



Promoting Education Quality in Curbing Business Crime Costs: A Quantile Analysis

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Vol. 3, No. 1 (Winter 2023)

Pages: 138 – 148

ISSN (Print): 2789-441X

ISSN (Online): 2789-4428

Key Words

Labor Productivity, Law of Diminishing Returns, Robust Regression

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Abstract: Studies have concentrated on numerous strategies and measures to curb the crime rate. Out of these, interventions via education are most promising as teaching children has a multiplier effect on crime reduction. Empirically there is a debate on the effect of education on the incidence of crime, and it is reasoned that education with opportunities, relevance, and ethics plays a decisive role in reducing crime. This study has used more comprehensive indicators and a robust distribution-free approach to estimate the effect of education on the crime rate. The contour plot of Quantile on Quantile regression helps assess each level of education quality on each level of the business cost of crime. This model does not require the assumption of normality and linearity of variables. This study points out that primary and science education reduces crime rates at low levels, while management studies and research help reduce crime at high levels. This study provides a robust assessment of how education may influence the cost of crime at their different corresponding levels. These estimates can help determine how the marginal effects will affect and change in response to the change in the cost of crime. This study is an instrument in for assessing the role of education on crime at each quantile data position.

Introduction

Enhancing the quality of education has continued to exist in the debate of both policymakers and academicians. Sustainable Development Goals (SDG-4) by the United Nations has put forward a comprehensive plan related to youth and adult education levels. It focuses on achievements of skills, equity and learning outcomes. Quality of school and student academic performance is positively associated (Wang et al., 2020), increasing legal job-related labour productivity. A classroom with a collaborative and active environment is more appealing to children compared to traditional classrooms. Most

countries have mentioned the right to education in their national constitution. This gives more children to get access to school. However, access is insufficient as it also requires the quality of learning. Education has been shown to reduce crime, improve health, lower mortality, increase political participation (Lochner, 2011) and alleviate poverty (Arshed et al., 2019a). Industrialization, urbanization and rapid social change have been accompanied by declines in crime (Rogers, 2007). According to the United Nations Children's Fund (UNICEF), child-friendly, primary, and high-quality education is

the main focus of Global Education 2030. In one of three countries, about 35% of teachers are not trained according to the national stands, delivering low-quality basic education for 130 million children enrolled in primary schools (Global Citizen, n.d.). Global statistics reveal that one in five children, adolescents and youth are out of school, and the numbers have barely changed during the past five years, according to the United Nations Educational, Scientific and Cultural Organization (UNESCO, 2015).

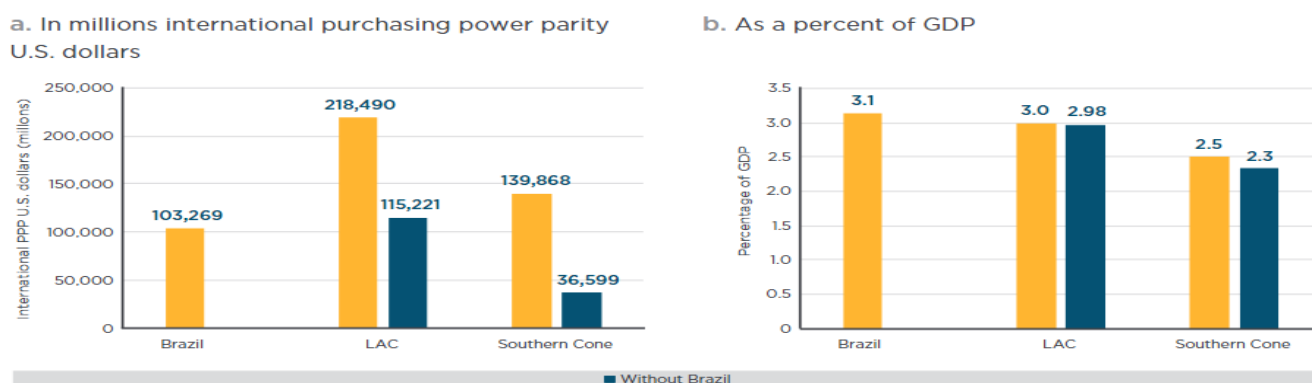
The tendency to crime is developed in early childhood. Criminologists identify that there is a significant schooling effect on delinquency and crime. So, policymakers focused on education reforms to cater to social problems, crime and delinquency associated with children. Inequalities in schooling and on-the-job training

