

INCOME AND CRIME RELATIONSHIP IN THE RECESSION PERIOD: A QUANTILE REGRESSION APPROACH

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ABSTRACT

This study investigates the relationship between income inequality and crime in the United States. For this purpose, 2004 and 2016 years are chosen to represent before and after great recession period to understand the potential relationship income and crime. All data set are taken from National Longitudinal Survey conducted by the United States Bureau of Labor Statistics. Crime variables are categorized big and small crimes based on the value of crimes. Because the crime variables are highly skewed, a quantile regression approach can be more appropriate than a regular regression. As result of the quantile regression approach, income inequality is positively associated with the crime variables. Considering the crime variables only the big crime variable which includes attack a property or using illegal substance has negative effect on income level over all quantile range.

Key words: Employment Status, Inequality, Crime Level, Micro Analysis, Quantile Regression.

EKONOMİK DURGUNLUK DÖNEMLERİNDE, GELİR VE SUÇ İLİŞKİSİ: KANTİL REGRESYON YAKLAŞIMI

Özet

Bu çalışmada gelir adaletsizliği ve suç arasındaki ilişki araştırılmıştır. Amerika Birleşik Devletleri'nde (ABD) özellikle Büyük Buhran döneminin analizi için, 2004 ve 2016 yılları arası incelenmiştir. Çalışmada kullanılan veri seti ABD Bureau of Labor Statistics' den elde edilmiştir, tüm verilere online olarak erişilebilir. Çalışmada kullanılan veri seti anket yöntemi ile elde edilmektedir. Bu ankette suç değişkeni büyük ve küçük suçlar olarak kategorize edilmiştir. Çalışmada kullanılan suç değişkeninin asimetrik dağılım sergilemesinden dolayı, kantil regresyon yaklaşımının uygun bir analiz yöntemi olacağına karar verilmiştir. Analiz sonuçlarına göre, gelir adaletsizliği suç değişkeni ile pozitif ve istatistiksel olarak anlamlı bir ilişki sergilediği gözlemlenmiştir. Ayrıca sadece suç değişkeni kantil regresyon sonuçları incelendiğinde, bir mülke saldırı, ya da yasadışı madde kullanımı gibi büyük suç kategorisinde sınıflandırılan suçların, bütün kantil sınıflarında gelir ile negatif bir ilişki içerisinde olduğu gözlemlenmiştir.

Anahtar Kelimeler: İşgücü Statüsü, Gelir adaletsizliği, Kantil Regresyon, Mikro Analiz, Suç.

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INTRODUCTION

A great deal of criminological and economic research investigates the relationship between income inequality and economic growth following Becker's study (1968). As a variety of social phenomena, lack of resources or the unequal distribution of the resources can be driven to society the crime or vice versa (i.e. Brush, 2007). The relationship between income inequality and economic growth and some key social variables, political conflict, gender, education, health, and crime are explored (Jiang et al., 2012). Most of studies in the literature stated the hypothesis that economic incentives to commit crimes are higher in areas with greater inequality (Ehrlich, 1973). Some studies show that various factors are responsible for promoting crime in the world such as Lee (2002). Kelly (2000) found that the robbery, assault and overall violent crime are strongly aggravated by income inequality.

Some of the income and crime studies investigate the income inequality and crime relationship in a macro perspective such as Gillani et al. (2009). The author used a time series data set to examine the crime and other factor relationship such as unemployment and poverty. For this purpose, they applied a Granger causality test on the 1975 to 2007 data set. Results of their study indicated that there is a clear relationship between unemployment, poverty and crime. Similarly, Gillani et al (2009) paper, Altindag (2009) examines how the unemployment effects on crime using country level data set. To examination the relationship, the author applied Ordinary Least Square (OLS) and 2 stage Least Square (2SLS) techniques on country level data for European countries. The results showed that unemployment has a positive influence on property of crimes. Also, the author points out that the 2SLS estimates are larger than OLS. Brush (2007) is another study used the country level data of the United States to estimate income inequality and crime relationship applying a cross sectional and also a time series analysis. While cross sectional analysis finds a positive relationship between income inequality and crime, time series analysis results show a negative coefficient for crime variable.

On the other hands of these macro studies there are some researches in the literature focused in the micro perspective while searching the income and crime relationship. For example, Omotor (2012) uses micro level data set to examine the relationship for Nigeria. The author used OLS and the results indicate a significant effect of income on crime. Another finding of this study represent that crimes are triggered due to the inefficient performance of law enforcement in Nigeria.

