Relationship between education, health and crime: fable, fallacy or fact

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RELATIONSHIP BETWEEN EDUCATION, HEALTH AND CRIME: FABLE, FALLACY OR FACT

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Abstract

The study is an empirical evaluation of specific criminal activities. The relationship of criminal activities with inflation, unemployment, investment, education and health are examined through an annual data set from 1980 to 2007. To test the order of integration, Augmented Dickey Fuller test and Philips Perron are used. To find the evidences of long run relationship, Cointegrating Regression Durban Watson, Engle Granger two step procedure and Johansen and Juselis method is used. Results show that education and health have a positive and significant relationship with most of the criminal activities in the study. Another unusual finding is that inflation and unemployment are insignificant in case of two out of three crimes, however, investment is found highly significant and negatively related with these crimes. The study indicates that an educated, healthy and legally employed person can also be involved in unsophisticated blue collar criminal activities.

JEL Classification: Z000

I. Introduction

Crime is generally treated as the deviant behavior of a person which goes against the letter or spirit of the law. This behavior can be triggered through many factors. Crime is also attributed as the outcome of mental sickness. There are criminals who are rational; they rationally adopt to be criminals. No matter what the causes are, criminal activities work as a disincentive to the social, psychological and economic growth and development of a country.

Studying crime is a multi-dimensional process. Different disciplines such as psychology, sociology, criminology, law and economics discuss the different aspects of criminal activities, however, these different dimensions are by no means mutually exclusive. In this way, various causes of crime are interrelated. For example, economic disorder is expected to cause social and psychological disorder which may affect in turn the economic condition of a person (as well as a nation).

Theoretical and empirical studies explain how different variables relate to criminal activity. As, criminal activity can be viewed through different dimensions, the related variables also belong to different disciplines. For example, urbanization, electronic media, poverty etc.

Though crimes are also taken as an outcome of mental illness, however, there are studies that specially focus on rational criminals (Becker, 1968). These studies take criminal activities as economic activities with high risk and high return. Criminals adopt criminal and non criminal behavior after analyzing the expected costs and benefits of their either type of activities.

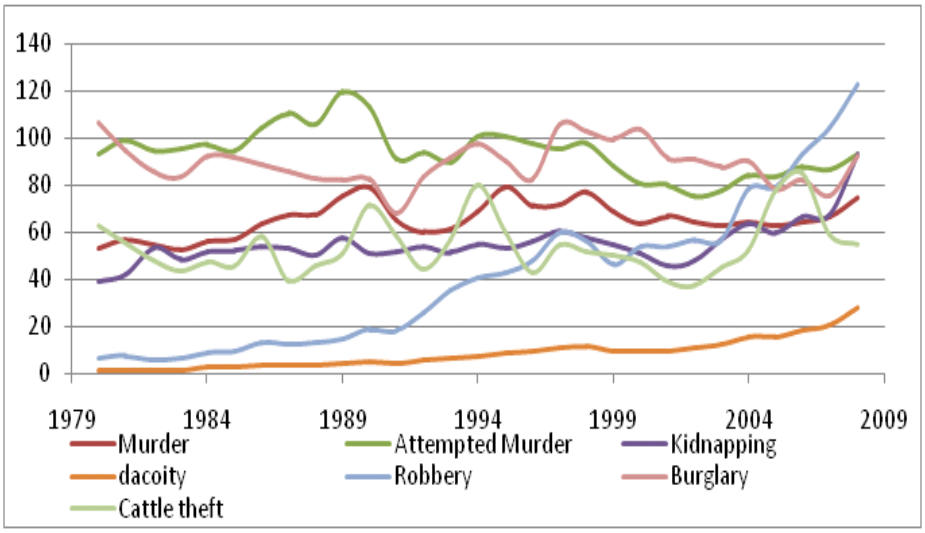
To curb criminal activities in the presence of these kinds of so called rational criminals, the best option is to make criminal activities economically prohibitively infeasible expensive. In other words, the undesirable activities led by economic incentives can be effectively controlled by imposing economic cost thus making the activities more expensive so that non-criminal behavior

becomes relatively cheaper and the rational criminal is suitably deterred. Criminal activity imposes a cost to the individual as well as to the society collectively. There are several studies on the cost of crime estimation which attempt to estimate the economic and social cost of criminal activities on the basis of several assumptions (Anderson, 1999).

