded that there is co-integration among the model's variables.

**Table 3 Unrestricted Co-integration Rank Test (Trace)**

$H_0$	$H_1$	Trace Statistic	0.10 Critical Value	Prob. <sup>a</sup>
$R = 0^*$	$R \geq 1$	90.2770	87.75366	0.0000
$R \leq 1^*$	$R \geq 2$	80.58159	79.81889	0.0034
$R \leq 2^*$	$R \geq 3$	60.73500	57.85613	0.0262
$R \leq 3^*$	$R \geq 4$	50.17108	39.79707	0.0453
$R \leq 4$	$R \geq 5$	13.16475	25.49471	0.1089

**Unrestricted Co-integration Rank Test (Max-Eigen)**

$H_0$	$H_1$	Max-Eigen Statistic	0.10 Critical Value	Prob. <sup>a</sup>
$R = 0^*$	$R \geq 1$	83.59537	50.07757	0.0000
$R \leq 1^*$	$R \geq 2$	43.84659	40.87687	0.0857
$R \leq 2^*$	$R \geq 3$	39.56392	37.58434	0.3034
$R \leq 3$	$R \geq 4$	27.00633	31.13162	0.1717
$R \leq 4$	$R \geq 5$	23.10936	24.26460	0.0755

<sup>a</sup>MacKinnon-Haug-Michelis (1999) p-values

\* denotes rejection of the hypothesis at the 0.1 level

The long run relationship among the variables of the model has been presented in the table 4. The results show that unemployment has a positive and significant impact on crime rate among the districts of the Punjab, Pakistan. Our findings are in-line with the findings of Ajimotokin et al., (2015), Campante (2008), Edmark (1995), Batu (2016), Winkelmann (1998), Rapheal and Winter-Ember (2001), Melick (2003), Gillani et al., (2015), Entorf and Sieger (2014), Chamblin and Cochran (2000) and Rapheal and Winter-Ebmer (2001). The results reveal that 1 percent increase in unemployment (0.142692) raise is occurring in crime rate among the districts of the Punjab. The estimated results reveal that industrialization has negative and significant impact on crime rates in the case of Punjab districts. Antonello and Cellini (1998), Edmark (1995), Rapheal and Winter-Ember (2001) mention that the economic situations play important role in deciding the level of crime in the society, hence rising industrialization is attached to lower the crime rate at all levels. Our results show that 1 percent increase in industrialization brings (-0.012132) percent decrease in crime rate among the districts of Punjab, Pakistan. Population density has a positive and significant impact on crime rates in the case Punjab. Khamis et al., (2014) and Lauridsen et al., (2013) mention that more populated areas are the best places for the criminals to hide, so crime rate is higher in those parts of the world where population density is higher as compared to lower density areas. Our findings show that 1 percent increase in population density (0.249320) percent increase will occur at the crime rate in the case of Punjab. The estimated results show that the amount of remittances has negative and significant impact crime rate in the case of Punjab. The rising amount of remittances is attached to higher labor employment in abroad, moreover, higher amount of remittances means that masses have higher resources for consumption. So, the rising amount of remittances discourages crime rate in the society. Our findings are in-line with the findings of Cinar and Cubucku (2012), Bhowmik and Chaliha (2011) and Gillani et al.,

(2011). Our estimated results show that 1 percent increase in the amount of remittances (-0.022016) percent is occurring in crime rate among the district of the Punjab, Pakistan. The estimated results show that social infrastructure has negative and significant impact on crime rates in the case of Punjab. Batu (2016) mentions that youth is one of the most favorable population to indulge in criminal activities. Because youth sex, marital status and education levels are very sensitive to the crime rate in the society. Our findings show that 1 percent increase in social infrastructure (-0.000388) percent decrease has been occurring among the districts of the Punjab, Pakistan.

**Table 4 Long Run Results**

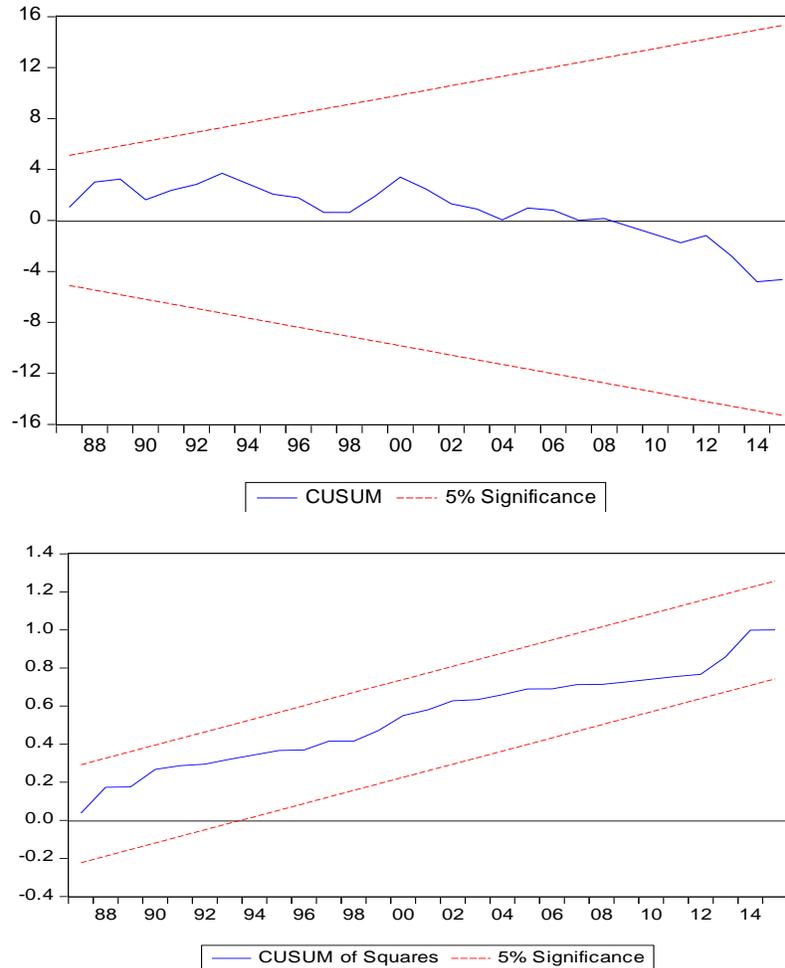
Dependent Variable: CRM			
Variable	Coefficient	t-Statistic	p-Value
UNEMP	0.142692	-1.80012	0.0000
IND	-0.012132	-1.09768	0.0024
PD	0.249320	-2.27283	0.0169
REM	-0.022016	2.54782	0.0000
SI	-0.000388	3.37636	0.0163