are related to the extent of specific crimes against property. Furthermore, the prevalence of many crimes is highly correlated with the distributional differences in education and training rather than their mean levels (Ehrlich, 1975).

Hence, crime is positively associated with huge economic costs to society, affecting businesses, households and victims (see figures 1, 2). Homicide ranked as the most costly crime, accounting for almost 31% of the total cost of crime, while drug offences and fraud account for 21% and 17%, respectively (Wickramasekera et al., 2015). There is another notion that education may increase crime in white-collar people. For example, Lochner (2004) discovers that white-collar crime arrest rates also climb when education levels grow.

Figure 1

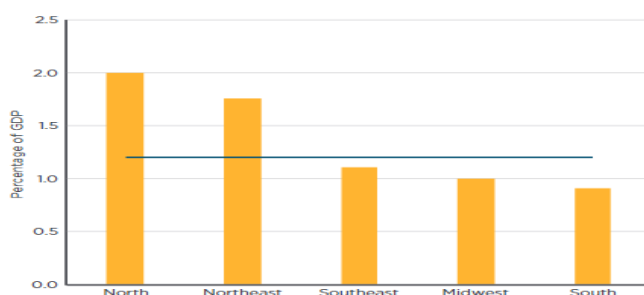
Cost of Crime



Source: Inter-American Development Bank (2017), Note: LAC = Latin America and the Caribbean

Figure 2

Public Expenditure on Security by Region, 2014 (percent of GDP)



Source: Inter-American Development Bank

Previous studies only used crime as a count of FIR reported (see, for instance, Anwar et al., [2017](#); Arshed et al., [2019b](#)). Since most crimes are not reported, this statistic does not assess the damage to the economy/society. So the present study's main objective is to empirically investigate the impact of the quality of education on the cost of crime. Empirical studies measured education incidence using primary, secondary or tertiary enrollment, literacy rates, or education expenditures. However, to assess the role of education on crime incidence, this study uses education quality. Both indicators are developed by World Economic Forum, which encompasses the previous indicators and adds more dimensions. The rest of the study is organized as follows.

Section 2 presents the literature of the previous studies; section 3 represents methodology, data and model; section 4 is dedicated to results and interpretation, while section 5 is reserved for conclusion and policy implications.

Literature review

Lochner and Moretti ([2004](#)) estimate the role of education on involvement in criminal activity. To consider the endogeneity of educational choices, they use changes in state compulsory schooling laws over time. The results of their study uncurtained that schooling significantly reduces the probability of incarceration and arrest. Furthermore, their results reveal that about 14 to 16 per cent of men's private return from high school graduation is associated with social savings from crime reduction. The impact of schooling on offences and crimes committed is highlighted by Groot and Brink ([2010](#)). According to the study, spending money on education can result in significant savings on the social costs of crime. In addition, they find that when one gets older and has more knowledge, the likelihood of committing crimes like stealing, vandalism, threat, assault, and harm reduces. However, the likelihood of committing tax fraud rises with years of education. They also discover that those with greater levels of education have more tolerant attitudes and societal norms about illegal

activity. Machin et al. (2010) developed an empirical link between education and crime for the British. Their findings conclude that higher levels of education are adversely correlated with criminal activity. Nevertheless, the direction of causation essentially flows from education to crime. As a result, they use changes in compulsory schooling to measure the impact of education on involvement in criminal behaviour, leaving age laws to take into account education's endogeneity gradually. In this causal approach, the negative crime-education relationship remains strong and significant for property crimes. Empirically, a positive effect of education on crime has been observed because more educated people are less likely to fear crime or lack the focus on morality. Qadri and Kadri ([2011](#)) argue that unsophisticated blue-collar criminal activities might be associated with educated, healthy and legally employed people. Further, results reveal that education and health significantly impact criminal activities. Another study finding uncovered that inflation and unemployment are insignificant in the case of two out of three crimes, while the role of investment is significant and reduces these crimes.

