

## **Economics, Law Enforcement and Crime Connection [A Longitudinal Data Approach]**

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Current study empirically investigates the effect of various socio-economic and law enforcement variables on crime rate by using cross-sectional time series data set of 35 districts of Punjab. An Interaction term of police strength with economic activity and divisional analysis on the basis of more or less crime dense districts has empirically proved that magnitude of deterrence effect of increasing police strength in a community depends upon its allocation regarding some specific characteristics of that area. An increase in Population growth and increase in Untraced Criminal cases by crime prevention authorities have a significant positive impact on crime rate of a society. While an increase in Economic Activity and Education level have a significant negative impact on crime rate. Initial findings have been obtained by applying fixed effect modal which are quite consistent with Log-linear, Least Square Dummy variable, Interaction term and Divisional analysis models that can be taken as robustness of our empirical findings. Furthermore, an empirical finding has revealed a strong positive relationship of increase in Police strength on crime rate of Lahore division which is indicating of low efficiency of police department in respective years. Current study stands distinct regarding policy purposes as it indicates a clear idea about allocation and performance of police in various divisions of Punjab along with identifying the socio-economic and demographic determinants of crime.

### **1. Introduction**

There is a growing concern about higher crime rate in different areas of Pakistan which is a threatening situation regarding economic and political scenario of Pakistan. It needs a reasonable attention of all

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concerning authorities to take feasible actions related to minimize the illicit behavior of the natives of the country. Becker (1968) in his influential work has called criminals and law enforcement agencies as rational one which is a motivation for economists to identify various economic reasons behind high crime rate of some society.

Economics of Crime is a newly emerging discipline in Pakistan and few available studies comprises of time series data of country level seems less sufficient to explain the deep insights of nature of activity (crime). According to best of our knowledge most of the studies in this discipline has less concentrated on isolation of various socio-economic, demographic and law enforcement variables at districts and divisional level, therefore, understating or overstating their effect on crime rate<sup>4</sup>. All available studies ignored the possible heterogeneity among different districts and divisions of Pakistan as these studies only focused country level time series analysis [Jabbar, M. S., & Mohsin, H. M. (2014); Kennedy et al (2008)]. So space is available in literature to extend the crime and economics analysis on districts and divisions level in Pakistan.

Furthermore, direction<sup>5</sup> (sign) of police strength in most of the empirical studies of Economics of Crime, Law and Economics and Criminology creates ambiguity either increase in police strength has deterrence effect on crime rate or not. This study highlighted that deterrence effect of police strength on crime rate is conditional upon its decision of allocation by crime prevention authorities based on some specific characteristics of different areas or according to nature or severity of crime. For this purpose study focused on using a balance panel data set for the year (2008-2012) of thirty five (35) districts of Punjab [Pakistan] keeping in mind the regional disparity and use of suitable econometric technique to get more reliable empirical findings.

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<sup>4</sup> There is no available study on panel data study of districts and divisional level in literature of Crime and Economics of Pakistan.

<sup>5</sup> Erdal Gumus (2002) defended his positive sign by arguing that, Government announces new vacancies in police department in those areas where there is high crime rate that leads to a positive sign between police strength and crime rate. While in context of Pakistan Jabbar, M. S., & Mohsin, H. M. (2013; 2014) have empirically explored negative sign between these two variables and state increase in police strength has a deterrent effect on crime rate as it enhance the probability of arrest that may increase the cost of crime.

Study has used an interaction term with respect to economic activity and has introduced regional dummy models to test either empirical findings of current study supports the above stated hypothesis or not?

It is of note that current study is using law enforcement variables along with socio-economic variables to avoid expected omitted variable bias in economic equation of crime. Moreover care has also been taken regarding use of some more reliable econometric technique to get empirical findings of this study.

Letter half of study is arranged as follow; Section 2 portrays literature review related to our work. Section 3 explains some economic theory of crime model that are used for empirical estimations. Section 4 portrays empirical results along with interpretation and discussion on empirical findings. Section 5 concludes our paper and some policy implications of current study have been suggested on the basis of our results.

