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Can Government Expenditures Deter Crime? An Empirical Analysis Across the District of Punjab

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Abstract: Crime is an outcome of illegal market returns overweighing legal market returns. This study proposes few deterrence expenditures which indicate direct or indirect government intervention to crime control. This study uses random effect panel Poisson regression approach to determine the effects of proposed deterrence expenditures on crime for districts of Punjab, Pakistan. The results indicate that enrollment in schools, employment, education expenditures and health expenditures significantly deter crime. While between the proposed direct interventions, the police expenditures have appeared to be the most effective deterrent. The efficiency estimates using frontier analysis, shows that the government efforts are 63% efficient in minimizing crime rate. It can be further improved by aligning objectives of all the districts and efficiently utilizing national resources.

INTRODUCTION

Every day of a human life starts with the decision to allocate its time in employment and leisure while ensuring a sustainable income for consumption and other expenditures. Humans make haste in their decision to fulfil short term benefits (Al Quran [17:11]). While making the short term decisions it weighs all legal and illegal options, hence, he is prone to opt to commit crime if its benefits overweigh others (Al Quran [4:28]). For this Islam provides guidance that the real benefits are long term benefits (in this life and hereafter), Allah will test its creation with difficulties in the short term and bestow whose who are patient (Al Quran [2:155]).

The impatience of humans in the time of hardship could lead to allocation to criminal activities if its apparent returns are higher. This increase in incidents of crime could lead to unrest in the society as people will feel that their lives and property are not protected any more (Al Quran [5:32]). This doubt will tarnish any benevolence left among the mankind. Islam promotes the peace in the society, for this it has made protection of human life (Shahih Al Bukhari [11]; Shahih Muslim [68]) and property (Jami at-Tirmidhi [2627]); a basic prerequisite to become a Muslim and a believer.

Reduction of crime and illegal activities is an important challenge for Pakistan for the last two decades. The activity of crime lowers the quality of life in many ways; first, it limits the employment and educational opportunities; on the other hand it discourages private and public investment in the country. Criminal activities, especially in developing economies, hurt the poor because of low income and productivity (Gillani *et al*., 2009). Hence, it is important to control the crime rate in

developing economies like Pakistan, where people are forced to spend a fortune on security their lives and property. Marshall and Clark (1952) wrote "A crime is any act or omission prohibited by public law for the protection of the public and punishable by state in a judicial proceeding in its own name." Similarly Tappan (1960) defined that "A crime is an instrumental act or omission in violation of criminal law, committed without justification and sanctioned by the state as a felony or misdemeanor."

Islam attached a responsibility to the individual and the government to promote what is right and lawful and forbids what is harmful and illegal and stay within the limits (Al Quran [9:112]). Governments should ensure they are participating in eliminating the harmful elements (Sunan Ibn Majah [2341]).

Fleisher (1966) initiated the study of determinants of crime and elucidates that low income and unemployment leads to an increase in the crime rate. However, Becker (1968) presented the model of rational behavior of criminal choice. His results suggested that an individual chooses to commit crime when the expected returns in an illegal market are higher as compared to the legal market. Many economists try to estimate the factors that deter crime. The role of deterrence factors is that it can overweigh the returns in the legal market as compared to the illegal market. This deterrence can influence in two ways, first it can increase the returns in the legal market, like an increase in productivity via promotion of education and health or an increase in probability of getting employed; second, it can decrease the returns of illegal market, like an increase in probability of getting caught via better working of police and courts.

The expenditure of government on education and health can indicate the efforts of improving the productivity of people in the legal job market; higher enrollment in schooling increases their contribution in economic growth which is the contribution of all legal markets (Hanif and Arshed, 2016). Similarly the government can spend on police, law and courts, public safety and prisons, all of these expenditures improve the probability of conviction in penalty process. In early studies of crime, Cameron (1988) found that high risks in committing crime will lead to decrease in the crime rate because criminal must consider the probability of being caught and the severity of penalties, therefore, government investment in law enforcement agencies leads to decrease in the crime rate.