Deming ([2011](#)) calculates how selecting a top middle or high school might affect adult criminality. He uses information from the Charlotte-Mecklenburg school district's public school choice lottery (CMS). According to the study, crime decrease occurs mostly years after participation in the selected school has ended. The effects are focused on high-risk teenagers, who commit crimes at a rate of around 50% lower across a range of outcome indicators and criminal severity grading. According to the author, peer influences are more significant in middle school, but school quality explains a greater portion of the impact in high school.

Arshed et al. ([2016](#)) investigated the role of expenditures and economic factors in determining the incidence of crime across Punjab districts from 2005 to 2013. They apply pooled OLS (Ordinary Least Square), fixed effect and generalized method of moment approaches to examine the relationship among variables. Results of pooled OLS, fixed effect and

generalized method of moment reveal that police and health expenditure's coefficient positively correlate with all reported crimes. Education elucidates different results with different variables. Education expenditure and primary school density are valuable in reducing crime, while middle school density is positively related to crime. However, population density expresses a positive association with all reported crimes.

Cano-Urbina and Lochner (2019) examine the role of education levels and the quality of schools on crime among American women. They discover a significant relationship between educational achievement and the likelihood of detention using modifications to legislation requiring compulsory schooling as their tools. Additionally, they predicted that raising the average level of education would lower arrest rates for violent and property crimes but not for white-collar crimes. The relationship between access to secondary school and crime was examined by (Huttunen et al., 2019). In general, they apply a regression discontinuity design to account for the impact of post-compulsory education on crime. According to their findings, successful students are less likely to commit crimes for the first five years after admission. Crime decreases during and outside the school year, suggesting that incompetence alone cannot account for how education influences crime. Additionally, they discovered no impact on the offence committed six years after admission. According to recent research by Lochner (2020), education and crime are related. His study provides empirical evidence that higher levels of education significantly lower later violence and property crime, which has major positive societal effects. The study shows that increases in educational quality affect crime. However, some studies do indicate significant benefits in lowering crime. Additionally, school attendance decreases recent property crime but,

in certain situations, increases recent violent crime among young people.

Rakshit and Neog (2020) determine the role of education in crime. They used data from 2001 to 2013 for 33 Indian states. The study also considers the role of selected macroeconomic, demographic and socio-economic factors in determining fluctuating crimes in India. According to the study's empirical results, a 1% rise in the gross enrollment ratio results in an 8% decrease in overall crime. But a novel finding shows a favourable correlation between higher education and economic crime. The widespread perception that criminals often have lower levels of education than non-criminals is further refuted by this research. The previous literature on crime and education does not identify the quality aspect of education. This study addresses this by using the quality of education indices against the business cost of crime. Most studies exploring the role of human capital or education on crime have used the OLS approach and assumed data is normal. This study proposes that the effect of education on crime depends on the incidence of both dependent (DV) and independent variables (IV). This study has compared several quantiles of IV with several quantiles of DV and presented the map of effects. Unlike simple regression methods, this method is free of normal distribution restriction.

Data and Methods

Variables and Data Sources

The secondary data was selected between 2008 and 2018 from 159 countries listed in the Global Competitiveness Index (GCI) reports by World Economic Forum (WEF). Table 1 reports the definition and source of the data. Here all the indices are scaled between 1 to 7, where 7 is the best situation, making data homogenous and comparable.