## **2. Literature Review**

History of illegitimate activities started with the history of human beings and it remained a subject of interest in every society. However economists re-concentrated on crime and economics discipline with modern ideas and techniques after Becker (1968) who concentrated on modeling the criminal behavior to show rationality of criminals also an optimal level of law enforcement by crime prevention authorities. He preferred private law enforcement to public law enforcement by arguing that it may lead to have a less burden on tax payers. He led the theoretical foundations of modern school of thought of crime and economics' discipline and after that Fleisher (1966), Tullock (1967), Rottenberg (1968), Stiggler (1974), Landes and Posners (1974) have also done seminal work in this discipline [Issac Ehrlich (1996)]. Now a bulk amount of literature comprises of time series, cross-sectional and panel data approaches is available to identify socio-economic factors which may declare a very reason of different magnitude of crime rate in different societies. A comprehensive literature supports to claim that if panel data set is available then it can control unobservable country specific characteristics that may be correlated with deterrent variable like Justice [Altindag D.T (2011) ; Entorf and Spengler (2000)].

At national level literature of crime and economics, few studies are available. Gillani et al. (2011) empirically investigated the effect of

unemployment, Inflation and poverty on crime rate in Pakistan by using a time series data 1975-2007. They applied Johenson cointegration approach to conclude that unemployment rate, poverty and inflation are granger cause of crime in Pakistan.

Jalil et al. (2010) has attempted to explore the link between urbanization and crime rate of Pakistan by using a time series date set for the year 1964-2008. He also used Johenson cointegration approach to report that lack of planning regarding to the expansion of urban areas increases crime rate while literacy rate and unemployment has a significant and negative impact on crime rate of the country.

The recent contribution in this newly emerging discipline at country level has been made by Jabbar and Mohsin (2014; 2013) in which they highlighted the measuring error problem in crime data and lack of deterrent variables in the economic modal of crime at country level literature. They emphasized the regional disparity in socio-economic and demographic variables of Pakistan so that not to overstate or understate the role of economics behind the illicit behavior. Using time series data set of Punjab from the year 1978-2013, they applied Johenson cointegration approach and showed that police strength, high conviction rate and education have significant negative impact on murder crime rate while the impact of unemployment on violent crime is ambiguous.

A common characteristic of above empirical investigations is that they have used time series data set with a limited number of observations while immense literature of said discipline has emphasized econometrics technique other than time series to claim more reliability of their empirical findings. For example, Entorf and Spengler (2000) emphasize to analyze the impact of demographic changes, unemployment and income inequality on crime rate at aggregate and disaggregate level in Germany. They tested the deterrence hypothesis by using static and dynamic economic techniques. They have found that socio-economic and demographic factors have strong influence on crime. Their empirical findings supported the theory of Ehrlich (1973) which states that absolute income of a country works as an opportunity for illegal activities. A high crime rate was found in high dens areas and young population found to be positively related to most of the categories of crime. While relationship between unemployment and crime remained ambiguous.

Similarly Altindag D.T (2011) has investigated the impact of unemployment on crime rate and found 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. He used country specific panel data set of Europe and considered 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 has a significant impact on crime rate.

So current study intends to fill this gap in country level literature of said discipline and we have used a panel data technique to identify various determinants of crime rate in districts and divisions of Punjab.

### 3. Theoretical Background of Economic Model of Crime

In social sciences, criminal behavior has been discussed by different theories however economists consider criminals as economic agents by stating that they participate in criminal sector to enhance their expected utility. They believe in rationality and argue that the choice of committing criminal activity depends upon its net-payoff ( $\pi_i$ ). According to them participation in criminal sector ( $P_i$ ) is decreasing function of expected cost ( $C_i$ ) and an increasing function of gain ( $G_i$ ) of some criminal activity. Simply it can be manipulated as under;

$$P_i = f(C_i, G_i) \quad (1)$$

$$C_i = f(dc_i, w_i, pa_i, fn_i) \quad (2)$$

$$G_i = f(L_i) \quad (3)$$

Where,  $C_i$  is total cost faced in committing a crime while  $dc_i$  has been labeled as direct cost faced by a criminal in term of time spend in planning and committing of a crime, efforts of self-defense<sup>6</sup>. Moreover in equation (2)  $w_i$  stands for foregone illegitimate labor market wages in case of arrest, accused, being convicted or condemned in case of