Keeping in view the above mentioned literature, the present study intends to fulfill the following objectives. First, it is aimed to find the possible factors that influence crime and build a valid model with it. Secondly, this study will introduce four types of deterrence variable based on government expenditures, to avoid multicollinearity and construction of comparison; four models will be estimated using a different government expenditure deterrence variable in each model. Lastly, the best performing model selected using an AIC method (Akaike, 2011) and efficiency of the crime minimizing ability of independent variable will be calculated.

Literature review: There are many theoretical and empirical studies found which have focused on economic determinants of crime and proposed crime as result of cost benefit analysis between legal job and illegal job market (Fleisher, 1963, 1966; Becker, 1968; Ehrlich, 1973).

Islam places the direct responsibility of the government to intervene all sorts of criminal activities. Based on approach provided in hadith of the Holy Prophet (S.W.A.), government and individuals when they see the wrong is being done, they can directly intervene by warning, penalizing or restricting, for this there is system of police, courts and prison. If this approach is not possible, then an indirect intervention can be done by talking, preaching or teaching at government level, it can also be done using educational institutes. Out of these three approaches, the last one represents the responsibility of the people which is the weakest form of faith (Sunan an-Nasa'i [5009]).

Studies like, Benson *et al*. (1994) and Levitt (1997) found that an increase in police expenditure which acts as deterrent variable would not reduce the crime because funds are not always allocated at the right place and police incentives were not always taking into account. In addition, Donohue and Levitt (2001) confirm that better police strategies, also act as a deterrent for crime by using data analysis while the severity of punishment did not act as a deterrent factor for reducing crime, however, shifting of resources from imprisonment to police duties such as petrol would be useful in reducing the incidence of crime (Cameron, 1988; Benson *et al*., 1994). Ajilore and Smith (2011) elucidate that increase in police expenditure lowers the crime rate over the period of time. Wan *et al*. (2012) confirm the negative relationship between arrest rate and future crime. Their results show that property and violent crime decrease by 0.1 and 0.19% with the 1% increase in arrest rate in the short run while in the long runa 1% increase in arrest rate will lead to decrease in property and violent crime by 0.14 and 0.3%, respectively.

Blackburn *et al*. (2012) summarized two rationales behind maintaining prisons. The utilitarian rationale is to deter crime, incapacitate the criminals and to rehabilitate them, so that, they cannot harm the society again (Auerhahn, 1999). While the retributive rationale is that there is a social contract between people and the government whereby the government has right to punish equal to the wrongful act (Mickunas, 1990). Cesare Beccaria (1738-1794) in her book 'a treatise on criminal law' stated that the effectiveness of punishment depends on the certainty of punishment, not the severity, hence,

incapacitation of criminals will deter others to commit crime (Grogger, 1991; Blackburn *et al*., 2012). On other hand, Blackburn *et al*. (2012) proved that there is a weak relation between the crime rate and the prison rate.

Bowles *et al*. (2005) argue that weak institution will also lead to increase in crime rate by marginalizing the appropriate activities of criminal law. However, in some countries, criminal justice may not work properly due to political and economic powers. Sanchez and Fazio (2010) find that low judiciary efficiency leads to increase in violent crime rate in Colombia by using various methodologies such as spatial econometric, dynamic optimization, inter-temporal choice models. Montenegro and Posada (1994) show that in the absence of strong, coherent institutional system; an increase in economic growth leads to increase in the homicide rate.