Table 1

Descriptive Statistics

Statistic	BCRI	QMS	QMSC	QPRI	QRR
Obs	1538	1538	1538	1538	1538
Range	5.33	4.62	4.95	5.33	5.09

Median	4.69	4.17	4.03	3.86	3.70
Mean	4.59	4.20	4.01	3.89	3.87
Std. Dev.	1.09	0.56	0.24	0.28	0.25
Skewness	-0.39	0.09	0.03	0.23	0.44
Kurtosis	-0.39	-0.40	-0.54	-0.69	-0.45
SW – P val.	0.00	0.00	0.00	0.00	0.00

Estimation Method

Empirical studies focused on the use of the OLS approach, which used the mean as the point estimate for slope coefficients. This OLS approach is prone to unsuitability for inference if the data is not normally distributed. Empirical studies have used quantile regression to make an inference, but this model only assesses one point (median) in the data set. Further, if the results are expected to be non-linear, as empirical studies related to education have shown (Arshed et al., 2018, 2019), median-based quantile regression provides heteroskedastic estimates. This problem was also sorted using a quadratic function (Arshed et al., 2018, 2019a; Hanif, Arshed & Aziz, 2019; Iqbal, Kalim & Arshed, 2019). This is an approach to control for slope heterogeneity because of the difference in the incidence. The disadvantage of this quadratic transformation is that it applies the non-linear fit of the independent variable to every type of dependent variable, which causes a nuisance in estimates. This study has proposed the Quantile-on-Quantile (QQR) estimates that estimate quantile vs quantile analysis between dependent and independent variables (Sim & Zhou, 2015). It provides a complete spectrum of

the change in the nature of the effects. According to Mallick et al. (2019), this QQR model supports determining how dependent and independent variables relate to one another when evaluating district points in their distribution. Therefore, in this approach, the normal distribution is not required.

Estimation and Results

Descriptive Statistics

Table 2 provides detailed descriptive statistics for the variables included in the study. Here we can see that the mean and median values are not equal. Further, the Shapiro-Wilk probability values are less than 0.05, which means that all the variables are not normally distributed, making standard OLS estimates unsuitable for inference.

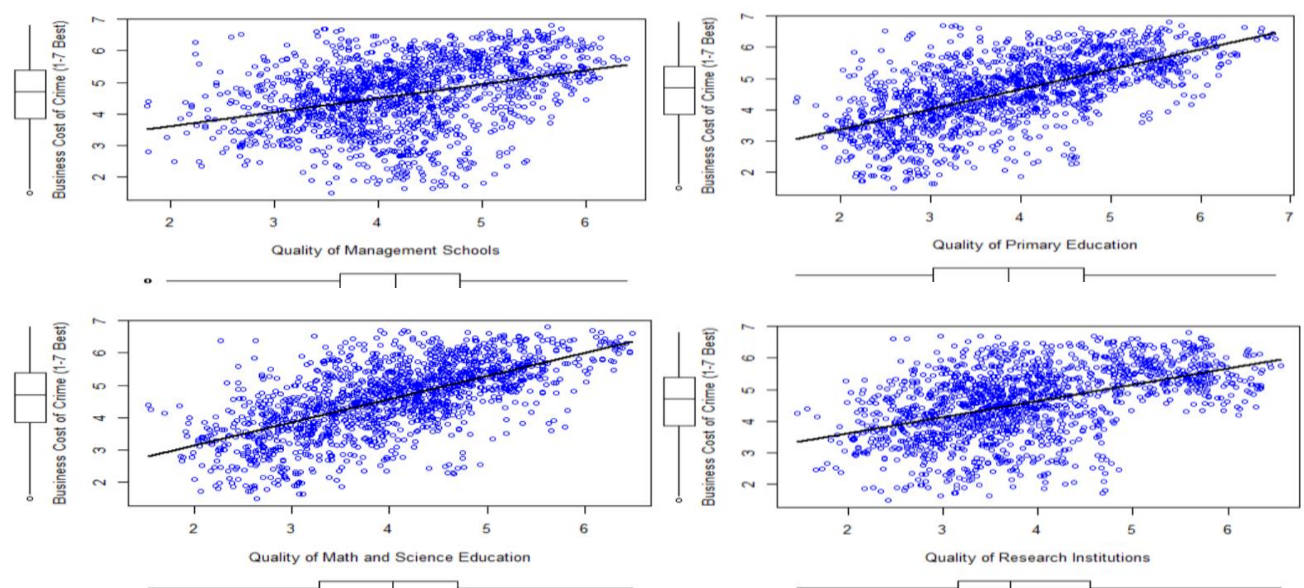
Figure 3 first provides the box plots for all the variables shown on the axis of each graph. Since none of the box plots is in the middle, this confirms that all variables are not normal. While assessing the scatter plots, it can be seen that an increase in education quality is positively associated with a decrease in the business cost of crime for the global data.

