

Identifying the Role of Socio Economic Demographic and deterrent variables on crime rate of Punjab



By

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A Research Dissertation submitted to Pakistan institute of Development Economics (PIDE), Islamabad, in partial fulfillment of the requirements for the award of the degree of Masters of Philosophy in Economics.

August, 2013

DEDICATION

DEDICATED TO ALL MY FAMILY, TEACHERS AND FRIENDS

This is to certify that this thesis entitled, “**RESOURCE ABUNDENCE IS BLESSING OR CURSE**” submitted by Mr. Abdul Hannan, is accepted in its present form by the Department of Economics, Pakistan institute of Development Economics (PIDE), Islamabad as satisfying the requirement for partial fulfillments of the Degree of Master of Philosophy in Economics.

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ABSTRACT

This study describes the role of various socio-economic, demographic and deterrent variables on crime rate of Punjab. For this purpose current study has estimated a set of four crime equations by taking total crime, property crime, violent crime and murder as a dependent variable along-with the population density, unemployment rate, literacy rate, police strength, conviction rate and number of police proclaimed offenders in a society as independent variables. In this regard study has used a time-series data set of Punjab from the year 1978 to 2012 and Johenson cointegration approach has applied to determine the long run relationship and VECM for the short run analysis of the variables used in this study. Empirical findings suggest that population density has a significant positive and education has a significant negative impact on all the categories of crime in Punjab. While unemployment has a significant and positive impact on total crimes and has a negative impact on rest of the categories of crime. As for as concerned with the law enforcement variables, conviction rate has a strong deterrence effect on murder crime rate and police strength also has a deterrence effect on all the above defined categories of crime other than the total crime. Finally it has been indicated that an increase in proportion of police proclaimed offenders in society has a positive and significant impact on property crime rate of Punjab.

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CHAPTER 1

INTRODUCTION

History of crime is in fact the history of mankind and it remained a subject of interest in every society. However various societies differ in their crime rate because each society has its own causes and effects of crime. A single universal definition and even determinants of crime is hard to find due to the socio economic, religious, cultural and psychological disparities but in a broader sense crimes are all those actions that intentionally and deliberately threatens, attempts or that actually causes physical harm, property harm, freedom harm, or harm the prevailing public order of some state or country. Moreover all those offences, that intentionally and deliberately threatens, attempts or that actually causes physical harm, are known as crime related to persons or violent crimes and all those offences that intentionally and deliberately threatens, attempts or that actually causes property harm are known as crime related to property [Buonnano and Montolio (2008), Annual crime analysis report of AIG Crime Punjab for the year 2011].

Marshall and Clark (1952) define crime in these words: “any action that is not allowed to commit by prevailing public law of some country/state for the sake of protection of the public and such prohibitions by some state having judicial proceedings in its own name.” Being an economist Becker (1968), considers a criminal to be rational one because before committing a crime he always makes a cost and benefit analysis.

A high crime rate prevails as a pain in some society. It has a negative externality because it not only harms the potential victims but also has a loss of social, economic and mental wellbeing of other people of society [Francesca and Andrew Leigh (2011)]. This high opportunity cost of crime reveals economists to play their role in suggesting such economic policies to the

policy makers that can be helpful in identifying those potential factors that can affect the crime rate of some society. Although multi disciplines are involved in determining illicit behavior like psychological, anthropological, geographical, political, demographic and religious, factors play a vital role [Gillani et al (2009)] but still the role of socio-economic and demographic factors stand distinct.

Crime prevails in every society with different rates that is why a lot of theoretical and empirical research is going on in different parts of the world to elucidate the illicit behavior of the natives of a society. Economists re-connected to the discipline of crime and economics after the phenomenal work done by Becker (1968) and Ehrlich (1973). Becker (1968) introduced crime and economics discipline in a modern way by calling criminals and law enforcement agencies rational one. His work provided a food for thought to the economists to have a new field of empirical research with a purpose to verify the different economic, socio-economic, demographic and deterrent Variables that can affect the crime rate of a society.

After incorporating this modern idea by Becker (1968), some comprehensive theoretical and empirical studies started to find the facts due to which crime rate differs among the societies. In this regard some outstanding work has been done in America by Ehrlich (1973) and Freeman (1996) while in United Kingdom by Wolpin (1978) and Machin (2004). In Spain, Buonnano and Montolio (2010) attempted to explore the socio-economic and demographic reasoning behind crime. In Latin American countries, Gaviria (2000) and Garcette (2003) also provided a remarkable literature in exploring the dynamics of crime to ensure peace and prosperity.

Pakistan is an emerging economy where crime rate is increasing over time and it needs a considerable attention of the economists to contribute in the discipline of economics and crime in

suggesting some preventing measures to control high crime rate in society. However some of the economists of country have contributed in this discipline to highlight the potential socio-economic and demographic determinants of crime [Jalil et al (2010), Gillani et al (2009; 2011) and Syed (2008)]. Most of the empirical efforts has made so far in Pakistan are using national level data and concentrating more on taking total crime as a proxy of determining the criminal behavior. It is noteworthy that total crime consists of various categories and types of crime which differs from each other regarding its nature and severity i.e. some crimes are heinous and some crimes are not as severe as murder, hurt, rape, burglary, and kidnapping for ransom etc. Thus literature of crime and economics discipline claims that different types and categories of crime yield different results with the same types of explanatory variables [T.G Chiricos (1973)]. These explanatory variables can be in form of socio-economic, demographic or deterrent variables and the effect of these explanatory variables on different categories of crime can be different.

An immense literature of crime and economics discipline suggests using different types and categories of crime keeping in mind the geographical situation of some state or country so that to understand the effect of various socio-economic, demographic and deterrent variables on the crime rate in a more comprehensive way. Moreover there is also a lack of deterrent variables in these studies on which international discipline of crime and economics immensely focused to understand the crime and economics relationship in a more comprehensive way. Current study is incorporating different categories and types of crime keeping in mind the importance of geographical location and economic situation of country to understand the effect of various socio-economic, demographic and deterrent variables on crime rate.

The recent economic, political and geographical situation of Pakistan as a whole and Province wise contains a high variability in socio-economic and demographic aggregates that

provides a genuine reason to isolate the effect of different socio-economic and demographic variables on different categories of crime. Moreover judicial system and police departments are also organized at the provincial level that allows such isolation to see the dynamics of crime rate at provincial level. Since Punjab comprises 60% of the total population of Pakistan and plays a vital role in all the disciplines of economy. Moreover various types of heinous crime in Punjab are increasing at alarming rate particularly in past few decades is also providing a temptation to prefer this province for crime analysis in this study. Current study also debates on the crime scene of Punjab in next chapter, however in term of total crime a brief view is given below,

Table 1.1: Total Population and All Reported crime in Punjab

Year	1977	1987	1997	2007	2011	2012
Total crime	84187	153042	235855	344925	419365	395006
Total Population(million)	43	55.98	72.432	88.289	94.4	96.676
Crime per Lac	196	273	326	391	444	409

Source: [Various Issues of Punjab Development Statistics Bureau of Statistics Punjab, Various Issues of Annual Crime reports, DIG of Police (Crime), Punjab, Lahore]

In the above mentioned table it has been cleared that crime rate of Punjab has not only increased in absolute but also in term of rate. Per lac crime has been obtained by normalizing total crime to the total population of the province. A simple mathematical calculation by dividing total number of registered crime to the total population and then multiplied it by one lac shows that 195 crimes per Lakh (100,000) were recorded in the year 1977 that increased up to 409 crimes per Lakh (100,000) in the year 2012, which indicates the increase in criminal behavior of the natives of Punjab. It can be argued that the poor economic, socio-economic, demographic, cultural and moral circumstances are may be able to describe the increasing tendency of criminal behavior in Punjab. This alarming tendency of increase in criminal behavior of the natives of the province reveals a lot of space is available for the economists in identifying the role of those

potential socio-economic, demographic and deterrent variables that can affect the crime rate of Punjab.

Thus the main objective of this study is to investigate the effect of various socio-economic, demographic and deterrent variables that can affect the crime rate of Punjab. Study will focus to see the effect of each socio economic, demographic and deterrent variable separately on different categories of crime to propose some valid policy in crime prevention. For this purpose study intends to use a time series data set of Punjab for the year 1978-2012. On the basis of above discussion, I am strongly hopeful current study will not only develop some meaningful and better policies regarding crime prevention measures in Punjab but it will be a better contribution in the existing literature of crime and economics at national level.

The significance of current study can be check by the fact that it claims to be the first one in Pakistan which has incorporated different categories and types of crime with respect to using various types of socio-economic, demographic and deterrent variables as an explanatory variables to observe the dynamics of crime at sub national level. Furthermore it is wide open that the crime data is either over reported or under reported and this study has also concentrated on this issue by treating murder as a dependent variable to tackle this measurement error problem.

Moreover murder as a dependent variable can be used to proxies a famous crime category known as violent crime. As a special case, famous deterrent variable on conviction rate (total number of convicted in murder cases) has been used first time at national level in this study to see the deterrence effects of conviction on murder crime rate of the Punjab. In other words it is actually an empirical test of deterrence hypothesis of Beccaria (1764), Bentham (1789) and Becker (1968) that can be summarized in these words, “an increase in a particular offender's

chance of being convicted definitely decreases that crime.” At national level literature of crime and economics it is also another novelty. Current study is also incorporating per capita police employees in Punjab which is much emphasized variable in immense international literature but widely ignored at country level literature. Finally an explanatory variable Population of Police proclaimed absconders is incorporated to capture the effect of past criminal experience on current crime rate. It is known as crime inertia [See Montolio et al (2008)]. At country level it is the first attempt to capture the effect of past criminal experience on the current crime rate along with the crime detection ability of some province.

In this study there is a positive impact of population density on crime rate, negative impact of education and conviction on crime rate while unemployment, police strength and population of proclaimed offenders yield different impacts on crime rate with respect to different categories of crime used as dependent variables. These empirical findings are not only justifiable regarding to immense literature but are also justifiable and suitable according to intuition and culture of the under discussed province.

Letter half of this study is arranged as; in chapter 2, there will be a review of literature under heading theoretical framework and empirical findings. Then study will discuss crime scene of Punjab in chapter 3. In chapter 4, study will discuss the theoretical framework and empirical procedure along with the data and its sources. In chapter 5, study will narrate its empirical results obtained from the estimation procedure and then there will be a debate on final findings of study. Finally in chapter 6, there will be concluding remarks along with a policy recommendation to prevent crime in Punjab.

CHAPTER 2

LITERATURE REVIEW

History of illegitimate activities started with the history of human beings and it remained a subject of interest in every society. When father of economics Adam Smith (1776, p.670) talked about the accumulation of wealth by people, he also talked about the motivation of crime and demand of people for the protection from crime while they are accumulating wealth. William Paley (1785), focused on those factors (i.e. severity of punishment and probability of arrest) due to which crime rate differs among the societies. However, it was Jeremy Bentham (1789), who introduced calculus while determining the criminal behavior of offenders along with the calculation of optimal enforcement of law by crime prevention agencies.

Thus economists re-concentrated on crime and economics discipline with modern ideas and techniques after the phenomenal work done by Becker (1968) under the heading “Crime and punishment”. Moreover Fleisher (1966), Rottenberg (1968), Stiggler (1974), Landes and Posnars (1974) also contributed a lot to reconnect economists with Crime and Economics Discipline [Issac Ehrlich (1996)]. All these economists along with the Friedman (1984; 1995) concentrated on modeling the criminal behavior to show the rationality of criminals towards committing crime along with the optimal level of law enforcement by crime prevention authorities to have a less burden on tax payers. In brief all of the above said economists lead the theoretical foundations of Modern Crime and Economics Discipline.

While discussing the history of empirical framework of crime and economics the first empirical attempt was made by Thomas (1925), when she correlated crime rate with business

cycle and drunkenness. She found a weak and negative correlation between business cycle and crime rate but a strong positive relationship in case of Drunkenness and Business cycle[Wong Y.C.R. (1993)]. A brief view on the theoretical and empirical framework of above said discipline is discussed below.

2.1 Theoretical Background of Crime and Economics Discipline

It is a wide open that modern theoretical foundations of crime and human behavior have been focused by Becker (1968), Stigler (1995), Ehrlich (1973) and Friedman (1995). Becker (1968) was of the view that every criminal is an economic agent and he commits crime only when he expects an increase in his expected utility. He also discussed the optimal structure of institutions that are responsible for crime prevention by stating that institutions should be designed so that they suffer minimum cost in crime prevention of a society. He along with Stigler (1968) preferred to private enforcement of law rather than public enforcement in detection and prevention of crime because public enforcement has perverse incentives. Moreover they called public enforcement of law more expensive as compare to private enforcement. Finally it can be stated that his basic analysis was about the probability of arresting a criminal, apprehension cost and the cost of conviction. Moreover in his work, he formulated the policies related to the cost of illegal behavior.

William M. Landes & Richard A. Posner (1975) criticized the above mentioned idea of Becker of turning the most likely and an ideal public enforcement of law into private enforcement of law. They were of the view that private enforcement has severe drawbacks i.e. it can lead us not only towards the over enforcement but under enforcement is also possible. However they favor private enforcement of law only in civil offenses because these can be detected with an ease and can be punished at zero cost in term of monetary fines.

David Friedman (1984) defended the idea of private enforcement of law by Becker and Stigler (1968) in his article “an efficient enforcement of law”. He quoted the historical example of Ireland where private enforcement of law prevailed for three hundred years not only in civil offences but also in severe criminal offences like murder during the Anglo-Saxon period. He called it the reason of sound formal and informal institutions of Ireland during this period and concluded that private enforcement is much effective in civil offences rather the offences under Criminal law. Finally he reported inefficiencies regarding to private enforcement in criminal offences can easily be eliminated by having some minor changes in some of the formal and informal institutions that play a role in crime prevention of some state.

David Friedman (1995) contributed again in the discipline of crime and economics with a new idea of turning the criminal law into civil law to support the Becker’s idea of private enforcement of law. He starts with a simple assumption that all criminals, potential victims and crime control agencies are rational by their own sides. He reported that before committing a crime not only a criminal but the institutions to prevent crime also make a cost and benefit analysis of their plans to deter crime. He concluded that punishment for the crime prevention either in term of imprisonment or execution possesses some sort of cost. Thus turning the criminal law into civil law will enable us to punish the offenders in term of monetary fines at zero cost that will lead a society towards the optimal enforcement of law.