Education may affect criminal offense rate in different ways. It reduces the opportunity cost of crime by improving the legal labor market productivity. Considering the education level of offenders (Freeman, 1991; Grogger, 1995, 1998) argued that offenders were mainly from poorer background and tend to be less educated. In order to clarify the association between crime and education, Lochner and Moretti (2001) confirmed that education raises the opportunity cost of crime by raising the abilities of individual and skills in lawful market. The benefits of education were not only confining at the individual level but also include social benefits. Freeman (1991) analyzed that three-fourth of convicted and prisoned population between the ages of 18-24 had achieved <12 years of education. Against the results of Lochner and Moretti (2001) and Freeman (1991), taking into account the panel data studies of 28 Nigerian States from 2002-2005, Douglason (2010) estimated that primary school enrollment did not help in reducing the total and property crime. Reviewing the panel study across the different regions of Italy from 1980-1995, Buonanno and Leonida (2005) suggested that high school enrollment lowers violent crime but it tends to increase financial crimes like a fraud.

Gumms (2004) assured the positive link between unemployment and criminal action in the long run but in the short run his results showed insignificant impact across the 75 metropolitans of the United States. Chen (2009) found the similar findings of Gumms (2004) by applying VAR (Vector Autoregressive) model. He concluded that in the long run unemployed people usually involve in an offensive activity in Taiwan from 1976-2005. Splitting up the effects of different age group Smith *et al*. (1992) categorized the people in four different age groups (16-19, 20-24, 25-34 and 35-44); the results revealed a positive relationship between unemployment and a property crime and insignificant effect on violent crime among all age groups. In addition, Allen (1996) employed OLS technique and considered the effect of unemployment and an offence between two classes of white and black. He examined the positive and significant link between the white communities while black society showed an insignificant impact on offensive activity.

The present study will explore the different perspectives of the causes of crime based on fiscal federalism theories such as expenditures of the government and district wise allocation of resources. Only a few studies have explored the economic determinants of crime in the case of Punjab but no onehas analyzed the deterrence based expenditures and allocation of resources in relation to the crime rate. The distinction of this study is the comparison of different deterrence expenditures in relation to crime rate with respect to Punjab (The largest province of Pakistan have majority share of population and economic activity in Pakistan). This study has used population density which positively effects crime (Lipton and Gruenewald, 2002; Andersen, 2005) to scale all the districts by excluding the effect of size and population. Since all the variables are expected to deter the crime, this study will evaluate how efficient these expenditures are in minimizing the crime rate.

MATERIALS AND METHODS

Methodology and data source: The number of crimes reported is a discrete variable which has been taken in the present study. No study has used poisson regression in the panel data framework at district level data of Pakistan. Secondly, there is not any study in case of Pakistan, which has used government expenditure based crime deterrence variables and done comparison in terms of its marginal impact. Instead of using aggregate data of Pakistan, this study uses district wise data of Punjab province. Punjab province in selected because it is the largest province in Pakistan based on its contribution in economic activity and proportion of population. The advantage of shifting from aggregate study to smaller district wise cross section allows to study the geographic heterogeneity of districts and its effect on crime.

Since, the data is varying across time and districts, hence, the constructed equation will have panel data configuration. This study will use four government expenditure based deterrence variable into four estimation models in order to avoid multicollinearity and create the comparison in terms of their deterrence potential:

$$\begin{aligned}\text{crime}_{it} = {} & \alpha_{1i} + \alpha_2 \text{hexp}_{it} + \alpha_3 \text{edexp}_{it} + \alpha_4 \text{empl}_{it} + \alpha_5 \text{pris}_{it} + \\ & \alpha_6 \text{meds}_{it} + \alpha_7 \text{highs}_{it} + \alpha_8 \text{popden}_{it} + \alpha_9 \text{polexp}_{it} + \varepsilon_{1it}\end{aligned} \quad (1)$$

$$\begin{aligned}\text{crime}_{it} = {} & \beta_{1i} + \beta_2 \text{hexp}_{it} + \beta_3 \text{edexp}_{it} + \beta_4 \text{empl} + \beta_5 \text{pris}_{it} + \\ & \beta_6 \text{meds} + \beta_7 \text{highs} + \beta_8 \text{popden}_{it} + \beta_9 \text{lcexp}_{it} + \varepsilon_{2it}\end{aligned} \quad (2)$$