Table 2

Variable Name (Symbol)	Definition	Source
Crime (BCRI)	Business Cost of Crime (1-7 Best)	GCI
Primary Education (QPRI)	Quality of Primary Education (1-7 Best)	GCI
Management Schools (QMS)	Quality of Management Schools (1-7 Best)	GCI
Math and Science Education (QMSC)	Quality of Math and Science Education (1-7 Best)	GCI
Research Institutions (QRR)	Quality of Scientific Research Institutions (1-7 Best)	GCI

Figure 3

Univariate Box Plots and Bivariate Associations

**Figure 4**

Quantile wise association between Business Cost of Crime and Quality of Education Indicators.

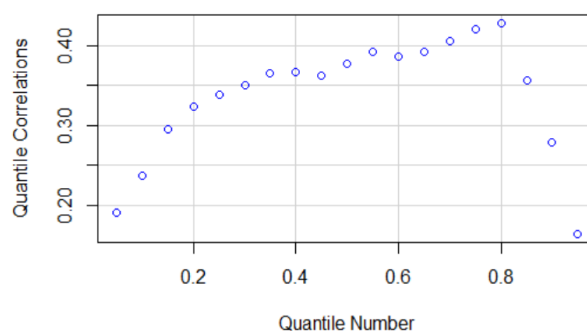
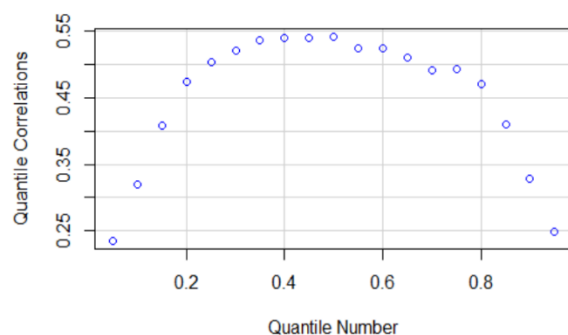
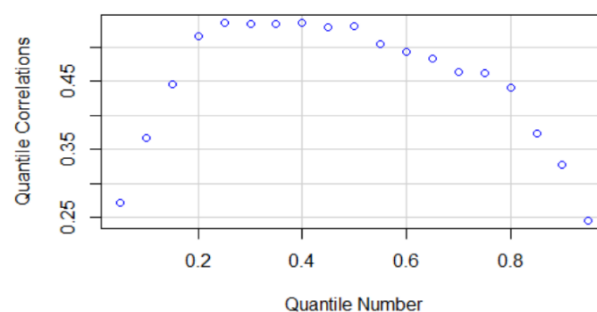
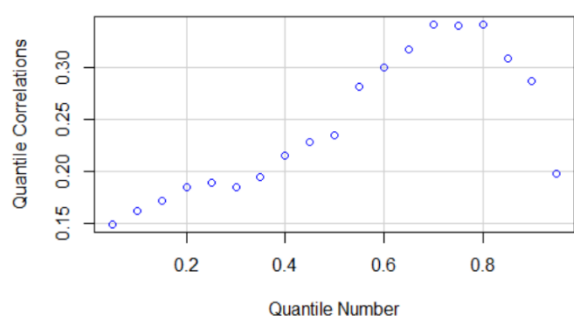


Figure 4 provides the quantile-wise correlation between the Business Cost of Crime and each Quality of Education indicator. Here, there is a high positive association between a reduction in business cost of crime and an increase in education quality at a very high level of quality of management schools and research institutes. In contrast, a high association is stated between the reduction in the cost of crime and quality of education at low levels of quality of math and science education and quality of primary education. This shows that basic skills like primary education and math & science skills are altering the gains from engaging in criminal activities very early. Advanced skills like management schools and research are only effective in discouraging crime or reducing costs at very high levels. Further, since these correlations are not constant, it indicates that the effects of quality of education on the business cost of the crime depend on their incidence.