The above mentioned debate about the rationality of criminals in decision making of crime and efficient law enforcement by crime prevention authorities in some state is the main theme of modern crime and economics discipline. First it was presented by Becker (1968) and later on Stigler (1995), Ehrlich (1973) and David Friedman (1995) supported and promoted the same idea. All the above mentioned researchers can truly be labeled as the founders of the above

said discipline. All empirical studies of this discipline contain the same above mentioned basis in one or another way particularly the idea of Becker's (1968) and Ehrlich (1973).

2.2 Empirical Background of Crime and Economics Discipline

As current study is going to identify various determinants of crime empirically, so it will concentrate more on the empirical framework of crime and economics discipline. Since a criminal activity involves multi-disciplines but study will concentrate only on those national and international studies which are related to identifying socio-economic, demographic and deterrent variables that can affect the crime rate in a society. In this regard we concentrated on following studies by some naming researchers in different periods;

Fleisher (1966) discussed the demand and supply side effects of income on criminal behavior. To explain the demand side effect of income, he narrated people with high income facilities having more to lose in case of arrest that is why they hesitate to involve in criminal activities. He empirically estimated that if there is 1% increase in income of an individual then there will be 2.5% decrease in committing an illegal activity by some individual. While in discussing the supply side effect of income, he is of the view that when there is increase in income of an economy people tempted to get it through some criminal activities and it may be the result of prevailing income inequality in that society.

Allison (1972) investigated those economic factors which cause a high crime rate. He investigated the effect of various characteristics of population, police strength, Per Capita Income of a community, recreation and educational expenditures on crime rate. His regression and correlation analysis declared that even in strength these variables differ but these are the root cause of high crime rate of some society in one or another way.

Bechdolt Jr. (1975) empirically analyzed the effect of various socio-economic variables on crime rate in two big U.S Cities, Los Angeles and Chicago. He decomposed the total crime into property crime and violent crime and analyzed the effect of crowding, population density, unemployment and income on crime rate. In this empirical work he reports not the income level but there is unemployment rate that causes a high crime rate in these cities. While in discussing the property crime he concludes that unemployment stimulates property crime rate in more extent as compare to poverty. Finally in case of the violent crimes not only the unemployment but population density also plays a vital role to stimulate these sorts of crime.

T.G Chiricos (1987) tried to explore the unemployment crime relationship because it became a debate when some of the researchers like Coack and Wilson (1985) found insignificant and weak relationship between unemployment and crime rate. After a keen research he concludes, we can get a weak and insignificant relationship between crime and unemployment if we use a time-series data or the data of U.S economy for unemployment through period 1970's. He concluded that relationship between unemployment and crime rate can't better explained by a time series analysis as compare to a cross-sectional analysis.

Saridakis and Spengler (2009) empirically estimated the relationship between crime, deterrence and unemployment by using a panel data model based on the GMM estimator. Their empirical findings reported, property crimes have a negative and significant relationship with higher clear-up rates and a significantly positive relationship with unemployment rate in Greece. However the effect of the clear-up rate and unemployment are found to be weaker and insignificant in violent crime cases. They concluded that these associations could be detected for violent crime after employing gender-specific unemployment rates in the rape model.

Steven Raphael (1998) analyzed the effect of unemployment on seven felony offenses using the panel data of 50 US states for the period 1971-97. They found a positive relationship between unemployment and crime rates. OLS and 2SLS methods have been used and while using 2SLS oil shock has been taken as an instrument of unemployment. 2SLS estimate results are stronger than OLS estimates and these results indicated that violent crime of robbery is positively associated with unemployment. Initial results also indicated that Murder and rape are negatively correlated with unemployment as unemployed persons are less likely to be involved in violent crimes.

Duha T. Altindag (2011) investigated the impact of unemployment on crime rate. In this study he is of the view that an overall unemployment rate may be unable to identify people on the margin of committing a crime thus he decomposed the overall unemployment rate into labor force shares of the unemployed with primary education and high education. By using a country-level panel data set from Europe and taking earthquakes, industrial accidents and the exchange rate movements as instruments for the unemployment rate, he concluded that 2SLS point estimates are larger than OLS estimates and only the unemployment of individuals with low education is a significant determinant of the impact of the unemployment rate on crime.

William et al (1994) estimated a crime model with panel data approach. The purpose of this study was to realize the fact that degree of criminal justice system to deter crime was not as strong as it was depicted by the results of some previous relevant studies. Moreover he emphasized on the importance of using panel data approach into the discipline of economics and crime. They stated that if Panel data set is available then it can control unobservable country specific characteristics that may be correlated with some other deterrent variable like Justice and as a result endogeneity will be control in a pretty well manner. After using the panel Data set to

find the relationship between various deterrent, socio-economic and demographic variables they found that, proportion of young male in total population, proportion of minority in population and Police strength has a vital influence on crime rate in some society.

Peterson et al (1996) explored the relationship of crime with structural disadvantages and racial differences, particularly for the violent crime. They use a census base data (1990 census) for a US city Columbus and apply OLS method to get results. Author analyzed the effect of percentage of black in population; young males in population, community instability and rental occupancy on the crime rate of Columbus. Finally he concluded that all the above mentioned explanatory variables have positive Signs with property and violent crime. The dummy variable introduced in this study to capture the effect of disadvantaged neighborhoods to crime also depicted a higher positive relationship with violent crime rather than property crime.

Zsolt Beccsi (1999) empirically investigated the effect of age specific population, unemployment rate, per capita personal Income, Public welfare expenditures, primary and secondary education, conviction rate and police strength on different categories of crime. By using a panel data set of year 1971-94 of the eight states of USA he concluded education expenditures and welfare expenditures are not statistically significant. While unemployment, is positively significant for all the categories of crime. In the end he reported that, by increasing the expenditures on police or by increasing the police members in a society, we are unable to control the crime rate unless rate of imprisonment and rate of conviction is not high.

Gumus (2004) investigated the effects of deterrent, Socio-economic, and demographic variables on crime rate of 75 large U S cities by using a cross sectional data. He concluded that

Per Capita Income and Poverty are the root cause of crime in large US cities while the unemployment was statistically significant only in 1/8 of empirical equations used in this study.

Imroho et al (2006) examined the effect of various economic, socio and demographic variables on the crime rate across the different countries of the world. In this cross-sectional analysis they selected at least one country from each of the continents of the world and year 1980 in USA as a benchmark. Study investigated those factors due to which crime rate differs across the countries of world. They checked the effect of unemployment rate, fraction of low human capital individuals in an economy, Income inequality, age categories, and the probability of apprehension along with duration of jail sentence on property crime. To check the effect of above said variables on property crime rate they used overlapping generation model to allow individuals to participate in either of the legitimate market activities or in illegal activities.

In final findings they amazingly found that 79% people involve in property crime are not unemployed. They called it result of under employment that temptate such a large proportion to involve in property crimes. Moreover their model also predicted that 18 years of age or younger were 76% of the total criminals who participated in property crimes. Furthermore 46.1% people who were found to be involve in property crimes that were without a high school diploma. Moreover they concluded that, there are probabilities of apprehension and income inequality, in which a little difference can generate a significantly large difference in the crime rates across similar environments.

Paolo Buonanno et al (2008) studied the socio-economic and demographic determinants of crime in Spain. It is noteworthy that authors decomposed their dependent variable in two well-known categories property crime and violent crime to see separable effects of independent

variables on property crime rate and violent crime rate. They used panel data set of Spanish provinces from 1993 to 1999 and applied GMM system estimator to get result. Their final findings reported that property crimes are better explained by socio-economic variables i.e. youth unemployment rate and education. However violent crimes depend on other factors that are not so easy to explain with such a type of aggregated data. They also concluded that property crime and total crime are significantly correlated to the fraction of foreigners to the total population while it is not true for violent crime. Moreover authors found urbanization as a positive and significant explanatory variable in context to all the categories of crime.

Gillani et al (2009) empirically investigated the effect of unemployment, Inflation and poverty on crime rate of Pakistan by using a time series data [1975-2007]. By applying Johenson cointegration approach they concluded that unemployment rate, poverty and inflation are granger cause of crime in Pakistan.

Omotor (2009) used inflation, income, literacy rate, and unemployment rate to investigate their role in crime nexus of Nigeria. By using ECM and cointegration approach, he tested the existence of long run relationship between crime rate and above said socio-economic variables. He conclude that unemployment has a positive relationship with crime rate while a low literacy rate and high population of Nigeria were not found as a root cause of stimulating crime rate in Nigeria.

Jalil et al (2010) concentrated to investigate the link between urbanization and crime rate in Pakistan by using a time series date from 1964-2008. They used Johnston cointegration approach in their empirical investigation and reported a high population density and lack of planning regarding to the expansion of urban areas increase crime rate.

However a lot of research efforts available now in which economists have used time series, cross-sectional and panel data approaches to highlight those economic factors which are helpful to motivate criminal behavior and cause the high crime rate in different societies. Finally the literature of crime and economics is still developing both nationally and internationally to provide new insights related to crime and its determinants.

CHAPTER 3

CRIME SCENE IN PUNJAB

INTRODUCTION

In this chapter study will debate on the crime scene of Punjab regarding to total crime, property crime and violent crime. In section 3.1 total crimes after normalizing to population and in section 3.2 different types of violent and property crime are discussed. As literature of crime and economics is newly emerging at country level so it will be supportive to understand the different categories and types of crime that study will follow.

3.1 Category wise Crime scene in Punjab

The study has taken total crime (TC), violent crime (VC) and Property crime (PC) out of the total categories available regarding to discuss category wise crime scene of Punjab in following table.

Table3.1: Crime Analyses in Punjab regarding to its Major Categories

YEAR	TC	PC	VC	POP(000)	Per Lac TC	Per Lac PC	Per Lac VC
2001	227107	40579	37992	79444	286	51	48
2002	247888	40441	37335	80875	307	50	46
2003	248979	47549	42364	82330	302	58	51
2004	273519	53330	47109	83811	326	64	56
2005	276411	58801	44701	85318	324	69	52
2006	342561	70321	48354	86812	395	81	56
2007	344925	63859	46030	88289	391	72	52
2008	374400	77282	51382	89790	417	86	57
2009	383379	80692	50829	91316	420	88	56
2010	386437	90941	52971	92869	416	98	57
2011	419365	104491	56131	94401	441	110	59
2012	395006	92882	54267	96676	409	96	56

Source: [Various Issues of Punjab Development Statistics, Bureau of Statistics Punjab; Various Issues of Annual Crime reports, DIGof Police (Crime), Punjab, Lahore]

The Columns 2, 3&4 of table 3.1 exhibit the number of total crime recorded by Punjab police during last decade in absolute term while there is a normalization of these crimes with respect to crimes per Lakhs inhabitants of Punjab in the columns 6, 7&8 of this table

The above mentioned table shows that during the last decade there is a spectacular increase in all the categories of crime not only in absolute term but also in term of rate. In absolute sense total recorded offences by Punjab police under the heading total crime (TC) and Violent crime (VC) has become almost double and property crime (PC) has become thrice in 2011 as compare to offences recorded in year 2001. Moreover in term of rate we find that Total Crime (TC), Property Crime (PC) and violent crime (VC) has also been increased from (286,51,48) offences per one Lakh persons in 2001 to (409,96,56) offences per one Lakh persons in 2012, respectively for TC,PC, VC. Graphically it can be viewed as under;

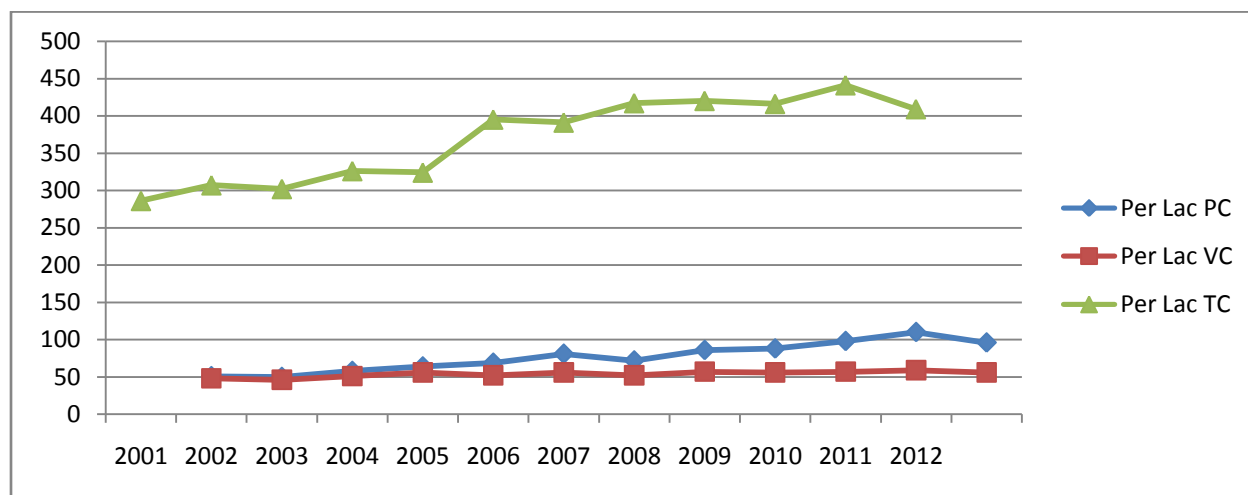


Fig.3.1 Total number of Crimes, Property Crimes and Violent Crimes in term of rate in Punjab, during last decade

3.2 Crime Scene in Punjab with Types

This section of study deals with the various types of property crime and violent crime to see the criminal tendency of natives of Punjab regarding to these types. It will not be only helpful

to understand the aggregations of property crime and violent crime that study follows but it will also be helpful to know that increase in various types of property crime is relatively higher as compare to violent crime.

3.3 Types of Crime Related to Property (Property Crime)

In Punjab, various types of property crime from year 2000 to 2012 are given below in table 3.4. There is a rapid increase in all the types of property crime particularly in Dacoity, Robbery, all other theft and MV theft. After normalizing it to population of the province it becomes clear that in year 2000 per lac Dacoity, Robbery, all other theft and MV theft were recorded (1, 7, 21, 8) offences per one Lakh persons which has been increased up to (3, 14, 34, 21) offences per one Lakh persons in year 2012. It indicates more than double increase in most of the types of property crime rate in Punjab.