$$\text{crime}_{it} = \gamma_{1i} + \gamma_2 \text{hexp}_{it} + \gamma_3 \text{edexp}_{it} + \gamma_4 \text{empl}_{it} + \gamma_5 \text{pris}_{it} + \gamma_6 \text{meds}_{it} + \gamma_7 \text{highs}_{it} + \gamma_8 \text{popden}_{it} + \gamma_9 \text{poexp}_{it} + \varepsilon_{3it} \quad (3)$$

$$\text{crime}_{it} = \theta_{1i} + \theta_2 \text{hexp}_{it} + \theta_3 \text{edexp}_{it} + \theta_4 \text{empl}_{it} + \theta_5 \text{pris}_{it} + \theta_6 \text{meds}_{it} + \theta_7 \text{highs}_{it} + \theta_8 \text{popden}_{it} + \theta_9 \text{prisexp}_{it} + \varepsilon_{4it} \quad (4)$$

Here, the variables are the data for the above stated variables are taken from Punjab development reports and Punjab provincial expenditure budget report for 36 districts (District names are provided in appendix) of Punjab between the years of 2010-2014.

- Total crimes reported (crime); Expenditure on police (polexp)
- Expenditure on law and courts (lcexp); Expenditures on health (hexp)
- Expenditure on prison administration (prisexp); Population density (popden)
- Public order and safety expenditures (poexp); Employment in factories (empl)
- Expenditures on education (edexp); Student enrollment in primary (pris)
- Student enrollment in middle (meds); Student enrollment in high (highs)

Since, the dependent variable number of crimes reported is discrete, hence, estimating this panel data with standard ordinary least square approach will be inappropriate. For this, we can use the Poisson model (Cameron and Trivedi, 2013) with fixed or random effect specification depending upon the results of the Hausman (Hausman, 1978) test. The basic Poisson model is:

$$\Pr(y_{it}) = f(y_{it}) = \frac{e^{-\lambda_{it}} \lambda_{it}^{y_{it}}}{y_{it}!}$$

Where:

i = Islamic countries
t = No. of years
λ = Function of proposed independent variables

$$\tilde{\lambda}_{it} = \exp(x_{it}'\beta + \varepsilon_i) = \lambda_{it}\mu_i$$

Hausman *et al*. (1984) developed the random effect version for the panel poisson regression:

$$\log \lambda_{it} = x_{it}'\beta + \mu_i$$

Here μ_i is exp (ε_i) is the random component in regression which will vary randomly across districts of Punjab. Also x_{it} is set of all independent variables and overall average intercept. In this model $\tilde{\lambda}_{it}$ and $\tilde{\lambda}_{it}$ are uncorrelated because of the μ_i, also $\tilde{\lambda}_{it}$ and $\tilde{\lambda}_{jt}$ are unrelated because of cross sectional independence:

$$\Pr(\text{attempts of domestic crime}_{it}) = f(\text{crime}_{it}) = \frac{e^{-\lambda_{it}} \lambda_{it}^{\text{crime}_{it}}}{\text{crime}_{it}!}$$

$$\log \lambda_{1it} = \alpha_{1i} + \alpha_2 \text{hexp}_{it} + \alpha_3 \text{edexp}_{it} + \alpha_4 \text{empl}_{it} + \alpha_5 \text{pris}_{it} + \alpha_6 \text{meds}_{it} + \alpha_7 \text{highs}_{it} + \alpha_8 \text{popden}_{it} + \alpha_9 \text{polexp}_{it} + \varepsilon_{1t} + \mu_{i1} \quad (5)$$