I.I Crime trend in Pakistan

Observing crime trends in terms of their absolute values over time can be misleading for several reasons. Most important among them is the lack of comparability of crime trends because the population of different countries generally varies significantly. In this context, a relatively better measure is the population adjusted crime trend of Graph 1 below presents the population adjusted crime trends of specific criminal activities.

Graph 1: Trend in Specific Criminal activities in Pakistan from 1979 to 2008



* The trend shows specific crimes per million population

Source: Economic Surveys, 1980, 1990, 2000, 2009.

The trend at a glance seems ambiguous, however, on a close look it exhibits some stylized facts. For example, population adjusted dacoity was the lowest among other crimes at the beginning of the period and remained the lowest at the end. Despite being the lowest among the seven selected crimes, the growth of dacoity is the most consistent trend. If this trend continues, it can cross some of the other criminal activities in the next ten years. Growth rate of robbery is the highest among all crimes. Robbery, which was the second lowest at the beginning of the period, has the highest population adjusted crime rate among the seven criminal activities at the end of the period. Kidnapping, the third lowest in the early years, ended much close to the second highest criminal activity. Murder, the fourth lowest in the early 80's, ended as the third lowest criminal activity. Except for cattle theft, all crimes exhibit positive growth during the observed period.

The previous studies on the subject generally took aggregate criminal activities and different economic indicators however the economic and social impact of different criminal activities varies greatly. The present study is an attempt to analyze the relationship between specific criminal activities with economic and social indicators of the economy. Section 2 of the study comprises of a brief review of literature on the subject, Modeling framework of the current study is explained in Section 3. Section 4 discusses the empirical findings and concludes the study.

II. Review of literature

Cerro and Meloni (2000) studied the determinants of crimes in 22 provinces of Argentina for the period 1990 to 1999. The study was primarily based on Becker (1968) framework. Along with the probabilities of the different costs (like being arrested or imprisonment etc.) associated with crime, unemployment, income and income inequality were also included in the model. The author found strong deterrence effects of socioeconomic variables such as unemployment and inequality were found to be positively related with crime as expected.

Income was found to be positively related with crime. The author stated that as the richer areas attract more criminals so the result may indicate this income-criminal activities relationship.

Coomer(2003) studied the effect of various variables like unemployment, inflation, poverty, income and education on criminal activities. The author applied OLS on an annual data set from 1967 to 1998. The results suggested that unemployment, inflation and poverty affect crime positively. The relationship of income and education was also found to be positive with crime, however, the author gave various reasons for this unusual finding like incorrect hypothesizing or model specification flaws.

Gumus (2004) presents a cross sectional attempt to find out the determinants of crimes in large cities of the United States. The study has primarily focused on the two types of urban crimes; property crime and personal crime. The author took per capita income, unemployment rate and poverty as economic determinants of crime. As socioeconomic –demographic variables, the author used city population as a proxy for urbanization; city government police expenditures, black population as a possible determinant and high school dropouts. The method of OLS was used in the study and concluded that per capita income, income inequality, overall population, presence of black population, unemployment rate and expenditures on police are important determinants of urban crimes. The author explained the unexpected positive relationship between expenditures on police and crime as this may be because of the fact that the increase in police expenditures are lesser than the increase in the population, therefore, the available funds become insufficient to reduce crimes.

Gillani et al. (2009) conduct an empirical study identifying the determinants of crime. The authors used an annual data set from 1975 to 2007 on crime, unemployment, poverty and inflation. They employed Johansen cointegration to examine the long run relationship of crimes with unemployment, poverty and inflation. They also used Granger causality through Toda Yamamoto procedure. They found that those crimes are caused

by inflation, unemployment and poverty in Granger's sense. This is a comprehensive study on the determinants of crimes in Pakistan. Though the long run relationship was estimated through Johansen cointegration procedure, however, the magnitude of this relationship should also have been discussed.