Table 3.2: Crime Analyses in Punjab regarding to Various Types of Property Crime

YEAR	Dacoity	Robbery	Burglary	Cattle Theft	All Other Theft	MV Theft	Kidnaping For Ransom
2000	787	5361	11074	5696	16535	6066	92
2001	743	5136	9759	4811	14792	5275	63
2002	816	5334	9639	4679	14029	5866	78
2003	1319	7472	9508	5895	16713	6549	93
2004	1607	8311	10274	6992	18215	7808	123
2005	1545	8786	8961	11153	20262	7968	126
2006	1825	10567	9927	12577	25781	9492	152
2007	1446	11225	8703	8472	23437	10386	190
2008	2136	13949	11216	8022	29729	11982	248
2009	2352	13968	11561	8640	29886	14061	224
2010	2752	16604	13065	7661	31929	18738	192
2011	3771	20790	14991	8549	33951	22224	215
2012	3099	13833	14686	8071	32615	20418	160

Source: [Various Issues of Punjab Development Statistics, Bureau of Statistics Punjab; Various Issues of Annual Crime reports, DIG of Police (Crime), Punjab, Lahore]

These crime statistics indicate poor socio-economic, demographic, cultural and moral conditions in Punjab. Since property crimes are associated to youth [Becsi, (1999); Montolio et al (2008)] and our country is passing through such a demographic phase where, proportion of youth is higher in total population and it is causing a higher tendency towards property crime as compare to violent crime. Moreover it can also be argued that property crimes directly associated with the economic incentives [Buonnano et al (2008); Gumus, (2004)], thus high inflation, unemployment and poverty can also label as reasons of increasing trend of the property crime in Punjab.

This higher tendency towards property crime is spreading the state of insecurity, frustration and mental unrest into the society [Gillani et al (2009), pp.85]. People are losing their legal earnings. The following statistical figures will be helpful to understand the intensity of insecurity and mental unrest in society due to increasing trend of property crime rate in Punjab;

Table 3.3: Total Money Lost by People in Property Crimes during year (2011)

<i>Type of property crimes</i>	<i>Money lost (Million Rs)</i>
<i>Docaity</i>	<i>2,733</i>
<i>Robbery</i>	<i>4.302</i>
<i>Street crime</i>	<i>122.6</i>
<i>Burglary</i>	<i>4,468</i>
<i>382 PPC</i>	<i>164</i>
<i>MV Theft</i>	<i>3,058</i>
<i>Cattle Thef</i>	<i>875.4</i>
<i>All other theft</i>	<i>1,940</i>
Total Loss	<i>18,072</i>

Source:[Annual crime report (2012), D.I.G of Police (crime), Punjab]

3.4 Types of Crime Related to Persons (Violent Crime)

In Punjab crimes related to persons from the year 2000 to 2012 are discussed under table 3.4.

Table 3.4: Crime analyses in Punjab regarding to Various Types of Violent Crime

YEAR	Murder	Attempted Murder	Hurt	Kidnapping/ Abduction	Assault on Public Servant	Rioting	Rape
2000	4566	6150	19574	5356	1406	303	1714
2001	5000	6106	19240	4880	1172	171	1423
2002	4898	5576	19284	5040	990	126	1421
2003	4864	6185	22020	6364	1110	150	1671
2004	5050	7061	24429	7449	1213	168	1739
2005	5111	6837	22918	7036	1207	151	1441
2006	5233	7385	24619	7948	1467	183	1519
2007	5184	6755	23334	7712	1345	203	1497
2008	5671	7128	23669	11155	1475	261	2023
2009	5836	6784	22067	11924	1666	207	2345
2010	6242	7309	21388	13497	1806	148	2581
2011	6666	7722	21996	15114	1778	168	2687
2012	6312	7549	20327	15562	1789	122	2606

Source: [Various Issues of Punjab Development Statistics, Bureau of Statistics Punjab; Various Issues of Annual Crime reports, DIG of Police (Crime), Punjab, Lahore]

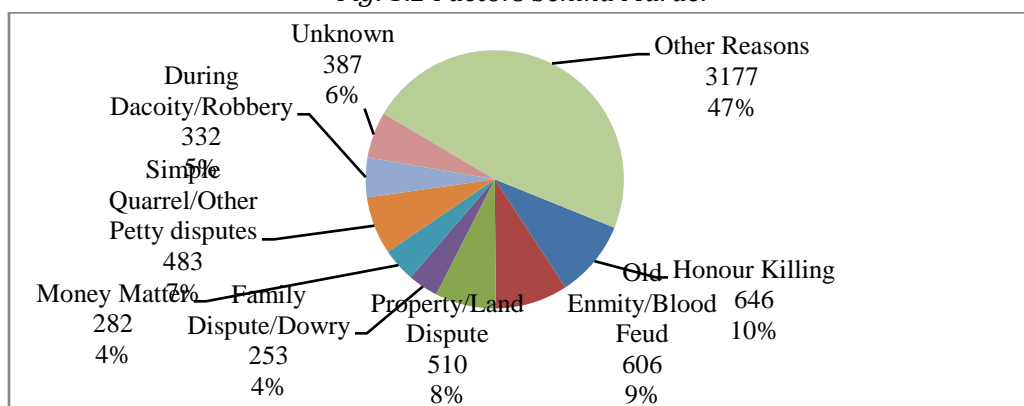
After normalizing it to population of the province an increase in some of the major types of violent crimes can be observed. Murder, rape and kidnapping for abduction was recorded (6, 2 and 7) offences per one Lakh persons in year 2000 that has been increased up to (7, 3 and 16) offences per one Lakh persons in year 2012. While figures of per lac attempted murder and assault on public servant although having a bit fluctuation during the decade but over-all its rate is sticky in year 2012 as it was in 2000.

Although these crime statistics do not indicate a rapid increase in most of the types of violent crime but it is thought provoking that crime prevention authorities are still unable to minimize the violence behavior among the masses. There is only rioting that decreased over time but in this regard it can be argued that a democratic government in most of the years mentioned

above may have suggested crime detection authorities not to depict the exact figures of rioting for their own political incentive because rioting is often considered negatively associated with political stability.

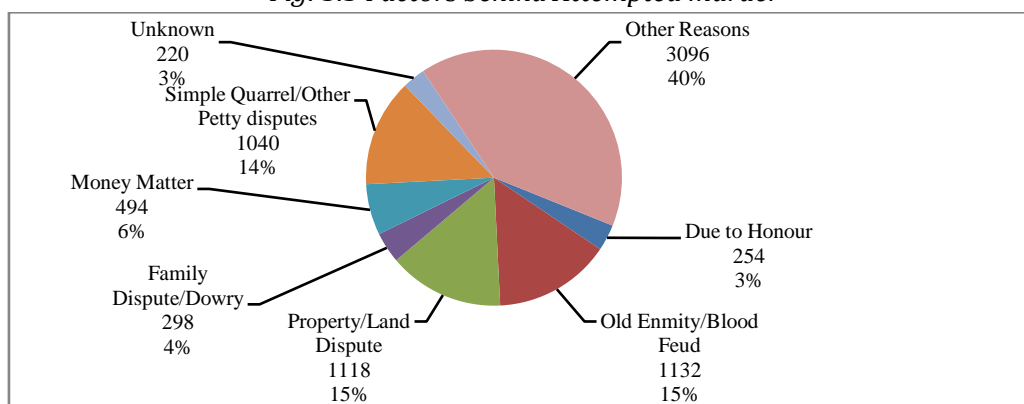
Inspit of having poor economic conditions a little increase and stickiness in some of the types of violent crime indicates the complexity of violence behavior to interpret because there are many factors behind this. In this regard a survey was conducted by Punjab Police in year 2011 which reported the following main findings of the violence behavior in Punjab;

Fig: 3.2 Factors behind Murder



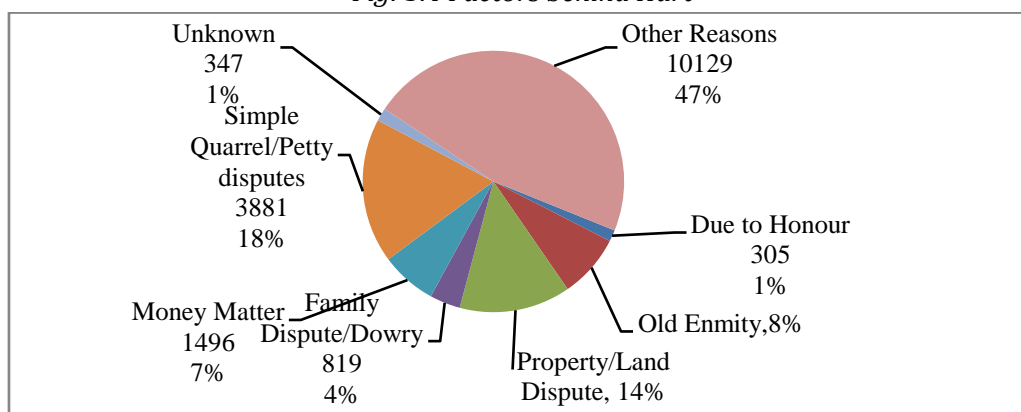
Source: [Annual crime report (2011), DIGof Police (Crime), Punjab, Lahore]

Fig: 3.3 Factors behind Attempted murder



Source: [Annual crime report (2011), DIGof Police (Crime), Punjab, Lahore]

Fig: 3.4 Factors behind Hurt



Source: [Annual crime report (2011), DIG of Police (Crime), Punjab, Lahore]

This analysis related to three of the famous types of violent crime shows, not only the economic factors but factors from other disciplines are also involved in violence behavior of the natives of a society. These cultural, religious and psychological factors most of the times dominate on the economic factors in discussing the various types of violent crime. Potential factors found in Punjab regarding to the violence behavior are old enmity and honor killing (culture), family disputes and dowry disputes (Informal institutions or illiteracy), simple quarrel (Psychological reason or result of illiteracy), sectarian, political, religious and terrorism activities (depicted by other factors in graphs). It can be concluded that not only the economic factors but factors from other disciplines are also liable to boost the violence behavior. However it can be argued that economic incentives are indirectly involved in violence behavior of the natives of Punjab.

3.5 Conclusion

Above mentioned detail about prevailing a high crime rate in Punjab reveals that enough space is available in the discipline of crime and economics for the researchers. Economists can play their role by investigating some potential socio-economic and demographic determinants of crime to purpose some valid policies for decision makers to prevent crime in province of Punjab.

CHAPTER 4

THEORATICAL FRAMEWORK AND EMPIRICAL PROCEDURE

Introduction

Study will discuss the economic rationale used in specification of the model along with justifying various socio-economic, demographic and deterrent variables that are used in empirical equations to get final findings in section 4.1 of this chapter. Moreover definitions of all the variables used in this study along with their data sources are given. In section 4.3 there will be a presentation of descriptive statistics of data of the variables used and in section 4.4 there is a detail of empirical procedure to get final findings of study. In empirical procedure there will be a detail discussion on the unit root test, Johansen cointegration approach for a long run analysis and Vector Error Correction model for the short run analysis.

4.1 Theoretical Framework and empirical procedure

In social sciences criminal behavior can be discussed by a numerous ways as social scientists have developed different theories for this purpose. Being a social scientist an economist has his own ideas to examine the criminal behavior and in most of their empirical studies they focus on rational economic theory to explain the criminal behavior of the natives of a society. Rational economic theory compels economists to believe that a criminal is an economic agent because he commits crime to enhance his expected utility [See Mathur (1977)]. David Friedman (1996) states this fact in these words: a burglar has same reasons of his burglary that a teacher has for his teaching profession because both want to maximize their utility.

Thus it can be stated that choice between committing and not committing a criminal activity depends upon the net payoff (φ_i) of some criminal activity. Decision of participation in

an illegitimate activity (P_i) is a decreasing function of its expected cost (C_i) and increasing function of expected gain (G_i) of that activity i.e.

$$P_i = f(C_i, G_i)$$

Whenever;

$$C_i = f(c_i, wl_i, p_i, f_i)$$

Where; C_i , is total cost faced while committing a crime, c_i , is direct cost that a criminal pays in term of effort he made in acquiring gains from criminal activity. These can be the efforts of self-defense to avoid penalties or to avoid arrest / imprisonments etc. wl_i , denotes the foregone of legitimate labor market wages in case of arrest or conviction, p_i , stands for probability of arrest or conviction, f_i , represents the fines or other penalties in term of imprisonment etc.

Moreover gain of some criminal activity can be shown by following function.

$$G_i = f(L_i)$$

In the above stated function gross gain is denoted by G_i which is positively related to L_i and L_i is something gained (loot) as a result of some criminal activity.

Finally net pay off φ_i can be defined as the difference of gross gain and total cost i.e.

$$\varphi_i = G_i - C_i$$

Or
$$\varphi_i = L_i - c_i - wl_i - p_i f_i$$

The net pay-off (φ_i) can also be declared as expected utility of committing a crime and someone may be able to claim that a criminal activity takes place if and only if;

$$\varphi_i > 0$$

Or
$$E [G_c] > E [C_c]$$

In most of the criminal activities expected gains $E [G_c]$ are economic incentives, however due to the universality of the definition of crime these incentives can be psychological. While the expected cost of crime includes wastage of time, fine penalties or foregone wages from the legitimate labor market activities in case of arrest or imprisonment as discussed above. Above discussion about expected gains and expected cost of some illegal activity permits to claim that, only those who want to maximize their expected utility participate in the criminal sector [See Becker (1968); Ehrlich (1973); Witt (1984) and Becsi (1999)]. Moreover this discussion is the core of economic model of crime that study will use in its empirical procedure. It will be helpful in identifying the role of various socio-economic, demographic and deterrent factors that can affect the crime rate in Punjab. After considering Buonnano et al (2008); Friedman (1996); Cherry et al (2002); Becsi (1999); Allison (1972) and Jalil et al (2010) study has narrated the following function of crime;

$$\text{Crime} = f(\text{population, unemployment, education, police strength, police absconders})$$

The above mentioned function of crime contains those socio-economic, demographic and deterrent variables that are quite logical according to the theoretical frame work of current study also has been used in a numerous empirical investigations of economics and crime discipline in one or another way. The first variable in above stated function is demographic in nature and labeled as population. It has been used to investigate the relationship between population and crime rate regarding different of its characteristics and it has been declared a potential determinant of crime in immense national and international studies. Current study proxies the

above discussed demographic variable into population density that can be the representative of urbanization [Gumus (2004)]. Since increase in population density can decrease the probability of arrest that leads to decrease the expected cost of crime and it can motivate someone to commit a crime [See Becsi (1999) and Buonnano et al (2008), Burley et al (1975), Allison (1972)].

The next variable is labeled as unemployment, which is fairly one of the most popular measures of economics and crime analysis. Temptation of an unemployed person towards crime can be more because he has a low cost of crime due to not having legitimate labor market wage to forego [See Allison (1972), Becsi (1999), Jalil et al (2010)]. It is noteworthy that some of the naming researchers of above said discipline are of the view that unemployment reduces the crime targets if it prevails in a society for a long time that can reduce the property crime rate in such a society [Cantor and Land(1985); Cook and Zarkin (1985)]. Thus unemployment is likely to be correlated with crime in one or another way.