$$\log \lambda_{2it} = \beta_{1i} + \beta_2 \text{hexp}_{it} + \beta_3 \text{edexp}_{it} + \beta_4 \text{empl}_{it} + \beta_5 \text{pris}_{it} + \beta_6 \text{meds}_{it} + \beta_7 \text{highs}_{it} + \beta_8 \text{popden}_{it} + \beta_9 \text{lcexp}_{it} + \varepsilon_{2t} + \mu_{2i} \quad (6)$$

$$\log \lambda_{3it} = \gamma_{1i} + \gamma_2 \text{hexp}_{it} + \gamma_3 \text{edexp}_{it} + \gamma_4 \text{empl}_{it} + \gamma_5 \text{pris}_{it} + \gamma_6 \text{meds}_{it} + \gamma_7 \text{highs}_{it} + \gamma_8 \text{popden}_{it} + \gamma_9 \text{poexp}_{it} + \varepsilon_{3t} + \mu_{3i} \quad (7)$$

$$\log \lambda_{4it} = \theta_{1i} + \theta_2 \text{hexp}_{it} + \theta_3 \text{edexp}_{it} + \theta_4 \text{empl}_{it} + \theta_5 \text{pris}_{it} + \theta_6 \text{meds}_{it} + \theta_7 \text{highs}_{it} + \theta_8 \text{popden}_{it} + \theta_9 \text{prisexp}_{it} + \varepsilon_{4t} + \mu_{4i} \quad (8)$$

The one assumption of the poisson regression is that the poisson distributed count variable must have conditional mean and conditional variance equal to each other.

Since, the above equations are based on panel data specification, the residuals will be decomposed into two sections. First is the cross sectional residuals which vary because of heterogeneity in the cross sections. Second, it is the time series residuals which vary because of time. We have used the population density variable to incorporate the structural differences between the districts, so if there is any standard deviation left in the cross sectional residuals, that will be because of systematic differences which can be removed. Since the above model is valid assuming i.i.d., residuals hence the second type of residuals are totally random. So, the standard deviation of time series residual will only show random differences of crime rate across districts.

An efficient policy has a characteristic that it accounts for the heterogeneities between the cross sections so that the overall crime level is reduced. While estimating a panel data model which uses the policy inputs as independent variable and its outcome as independent variable, it generates two types of error. First is the cross sectional variant error and the second is the time variant error. For the estimation purpose, we assume time variant error to be random, thus, redeeming cross sectional error to be systematic. By systematic we mean that this is the portion of the dependent variable which could have been managed but because of certain inefficiencies independent variables fail to do so (Production possibilities frontier approach proposed by Kumbhakar and Lovell (2003)).

After the estimation of the panel Poisson model, the systematic standard error (δ_u) can be calculated from the standard error of the intercept of the model, while the random standard error (δ_v) is calculated from the term. So the efficiency of independent variables in minimizing the crime rate can be calculated as:

$$\text{Efficiency} = \left(1 - \left(\frac{\delta_u}{\delta_u + \delta_v}\right)\right) \times 100$$

Hypothesis: Following are the alternative hypothesis which is based on the objectives of the study:

- H_1: Does expenditure on education have a deterrent effect on crime?
- H_2: Does expenditure on health have a deterrent effect on crime?
- H_3: Does education enrollment in primary, middle and high school have a deterrent effect on crime?
- H_4: Does expenditure on police have a deterrent effect on crime?
- H_5: Does expenditure on law and courts have a deterrent effect on crime?
- H_6: Does expenditure on public order and safety have a deterrent effect on crime?
- H_7: Does expenditure on prison have a deterrent effect on crime?

RESULTS AND DISCUSSION

From Table 1 shows the descriptive statistics of the variables included in the model. From the probability value provided for the adjusted Chi square value for the Jarque Bera test, it can be said that other than health and education expenditures, all the variables are non-normal. This suggests that either the skewness is not equal to 0 or the kurtosis value is different from 3, both of these cases arise when the observed variable differs considerably across the cross sections.