The short run results of the study have been presented in the table 5. The result shows that unemployment and population density have a positive and significant impact crime rate among the districts of the Punjab. The estimates reveal that industrialization, the amount of remittances, social infrastructure have a negative and significant impact on crime rate among the districts of the Punjab, Pakistan. The short run impact of independent variables on the dependent variable is same like a long run. ECM value is negative and significant which is theoretically correct and shows the speed of convergence from short run time period to long run time period. The estimated value of ECM shows 0.273583 percent short run deviation is corrected very next year and short run needs 3 years and 3 months to converge in the long run.

**Table 5 Short Run Estimates**

Dependent Variable = DLIFE			
Variable	Coefficient	t-Statistic	p-Value
dUNEMP	0.142692	-1.80012	0.0000
dIND	-0.012132	-1.09768	0.0000
dPD	0.249320	-2.27283	0.9590
dREM	-0.022016	2.54782	0.3069
dSI	-0.000388	3.37636	0.0002
ECT	-0.273583	[-2.50101]	0.0000
R-squared 0.989671		Mean dependent var 0.306534	
Adjusted R-squared 0.989513		S.D. dependent var 0.121664	
S.E. of regression 0.002686		Akaike info criterion -8.736501	
Sum squared resid 0.000195		Schwarz criterion -8.151379	
Log likelihood 193.0983		Hannan-Quinn criter. -8.523432	
F-statistic 6311.875		Durbin-Watson stat 1.929715	

Hansen (1996) points out that the model misspecification may provide biased results and policy based on these results may be misleading. The CUSUM and CUSUMsq tests are employed to test the parameters constancy. Further, Brown et al., (1975) pointed out that these tests provide help in testing the gradual changes in parameters. The expected value of recursive residual is zero leading to accept the null hypothesis of parameter constancy is correct, otherwise not. This study has investigated the impact of unemployment, industrialization, population density, the amount of remittances and social infrastructure on crime rate among the districts of Punjab, Pakistan. The plots of both CUSUM and CUSUMsq are shown by Figure-1 and 2 at 5 per cent level of significance. Results indicate that the plots of both tests are within critical bounds at 5 per cent level of significance.



## V. Concluding Remarks

The main objective of this study is to examine the impact of unemployment, industrialization, population density, the amount of remittances and social infrastructure on crime rate among the districts of Punjab, Pakistan. The data of selected variables have been taken from Pakistan Bureau of Statistics, the Multiple Indicator Cluster survey (MICS), Punjab Development Statistics (2018). ADF unit test has been applied for checking the stationarity of the selected variables and Johansen method has been used for cointegration among the selected variables. The estimated results show that unemployment and population density have a positive and significant impact on crime rate among the districts of the Punjab, Pakistan. This highlights that for the reduction of crime rate in Punjab, the government of Punjab should reduce unemployment. For this purpose, skill development programs can be started so that youth can get employment soon after completing education. Punjab has a higher population density as compared to other provinces in Pakistan, so government of Punjab should provide employment in rural areas so that population density among the different districts can be maintained. Moreover, strict population control policies can be adopted to control, faster population growth in Pakistan, which is higher in this region. Nolan et al., (2004) mention that unemployment and higher population always encourage crimes in the society. The estimated results reveal that industrialization, social infrastructure, the amount of remittances have a negative and significant impact on crime rate among the districts of the Punjab, Pakistan. So, for the reduction of crime rate, the government of Punjab should facilitate youth to join the labor market in the Middle East and Europe, so that they send money in the form of remittances back home. Government should frame those strategies that check the movement of remittances in the homeland. This further reduces crime rate among the districts in Punjab. The government of Punjab should also facilitate industrialists, so they crime rate can be controlled. For increasing industrialization, the government can control load shedding, soaring prices of fuel, failures to growing another energy resource. There are a number of methods which can control crime

rate i.e. enhance education level, judicial measures control of corruption. Crimes have direct relations with school dropout proportion. The government of Punjab should aware masses about the importance of education in the society.

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