Thirdly, socio-economic variable incorporated in above specified function is education that can affect the decision of committing or not committing some illicit activity. Education enhances the cost of crime in case of conviction or imprisonment. Therefore an educated person has fewer chances of participation in criminal activities [See Becsi (1999), Jalil et al (2010) and Usher (1997)].

Fourth variable included in empirical model of the study is deterrent in nature and labeled as police strength. In literature of crime and economics deterrent variables are often expected to be negatively correlated with crime rate because it can increase the expected cost of crime by increasing the probability of arresting the criminals [Cornwell et al (1994) and Cherry et al (2002)]. However some of the researchers believe in a positive relationship between police

employment and rate of crime by stating that, government takes interest to announce new vacancies in police department when a high crime rate prevails in some society [Allison (1972), Gumus (2004), Buonnano et al (2008)]. A bulk amount of international literature uses this deterrent variable to measure the crime detection and prevention ability of some state, country or province etc.

The last variable included in empirical modal is the number of police proclaimed absconders in a society. Police proclaimed Absconders are those persons who have committed some crime in past and they are wanted to police under their offences but they are still un-arrested by crime prevention authorities/police. An adequate criminal know how due to the past criminal experience leads to a low opportunity cost of committing crime that can compel these persons to join illegitimate activities for their material wellbeing. Various police reports call it as one of the major reasons of high property crime rate in Punjab. The above mentioned detailed discussion about the determinants of crime reveals to purpose the following complete specification of empirical modal,

$$TC_t = \alpha + \beta_1 POP_t + \beta_2 UR_t + \beta_3 EDU_t + \beta_4 PS_t + \beta_5 PPO's_t + e_t \quad (1)$$

First of all there will be the estimation of above mentioned equation in which, total crime (TC) is a dependent variable along with the five independent variables. The details of all these explanatory variables is; POP_t , stands for population density, UR_t represents the unemployment rate, EDU_t represents the literacy rate, PS_t exhibits the police strength i.e. number of police employees available to per 1000 inhabitants of Punjab, $PPO's_t$ stands for the number of police proclaimed absconders in Punjab, during some t year. Finally e_t depicts the error term.

Since it has been stated that study will decompose the total crime into two of its broad categories [property crime (PC_t) and violent crime (VC_t)] for a more comprehensive analysis of crime nexus. Theoretical frame work of current study along with immense international literature favors this decomposition by stating that property crimes are more responsive to economic incentives while a lot of crimes related to persons seem to be committed as a byproduct for some economic gain [Becsi (2008)]. In this regard have a look at following crime statistics;

Table4.1 Motives behind the violence behavior in Punjab (No. of registered crimes)

<i>Year (2011)</i>	<i>Money matters</i>	<i>Property/land disputes</i>	<i>Dowry disputes</i>	<i>In daccuity/ robbery</i>
<i>Murder</i>	(282)	(510)	(253)	(332)
<i>Attempted murder</i>	(494)	(1,118)	(298)	N.A
<i>Hurt</i>	(1,496)	(2,985)	(819)	N.A

Source: [Annualcrime report(2012), DIGof Police (Crime), Punjab, Lahore]

The above mentioned statistics indicate that even in case of violent crimes economic incentives are playing vital roles. It also favors the hypothesis of declaring the violent crimes as a byproduct of property crimes and it can be claimed that violent crimes are not the crimes of passion but these are also committed for economic gain directly or indirectly [Becsi (1999)]. Thus on the basis of above discussion current study focused on following econometric equations to estimate for decomposition of total crime into its broader categories,

$$PC_t = \alpha + \beta_1 POP_t + \beta_2 UR_t + \beta_3 EDU_t + \beta_4 PS_t + \beta_5 PPO's_t + e_t \quad (2)$$

$$VC_t = \alpha + \beta_1 POP_t + \beta_2 UR_t + \beta_3 EDU_t + \beta_4 PS_t + \beta_5 PPO's_t + e_t \quad (3)$$

In these two equations PC_t and VC_t are two different dependent variables with the same explanatory variables. The intuition behind same explanatory variables in these empirical equations lies in the line of assuming the violent crimes as a by-product of property crimes [See Becsi (1999)].

Finally study is going to discuss a very important issue regarding to the measurement error of crime data. It can be under reported either by the side of crime control agencies to show their better performance or by the side of potential victims to save their time and money [Cherry and List (2002), Dilulio (1996), Becsi (1999)]. In Punjab registration of a crime is not only cost oriented in term of time and money but also cultural that can lead the crime statistics under reported or over reported simultaneously. Thus keeping in mind these serious measurement error problems study is going to state another empirical equation where ‘murder’ is taken as a dependent variable.

Murder is considered as less contradictory in sense of having measurement error problems because several other factors like media, emotions and honor etc. are involved to ensure the registration of murder crime [See Goves, Hughes and Greeken (1985), Becsi (1999), and List et al (2002)]. Furthermore in this special case study is also introducing a popular deterrent variable labeled as conviction which is expected to be negatively correlated with murder crime [See Montolio et al (2008)]. Thus the above mentioned detail discussion purposes the following econometric equation to estimate;

$$M_t = \alpha + \beta_1 POP_t + \beta_2 UR_t + \beta_3 EDU_t + \beta_4 PS_t + \beta_5 Conviction_t + e_t \quad (4)$$

Where, M_t denotes the total number of murders and $Convict_t$ stands for conviction rate i.e. ratio of offenders convicted to the total number of offenders recorded in murder cases. While rest of the independent variables has same monotonous explanations with the same intuition discussed above in equation number 2 and 3. Finally there will be an estimation of following four empirical equations in identifying the role of various socio economic, demographic and deterrent variables on crime rate of Punjab;

$$TC_t = \alpha + \beta_1 POP_t + \beta_2 UR_t + \beta_3 EDU_t + \beta_4 PS_t + \beta_5 PPO's_t + e_t(1)$$

$$PC_t = \alpha + \beta_1 POP_t + \beta_2 UR_t + \beta_3 EDU_t + \beta_4 PS_t + \beta_5 PPO's_t + e_t(2)$$

$$VC_t = \alpha + \beta_1 POP_t + \beta_2 UR_t + \beta_3 EDU_t + \beta_4 PS_t + \beta_5 PPO's_t + e_t(3)$$

$$M_t = \alpha + \beta_1 POP_t + \beta_2 UR_t + \beta_3 EDU_t + \beta_4 PS_t + \beta_5 Conviction_t + e_t (4)$$

4.2 Detail of variables and Source of Data

This study is using a data set of dependent variables consists of, Total number of registered Crime, Property Crime, Violent Crime and Murder in Punjab during the years 1978-2012. Total crime (TC) reported in a year contain all the types of crime related to property, persons, and related to local and special law. The blend of all these three categories is taken as Total Crime and it can be stated as under;

$$Total\ Crime = Property\ Crime + Violent\ Crime + Crime\ under\ Local\ and\ special\ laws$$

Property Crimes (PC) are related to loss or harm of property and it is taken as the sum of dacoity, burglary, [including motor vehicle snatching], Motor vehicle Theft, cattle theft, all other theft and kidnapping for ransom in current study. Violent Crimes (VC) are related to persons and in this study it has been treated as an aggregation of crimes related to murder, attempted murder, hurt, kidnapping for abduction, assault and rioting. Major types of crimes under local and special laws are consists of prohibition orders (use or sale of drugs/narcotics), arm ordinance (illegal possession or illegal sale of illicit arms) and gambling etc. Punjab police is in a custom to record his total crime data in above mentioned three categories and a numerous international literature also follow the same pattern [Gumus (2004), Becsi (1999), Cherry et al (2002), Buonnano et al (2008)]. However it is important to note that to keep this study simple like a massive national

and international literature of crime and economics discipline current study is also not incorporating the types of crime related to local and special law as a separate category.

Moreover, Murder (Qatl) means causing death of a person [Under Section: 299 (j) PPC, 1860 (XLV of 1860)], which is used as dependent variable in empirical equation (4) of the current study. The data of all these dependent variables has been taken from various issues of Punjab Development Statistics. Bureau of statistics, Government of the Punjab Lahore is in a custom to obtain the data of all registered crimes from Deputy Inspector General of Police (Crime) Punjab, Lahore. Thus some of the additional or missing data related to all above categories of crimes as per requirement of study has been taken directly from Deputy Inspector General of Police (Crime) Punjab, Lahore.

As for as concerned with the explanatory variables, the first variable labeled as population density is defined as Population of Punjab in per square miles during some specific year. It is obtained by using a simple mathematical formula i.e. $\text{Population Density} = \frac{\text{Total population}}{\text{Total area of Punjab}}$. Data related to population density is taken from various issues of Punjab Development Statistics. The second variable used in empirical model is Unemployment Rate which is defined as, “the number of persons who are unemployed out of the Total Labor force in Punjab”. The data related to unemployment rate has been taken from the various issues of Labor Force Survey. While dealing with social sciences a few missing values in the data set is not amazing. Thus regarding to unemployment there were some missing values but only for those years in which Labor Force Survey was not published. As per recommendation of literature study has got these values by taking average and compound interest formula [See Jalil et al (2010)].

Thirdly socio-economic variable narrated in empirical procedure is education which has proxies by taking literacy rate of Punjab. It is defined as, a person is said to be literate who can read and write his/her name. Data related to literacy rate of Punjab is also taken from the various issues of Labor Force Survey and same above mentioned technique is used to get missing values of literacy rate as it was discussed in case of unemployment.

The next deterrent variable included in empirical model is labeled as police strength which is defined as, the number of police employees available to per thousand members of Punjab in some particular year. Data related to number of police employees in Punjab during different years has been taken from Deputy Inspector General of Police (Establishment) Punjab, Lahore. Another popular deterrent variable under the heading of conviction has used in this study which is defined as the ratio of the number of offenders convicted to the total number of offenders recorded in a given category of crime [Montolio et al (2008)]. Data related to conviction rate has been taken from Various Issues of Annual Administration Report, Deputy Inspector General of Police (Crime) Punjab, Lahore.

The last variable included in empirical equations is number of police proclaimed absconders. Police Absconders are the persons who have committed some crime in past and they are wanted to police under their offences but they have not been arrested by crime prevention authorities/police. For the estimation purposes, the study has normalized the number of police proclaimed offenders to total population of Punjab i.e. the number of police proclaimed absconders present in Punjab to per 1000 persons in society. Data related to above defined variable has been taken from Various Issues of Annual Crime Reports, Deputy Inspector General of Police (Crime) Punjab, Lahore.

4.3 Descriptive Statistics

Descriptive statistics for the variables used in this study are given below in table 4.1. For quantitative descriptions of the data mean and standard deviation have been used as measures of central tendency and as measures of dispersion respectively. Moreover, maximum and minimum values of the data have been taken to find the range of the data and the coefficient of variation has been taken to indicate the spread of data which is obtained by dividing the standard deviation by its mean. In the last 34 years, the average values of Total crimes (TC), Property Crime (PC), Violent Crime (VC) and Murder per 1000 persons are 3.02, 0.59, 0.46 and 0.06 respectively. More explicitly, it can be narrated that, on average 302, 59, 46 and 6 total, property, violent and murder crimes have been committed respectively in a population of 100,000 persons in Punjab. According to the coefficient of variation, the unemployment rate has the least variation, ranging from 5.5 to 8.6. However, population density, TC/1000 and literacy rate are more volatile variables as indicated by their minimum and maximum ranges also by the magnitude of their coefficients of variation. Except for the average value of proclaimed offenders which lies above the middle of the data, the averages of the rest of the variables in the data lie almost in the center of the data, which shows that the data is almost equally spread to its mean values.

Table 4.2: Descriptive Statistics

<i>Variables</i>	<i>Mean</i>	<i>S.D.</i>	<i>Min.</i>	<i>Max.</i>	<i>Coefficient of variation</i>
<i>Total Crime Per 1000 Persons</i>	3.02	0.72	1.97	4.41	23.82
<i>Property Crime per 1000 Persons</i>	0.59	0.20	0.30	1.09	34.08
<i>Violent Crime per 1000 Persons</i>	0.46	0.10	0.28	0.59	22.27
<i>Murder per 1000 Persons</i>	0.06	0.01	0.04	0.07	16.73
<i>Population Density</i>	337.96	78.46	215.18	470.8	23.21
<i>Unemployment Rate</i>	6.97	1.02	5.46	8.60	14.69
<i>Literacy Rate</i>	45.42	9.59	31.25	60.6	21.11
<i>Police strength</i>	1.32	0.30	0.84	1.91	22.83
<i>Proc. Offenders</i>	0.21	0.23	0.02	0.88	110
<i>Conviction</i>	35.36	5.34	26.9	52	15.10

4.4 Estimation Procedure

Like a lot of empirical researches in economics this study also based on a time series analysis and that is why a standard practice to check the stationarity or non stationarity of data is followed. For this purpose there are different unit root tests, such as the Phillips-Perron test and the Schmidt-Phillips test but study will follow the most prominent and commonly used ADF test. If ADF test will indicate that all the variables using in this study are stationary level (I=0) then it will be suitable to apply OLS and if all the variables using in this study are stationary at first difference (I=1) then it will be appropriate to apply Johenson cointegration approach [Asteriou and Hall, 2006-07].

4.4.1 The Augmented Dickey-Fuller (ADF) Test

In the Augmented Dickey-Fuller (ADF) test, the lags of the first difference are included in the regression equation in order to make the error term μ_t white noise and, therefore, the regression equation is presented in the following form:

$$\Delta y_t = \alpha + \beta_t + \lambda y_{t-1} + \sum_{i=1}^k \beta_i \Delta Y_{t-1} + \mu_t$$

The above mentioned, equation is a comprehensive equation containing both trend and intercept truly depicting the testing procedure for the ADF. Where; α is a constant, β_t is a coefficient on a time trend series, λ is the coefficient of y_{t-1} , k is lag order of the autoregressive process,

$\Delta y_t = y_t - y_{t-1}$ are the first difference of y_t and y_{t-1} .

The testing procedure can be stated as;

Set the null and alternative hypothesis as;

H0: $\alpha = 0$ (series are stationary)

H1: $\alpha < 0$ (series are non-stationary)

Determine the test statistic using,

$$F\tau = \hat{\alpha} / SE(\hat{\alpha})$$

Where;

SE($\hat{\alpha}$) is the standard error of α .