Tang (2009) is an empirical study regarding the relationship between inflation, unemployment and crime in Malaysia. It is a time series study which studies the variables through an annual data set from 1970 to 2006. The study employed cointegration technique to identify the long run relationship among these variables and Granger causality test through Toda and Yamamoto procedure. The author found evidence of long run relationship of inflation and unemployment with crime. It is also found that inflation and unemployment cause crime in Granger's framework.

III. Modeling Framework

In the light of the above literature review, a simple model of criminal activities is given below:

$$C = f(he, inf, ue, k, h) \quad \ldots\ldots(I)$$

Where C represents crime which is measured through the number of registered crimes per million population. Higher education (he) which is proxied through aggregate enrolment in the colleges and universities, inflation (inf) measured through Consumer Price Index, unemployment rate (ue), capital formation (k) which is proxied through investment, GDP ratio and health (h) which is proxied through government expenditures on health as a percentage of G.D.P[1]. The functional form of the model is stated below.

$$C_t = \hat{a}_0 + \hat{a}_1 he_t + \hat{a}_2 inf_t + \hat{a}_3 ue_t + \hat{a}_4 k_t + \hat{a}_5 h_t + \mathring{a}_t \quad \ldots\ldots(II)$$

[1] See Appendix for the different studies that employ these proxies.

Here $\hat{a}_0$ is the intercept of criminal activities while $å_t$ would capture the effect of unexplained factors. All variables in the equation 2 are taken in log form in order to evaluate the relative responsiveness of criminal activities associated with the explanatory variables. To evaluate the relationship of the explanatory variables with some specific kinds of criminal activities, equation 2 can be converted into the following equation.

$$C_{it} = \hat{a}_0 + \hat{a}_1 he_t + \hat{a}_2 inf_t + \hat{a}_3 ue_t + \hat{a}_4 k_t + \hat{a}_5 h_t + å_t \quad \text{(III)}$$

In this equation, the subscript i represent specific crimes where i=1 for murder, i=2 for Dacoity and i=3 for Robbery in a given period of time t. The rest of the variables are the same as defined before. The data on of all the variables is annual, which is taken from various issues of Economic Surveys and Statistical supplements from the Federal Bureau of Statistics, Government of Pakistan. I.

IV. Empirical Analysis

Before applying any inferential statistical technique, it is necessary to know the order of integration of the time series. The order of integration is identified through the application of Augmented Dickey fuller test. The procedure is repeated through Philips-Perron test in order to cross check the finding of the test. The results obtained from these tests are presented in Table 1 below:

Table 1: Test of Stationarity

	ADF Test				Philips-Perron Test			
	Level		First difference		Level		First difference	
Variables	C	C & T	C	C & T	C	C & T	C	C & T
AC	-3.428	-4.320	-7.960	-7.808	-3.376	-4.320	-11.542	-11.316
R	1.579	-1.159	-4.831	-5.554	1.828	-1.159	-4.828	-5.554
M	-2.414	-2.268	-4.713	-4.649	-2.378	-2.240	-5.329	-5.765
DA	1.817	-0.472	-4.216	-4.829	1.753	-0.737	-4.269	-4.854
HE	2.986	1.999	-6.699	-7.757	2.583	-0.127	-6.599	-7.756
H	-1.184	-2.171	-4.027	-4.015*	-1.399	-2.257	-4.007	-3.968*
INF	-2.523	-2.464	-6.603	-6.557	-2.453	-2.396	-6.607	-6.573
UE	-1.471	-2.043	-4.868	-4.802	-1.471	-2.043	-4.868	-4.802

* Critical values on level with constant and constant with trend at 1 percent are -3.699 and -4.339 respectively. On 5 percent, the values are -2.976 and -3.587 respectively. The critical values on first difference with constant and constant with trend at 1 percent are -3.711 and -4.356 respectively. On 5 percent, the values are -2.981and -3.595 respectively.

Source: Authors' estimation.

All variables in the model are integrated of order one. The findings of the ADF test are reconfirmed by Philips and Perron procedure as reported in the table. The results of both tests can be taken as an indication of the possible existence of a long run relationship between the variables. This possible relationship is further tested by Cointegrating Regression Durban Watson (CRDW) analysis and also by Engle Granger's two step procedure. The first step of the Engle Granger's procedure is to apply OLS on difference stationary variables. This step is performed on the models presented in equations 3 with i=1, 2 and 3 respectively. In the second step, the stationarity of the residuals in the three models was also determined. The results of the first step are reported in Table 2.