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<sup>6</sup> Efforts made to avoid penalties, arrest, imprisonments or monetary fines etc.

some criminal activity. Furthermore  $pa_i$  stands for probability of arrest or conviction and  $fn_i$  represents the fines or other penalties in term of imprisonment. Finally in equation (3),  $G_i$  is gross gain and  $L_i$  is something gained (loot) as a result of criminal activity. Thus net pay off  $\pi_i$  can be defined as the difference of gross gain and total cost i.e.

$$\pi_i = G_i - C_i \quad (4)$$

Or

$$\pi_i = L_i - dc_i - w_i - pa_i fn_i \quad (5)$$

It can be claimed that a criminal activity takes place if and only if;  
 $\pi_i > 0$

It is important to note that expected gain has been supposed as economic incentives because nature of activity under discussion is more responsive to socio-economic and law enforcement situations in some society [Becsi (1999)]. The above mentioned discussion is core of economic model of crime which has been used in this study and it has been stated as under;

Crime = f (Police Strength, untraced criminal cases, Population Growth rate, Economic Activity, Education)

Above stated economic equation of crime consists of socio-economic, demographic and law enforcement variables which are quite similar to the logic prescribed in most of the theoretical frameworks of discipline of Crime and Economics. There are two law enforcement variables labeled as Police Strength and Untraced criminal cases which are expected to be negatively correlated with crime rate. Police Strength is defined as number of Police stations available to per thousand people while the Untraced Criminal cases variable is defined as a ratio of untraced crime to total registered crimes in a district or division. Again it is quite logical that an increase into the number of untraced crime by the side of police department depicts their inefficiency in context of crime detection and crime prevention. It can result in boosting criminal behavior of the natives of that area because a lower clearance rate or increase in number of untraced crimes synonymously means a lower expected cost of committing some illegal activity.

Secondly, a demographic variable in form of population growth rate is likely to be positively correlated with crime rate of some district and thirdly there is a variable labeled as Economic Activity to represent the economic situation of districts. It is defined as a ratio of number of factories in a district to the total number of factories in a province. Intuitively, increase in number of factories in some district can be considered as a symbol of prosperity and urbanization of that district. It is worth noting that we have used Economic Activity instead of unemployment rate as it is considered as one of the most controversial variable in stating its true effect on crime rate [Chiricos (1988)]. Finally, a variable included in our modal is socio-economic in nature and has been labeled as education that can affect the decision of committing some crime.

### 3.1. The Empirical Procedure

In a country like Pakistan crime rate may be affected numerous unobserved characteristics which vary from district to district. These factors include family background, neighborhood effects, social contacts, geographic boundaries and political influence etc. These factors are not easy to observe but we cannot negate their strong influence on crime rate of some area. Since a longitudinal data take into account the effect of these implicit factors thus a fixed effect model seems more appropriate to get empirical results of current study. We have specified the following empirical equation to have our empirical findings;

$$C_{it} = c_i + \alpha X_{it} + u_{it} \quad (6)$$

$$C_{it} = c_i + \alpha_1 UT_{it} + \alpha_2 PS_{it} + \alpha_3 EA_{it} + \alpha_4 Ed_{it} + \alpha_5 Pop_{it} + u_{it} \quad (7)$$

$$t = 2008 \quad 2012 ; \quad i = 1, 2 \quad 32$$

Where  $C_{it}$  is total registered crime per thousand people in district  $i$  in time  $t$ .  $C_{it}$  is a function of deterrent, socio-economic, demographic and economic variables. We have measured the effect of untraced criminal cases ( $UT_{it}$ ) on crime rate of some district and data related to it has been taken from Annual Crime Reports of DIG Crime Punjab.

Police stations available to per thousand people in a district have been used to measure the effect of increase in police strength ( $PS_{it}$ ) on crime rate. While economic activity has been denoted by  $EA_{it}$  which represents the state of economic prosperity of that district as defined and discussed above in theoretical framework of this study. Socio-economic and demographic effects have been captured by literacy rate  $Ed_{it}$  and population growth by  $Pop_{it}$  respectively.