Compare the calculated test statistic with the critical value from Dickey-Fuller table, either to accept or reject the null hypothesis. The ADF test is a lower-tailed test, if $F\tau$ is less than the critical value, then it is the acceptance of alternate hypothesis i.e. variable of the series do not contain a unit root and are non-stationary or vice versa. If ADF results show that all variables are non-stationary at level but stationary at first difference then it will be a declaration that variables used in empirical equation can be cointegrated. If such a linear combination holds in some equation then equation is said to be cointegrating equation and interpreted as a long run relationship exists among the variables.

After the confirmation that the variables are stationary at first difference, study will apply the most intensive Johansen Maximum Likelihood (ML) approach for the set of empirical equations given above at the end of section 4.1.

4.4.2 Johansen Cointegration Techniques

Johansen's procedure directly constructs cointegrated variables on the basis of maximum likelihood estimation rather is dependent on OLS estimation. Johansen derived the maximum likelihood estimation using sequential tests for determining the number of cointegrating vectors.

Moreover it trusts comprehensively on the relationship between the rank of a matrix and its characteristic roots. In fact, Johansen's procedure is nothing but a multivariate generalization of the Dickey-Fuller test. It can estimate more than one cointegration relationship, if the data set contains two or more time series so it has an advantage over the Engle-Granger and the Phillips-Ouliaris methods. Johansen's procedure suggests two different likelihood ratio tests namely, the trace test and the maximum eigenvalue test.

Johansen's procedure

Johansen's method takes as a preliminary point the vector autoregression (VAR) of order p given by;

$$X_t = \pi_1 X_{t-1} + \pi_2 X_{t-2} + \dots + \pi_p X_{t-p} + \mu_t \quad (5.1)$$

Where X_t is $n \times 1$ vector of variables that are integrated of order one, that is, $I(1)$, μ_t is $n \times 1$ vector of innovations while π_1 through π_p are $m \times m$ coefficient matrices.

Subtracting X_{t-1} on both sides of the above equation we have a new reparameterised equation leads to,

$$\Delta X_t = \Gamma_1 \Delta X_{t-1} + \Gamma_2 \Delta X_{t-2} + \dots + \Gamma_{p-1} \Delta X_{t-p+1} - \Pi X_{t-p} + \mu_t \quad (5.2)$$

Where $\Gamma_1 = \pi_1 - I$, $\Gamma_2 = \pi_2 - \Gamma_1$, $\Gamma_3 = \pi_3 - \Gamma_2$ and $\Pi = I - \pi_1 - \pi_2 - \pi_p$.

There is Π matrix which concludes the degree to which the system is cointegrated and this Π matrix is known as impact matrix in econometric literature.

Let we came back to the equation 5.2 and we consider the first equation of the system as:

$$\Delta X_{1t} = \gamma'_{11} \Delta X_{t-1} + \gamma'_{12} \Delta X_{t-2} + \dots + \gamma'_{1p-1} \Delta X_{t-p+1} - \Pi'_1 X_{t-p} + \mu_{1t}$$

Where

γ'_{ij} , is the first row of Γ_j , $j = 1, 2, 3, \dots, p-1$ and Π'_1 is the first row of Π .

Here ΔX_{1t} is stationary, that is, $I(0)$, $j = 1, 2, 3, \dots, p-1$, are all $I(0)$, μ_t is assumed to be $I(0)$ and so for a meaningful equation, $\Pi'_1 X_{t-p}$ must be stationary, $I(0)$.

If not even a single components of X_t are cointegrated, then they necessarily should be zero. On the other hand, if they are cointegrated, all the rows of Π must be cointegrated but not certainly distinct and it is due to the fact that the number of distinct cointegrating vectors depends on the row rank of Π (Harris, 1995).

The order of Π matrix is $m \times m$ if it has rank m that is m number of linearly independent rows or columns, then it forms a basis for m -dimensional vector space, meaning that all $m \times 1$ vectors can be generated as linear combinations of its row and finally any of these linear combination of the rows would lead to stationary, meaning that X_{t-p} has stationary components if the rank of Π is $r < m$.

Thus we can rewrite $\Pi = \beta\alpha'$ for suitable $m \times r$ matrices, β and α .

Here;

$$\alpha'_1 = \begin{pmatrix} \alpha'_1 \\ \alpha'_2 \\ \cdot \\ \cdot \\ \cdot \\ \cdot \\ \alpha'_r \end{pmatrix}$$

And

$$\beta = [\beta_1 \beta_2 \dots \dots \dots \beta_r].$$

Then $\Pi X_{t-p} = \beta \alpha' X_{t-p}$ and all linear combinations of $\alpha' X_{t-p}$ are stationary. It should be noted that study will perform the ADF test to access the order of integration of each variable before applying Johansen's procedure. Johansen's procedure estimates the VAR subject to $\Pi = \beta \alpha'$ for various values of r number of cointegrating vectors, using the maximum likelihood estimator assuming $\mu_t \sim iid N(0; \Sigma)$. Thus its estimates can be written as under equation,

$$\Delta X_{1t} = \Gamma_1 \Delta X_{t-1} + \Gamma_2 \Delta X_{t-2} + \dots \dots \dots + \Pi_{p-1} \Delta X_{t-p+1} - \beta \alpha' X_{t-p} + \mu_t$$

Now the burning issue is about the process to detect the number of cointegrating vectors. To solve this issue Johansen proposed two likelihood ratio tests namely trace test and maximum eigenvalue test.

The Trace test

It examines the null hypothesis of r cointegrating vectors against the alternative hypothesis of n cointegrating vectors. The test statistic we use in this regard is given below;

$$j \text{ Trace} = -T \sum_{i=r+1}^n \ln(1 - \lambda_i^j).$$

It tests whether the trace of Π matrix significantly increased by adding Eigen values.

So null and alternative hypothesis are

$H_0: \text{rank}(\Pi)$

$H_a: \text{rank}(\Pi) > r$

The Maximum eigenvalue

While the maximum eigenvalue test, investigates the null hypothesis of r cointegrating vectors against the alternative hypothesis of $(r+1)$ cointegrating vectors. Its test statistic is given by;

$$jmax = -T \sum_{i=r+1}^n \ln(1 - \lambda^{\wedge}_i)$$

Where, T is the sample size, and λ^{\wedge}_i is the i th largest canonical correlation.

It test the many number of Eigen value are statistically different from zero. So

Null and alternative hypotheses are

$$H_0: \text{rank}(\Pi) = r$$

$$H_1: \text{rank}(\Pi) = r+1 \quad r = \text{rank}, r=0, 1, 2, \dots, k$$

4.4.3 Short run Analysis by Vector Error Correction Modal

After confirmation the existence of long run relationship between variables study will apply VECM in order to capture the short run dynamics of model. VECM is no longer applicable if long run relationship among variables does not exist. A significant coefficient of ECM shows that any short run fluctuations between independent and dependent variables will provide the stable long run relationship between variables. The VECM form of model is shown below;

$$\Delta TC_t = c + \sum_{i=1}^k \psi_{1i} \Delta TC_{t-i} + \sum_{i=1}^k \psi_{2i} \Delta V_{t-i} + \delta Z_{t-i} + e_t$$

$$\Delta PC_t = c + \sum_{i=1}^k \psi_{1i} \Delta PC_{t-i} + \sum_{i=1}^k \psi_{2i} \Delta V_{t-i} + \delta Z_{t-i} + e_t$$

$$\Delta VC_t = c + \sum_{i=1}^k \psi_{1i} \Delta VC_{t-i} + \sum_{i=1}^k \psi_{2i} \Delta V_{t-i} + \delta Z_{t-i} + e_t$$

$$\Delta M_t = c + \sum_{i=1}^k \Psi_{1i} \Delta M_{t-i} + \sum_{i=1}^k \Psi_{2i} \Delta V_{t-i} + \delta Z_{t-i} + e_t$$

Where

$$TC_t = (TC_t, POP_t, UR_t, EDU_t, PS_t, PPO'S_t)$$

$$PC_t = (PC_t, POP_t, UR_t, EDU_t, PS_t, PPO'S_t)$$

$$VC_t = (VC_t, POP_t, UR_t, EDU_t, PS_t, PPO'S_t)$$

$$M_t = (M_t, POP_t, UR_t, EDU_t, PS_t, Conviction_t)$$

$TC_{t-i}, VC_{t-i}, PC_{t-i}, M_{t-i}$ are the lags of the left hand dependent side variables and V_{t-i} , are the lag values of all the right hand side variables. Whenever Z_{t-i} are the error correction terms in the error correction equations and Ψ_{1i} reports the short run elasticities of the variables across all the equations and ' Ψ_{2i} ' are the coefficients of the error terms in each equations that capture the short run dynamics or fluctuations around the long run time path.

4.5 Conclusion

Study has developed a few empirical models related to different categories of crime for a broader view of crime analysis with respect to various socio-economic, demographic and deterrent variables that will be helpful to purpose some valid policy regarding to crime prevention in Punjab. While after checking the descriptive statistics of data study has narrated the empirical procedure that will check the existence of long run relationship by using the Johansen cointegration approach and VECM for the existence of cointegration in short run regarding to all the categories of crime used in current study.

CHAPTER 5

EMPIRICAL RESULTS AND DISCUSSION

5.1. Introduction

In section 5.1.1 of this chapter there is demonstration of the empirical results of the econometrics models regarding various categories of crime that study has proposed in previous chapter. Since ADF results have directed to use Johansson cointegration techniques to get an evidence of existence the long run relationship among the variables. If a long run relationship exists then Vector Error Correction modal to check the short run dynamics of different variables used in empirical models of the current study in section 5.2. While in section 5.3 study will interpret and discuss each independent variable with respect to dependent variables used in empirical equations stated above. It will assist to find how a socio-economic, demographic and deterrent variable behaves with respect to different categories of crime. Study will interpret and discuss population density, unemployment rate, literacy rate, police strength, conviction rate and population proportion of proclaimed offenders under the headings of discussion I, II, III, IV, V and VI respectively.

5.1.1 Results of ADF

Current study depicts the following results regarding to unit root test;

Table 5.1.1: Results of the Unit Root Test			
Variable	Only Intercept	Trend and Intercept	Conclusion
Total Crime			
Level	-0.77	-2.99	
1st Difference	-5.73	-5.57	I(1)
Property Crime			
Level	-0.32	-3.81	
1st Difference	-6.23	-6.22	I(1)
Violent Crime			
Level	-0.83	-2.37	
1st Difference	-6.65	-6.51	I(1)
Murder			
Level	-1.45	-2.15	
1st Difference	-6.41	-6.41	I(1)
Population density			
Level	0.96	-1.79	
1st Difference	-8.32	-8.62	I(1)
Unemployment			
Level	-2.7	-2.89	
1st Difference	-5.03	-4.97	I(1)
Literacy rate			
Level	0.06	-3.27	
1st Difference	-6.39	-6.27	I(1)
Police strength			
Level	-0.003	-2.03	
1st Difference	-4.14	-4.06	I(1)
Proclaimed offenders			
Level	-2.83	-0.58	
1st Difference	-3.87	-4.87	I(1)
Conviction			
Level	-2.57	-2.66	
1st Difference	-7.17	-7.09	I(1)

5.1.2 Results of Johansen Cointegration Techniques

In table 6.1 Purposed Augmented Dicky Fuller (ADF) test indicates that all the variables using in this study are stationary at first difference (I=1) and it is suitable to apply Johenson

Cointegration Approach to explore the long run relationship among, I (1) variables of empirical equations.

Let apply Johansen Cointegration test to first empirical equation where Total Crime (TC) is dependent variable;

Table 5.1.2: Cointegration Rank Test (Trace) [Total Crime]

<i>Hypothesized No. of CE(s)</i>	<i>Eigenvalue</i>	<i>Trace Statistic</i>	<i>0.05 Critical Value</i>	<i>Prob.**</i>
<i>None *</i>	0.80	148.43	103.84	0.00
<i>At most 1*</i>	0.72	94.94	76.97	0.001
<i>At most 2</i>	0.55	52.90	54.07	0.06
<i>At most 3</i>	0.296	26.52	35.19	0.31
<i>At most 4</i>	0.27	14.92	20.26	0.23
<i>At most 5</i>	0.12	4.39	9.16	0.35

Table 5.1.3: Cointegration Rank Test (Maximum Eigenvalue) [Total Crime]

<i>Hypothesized No. of CE(s)</i>	<i>Eigenvalue</i>	<i>Max-Eigen Statistic</i>	<i>0.05 Critical Value</i>	<i>Prob.**</i>
<i>None *</i>	0.80	53.48	40.95	0.001
<i>At most 1*</i>	0.72	42.04	34.81	0.005
<i>At most 2</i>	0.55	26.38	28.59	0.09
<i>At most 3</i>	0.29	11.59	22.29	0.69
<i>At most 4</i>	0.27	10.52	15.89	0.29
<i>At most 5</i>	0.12	4.39	9.16	0.35

Trace and maximum eigenvalue test indicates 2 cointegration equations at 5% level of significance in total crime modal. Thus variables in this modal named as population density, unemployment rate, literacy rate, police strength and population of proclaimed offenders have a long run relationship and suggest rejecting the null hypothesis stating that there are zero cointegrating vectors. Infact it is a permit to apply cointegration approach to estimate the parameters of variables. Similarly, current study has applied Johansen Cointegration test to explore the long run relationship among I (1) variables of empirical equation are discussed which is related to Property Crime (PC) Modal.

Table 5.1.4: Cointegration Rank Test (Trace) [Property Crime]

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
<i>None *</i>	0.97	239.69	103.84	0.00
<i>At most 1*</i>	0.86	122.36	76.97	0.00
<i>At most 2*</i>	0.53	60.19	54.08	0.01
<i>At most 3*</i>	0.49	36.01	35.19	0.04
<i>At most 4</i>	0.25	14.33	20.26	0.27
<i>At most 5</i>	0.15	5.05	9.16	0.28

Table 5.1.5: Cointegration Rank Test (Maximum Eigenvalue) [Property Crime]

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
<i>None *</i>	0.97	117.33	40.96	0.00
<i>At most 1*</i>	0.86	62.16	34.81	0.00
<i>At most 2</i>	0.53	24.18	28.59	0.16
<i>At most 3</i>	0.49	21.68	22.29	0.06
<i>At most 4</i>	0.25	9.27	15.89	0.40
<i>At most 5</i>	0.15	5.06	9.16	0.28

Trace test indicate four cointegration equations while maximum Eigenvalue test indicates two cointegration equations at 5% level of significance in property crime modal. Thus variables of the modal under discussion have long run relationship among each other and there is rejection of the null hypothesis stating that there are zero cointegrating vectors. Here to estimate the parameters of variables, cointegration approach is suitable to apply.