Estimation Results

Figure 5 shows the effect of each quantile of quality of primary education (QPRI) on the respective quantile of the business cost of crime (BCRI). Here the legend provides the colour based on the marginal effect's value. A brighter colour means a higher marginal effect. Here we can see that increase in primary education is more effective in reducing the business cost of crime for the cases where the business cost is high, while its effect diminishes when the business cost decreases. This means that there are diminishing returns on the negative effect of primary education on crime. This might be coined because primary education is only effective at the early stage of the carrier or in deciding on higher education.

Figure 5

Contour plot of BCRI and QPRI

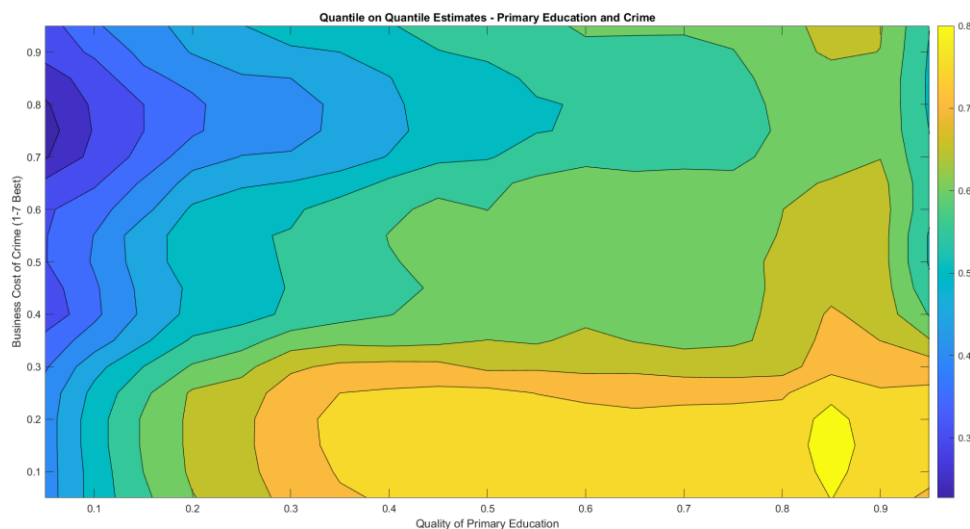


Figure 6 shows the effect of each quantile of the quality of math and science education (QMSC) on the respective quantile of the business cost of crime (BCRI). Here the legend provides the colour based on the marginal effect's value, and brighter colour means a higher marginal effect. Here an increase in the quality of math and science

education positively affects the decrease in the business cost of crime overall. Here the effect diminishes with the decrease in the business cost. The outcomes of the quality of math and science education are similar to that of primary education.