Table 2 shows the estimates of equation 1a-4a using random effect Poisson regression. The significant value of the Wald test indicates that these four models are fit and are significantly explaining the variance in the dependent variable.

The LR test of OLS versus random effect model, show significant results in four models shown below, it indicates that the random effect model is appropriate as compared to the pooled OLS. While the negative and insignificant values of the Hausman test indicate that fixed effect estimates are similar to random effect estimates, so we use the efficient model between these two which is a random effect model.

The results indicate that health expenditure, education expenditure, employment, primary school ratio, middle school ratio, high school ratio shows a negative effect on incidence of crime and this negative effect is consistent across four models while population density exhibits positive impact on the incidence of crime which is also robust to variable specification.

All four deterrence variables which are determining four estimation models including expenditure on police,

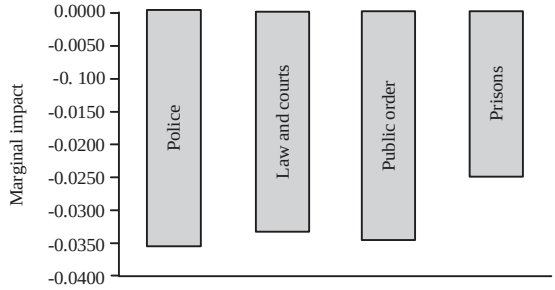

Fig. 1: Effect of deterrence expenditure on crime

expenditure on law and courts, expenditure on public order and safety and expenditure on prison have a negative effect on incidence of crime. The minimum value of AIC determines the best specification, according to this, the model constructed using Eq. 5 having expenditure on police as deterrence variable. It can be seen in Fig. 1, increase in expenditure on police has a highest deterrent effect on the crime. This model of police expenditure is free of multicollinearity as all VIF's are <10 and Tolerance is >0.1. About 1% Increase in health expenditure will lead to decrease in the incidence of crime by 0.03% on average across all districts of Punjab. Similarly, a 1% increase in the education expenditures by districts will lead to 0.14% decrease in the crimes on average (similar to Lochner (2011)). Both of these variables indicate the level of development which increases the capacity and productivity of the individuals to utilize them in legal jobs. The 1 % increase in employment will lead to 0.27% decrease in the incidence of crime across all the districts of Punjab. Availability of legal job opportunities reduces the chances o resorting to illegal activities, thus, confirming the results of Smith *et al*. (1992), Gumms (2004) and Chen (2009) for the case of Pakistan.

This study has used the student teacher ratio as indicator of education. An increase in the number of students in primary, middle and high school education will lead to decrease in the incidence of crime by 0.01%, 0.13 and 0.05%, respectively on average. This decrease indicates the shifting of people from illegal market to legal market because of availability of opportunities as mentioned by Lochner and Moretti (2001). The 1% increase in the population density leads to 0.32% increase in the incidence of crime. Higher population provides profitable grounds for the criminals, because of this the returns of illegal jobs increase, also confirmed by Lipton and Gruenewald (2002) and Andersen (2005).

In the case of deterrence expenditures by government, a 1% increase in the police expenditures, law and courts expenditures, public order and safety expenditures and prison expenditures will lead to 0.035, 0.033, 0.034 and 0.024%, respectively decrease in the incidence of crime, confirming the empirical results of Donohue and Levitt