Thirdly, Johansen Cointegration test has applied to explore the long run relationship among I (1) variables of empirical equation 3, in which Violent Crime (VC) is dependent variable.

Table 5.1.6: Cointegration Rank Test (Trace) [Violent Crime]

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
<i>None *</i>	0.92	189.03	103.85	0.00
<i>At most 1*</i>	0.72	106.61	76.97	0.0001
<i>At most 2*</i>	0.62	65.75	54.07	0.003
<i>At most 3*</i>	0.43	35.29	35.19	0.05
<i>At most 4</i>	0.31	17.09	20.26	0.13
<i>At most 5</i>	0.15	5.37	9.16	0.24

Table 5.1.7: Cointegration Rank Test (Maximum Eigenvalue) [Violent Crime]

<i>Hypothesized No. of CE(s)</i>	<i>Eigenvalue</i>	<i>Max-Eigen Statistic</i>	<i>0.05 Critical Value</i>	<i>Prob.**</i>
<i>None *</i>	0.93	82.42	40.96	0.00
<i>At most 1*</i>	0.72	40.86	34.81	0.008
<i>At most 2*</i>	0.61	30.46	28.59	0.03
<i>At most 3</i>	0.43	18.19	22.29	0.17
<i>At most 4</i>	0.31	11.73	15.89	0.20
<i>At most 5</i>	0.15	5.37	9.16	0.24

Here Trace test indicate 4 cointegrating equations and maximum Eigenvalue test indicates 3 cointegrating equations at 5% level of significance in violent crime modal (eq.3). Thus there exists a long run relationship among variables of violent crime modal and there is also rejection of the null hypothesis that there are zero cointegrating vectors that suggest applying cointegration approach to estimate the parameters of variables.

Finally study will see the application of Johansen Cointegration test to explore the long run relationship among I(1) variables of empirical equations 4 in which Murder is taken as a dependent variable.

Table 5.1.8: Cointegration Rank Test (Trace) (MURDER)

<i>Hypothesized No. of CE(s)</i>	<i>Eigenvalue</i>	<i>Trace Statistic</i>	<i>0.05 Critical Value</i>	<i>Prob.**</i>
<i>None *</i>	0.93	225.74	103.85	0.00
<i>At most 1*</i>	0.84	141.80	76.97	0.00
<i>At most 2*</i>	0.71	83.02	54.08	0.00
<i>At most 3*</i>	0.48	43.64	35.19	0.005
<i>At most 4 *</i>	0.35	22.75	20.26	0.02
<i>At most 5</i>	0.25	9.09	9.16	0.05

Table 5.1.9: Cointegration Rank Test (Maximum Eigenvalue) (MURDER)

<i>Hypothesized No. of CE(s)</i>	<i>Eigenvalue</i>	<i>Max-Eigen Statistic</i>	<i>0.05 Critical Value</i>	<i>Prob.**</i>
<i>None *</i>	0.93	83.94	40.96	0.00
<i>At most 1*</i>	0.84	58.78	34.81	0.00
<i>At most 2*</i>	0.71	39.37	28.59	0.002
<i>At most 3</i>	0.48	20.89	22.29	0.08
<i>At most 4</i>	0.348	13.67	15.89	0.11
<i>At most 5</i>	0.25	9.09	9.16	0.05

In this final modal Trace test indicates 5 co integrating equations and Maximum Eigenvalue test indicates 3 co integrating equations at the 0.05 level of significance. Hence it is concluded that all the variables in this modal have a long run relationship among each other. There will be rejection of the null hypothesis stating that there are zero cointegrating vectors. Here cointegration approach will be favorable to estimate the parameters of variables.

5.1.3 The results of Johansen estimation

Table given below demonstrates the coefficient of the variables along with the values of their standard errors which inform us about the significance of variables used in all the empirical equations of this study.

Table 5.1.10: The Results of Johansen Estimation

VARIABLES	Modal 1 Total Crime	Modal 2 Property Crime	Modal3 Violent Crime	Modal4 Murder Crime
	Coefficient (se)	Coefficient (se)	Coefficient(se)	Coefficient (se)
Population density	0.023 (0.007)	0.008(0.0004)	0.004 (0.0005)	0.002 (0.0002)
Unemployment rate	0.258 (0.072)	-0.127 (0.004)	- 0.038(0.0043)	-0.0022 (0.001)
Literacy Rate	-0.161 (0.061)	-0.059 (0.003)	-0.017 (0.004)	-0.015 (0.0015)
Police strength	3.513 (0.458)	- 0.065(0.0204)	-0.132 (0.026)	-0.028 (0.007)
Proclaimed Absconders	-1.275 (0.448)	0.393 (0.023)	-0.178 (0.032)	Not used
Conviction	Not used	Not used	Not used	-0.0019 (0.0002)

5.1.4 Total Crime, property Crime, violent Crime, Murder and Explanatory variables

After verifying the existence of long-run relationship among all defined categories of crime and their relevant explanatory variables based on equation (1), (2), (3) and (4), their long run coefficients are given below.

$$TC_t = +1.6 + 0.023POP_t + 0.258UR_t - 0.161EDU_t + 3.513PS_t - 1.275PPO's_t \quad (1)$$

(0.007) (0.072) (0.061) (0.458) (0.448)

$$PC_t = -1.3 + 0.008POP_t - 0.127UR_t - 0.059EDU_t - 0.065PS_t + 0.393PPO's_t \quad (2)$$

(0.0004) (0.0039) (0.003) (0.020) (0.023)

$$VC_t = -0.28 + 0.004POP_t - 0.038UR_t - 0.0171EDU_t - 0.132PS_t - 0.178PPO's_t \quad (3)$$

(0.0005) (0.004) (0.004) (0.026) (0.032)

$$M_t = -0.21 + 0.002POP_t - 0.0022UR_t - 0.015EDU_t - 0.028PS_t - 0.002Convict_t \quad (4)$$

(0.00018) (0.001) (0.0015) (0.007) (0.0002)

5.2: A Short run Analysis of different categories of crime by using Vector Error Correction Model [VECM]

As study has proved the existence of long run relationship between all the dependent and independent variables thus it permits to see the results of short run analysis of different categories of crime by applying Vector Error Correction modal (VECM). Moreover VECM narrated above also declares the existence of cointegration in short run regarding to all the categories of crime followed by study. These results are illustrated on the next page.

5.2.1A short run analysis of Total Crime Modal

Results obtained from short run analysis by using VECM in table 5.2.1 states that error correction term is significant in one of the six equations of VECM, which indicates that cointegration exists. If there is error or disequilibrium then 16% of the error is corrected by population density (X3) within one year. In the short run positively affected Y1 with the coefficients of proclaimed offenders (X1), police strength (X2) and Population density (X3) and negatively effects Y1 with unemployment rate (X4) and literacy rate (X5).

Table 5.2.1: Vector Error Correction Model

Error Correction:	D(Y1)	D(X1)	D(X2)	D(X3)	D(X4)	D(X5)
CointEq1	0.14 [0.31]	-0.04 [-0.46]	0.112 [1.13]	-16.04 [-4.46]	-1.13 [-1.38]	-1.08 [-0.98]
D(Y1(-1))	-0.20 [-0.43]	0.10 [1.18]	-0.04 [-0.37]	13.79 [3.56]	1.98 [2.24]	-0.25 [-0.21]
D(Y1(-2))	-0.17 [-0.41]	-0.01 [-0.16]	0.02 [0.22]	5.80 [1.69]	1.44 [1.85]	1.00 [0.94]
D(X1(-1))	0.19 [0.17]	0.37 [1.71]	0.018 [0.07]	1.64 [0.17]	-0.98 [-0.46]	-3.48 [-1.20]
D(X1(-2))	-0.16 [-0.14]	0.03 [0.14]	-0.14 [-0.54]	15.96 [1.71]	3.43 [1.61]	-0.29 [-0.10]
D(X2(-1))	0.643 [0.37]	-0.26 [-0.80]	0.33 [0.84]	-35.73 [-2.51]	-5.47 [-1.68]	-0.76 [-0.17]
D(X2(-2))	1.12 [0.91]	0.22 [0.94]	0.24 [0.85]	-16.04 [-1.57]	-2.73 [-1.18]	-1.86 [-0.59]
D(X3(-1))	0.017 [0.38]	-0.003 [-0.43]	0.01 [1.34]	-1.55 [-4.10]	-0.22 [-2.54]	0.03 [0.32]
D(X3(-2))	0.01 [0.29]	-0.004 [-0.58]	0.006 [0.61]	-0.45 [-1.25]	-0.05 [-0.61]	-0.08 [-0.77]
D(X4(-1))	-0.10 [-0.77]	-0.002 [-0.10]	-0.04 [-1.26]	-0.37 [-0.32]	0.15 [0.59]	-0.50 [-1.42]
D(X4(-2))	-0.033 [-0.31]	0.01 [0.48]	0.002 [0.11]	-0.75 [-0.83]	-0.29 [-1.42]	0.31 [1.14]
D(X5(-1))	-0.06 [-0.73]	0.02 [0.97]	-0.007 [-0.34]	0.91 [1.18]	0.33 [1.89]	-0.02 [-0.07]
D(X5(-2))	0.04 [0.57]	0.01 [0.70]	0.02 [1.03]	0.01 [0.02]	0.11 [0.79]	-0.04 [-0.22]
R-squared	0.18	0.36	0.36	0.51	0.59	0.48

5.2.2 A Short Run Analysis of Property Crime Modal

Results of our short run analysis by VECM in table 5.2.2 states that error correction term is significant in three of the six equations of VECM, which indicates that cointegration exists. If there is error or disequilibrium then 56% of the error is corrected by population density (X3), 59% of the error is corrected by property crime (Y2) and 10% of the error is corrected by literacy rate (X5) within one year. In the short positively affected Y2 with the coefficients of all the explanatory variables of the modal X1,X2,X3,X4 and X5.

Table 5.2.2: Vector Error Correction Model

Error Correction:	D(Y2)	D(X1)	D(X2)	D(X3)	D(X4)	D(X5)
CointEq1	-0.59 [-2.28]	0.26 [0.94]	-0.06 [-0.19]	56.42 [5.19]	0.16 [0.05]	-10.24 [-3.26]
D(Y2(-1))	-0.24 [-1.19]	0.03 [0.17]	0.22 [0.84]	-17.68 [-2.12]	0.11 [0.05]	3.32 [1.37]
D(Y2(-2))	-0.11 [-0.63]	0.08 [0.45]	0.11 [0.51]	-1.80 [-0.25]	2.50 [1.31]	-2.83 [-1.37]
D(X1(-1))	0.50 [2.36]	0.33 [1.43]	0.04 [0.16]	11.55 [1.29]	-1.29 [-0.54]	-4.35 [-1.68]
D(X1(-2))	0.14 [0.61]	-0.04 [-0.17]	-0.32 [-1.05]	5.56 [0.56]	1.70 [0.64]	1.11 [0.39]
D(X2(-1))	0.032 [0.17]	-0.14 [-0.72]	0.10 [0.43]	6.77 [0.87]	-0.96 [-0.46]	2.92 [1.29]
D(X2(-2))	0.22 [1.21]	0.25 [1.28]	0.10 [0.44]	13.62 [1.78]	-0.32 [-0.15]	-1.00 [-0.45]
D(X3(-1))	0.0006 [0.18]	-0.0005 [-0.14]	0.003 [0.72]	-0.13 [-0.89]	-0.12 [-3.19]	0.18 [4.49]
D(X3(-2))	0.0016 [0.38]	-0.0006 [-0.15]	4.38E-05 [0.007]	0.81 [4.54]	0.09 [2.05]	-0.045 [-0.89]
D(X4(-1))	0.028 [1.05]	-0.012 [-0.431]	-0.03 [-0.98]	-2.14 [-1.94]	0.50 [1.73]	0.35 [1.11]
D(X4(-2))	0.004 [0.15]	-0.014 [-0.52]	-0.003 [-0.09]	-4.29 [-3.96]	-0.42 [-1.45]	1.12 [3.59]
D(X5(-1))	0.016 [0.85]	0.002 [0.11]	-0.006 [-0.26]	-2.26 [-2.80]	0.05 [0.26]	0.43 [1.86]
D(X5(-2))	0.02 [1.18]	0.002 [0.11]	0.006 [0.29]	-0.77 [-1.18]	0.06 [0.38]	0.33 [1.73]
R-squared	0.59	0.29	0.27	0.56	0.51	0.59

5.2.3A short run analysis of Violent Crime Modal

Results of our short run analysis by VECM in table 5.2.3 given below states that error correction term is significant in three of the six equations of VECM, which indicates that cointegration exists. If there is error or disequilibrium then 82% of the error is corrected by population density (X3), 50% of the error is corrected by property crime (Y3) and 90% of the

error is corrected by police strength (X3) within one year. In the short positively affected Y3 with the coefficients of all the explanatory variables of the modal X1,X2,X3,X4 and X5.

Table 5.2.3: Vector Error Correction Model

Error Correction:	D(Y3)	D(X1)	D(X2)	D(X3)	D(X4)	D(X5)
CointEq1	-0.51 [-2.41]	-0.05 [-0.13]	-0.90 [-2.09]	82.26 [6.71]	6.58 [1.74]	-7.16 [-1.46]
D(Y3(-1))	0.23 [0.91]	0.33 [0.71]	0.22 [0.44]	-20.56 [-1.39]	-2.43 [-0.54]	-3.97 [-0.68]
D(Y3(-2))	0.35 [1.58]	-0.41 [-1.00]	-0.15 [-0.34]	-5.33 [-0.41]	4.82 [1.21]	-2.85 [-0.55]
D(X1(-1))	0.17 [1.38]	0.36 [1.58]	0.21 [0.83]	-13.09 [-1.77]	-2.48 [-1.09]	-1.48 [-0.51]
D(X1(-2))	0.09 [0.77]	0.006 [0.02]	0.02 [0.07]	-6.72 [-0.90]	1.31 [0.57]	0.99 [0.33]
D(X2(-1))	0.05 [0.52]	-0.14 [-0.73]	0.21 [1.00]	2.20 [0.36]	-0.56 [-0.29]	2.70 [1.10]
D(X2(-2))	-0.001 [-0.01]	0.29 [1.49]	0.21 [0.98]	3.26 [0.53]	-0.86 [-0.46]	0.99 [0.40]
D(X3(-1))	0.003 [1.28]	0.002 [0.51]	0.009 [1.80]	-0.48 [-3.32]	-0.17 [-3.84]	0.19 [3.29]
D(X3(-2))	0.004 [1.38]	-0.001 [-0.28]	0.01 [1.59]	-0.17 [-0.95]	0.01 [0.18]	0.08 [1.12]
D(X4(-1))	0.007 [0.52]	0.005 [0.21]	-0.004 [-0.14]	-1.67 [-2.05]	0.27 [1.09]	-0.07 [-0.23]
D(X4(-2))	0.0004 [0.04]	0.001 [0.07]	-0.01 [-0.58]	-0.087 [-0.13]	-0.34 [-1.66]	0.34 [1.27]
D(X5(-1))	0.005 [0.54]	0.013 [0.79]	-0.009 [-0.48]	-0.17 [-0.32]	0.14 [0.85]	-0.14 [-0.64]
D(X5(-2))	0.009 [1.16]	0.005 [0.34]	0.003 [0.24]	0.76 [1.59]	0.10 [0.69]	0.03 [0.15]
R-squared	0.411119	0.320449	0.404226	0.714588	0.568420	0.494646

5.2.4A short run analysis of Murder Crime Modal

Results of our short run analysis by VECM in table 5.2.4 states that error correction term is significant in two of the six equations of VECM, which indicates that cointegration exists. If there is error or disequilibrium then 39% of the error is corrected by unemployment rate (X4) and 27% of error is corrected by literacy rate (X) within one year. In short run positively affected

Y4 with the coefficients of police strength (X2), population density (X3) and literacy rate (X5) and negatively affected by unemployment rate (X4) and conviction rate (X6).