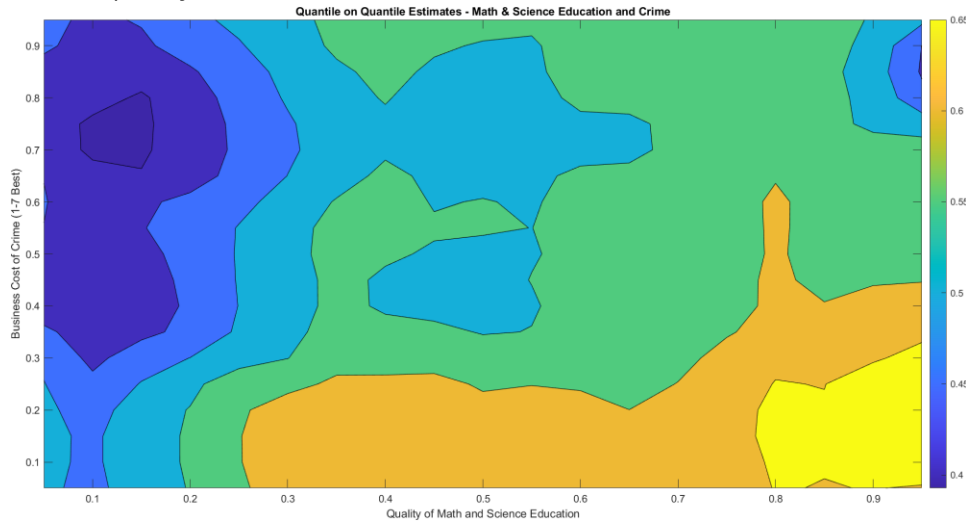
Figure 6*Contour plot of BCRI and QMSC*

Figure 7 shows the effect of each quantile of the quality of math and science education (QMSC) on the respective quantile of the business cost of crime (BCRI). Here the legend provides the colour based on the value of the marginal effect, and brighter colour means a higher marginal effect. It is observed that while observing horizontally (fixing a particular quantile of BCRI), there is an inverted U-shaped effect on the cost of crime (low

BCRI), and it is almost ineffective at a low cost of crime (high BCRI). This means that at the high incidence of the business cost of crime, the quality of management schools tends to follow the law of diminishing returns, which is limited by the national capacity to absorb specific graduates. While at low levels of the business cost of crime, management schools are ineffective in further improving the situation.

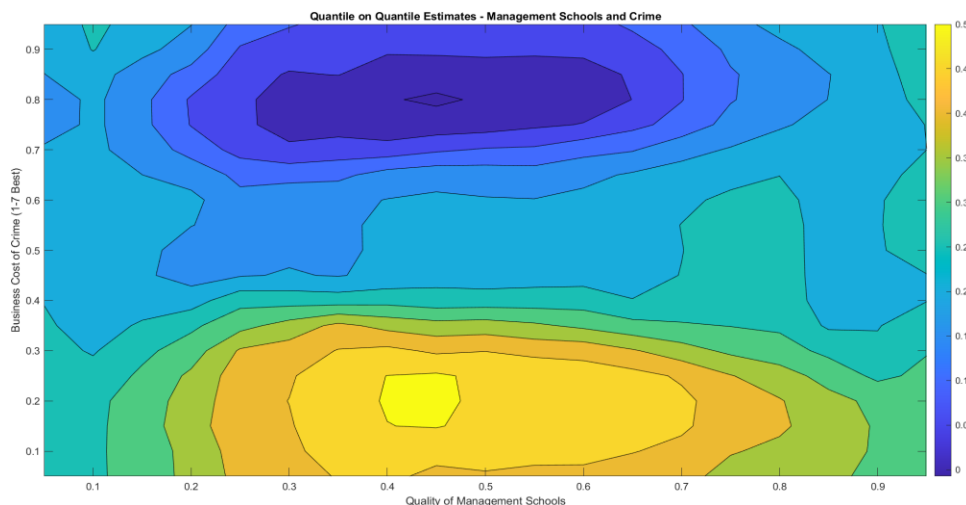
Figure 7*Contour plot of BCRI and QMS*

Figure 8 shows the effect of each quantile of the quality of math and science education (QMSC) on the respective quantile of the business cost of crime (BCRI). Here the legend provides the colour