Table 1: Descriptive statistics

Variables	Obs.	Mean	SD	Min.	Max.	Skewness (Prob.)	Kurtosis (Prob.)	Adj. Chi^2(2)	Prob.>χ^2
Crime	180	8940.8	12064.7	48	82678	3.91 (0.00)	21.41 (0.00)	-	0.00
Polexp	144	20.42	0.95	18.90	23.76	1.12 (0.00)	4.51 (0.01)	23.73	0.00
Lcexp	144	18.52	0.76	17.08	21.75	1.45 (0.00)	4.12 (0.00)	39.7	0.00
Poexp	144	20.70	0.92	19.15	23.96	1.09 (0.00)	4.53 (0.01)	23.17	0.00
Prisexp	144	17.10	2.40	12.19	20.55	-0.68 (0.00)	1.93 (0.00)	30.62	0.00
Hexp	180	20.30	0.49	18.81	21.56	-0.09 (0.62)	2.85 (0.83)	0.29	0.86
Edexp	180	21.84	0.51	20.57	23.15	0.05 (0.79)	2.58 (0.23)	1.53	0.46
Empl	180	9.35	1.24	5.58	12.12	0.04 (0.84)	3.98 (0.02)	5.11	0.08
Pris	178	3.63	0.42	0.84	4.81	-4.19 (0.00)	25.99 (0.00)	-	0.00
Mids	178	3.35	0.15	2.99	3.67	-0.15 (0.39)	2.38 (0.03)	5.61	0.06
Highs	178	3.44	0.13	3.14	4.06	0.29 (0.15)	5.10 (0.00)	12.28	0.00
Popden	179	6.20	0.74	4.76	8.54	0.45 (0.02)	3.97 (0.03)	9.34	0.01

Table 2: Panel poisson regression

Determinants of crime

Models	1a Coef. (prob.)	2a Coef. (prob.)	3a Coef. (prob.)	4a Coef. (prob.)
Hexp	-0.03 (0.00)	-0.03 (0.00)	-0.03 (0.00)	-0.03 (0.00)
Edexp	-0.14 (0.00)	-0.14 (0.00)	-0.14 (0.00)	-0.14 (0.00)
Empl	-0.27 (0.00)	-0.24 (0.00)	-0.26 (0.00)	-0.20 (0.00)
Pris	-0.01 (0.00)	-0.01 (0.00)	-0.01 (0.00)	-0.01 (0.00)
Meds	-0.13 (0.00)	-0.13 (0.00)	-0.13 (0.00)	-0.16 (0.01)
Highs	-0.05 (0.00)	-0.05 (0.00)	-0.05 (0.00)	-0.05 (0.00)
Popden	0.32 (0.00)	0.32 (0.00)	0.32 (0.00)	0.30 (0.00)
Polexp	-0.035 (0.00)			
Lcexp	-0.033 (0.00)			
Poexp		-0.034 (0.00)		
Prisexp			-0.024 (0.00)	
Constant	15.25 (0.00)	14.82 (0.00)	15.11 (0.00)	14.49 (0.00)
Diagnostics				
Observations	143	143	143	143
Wald F Test	1530 (0.00)	1515.62 (0.00)	1524.22 (0.00)	1495.68 (0.00)
LR Test	71000 (0.00)	83000 (0.00)	73000 (0.00)	130000 (0.00)
LL	-4449.19	-4456.83	-4452.48	-4466.91
AIC	8919.37	8933.66	8924.96	8953.83
Hausman Test	-47.72 (1.00)	-54.35 (1.00)	-49.11 (1.00)	0.00 (1.00)

p-values are in parenthesis

(2001), Blackburn *et al.* (2012) and Sanchez and Fazio (2010). While comparing the magnitude of the coefficients and AIC value, expenditure on police comes out to be a variable which has high potential to reduce crime.

From the most appropriate estimation model 5 which has used expenditure on police as deterrent variable, the value of systematic standard error is 0.536 and the value of random standard error is 0.926. So the degree of efficiency is 63% (= (1-(0.536/(0.536+0.926)))×100). This level of efficiency indicates that the crime deterrence policy is not optimized for the differences in the incidence of crime in cross sections. This inefficiency does not necessarily mean that there is corruption; it might indicate mismatch of objectives and priorities of different districts of Punjab (Appendix 1).