Table 5.2.4: Vector Error Correction Model

Error Correction:	D(Y4)	D(X2)	D(X3)	D(X4)	D(X5)	D(X6)
CointEq1	0.12 [1.25]	2.24 [1.28]	-117.19 [-1.29]	-39.02 [-2.41]	-10.18 [-0.51]	-27.02 [-2.05]
D(Y4(-1))	-0.20 [-0.52]	-10.53 [-1.52]	603.72 [1.67]	89.62 [1.38]	-90.00 [-1.12]	27.35 [0.52]
D(Y4(-2))	-0.13 [-0.49]	0.27 [0.05]	-204.38 [-0.80]	34.55 [0.75]	-23.92 [-0.42]	28.73 [0.77]
D(X2(-1))	-0.001 [-0.13]	-0.07 [-0.27]	22.60 [1.67]	1.27 [0.52]	1.09 [0.36]	-0.52 [-0.26]
D(X2(-2))	0.005 [0.43]	0.10 [0.49]	8.05 [0.73]	1.06 [0.54]	0.09 [0.04]	-0.44 [-0.27]
D(X3(-1))	0.0007 [1.71]	0.007 [0.96]	-0.24 [-0.63]	-0.24 [-3.57]	0.09 [1.08]	-0.11 [-2.01]
D(X3(-2))	3.40E-05 [0.07]	0.012 [1.44]	0.25 [0.57]	-0.07 [-0.85]	-0.014 [-0.15]	-0.09 [-1.53]
D(X4(-1))	-0.0005 [-0.36]	-0.02 [-0.84]	0.28 [0.22]	0.25 [1.08]	-0.30 [-1.03]	-0.02 [-0.11]
D(X4(-2))	0.0004 [0.31]	-0.02 [-0.81]	0.77 [0.59]	-0.23 [-0.98]	0.33 [1.14]	0.084 [0.44]
D(X5(-1))	0.0006 [0.49]	-0.03 [-1.33]	0.07 [0.05]	0.36 [1.69]	-0.07 [-0.29]	0.29 [1.71]
D(X5(-2))	-0.0002 [-0.27]	0.009 [0.58]	1.31 [1.51]	0.15 [1.004]	0.086 [0.45]	0.14 [1.16]
D(X6(-1)/10)	-0.001 [-0.64]	-0.09 [-2.34]	2.69 [1.26]	0.47 [1.24]	0.17 [0.37]	-0.10 [-0.33]
D(X6(-2)/10)	-0.0003 [-0.16]	-0.017 [-0.43]	2.19 [1.02]	0.27 [0.71]	0.23 [0.50]	-0.008 [-0.02]
R-squared	0.29	0.47	0.15	0.57	0.54	0.37

5.3 Discussion on Empirical Results

In this section study will interpret and discuss each independent variable with respect to dependent variables used in empirical equations stated above. It will assist to find how a socio-economic, demographic and deterrent variable behaves with respect to different categories of crime. Study will interpret and discuss population density, unemployment rate, literacy rate,

police strength, conviction rate and population proportion of proclaimed offenders under the headings of discussion I, II, III, IV, V and VI respectively.

5.3.1 Discussion I

In this section study interprets the empirical findings related to population density and different categories crime along with a detail discussion on these results to elaborate the role of this demographic variable as a determinant of crime rate in Punjab.

Total Crime, Property Crime, Violent Crime, Murder Crime and Population Density

Like a massive international literature empirical finding of this study indicates a positive and significant relationship between population density and all the categories of crime i.e. total crime, property crime, violent crime and murder. These results lie in the line of Buonanno et al (2008) who reports a positive and significant relationship of population density (proxies as urbanization) for all the typologies of crime. Moreover Burley V. Bechdolt Jr.(1975)also suggested thatProperty crime rate and violent crime rate tend to be higher where population density and crowding is high.Regoeczi (2003) and O'Brien et al (1980) also found a positive relationship between property crimes and population density. The results are also supporting the empirical findings of Keith Harries (2006) and Erdal Gumus (2008) who found a positive and significant relation regarding to the population density and crime rate. Above detail depicts that empirical findings are consistent with immense literature of crime and economics and population density is a major determinant of crime in Punjab.

Rationale behind this result is quite simple i.e. population density reduces the expected cost of illicit behavior by minimizing the probability of arrest in much dense areas.Moreover crowded and poor living conditions often cause violence and problem becomes more severe in

those areas where there is a resource constraint[Lorenz (1967), Curtis (1975)]. Since population density is increasing with the passage of time along with the resource constraints in Punjab, so a positive relationship of population density with all the categories of crime is justifiable.

Moreover culture has impact on illicit behavior of the natives of a society. If a nation has a crime culture then a dense population has a positive impact on criminal behavior or vice versa [Nisbett (1993)]. Various issues of annual crime reports of Punjab depict a plenty of evidences of prevailing crime culture in term of old enmity, honor killing and target killing etc. and demographic conditions of Punjab also report the evidence of increasing population density of the province. Thus a positive relationship between population density and all the categories of crime is quite suitable regarding to these circumstances of Punjab.

Occurrence of some criminal activity needs to have a motivated offender, a suitable crime target, and the absence of a capable guardian. Increase in population density of some area indicates the completion of all above mentioned pre-requisites of some illicit activity [Routine activity theory of crime presented by Lawrence E. Cohen and Felson (1979)] Thus a positive and significant relationship of population density with respect to all the types of crime is not surprising in Punjab.

Finally in Punjab the theory of overcrowding and anti-social behavior presented by Lorenz (1967) also holds because empirical findings of current study also reports a positive association between population density and crime rate. However these results oppose the theory of Jane Jacobs (1961), which states that crowded streets (especially those with multiple windows facing them) work to stop the occurrence of crime as a behavior. This environmental explanation holds that informal neighborhood surveillance prevents crimes from occurring. Above detail

discussion describes that empirical finding of current study in term of having a significant positive relationship between population density and all the categories of crime rate are logical and consistent with immense literature of crime and economics.

5.3.2 Discussion II

In this section empirical findings related to unemployment and different categories crime will be discuss. There will be a detail discussion on these results to elaborate the role of this economic variable as a determinant of crime in Punjab. This discussion enables to understand the reasons behind different results regarding to different categories of crime.

Total Crime, Property Crime, Violent Crime, Murder Crime and Unemployment

In discipline of crime and economics unemployment is considered as most popular and most controversial variable [T.G Chiricos (1987)]. Thus empirical findings of current study regarding to this variable differ for different categories of crime as it was expected earlier. Study declares a positive relationship between unemployment and total crime while a negative relationship between unemployment and rest of its categories i.e. regarding to property, violent and murder crimes.

A positive relationship regarding to total crime and unemployment purposed by current study is supported by a numerous national and international studies. There are Ehrlich (1973), Fleisher (1966), Smith et al (1992), Riccardo et al (1997), Carmichael and Ward (2001), who also reported a significant positive link between unemployment rate and crime. While at national level literature of crime and economics Gillani et al (2009) and Jalil et al (2010) also concluded that unemployment has a positive impact on crime rate of Pakistan. The reason is intuitively appealing and grounded in the notion that individuals respond to incentives. Since

unemployment rate decreases the costs of committing crime so a rational offender compares returns to time use in legal and illegal activities and an unemployed person easily tempted towards criminal activities because of having no legitimate market wages [Steven Raphael and Rudolf Winter-Ember (1998)].

The results of current study regarding to total crime are oblige the results of previous national and international studies but have a conflict regarding to the empirical results of unemployment and rest of the categories. Unemployment crime (U-C) relationship is found to be negative for property crimes and violent crimes. It does not mean these results are illogical or it can't be the case because numerous studies of "consensus of doubt" school of thought in crime and economics discipline strongly support my arguments related to the complex nature of unemployment and crime (U-C) relationship.

A negative relationship between unemployment and property crime reported by this study lies in line of Entorf and Spengler (2000) who also have reported a negative estimates for some of the theft crimes. Cantor and Land (1985) also argued that unemployment can affect the crime rate positively and negatively. Erdal Gumus (2004), in six out of the eight empirical equations found a negative and insignificant coefficient of Unemployment and he declared these results are identical with those of Masih and Masih (1996). Moreover empirical results obtained by current study are also in line of Imrohoroglu et al (2001) who concluded that 79% of the people engaging in criminal activities are employed and only the remaining 21% are unemployed.

Intuitively increased unemployment implies less people in movement and less money in circulation, which decreases the supply of crimes [Gillani et al (2011), Ehrlich (1973)]. Moreover when unemployment rises there are fewer economic goods (crime targets) in

circulation and those that exist are better protected [Cantor and Land (1985), Cook and Zarkin (1985)]. In addition, the link between unemployment and crime may be driven by the availability of theft-worthy goods. Specifically, during a recession individuals' incomes decline and this possibly reduces the consumption of high value and storing goods like jewelry or consumer durables. The decrease in consumption of such wealth-storing goods may decrease the expected returns to criminal activity and therefore, leads to a reduction in crime rate. Duha T. Altindag (2011).

Since literature of crime and economics suggest that rise in crimes is not only related to illiterate, unemployment and poor class of society but there are also rich, educated, employed and underemployed people are also involved in crimes so it may be describe as a reason of negative direction of crime and unemployment [Gillani et al (2011), Amroho et al (2001)]. Moreover possibility of committing some certain types of property crime like fraud may be better for those who hold certain types of jobs, which indicates that unemployment could be negatively correlated with these specific types of property crimes [Entrof and Spengler (2000)].

These above mentioned Justifications regarding to negative relationship between unemployment and property crime are quite suitable according to circumstances of Punjab thus intuitively empirical results of current study are justifiable. It is very important to note that literature of economics and crime discipline also narrates following technical reasons of such a seemingly inadequate result of U-C;

The foremost reasons of this negative relationship can be described as a result of "The dark figures" in crime or unemployment data by the side of data collection authorities. It can be argued that study may have dropped the chances of a positive and significant relationship due to

under reporting or over reporting of crime or unemployment data of Punjab. About the unreliability of available data of unemployment rate, it can be argued that official rates of unemployment considerably understate the true numbers of people who are sans work. In official surveys, data collectors count only those who had looked for work in the past survey week or past survey month and those who had stopped looking, or had never looked for work are not entertained as a part of labor force and are not counted as unemployed.

Consensus of doubt suggests using Motor Vehicle theft or Motor Vehicle snatching as a dependent variable because it has less measurement errors due to the interference of insurance companies for compensations of their victimized customers. Moreover use of a victimized survey data in some empirical research can also increase the chances of a positive relationship between property crime and unemployment [Fougère et al (2009), Geerken et al (1985)].

Another important reason of negative relationship in crime and unemployment relationship can be stated as aggregation by time period. Aggregation by time period in case of unemployment can cause some particular direction of U-C relationship. A connection between unemployment and crime that might once have been observed in a period can be no longer observed in some other period. In USA Studies using 1970s data produce substantially greater frequencies of significant/positive relationships for both the violent and property crimes rather than the studies using pre-1970 data. [Chiricos's (1987)]

Finally, study empirically reported a negative and significant relationship between unemployment and violent crime/murder. These results are very similar to the result of Cook and Zarkin (1985) who also found significantly negative relation between unemployment and murder, OLS estimates of Lin (2008) also show the same exact pattern and Duha T. Altindag

(2011), who is of the view that unemployment, may be able to induce motivation to earn income illegally, but it does not necessarily increase the violent behavior.

Since violent crime consists of murder, attempted murder, hurt, rape, assault, rioting and kidnapping for abduction and nature of all these types of crime may be less affected by the economic condition (unemployment) as compare to other psychological, cultural or anthropological factors. In Punjab old enmity, honor killing, target killing and rioting is quite common. So these cultural, political and religious factors can be more effective rather than unemployment factor to stimulate violence behavior into the province. [Also see pie charts in section 3.2.4 of chapter 2 in current study]

One of the possible reasons of negative direction of unemployment and violence behavior/murder can be the econometric technique that study is following. Conses of doubt school of thought claims that time series and cross sectional data expose different results in this regard. The crime unemployment relationship is considerably weaker in time-series as compare to cross-sectional comparisons [Chiricos (1987), Freeman (1995)].

Literature of crime and economics discipline suggests using some other proxy for unemployment if intention of the study is to get a positive and significant relationship between unemployment and violent crime/murder. In this regard share of unemployed into the total population of a given age can provide a better proxy to have a positive and significant relationship between unemployment and some violent activity [Fougère et al (2009); Gove, Hughes, and Geerken (1985)].

This detail discussion about unemployment and crime (U-C) relationship concludes that a general belief of positive relationship between unemployment and crime as followed by most of

the national level studies is not necessarily to be proved true in each study. It is not surprising that empiricists have neither discovered a consistent, reasonably precise relationship between economic status [unemployment] and crime, nor reached a consensus that such a relation does not exist. However the strength and direction (positive or negative) of unemployment crime (U-C) relationship still has a question mark in its nature and robustness [Chiricos (1987), Cantor and Land (1985)].

5.3.3 Discussion III

In this section study interprets the empirical findings related to education and different categories crime that has been defined in section4.1. There is a detail discussion on these results to elaborate the role of this socio-economic variable as a determinant of crime in Punjab. This discussion will be helpful to understand the importance of enhancing literacy rate regarding to minimize criminal behavior.