This study has used secondary data which has taken from different government publications. Data related to socio-economic and demographic variables has been taken from annual publications of Punjab Development Statistics (2008-2012). While the data related to deterrent variable defined as  $PS_{it}$  has been taken from Annual Administration Reports of DIG Establishment Punjab and data related to untraced criminal cases ( $UT_{it}$ ) has been taken from Annual Administration Reports of DIG Crime Punjab. Our panel data set consists of five years as it is maximum available data due to limited numbers of annual publications starting from 2008 to 2012. We have incorporated 35 districts of Punjab (Pakistan) which give our data more diversification.

Idiosyncratic disturbances  $u_{it}$  in above mentioned empirical equations (6) & (7) are independent and identically distributed which changes both across time and districts while  $c_i$  is individual effect which captures unobserved factors that affect crime rate in each district of Punjab (Pakistan).

In fixed effect approach, individual effect can either be captured by dummy variable model or within transformation method but least square dummy variable model faces incidental parameter problem when there are too many groups in the panel (Baltagi 2001) and within group effect model removes incidental parameter problem as it does not require dummy variables. So we are using the following model to compute our parameters.

$$TC_{it} - \overline{TC}_{i\bullet} = \alpha(X_{it} - \overline{X}_{i\bullet}) + (u_{it} - \overline{u}_{i\bullet}) \quad (8)$$

$\overline{TC}_{i\bullet}$ , is total mean of district  $\overline{X}_{i\bullet}$  is mean of explanatory variables of district i. Another method used to remove the individual is first



differencing method but the difference lies between two estimates when time period is greater than 2. If there are only two time periods then two estimators are same ( Wooldridge, 2002).

Slope dummies have introduced in the regression to check the relationship of police strength and total crime in each division of Punjab (Pakistan). It will enable us to claim either the coefficient of police strength differs across divisions or not. Moreover, an interaction term in economic model of crime has also introduced to see how the relationship between police strength and total crime rate changes when there is a high or low economic activity.

$$C^*_{it} = c_i + \alpha_1 UT^*_{it} + \alpha_2 PS^*_{it} + \alpha_3 EA^*_{it} + \alpha_4 Ed^*_{it} + \alpha_5 Pop^*_{it} + \alpha_6 PS^*_{it} * EA^*_{it} + u_{it} \quad (9)$$

$UT^*_{it}$ ,  $PS^*_{it}$ ,  $EA^*_{it}$ ,  $Ed^*_{it}$ ,  $Pop^*_{it}$  are untraced criminal cases, police strength, economic activity, education and population growth respectively.

### 3.2. Descriptive Statistics and Graphical Analysis

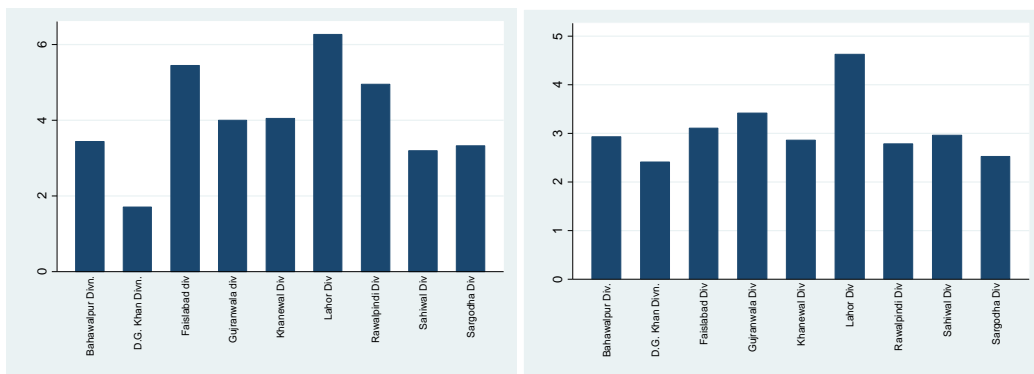
Table 1 shows values of mean, standard deviations and range of the variables used in econometric model. It reveals that on average there are 3.15 total registered crimes per thousand people in each district of Punjab with standard deviation of 1.11. There are 4.06 untraced criminal cases per thousand people in each districts of Punjab with a standard deviation of 2.75. In table 1, almost all variables are indicating a low standard deviation which shows less variability of data set.