Table 2: C R D W and Engle-Granger Two Step Procedure Results

	Dependent Variables					
	$Log(C_{1t})$		$Log(C_{2t})$		$Log(C_{3t})$	
Constant	1.276	(0.14)	-12.577	(0.00)	-10.064	(0.00)
Log(He)	0.298	(0.00)	2.034	(0.00)	1.967	(0.00)
Log(Inf)	0.049	(0.15)	0.051	(0.59)	0.170	(0.07)
Log(Ue)	-0.112	(0.20)	0.277	(0.27)	0.550	(0.02)
Log(k)	-0.428	(0.01)	-1.123	(0.02)	-1.400	(0.00)
Log(H)	0.268	(0.03)	0.762	(0.03)	0.316	(0.33)
Adjusted R^2	0.615		0.947		0.957	
Durban Watson Statistics	1.832		1.843		1.743	
F-Statistics	9.648		97.672		123.153	
Prob(F-statistic)	0.000		0.000		0.000	

*P values are in parenthesis
Source: Authors' estimation

The findings of the table support the possibility of the existence of a long run relationship between the variables in the equation 3 with i=1, 2 and 3 respectively. The value of CRDW is higher than the critical value in all cases[2] indicating the existences of cointegrating vectors in all models. This evidence was further strengthened because the residual series in all the models were found to be stationary at level[3] though the variables were integrated of order 1. In case of a long run relationship between the variables in the models of equation 3 with i=1, 2 and 3 respectively, the obtained coefficients are the long run responsiveness of these criminal activities associated with these explanatory variables.

The direction and the magnitude of the long run coefficients indicate some unexpected trend. Before interpreting of the long run coefficients, the long run relationship is further investigated by using Johansen and Juselius method. There are two statistics used in this method in order to determine the number of cointegrating vectors trace statics and maximum Eigen value statistics. The comprehensive findings of cointegration test on all the three equations are presented in Table 3.

[2] See Critical value at 1 percent is 0.511. Engle and Granger (1987).
[3] See Appendix 1.

Table 3: Test for Co-integration through Johansen and Juselius method

C_{1t}=f(HE, INF, UE, K, H)	Trace Test			Max Eigen Value Test		
Null Hypothesis	r = 0	r = 1	r = 2	r = 0	r = 1	r = 2
Alternative Hypothesis	r > 0	r > 1	r > 2	r = 1	r = 2	r = 3
Trace Statistics/Max Eigen Value Statistics	180.479	118.018	68.448	62.460	49.570	35.903
Critical Value on 5 percent	117.708	88.803	63.876	44.497	38.331	32.118
Probability	0.000	0.000	0.019	0.000	0.001	0.016
C_{2t}=f(HE, INF, UE, K, H)						
Null Hypothesis	r = 0	r = 1	r = 2	r = 0	r = 1	r = 2
Alternative Hypothesis	r > 0	r > 1	r > 2	r = 1	r = 2	r = 3
Trace Statistics/Max Eigen Value Statistics	147.627	91.246	54.455	56.381	36.791	28.390
Critical Value on 5 percent	103.847	76.972	54.079	40.956	34.805	28.588
Probability	0.000	0.002	0.046	0.000	0.028	0.053
C_{3t}=f(HE, INF, UE, K, H)						
Null Hypothesis	r = 0	r = 1	r = 2	r = 0	r = 1	r = 2
Alternative Hypothesis	r > 0	r > 1	r > 2	r = 1	r = 2	r = 3
Trace Statistics/Max Eigen Value Statistics	144.785	98.613	62.135	46.171	36.477	34.565
Critical Value on 5 percent	117.708	88.803	63.876	44.497	38.331	32.118
Probability	0.000	0.008	0.069	0.032	0.080	0.025