Total Crime, Property Crime, Violent Crime, Murder Crime and Education

The socio-economic variable in term of literacy rate of Punjab yields a negative and significant relationship on total crime, property crime, violent crime and murder. Immense national and international literature supports these empirical findings i.e. Paolo Buonanno (2003), found a negative and significant relationship between education and all the types of crime that support empirical findings of current study. Moreover Usher (1997), Lance Lochner (2007; 2001) and Jalil et al (2010) also concluded a negative association of education and lucrative criminal opportunities.

The economic rationale behind a negative relationship of high literacy rate with respect to total crime, property crime and violent crime/murder lies in the line of cost and benefit analysis

that a criminal makes before committing some illicit activity. Since attaining education requires some monetary and time investment which increases the expectation about legitimate earnings in term of high expected wages. Thus the expected cost of crime in term of time, imprisonment or penalties becomes higher for a well-educated person and he avoids participation in every sort of criminal activity [Becsi (1999),Lochner (2004), Jalil et al (2010) and Usher (1997)].

Education not only increases the opportunity cost of criminal behavior but it also promotes honesty, hard-working, norms and the values of society along with promoting culture of serving the societies. Moreover attaining education teach the individuals to be more patience and forward-looking and it becomes an important cause of negative associations of education and illicit behavior [Usher (1997), Lochner (2007), Becsi (1999), Buonnano et al (2008)]. Finally one of the implicit effect of education is that it enhance the preference of individuals towards risk i.e. educated individuals become more risk averse and they try to avoid any sort of illicit activities.

5.3.4 Discussion IV

In this section study interprets empirical findings related to Police Strength and different categories crime to elaborate the role of this deterrent variable as a determinant of crime that will enable to understand the crime detection ability of province.

Total Crime, Property Crime, Violent Crime, Murder Crime and Police Strength

Empirical findings of current study reports that, deterrent variable labeled as Police strength is positively related to total crime and negatively related to property crime, violent crime and murder. A positive and significant relationship between total crime and police strength is similar to the results of Becsi (1999), Allison (1972), Gumus (2004), and Buonnano et al (2008). These researchers intuitively justify their results by saying that Government takes interest announcing new vacancies in police department when a high crime rate is observed in a society which causes a positive and significant relationship between these two variables.

This positive relationship between total crime and police strength in Punjab can justify on the demographic ground by saying that Population growth rate remained higher as compare to the growth rate of police employment in Punjab police. It can be judge by the fact that province is still unable to meet the international standards of number of police employees for detection and prevention of crime in society. United Nations Organization (UNO) suggests at least one policeman available to 250 natives in urban areas and 1 policeman to 350 natives in rural areas while in Punjab this ratio is 1/550 which is not up to the standard for crime prevention [Annual Administration Report, Deputy Inspector General of Police (establishment) Punjab, Lahore]. It can be stated that Government is trying to meet this international standard and that is why there is a positive relation between total crime and police strength in this specific period when province is below the optimal level of police strength regarding to crime detection and crime prevention.

Preferences in allocation of police employees regarding the nature of area and nature of crime can also be stated as a reason of this positive relationship. Since total crime consists of all the minor and major types of crime that extend the aggregation of total crime. While a lot of minor crimes included in total crime are less preferred by crime prevention authorities regarding

to their deterrence because of their limited resources that can cause a positive and significant relationship between police strength and total crime in Punjab.

An uneven allocation of police employees in Punjab can also be declared as a factor of positive relationship between above said dependent and independent variables. When Government observe a high crime rate in society they announce job vacancies and after this recruitment a major proportion of these newly recruited police employees deputed to serve and protect only the political and influential personalities in Punjab. That is why allocation of this new recruitment proves less effective and crime prevails in society at the same rate or even this rate can also increase sometimes that can lead the province towards having a positive relationship between total crime and police strength.

Since results of different socio-economic, demographic and deterrent variables will be different if there is a change in proxies or magnitude of the dependent variables [Chiricos (1987)]. That is why study has different results in line of police strength and various categories of crime i.e. police strength with respect to property crime, violent crime and murder portrays a negative and significant relationship as it was expected regarding to crime scenario in Punjab.

These empirical findings lie in the line of David Lawrence Sjoquist (2012), Baltagi (2006), Vollaard (2005), Berkeley et al (2012), Kelaher and Sarafidis (2011) who also found the same results in one or another way. It can easily justify with the help of economic rationale that police strength increases the probability of arrest thus expected cost of crime increases which negatively effects the decision of committing some crime. Argument lies in line of Beccaria (1776), who argued that people are self-interested and if they realizes that the pain obtained from

punishment exceeds the pleasure obtained from crime then people will not choose to commit such a type of crime. (Vold, Bernard, & Snipes, 2002, p. 17)

However empirical findings reported above are quite suitable according to political and cultural circumstances of the province. As study has narrated above that police effectiveness regarding to reducing crime and disorder depends upon the geographically focused police practices along with the hot-spots policing in Punjab. Thus negative and significant results in case of property crime, violent crime and murder can be stated as a result of the preference in allocation of police employees by crime control authorities.

Since it has been discussed above, all (criminals, potential victims, police and judiciary) having links with crime scenario are rational Friedman (1995), thus it is up to the crime prevention authorities to decide the type, place, and quantity of crime to deter first within its resource constraints. Hence authorities try to deter those types of crime first in which they have their own financial, or job related incentives. Crime prevention authorities in their first preference try to deter property crimes in big cities [since property crime is urban phenomenon Gumus (2008)] also the violent crimes like murder, attempted murder, rape and gang rape etc. in society to avoid media and political authorities. In this regard crime prevention authorities try to allocate relatively more efficient of their employees with best available resources (equipments) to deter property and violent crimes/murder in society that causes a strong deterrence effect of police strength on these categories of crime. Finally it can be concluded that preference of allocation of police employees regarding to nature of crime decides about the deterrence effect of police strength.

5.3.5 Discussion V

In this section study interpret and discuss the empirical findings related to conviction and murder to elaborate the deterrence effect of conviction rate on the murder crime rate in Punjab.

MurderCrime and rate of Conviction

A negative and significant relationship between murder and conviction is reported by the empirical findings of the study. Findings are quite logical as well as supported by an immense international literature. Montolio et al (2008), Sjoquist (2012), Baltagi (2006), Machin and Meghir (2000) also found the same negative and significant impact of conviction on crime rate of murder. The logic behind this negative relation is quite clear i.e. conviction is a necessary condition for punishment [Ehrlich, 1973] and in our judicial system there is a capital punishment for murder in term of life imprisonment or death sentence [Under Section: 302 (j) PPC, (XLV of 1860)]. Thus rational criminals consider intensely about the rate of conviction particularly when resultant incentives are economic or political. It is the most intuitive finding of deterrence hypothesis that if there is an increase in a particular offender's chance of being convicted it definitely decreases that crime. It is not only the core part of Becker's (1968) account of deterrence theory but it is also presented in historical articulations of deterrence theories that were presented by Beccaria (1767) and Bentham (1789). Empirical result proves the conviction as a primary mechanism of murder crime reduction in Punjab.

5.3.6 Discussion VI

In this section study will interpret empirical findings related to number of proclaimed offenders in a society to crime rate of the province. It will enable to understand that past criminal

experience has impact on current crime rate along with the fact that proclaimed offenders are most interested in committing property crime.

Total Crime, Property Crime, Violent Crime and Population of Police Absconders

Study reported a short run positive impact of number of proclaimed offenders on total and violent crime but this impact is negative in long run. While there is a long run positive and significant relationship between property crime and number of police proclaimed offenders in Punjab. A short run positive impact on total and violent crime can be observed by impulse response function as given below in the figures;

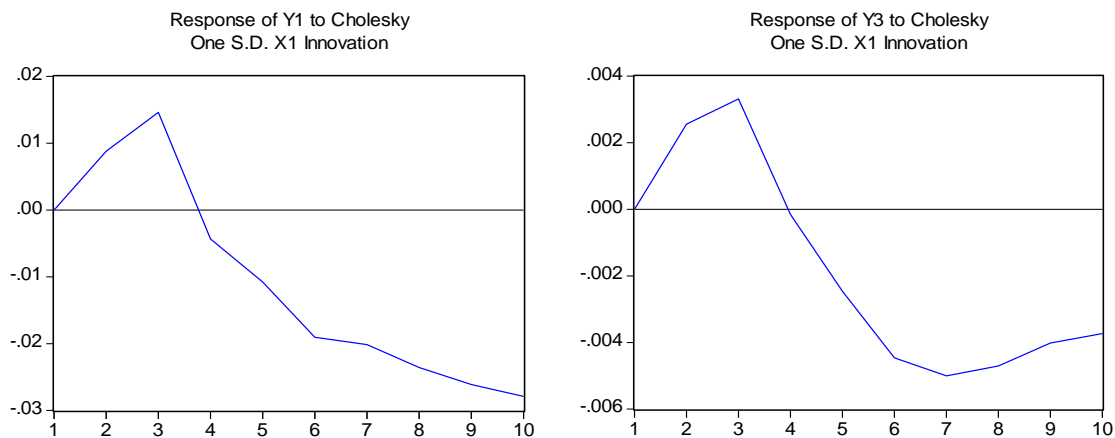


Fig: 5.1 Response of total crime (Y1) and violent crime (Y3) with respect to increasing the number of police proclaimed offenders(X1) in society

Dynamics of these results need discussion i.e. when police department declared a person as an absconder then there is an immediate termination of that person from legitimate labor market as a person with such a repute is not accepted as a labor by any of the person or organization. Moreover fear of arrest does not allow him to join some legal economic activity for his livelihood and it becomes inevitable for such a person to join illicit activities particularly

related to property crime like theft, snatching, dacoity, burglary and cattle theft etc. for his survival.

The economic rationale behind this behavior of proclaimed offenders lie in the line of cost and benefit analysis about committing some illegal activity. A low opportunity cost of committing a crime along with absconder's learning by doing from his past criminal activities helps him a lot to commit some illegal activity with an ease that has a positive impact particularly on current crime rate of some society [Buonnano et al (2008); Fajnzylber et al (2002); Sah (1991); Gorger (1995); Case and Katz (1991)].

Since proclaimed absconders can enhance the total crime as well as violent crimes in short run but in long run this effect is negative. One of the possible reasons of this indication is that proclaimed absconders are more interested in participating property crime rather than rest of the categories of crime. However in short run they can contribute in those types of total or violent crime that are closely connected with the attainment of material requisites i.e. smuggling, gambling, sale of drugs and sometime murders for monetary reward. As these types of crimes need a public dealing that increase the chances of arrest of a proclaimed offenders thus these crimes prove temporary and a rational criminal offender avoid doing so.

Moreover violence behavior of such persons can compel crime detection authorities to arrest or kill them out of the societies on immediate basis due to public and political pressure. That is why a rational police absconder always prefers to commit crime of theft and snatching for his survival and there are rare evidences available in Punjab when some absconder found to be involved in types of crime other than property crime. Thus a short run positive and long run negative relation regarding to total crime and violent crime is also justifiable.

The above mentioned detail discussion reveals to conclude that an increase in number of police proclaimed offenders in a society can positively affect the property crime rate and these empirical findings lie in the line of various police reports that declare the above mentioned fact as one of the greatest reasons of high property crime rate in Punjab.

CHAPTER 6

CONCLUSION AND POLICY RECOMMENDATIONS

6.1 Concluding Remarks

The main objective of study was to empirically identifying the role of various socioeconomic, demographic and deterrent variables as determinants of crime in Punjab. For this purpose a time series data set from the year 1978-2012 was taken. Johenson cointegration approach is applied to report the existence of long run relationship between dependent and independent variables in all the four empirical equations stated above in section4.1. Moreover vector error correction modelis used for a short analysis.

A positive and significant relationship of population density with all the categories of crime is first empirical finding of study that compels to declare that population density is a major determinant of crime in Punjab. Secondly unemployment depicts a positive relationship with total crime and negative relationship with property crime, violent crime and murder. However it is still difficult to negate the importance of unemployment as a potential determinant of crime in Punjab, because opposite direction of the results of unemployment with some of thecategories of crime can be declare as a result of the technicalities of data and empirical procedure that has been used in this study.

Third main conclusion reported by empirical procedure is that education plays a vital role in crime prevention as it has a negative and significant relationship with all the categories of crime. Moreover it is empirically proved that police strength has a positive and significant relation with total crime but a negative and significant relationship with property crime, violent crime and murder. It can be declared that police strength has a deterrence effect with respect to

some of the major categories of crime i.e. property crime and violent crimes/murder. However deterrence effect of police strength with respect to total crime can also obtain after having an optimal allocation of police strength and after achieving the target of per capita police available to society according to international standards (1/450) in Punjab.

Furthermore empirical results of study also purpose that conviction rate has a negative and significant relationship with murder crime. It can be declared that conviction has a deterrence effect regarding to some major types of violent crime. Finally empirical procedure depicted that number of police proclaimed offenders has a long run positive and significant relationship with property crime while it has a short run positive and long run negative relationship with respect to total crime and violent crime. It can be concluded that proclaimed offenders are more interested in committing property crimes for their livelihood as compare to rest of the categories of crime.

6.2 Policy Implications

Study brings some important policy recommendations regarding to crime prevention in Punjab. Policy makers should focus to control population growth rate so that to make the province less dense. Moreover there should be effective planning particularly in urban areas regarding to infrastructures of dense areas along with the check and balance on migrants from other areas which make the urban areas denser. Developing new housing colonies near populated areas can also be the effective measure to minimize the effect of increasing densities on crime rate.

Promoting education level can be a valid remedial measure to minimize the criminal behavior as empirical findings of study depicts a significant negative relationship between all the

types of crime and literacy rate (education). However care should be taken by state not only in creating more and more job opportunities but also improving the wages of prevailing jobs, otherwise a promoted educational level can be a curse to society. Some researchers of the above said discipline narrate that highly qualified individuals with fewer opportunities of earning high wages can frustrate in such circumstances and tendency of criminal behavior can boost. Moreover education can promote the awareness and technicalities of individuals that can promote white collar crimes in some society [Usher (1997) and Becsi (1999)].

Since the above mentioned policies recommendation seems to be effective in long run and current study has also recommended short run measures of crime detection and crime prevention into the province. In short run optimal allocation of police employees along with achieving the international standards regarding to per capita police men available to a society will be an effective measure to control crime rate in Punjab. Moreover Enhancing police strength by providing them better training, better transportation, better tools of communications and advance weapons can also be effective to detect and prevent crime. It will also be helpful to decrease the number of police proclaimed offenders and conviction rate in a society will also improve and as a result there will be a significant decrease in high crime rate of the province.

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