**Table 1:** Descriptive Statistics

Variables	Obs.	Mean	Std. Dev.	Min	Max
<b>TC</b>	175	3.10	1.11	1.21	8.47
<b>UT</b>	175	4.06	2.75	.2	14.3
<b>PS</b>	175	.007	.001	.003	.01
<b>Pop</b>	175	1.58	.28	1.09569	2.22
<b>Ed</b>	175	56.85	11.67	27	80
<b>EA</b>	175	.09	.06	.0114329	.32

Graphical analysis of total crime per thousand people revealed that Lahore division has highest untraced criminal cases while D.G Khan and Sargodha division are among the lowest side of crime. Performance of police is very weak in Lahore and Faisalabad divisions as there is greater number of untraced criminal cases in these divisions and Punjab police relatively performed well in D.G Khan, Sargodha and Sahiwal divisions as there are lower number of registered and untraced criminal cases.

**Figure 1:** Police is performing well in those divisions where there are lower untraced crime rate



#### 4. Results and Discussion

After applying the group effect test which has indicated that intercepts differ across the districts. Thus pooled regression is not appropriate in current scenario. Hausman test directed us to estimate the regression model by using fixed effect model as regressors are correlated with individual effect. Regression results in table 2, column (1), are indicating that economic, socio economic, demographic and deterrent variables have significant impact on the total crime rate in one or another way.

**Table 2:** Empirical Estimations by Fixed effect Modal

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	TC	TC	Log TC	Log TC	TC ( LSDV)	TC (Less dens districts)	TC (High dens districts)
<b>Police Strength</b>	181.2974*	238.474**	24.3806*	33.5525**	171.3231*	282.0303**	87.8152
	(78.6538)	(83.8437)	(11.8745)	(12.6451)	(77.8039)	(105.1671)	(62.5390)
<b>Untraced criminal cases</b>	0.1004**	0.0955**	0.0127*	0.0119*	0.0831*	0.1630***	0.1536**
	(0.0365)	(0.0355)	(0.0055)	(0.0054)	(0.0349)	(0.0470)	(0.0488)
<b>Population Growth</b>	4.1014***	4.2040***	0.5972***	0.6137***	4.1782***	6.7975***	6.1807***
	(0.9811)	(0.9772)	(0.1481)	(0.1474)	(0.9805)	(1.6611)	(1.7198)
<b>Education</b>	-0.0437**	-0.0431**	-0.0068**	-0.0067**	-0.0476**	0.0124	-0.0176
	(0.0155)	(0.0153)	(0.0023)	(0.0023)	(0.0150)	(0.0251)	(0.0231)
<b>Economic activity</b>	-4.4749*		-0.7099**		-0.7495**	-7.5611**	-5.2988*
	(1.7771)		(0.2683)		(0.2862)	(2.4186)	(2.3367)
<b>Police Strength* Economic Activity</b>		-644.352**		-102.908**			
		(228.9125)		(34.5239)			
<b>_cons</b>	-2.2722	-2.8589	-0.2600	-0.3546	-3.2294		
	(1.8852)	(1.9124)	(0.2846)	(0.2884)	(2.0075)		
<b>N</b>	175	175	175	175	175	80	80
<b>R2</b>	0.863	0.864	0.794	0.797	0.863	0.882	0.871

t statistics in parentheses, \* p < 0.05, \*\* p < 0.01, \*\*\* p < 0.001

Our foremost empirical finding is related to the deterrent variable, police strength, which indicates positive and significant relationship of police strength with the total registered criminal cases in districts of Punjab [Pakistan]. This empirical result is similar to Becsi (1999), Gumus (2004) and Buonnano et al (2008). These researchers instinctively justify their results by stating that Government announces new vacancies in police department when a high crime rate is observed in society which causes a positive relationship between these two variables. On the other hand Jabbar and Mohsin (2014), Sjoquist (2012), Baltagi (2006), Vollaard (2005), Kelaher and Sarafidis (2011) have found a negative relationship between police strength and crime rate. They have justified it with economic rationale that increase in police strength enhance the probability of arrest which may increase the expected cost of committing some criminal activity. So empirical literature gives mixed result regarding the relationship between police strength and total crime

rate and this conflict motivates to have a debate on the direction (sign) and magnitude of deterrence effect of police strength on the crime rate.