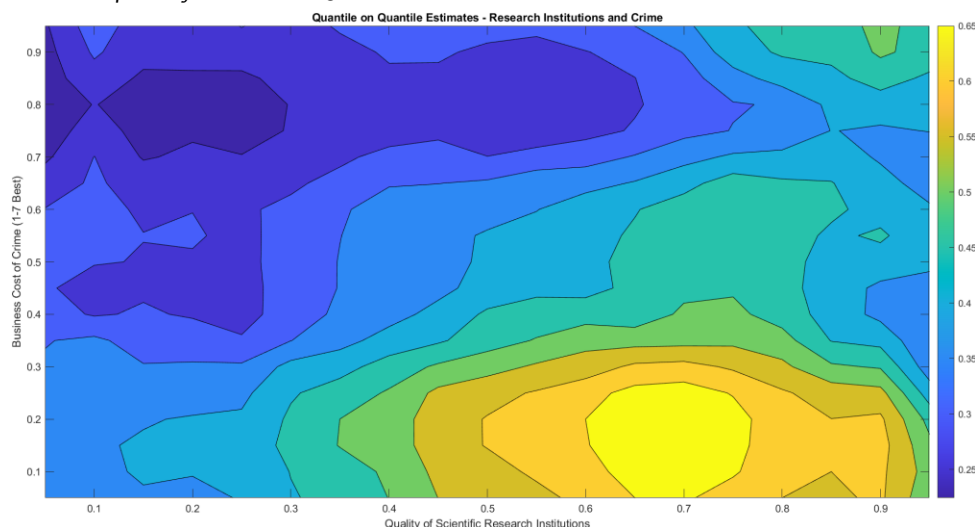
based on the marginal effect's value, and brighter colour means a higher marginal effect. Here an increase in the quality of research institutes positively affects the decrease in the business cost

of crime overall. Here the effect diminishes with the decrease in the business cost. The outcomes of

the quality of math and science education are similar to the quality of primary education.

Figure 8

Contour plot of BCRI and QRR



Conclusion

Worldwide most governments have enshrined a provision for the right to education in their national constitutions. As a result, many more children have access to school, but access is insufficient as it also requires quality learning. Schools are very important in predicting the probability of crime, delinquency, and imprisonment. Policymakers have resorted to educational changes to address the societal issues brought on by juvenile delinquency and adult crime. The main objective of the present study was to empirically investigate the impact of the quality of education on the cost of crime. The study used the business cost of crime index to incorporate the severity of crime rather than crime incidence. Quantile on Quantile approach was used for the analysis. The quantile-wise correlation between the business cost of crime and each indicator of education quality was performed. The study results revealed a highly positive association between a reduction in business cost of crime and an increase in the quality of education at very high levels of quality of management schools and quality research

institutes. In comparison, a high association is stated between the reduction in the cost of crime and quality of education at low levels of quality of math and science education and quality of primary education. This showed that basic skills like primary education and math & science skills were altering the gains from engaging in criminal activities at a very early stage. While advanced skills like management schools and research were only effective in a discouraging crime or reducing its cost at very high levels. The results showed the effect of each quantile of quality of primary education (QPRI) on the respective quantile of the business cost of crime (BCRI).

The results revealed that an increase in primary education is more effective in reducing the business cost of crime in cases where the business cost is high, while its effect diminishes when the business cost decreases. This means that there are diminishing returns in the negative effect of primary education on crime. This might be coined because primary education is only effective at the early stage of the carrier or in deciding on higher education. It is examined that while observing horizontally (fixing a particular

quantile of BCRI), there was an inverted U-shaped effect on the cost of crime (high BCRI). This means that at the high incidence of the business cost of crime, the quality of management schools tends to follow the law of diminishing returns, which is limited by the national capacity to absorb specific graduates. While at low levels of the business cost of crime, management schools are ineffective in further improving the situation. A similar case is for math and science education (QMSC) quality.

The advantage of quantile-on-quantile analysis shows us a spectrum of effects where the appropriate intervention of different types of education quality can be assessed. Economies with different levels of cost of crime and quality of education can define their specific target in the spectrum of effects and plan the development of education accordingly. The government should focus on deterring crime at an initial level of education by improving the quality of primary education and math & science education. This would send the potential delinquents to a new path of a respectable job with a good salary at a young age. This would reduce the average cost of crime. Further reduction can be made by increasing their demand by working on the quality of management schools and scientific research institutions' quality.

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