* Where r is the number of cointegrating vectors

Source: Authors' estimation

In case of C_{1t} as dependent variable, as per trace statistics and Eigen value statistics, all the three null hypotheses are rejected which indicates the presence of three cointegrating vectors in equation 3. All the three null hypotheses are again rejected in case of equation containing C_{2t} as a dependent variable through trace statistics, however, through Eigen value statistics; the first two null hypotheses could be rejected. The results imply that there are three cointegrating vectors according to trace statistics in equation 3 in case of C_{2t} as dependent variable and two cointegrating vectors as per Eigen value statistics. In case of C_{3t} as dependent variable, the first two null hypotheses are rejected by per trace statistics and only the first null hypothesis could be rejected through maximum Eigen value statistics. The results indicate that there are two cointegrating vectors in the equation 3 as per trace statistics and one cointegrating vector as per maximum Eigen value statistics in case of C_{3t} as a dependent variable. As the existence of long run relationship is reconfirmed through Johansen and Juselius method, the coefficients of Table 4 can be interpreted as the long run responsiveness of these specific crimes associated with these explanatory variables.

IV.II Fable, Fallacy or Fact

The most unusual finding of Table 2 is the highly significant positive relationship of education with all of the selected criminal activities. Theory postulates a negative, not a positive relationship between education and crime. This finding can be ignored as a statistical fallacy or a spurious relationship, however, the same can also be interpreted differently. First of all, it is known that dependency does not necessarily imply causality. The coefficient of education is positive in all observed criminal activities. This does not imply that education is causing crimes, however, it does indicate the positive relationship between education and crime. Can one take these positive signs as a coincidence? The consistency in the direction of relationship between education and crime indicates that this might not

be a coincidence. The finding is consistent with some earlier studies where education was found to have positive relationship with crimes (Coomer, 2003) or (Lochner, 2004), however, in the former study, the criminal activity in question was in fact white collar criminal activity and in the later study, the finding was attributed as an outcome of specification flaw. We found an insignificant relationship of two out of three criminal activities with inflation and unemployment. It is generally understood that poverty and illiteracy leads to crimes, however, our results show that though these crimes may be financially motivated, they are not committed by the lower income class. The reason is that if these crimes were committed due to poverty they must have had a strong positive link with inflation and unemployment.

All observed crimes are found to be negatively related with capital formation and the result is highly significant. It could be said that more investment results in more employment thus less crimes, however, it is not the case. Keeping in mind that unemployment is insignificant in two out of three cases; the coefficient of capital formation demands a very careful interpretation. High investment leads to the reduction in unemployment as well as an increase in the income of the previously employed labor. If employment is insignificant and capital formation significantly reduces crimes, it indicates that the criminal may not be jobless at all. Due to increase in capital formation in the economy, his legal earning increases which leads a substitution of the illegal activities with legal activities so criminal activities decline.

Another surprising finding is that health expenditures which is also a proxy for human capital input is found to be statistically significant and positively related with two out of the three criminal activities. Can this only be treated as a fallacy? No. There can be some meaningful interpretation of this finding as well.

Criminal activities are also taken as an outcome of mental illness. The state of mental health has not been seen

scientifically investigated in many developing countries in general and Pakistan in particular. The health expenditures may improve physical health but remained to be insufficient to address mental sickness and violent or aggressive behavior of the people. As a result, expenditures on health improve physical health but a combination of mental sickness with improved vigor and stamina can produce the results as present in the Table 2. To sum up, the results indicate that a person who is educated, physically healthy, employed and does not belong to the very low income strata may involve in these criminal activities. This situation demands serious and immediate attention.

V. Conclusion

The study found a series of variables which are related to criminal activities in an unexpected manner. Although some of the earlier studies have also found similar relationships like the positive relationship between education and crime, however, the current study is an attempt to analyze the relationship thoroughly.The findings of the study demand further research on the various dimensions of economic, social and psychological determinants of crimes. If education and health are positively related with some unsophisticated criminal activities, the area requires to be investigated carefully.

There is a need to assess the problems in the education system and reality based issues related to the educated population of the country. A significant part of health expenditure should be spent on the psychological health sector. It is important because this will not only save the life of a person with psychological problems but also so many of his potential victims.

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Appendix 1

Test of Stationarity of Residuals

	ADF Test	
	Level	
Variables	C	C & T
U	-5.263	-5.372
U2	-5.167	-4.982
U3	-4.409	-4.571

* Critical values on level with constant and constant with trend at 1 percent
are -3.699 and -4.339 and respectively.
Source: Authors' estimation.