Magnitude of deterrence effect of increasing police strength in some area is conditional upon the decision of allocation of police strength. So we have introduced an interaction term of police strength and economic activities in our empirical model. Additionally we have divisionally analyzed our empirical estimations on the basis of more crime dense and less crime dense districts and compared the coefficient of police strength in both regions.

Our empirical findings in column 2 & 3 of table 1 enable us to claim that increase in police strength has a deterrent effect in those areas where economic activities are higher and vice versa. Since increase in economic activity depicts more industrialization or urbanization and crime is often considered as urban phenomenon that may lead crime prevention authorities to deter crime in urban areas first.

Secondly, divisional analysis on the basis of more crime dense and less crime dense districts in column 6 & 7 of table 2 clearly indicates that performance of Punjab police is relatively better in more crime dense districts of Punjab as crime prevention authorities concentrate more on those areas where there is a high crime rate. The above discussion aids us to conclude that deterrence effect of police in various districts and divisions of Punjab is also conditional upon the decision of its allocation. In other words, police allocation is geographically focused and authority is following hot spot policy rather than community policy in Punjab.

The above mentioned fact becomes further clear when we incorporate slope dummies with police strength variable in our empirically model to analyze the relationship between these two variables. Empirical findings obtained in this regard are given below in table 3 which can be divided into three categories named as deterrent effect, strong positive impact and weak positive impact. Deterrent effect occurs in two divisions namely D.G Khan, Gujranwala and Sargodha Division and it is noteworthy that these divisions have a lower number of untraced criminal cases which also indicates relatively better performance of crime prevention authorities in these divisions.

On the other hand an increase in Police Strength has strong positive impact on crime rate in Lahore division. This indicates poor performance of police in this division due to strong political influence and a higher population density can. Since Lahore is capital of the province and a hub of most of the political activities and crime detection authorities may be more conscious about protection of political incentives rather than community policing. In Sahiwal and Rawalpindi divisions police strength has weak positive impact on total crime which shows relatively better performance of police as compare to Lahore Division.

Second foremost empirical finding of this study indicates that if there is increase in number of untraced criminal cases then it will have a significant positive impact on crime rate. It can be stated as inefficiency of police department in tracing criminal cases, thus leads to higher crime rate. Intuitively if police department has poor crime detection ability and a lot of registered crime remained untraced then it may leads to have a lower expected cost of committing crime that definitely will cause a high crime rate.

Thirdly, increase in population growth rate has a significant positive impact on the total crime rate which is quite rational and similar with the empirical findings of Jabbar and Mohsin (2013;2014), Regoeczi (2003), Keith Harries (2006), Buonnano et al (2008) and Erdal Gumus (2008). It seems reasonable to argue that in a dense populated area may lead to lower probability of arrest and reduces the cost of crime. As a result there will be a higher crime rate.