CONCLUSION

Economics dictates that crime is an outcome of trade-off between the returns of legal and illegal jobs. Need renders humans to allocate their time in the job which has higher payoffs. Though crime might have private benefits but it comes with high socioeconomic costs to the society. Earlier, empirical studies like, Fleisher (1963, 1966) and Ehrlich (1973) focused on the socioeconomic determinants of crime. This study uniquely used the intervention based indicators with socioeconomic indicators. The socioeconomic indicators include primary, middle and high school enrollment, factory employment and population density. The indirect intervention variables include education expenditures and health expenditures. The direct intervention variable include expenditure on police, expenditure on law and courts, expenditure on public order and safety and expenditure on prison.

This study used the data of 36 districts of Punjab for the time period from 2011-2014. The data is taken from Punjab development reports and Provincial expenditure budget. As panel data accommodates the interconnection of different cross sections, hence using data of districts instead of countries is more meaningful as people can shift districts at ease as compared to countries (Hsiao,

2007). Since, the dependent variable is the number of crimes reported is a discrete variable, estimation using standard fixed or random effect approach might not be appropriate. This study has used panel random effect Poisson regression approach (Cameron and Trivedi, 2013).

To avoid multicollinearity, four models are constructed, one for each direct intervention. All of these direct intervention variables, i.e., expenditure on police, expenditure on law and order, expenditure on public order and safety and expenditure on prison have significant negative effects on crime rate. Comparison of models 1a, 2a, 3a and 4a, using minimum AIC value and the size of the effect of direct intervention variable, showed that expenditure on police has the highest potential to deter crime similar to Ajilore and Smith (2010), Donohue and Levitt (2011) and Wan *et al*. (2012). Similarly, expenditure on education and health has a negative effect on crime. Increase in number of enrollment in primary, secondary and high school also lead to decrease in crimes as it promotes the productivity among the population as depicted by Hanif and Arshed (2016). Results also prompted that increase in legal employment do deter people to opt crime by increasing returns in the legal market (Becker, 1968). The efficiency analysis proposed by Kumbhakar and Lovell (2003), indicated that all these proposed independent variables are 63% efficient in minimizing the crime rate. This means that there is still room of 37% improvement in crime deterrence policies of the country.

This study highlighted that expenditure in education and the creation of jobs is the best deterrent to avoid crime ex-ante. Increase in education expenditures will increase the productivity level of the population coupled with the creation of employment, it will overweight the legal jobs as compared to the illegal jobs (Lochner and Moretti, 2001). Increase in education has a positive externality itself that it promotes the creation of jobs via entrepreneurship. Here, all of the direct intervention variables had potential to deter the crime, but while comparing the models it is revealed that police expenditures are best to deter crime ex-post, as it will incapacitate the criminals (Grogger, 1991).

Districts should manage the expenditure on police as they will improve the quality of investigation and police patrolling. It will ensure peace in the society and increase the probability of criminal being caught. The country should use an optimal combination of all four types of deterrence expenditures in order to minimize the crime rate. Since, it is impossible to achieve 100% efficiency, still 63% efficiency can further be improved by fine tuning the crime reduction policies depending upon the nature and intensity of crime.

Appendix 1: Priorities of different districts of Punjab

Numbers	Districts of Punjab
1.	Attock
2.	Bahawalnagar
3.	Bhakkar
4.	Bahawalpur
5.	Chakwal
6.	Chiniot
7.	D. G. Khan
8.	Faisalabad
9.	Gujranwala
10.	Gujarat
11.	Hafizabad
12.	Jhang
13.	Jhelum
14.	Kasur
15.	Khanewal
16.	Khushab
17.	Lahore
18.	Layyah
19.	Lodhran
20.	M. B. Din
21.	Mianwali
22.	Multan
23.	Muzaffargarh
24.	Nankana Sahib
25.	Narowal
26.	Okara
27.	Pakpatan
28.	R. Y. Khan
29.	Rajanpur
30.	Rawalpindi
31.	Sahiwal
32.	Sargodha
33.	Sheikhupura
34.	Sialkot
35.	T. T. Singh
36	Vehar

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