**Table 3: Empirical Estimations with Slope Dummy Modal**

	(1)	(2)	(3)	(4)	(5)	(6)
	TC	TC	TC	TC	TC	TC
<b>Police Strength</b>	217.0439** (81.0307)	201.9303* * (77.2613)	109.0303 (76.7764)	196.9998* (83.9050)	236.7010* * (79.5647)	177.0199* (78.7766)
<b>Clearance Rate</b>	0.0797* (0.0346)	0.0872* (0.0342)	0.0918** (0.0336)	0.0852* (0.0350)	0.0922** (0.0342)	0.0817* (0.0351)
<b>Pop growth</b>	4.1102*** (0.9727)	4.2294*** (0.9618)	4.4098*** (0.9439)	4.2291*** (0.9837)	4.4618*** (0.9628)	4.0945*** (0.9962)
<b>Education</b>	-0.0455** (0.0149)	-0.0583*** (0.0153)	-0.0450** (0.0144)	-0.0472** (0.0150)	-0.0437** (0.0147)	-0.0478** (0.0150)
<b>Economic activity</b>	-0.7481** (0.2837)	-0.8317** (0.2826)	-0.7427** (0.2748)	-0.7557** (0.2866)	-0.7373** (0.2795)	-0.7459* (0.2871)
<b>D.G. Khan Div.</b>	-475.5793 (258.5017)					
<b>Gujranwala Div.</b>		-1261.11* (499.895)				
<b>Lahore Div.</b>			256.0451* ** (72.6936)			
<b>Rawalpindi Div.</b>				-187.1993 (227.3149)		
<b>Sahiwal Div.</b>					-204.7709* * (74.1441)	
<b>Sargodha Div.</b>						-253.0059 (485.4327)
<b>_cons</b>	-3.2732 (1.9655)	-1.3537 (2.0932)	-3.6052 (1.9058)	-3.4385 (1.9914)	-4.3794* (1.9742)	-2.9323 (2.1150)
<b>N</b>	175	175	175	175	175	175
<b>R2</b>	0.866	0.869	0.875	0.864	0.870	0.863

The socio-economic variable in shape of literacy rate yields negative and significant relationship on total crime rate. Usher (1997), Lance Lochner (2007; 2001), Jalil (2010) and Jabbar and Mohsin (2013; 2014)

have also concluded same negative association of education and lucrative criminal opportunities. The economic rationale behind this negative relationship 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 and expected cost of crime in term of time, imprisonment or penalties becomes higher for a well-educated person [Lochner (2004) and Usher (1997)]. Moreover, schooling alters the way of thinking, changes the preference for risk taking and affects the social network (Lecher, 2007).

It is of worth note that empirical findings of current study do not change<sup>7</sup> when we estimate the regression equation by using least square dummy variable method (intercept dummies are not shown in this table) or in log linear arrangement. This tests the robustness of our empirical results<sup>8</sup>. Finally R-square in all regression models is greater than 0.78 which is quite convincing.

## 5. Conclusion and Policy Recommendations

This study has empirically analyzed the impact of law enforcement, economic, socio economic variables on total crime in 35 districts of Punjab [Pakistan] by using the fixed effect model which takes into account aggregation bias explicitly.

The Study has explored the relationship between police strength and total crime rate in a more comprehensive way by introducing an interaction term and regional slope dummies in the model as there are conflicting views on this issue in crime literature. Our initial results supported those arguments which suggest that high crime rates induces the government to increase the police strength in order to combat crimes, but results of our interaction term model suggested that government allocates police personnel on the basis of economic activity as police strength has deterrence effect in those districts where economic activities are higher and vice versa. Moreover, sample was divided into parts depending on high crime dense and low dense districts, results

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<sup>7</sup> See column 3 for log linear estimations and column 5 for least square dummy variable

<sup>8</sup> See table 2

supported our argument and indicated that coefficient of police strength variable has weak positive impact in high crime dense areas.

Slope dummy variables have also introduced in economic model of crime to see how the relationship between police strength and total crime changes in different division and its results showed that relationship differs across division. Police strength have weak positive impact on total crime in Sahiwal and Rawalpindi divisions while deterrent effect occurs in those divisions (D.G Khan, Gujranwala and Sargodha Division) where untraced cases are low. It is of policy concern to note that Lahore division, which is considered as a hub of economic and political activities, has highest positive coefficient which shows the inefficiency of police department in this division. So there is need to review the police allocation and performance in this division.

Untraced cases has positive and significant impact on total crime rate as low untraced cases enhances the chances of getting caught and increase the cost of committing crime. Population growth has positive impact on the total crime since high density mitigates the probability of arrest. Literacy rate and economic activity plays a positive role in reducing total crime rate as our empirically results of all model showed that literacy rate and economic activity has negative impact on total crime rate. Robustness of results is checked by applying Least Square dummy variable model and log linear model and results remained the same.



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