This study examines whether or not an increase crime level can cause a decrease income level (or opposite) for this purpose in the United States. It specifically focuses before and after Great Recession period because fundamentally, recessions impact on economic variables in a negative way, such as, economic growth, unemployment rate and income inequality level. According to National Bureau of Economic Research, unemployment rate has risen 5% in the first quarter after the Great Recession period. An increase of the unemployment rate may trigger to crime level, for instance Heinemann, and Verner (2006) stated that unemployment is a factor motivating crime and homicidal especially in urban areas. Therefore, it is important to understand how the recession period impacted on the income and crime relationship. This paper is organized as follows: the detailed information about the data set and method is given in the Experimental part in section 2. Section 3 presents the analytical results. Section 4 provides the concluding comments.

I. EXPERIMENTAL SECTION

A. DATA

In this study, to analyze the effect of income on crime level, the years 2004 and 2016 is chosen as representing before and after the Great Recession period. In all 16365 observation are used and all of data set were obtained from National Longitudinal Survey conducted by the U.S. Bureau of Labor Statistics. In the study, 10 variables are chosen to examine the crime and income relationship. They are; gender, education, race, age, census region, type of settlement, employment status, income, crime.

First of all, income variable is used as a yearly income based on individual's total yearly wages or salary obtained from the previous year. Crime variable is also categorized as big and small crime. Small crime includes criminal activity like possessing a gun or stole something the value of it less than 50\$ and also individuals can be arrested with charges a limited amount of money according to NLSY web site. On the opposite, big crime is described as some criminal activity like, destroy a property or stole something more than 50\$ value, conviction or guilty plea, victimization and substance use, such as marijuana, or cocaine. Thus, if an individual involved in a small criminal activity in the survey year, SMALLC dummy gets 1, 0 otherwise. In an individual involved in a big criminal activity in the survey year, BIGC dummy variable get 1, 0 otherwise.

A dummy variable is created for gender, if an individual is male the gender dummy gets 1, 0 otherwise. Educational attainments of individuals are categorized as; (E1) less than a high school diploma, (E2) a high school diploma, (E3) college (or university) diploma, (E4) master degree, PhD or specialist. Race (or ethnicity) of individuals are categorized as; (R1) black or African American (R2) white (R3) Hispanic (R4) Non-Hispanic or Non-black. Census of Region of the USA is categorized as (NE) North East, (NC) North Central, (SO) South, (WE) West. A dummy variable is created based on the settlement type of individuals, if an individual resides in the urban area, the dummy (UR) gets 1, 0 otherwise. Another dummy variable is used for employment status (EmpS). If an individual works more than 35 hours in weekly, the individual considered as full-time workers and the (EmpS) dummy gets 1, 0 otherwise.

B. MODEL

In this study, I use a quantile regression approach because this approach helps to analyze the relationship at different percentages, like 0.25, 0.5, 0.75 and 0.9, and these percentages represent four different statutes. In addition, quantile regression approaches estimates the impact of explanatory variables on the dependent variables at different points of the dependent variable's conditional distribution.

Quantile regressions were initially introduced as a 'robust' regression technique which allows for estimation where the typical assumption of normality of the error term might not be strictly satisfied (Koenker, 2005). Also, this method uses the median as the measure of central tendency rather than the mean. The nonparametric median statistic may offer additional insight in the analysis of data, especially when compared to the parametric mean or average statistic. Another difference from ordinary least square approach is that the model does not require explanatory variables to be normally distributed. In this study, to understand the

relationship between income inequality and crime, a Quantile regression approach is used. For this purpose, the following regression is estimated;

$$\ln I_{i,t} = \alpha + \beta_1 G_{i,t} + \beta_2 R1_{i,t} + \beta_3 R2_{i,t} + \beta_4 R3_{i,t} + \beta_5 A_{i,t} + \beta_6 E1_{i,t} + \beta_7 E2_{i,t} + \beta_8 E3_{i,t} + \beta_9 EMP_{i,t} + \beta_{10} NE_{i,t} + \beta_{11} NC_{i,t} + \beta_{12} SO_{i,t} + \beta_{13} UR_{i,t} + \beta_{14} SMALLC_{i,t} + \beta_{15} BIGC_{i,t} + e_{i,t} \quad (1)$$

where I is yearly income. lnI is logarithmic of the income of the individual i. Logarithm of the yearly income is more appropriate due to the scale of the other variables. α is intercept. All β are coefficient of the variables which are calculated by quantile regression. Subscript i, t symbolizes individuals and time in sequence. G is gender. R1 through to R3 symbolizes race and E1-E3 is education, EmpS is employment status, NE, NC, and SO are regional variables. UR is type of settlement of the individuals. SMALLC symbolizes small crime while BIGC symbolizes individual involved in a big crime. For detail description of the data set and variable please see data section. Finally, e is an error term.

II. ANALYSIS RESULTS

First of all, descriptive statistics are shown in Table-1. According to the descriptive statistics around 54 percentages of the samples are male and 46 percentage of it is female. Majority of the samples are having a high school diploma. Almost 78 percentages of the samples reside in the rural areas while 22 percentage of it resides in urban areas. Majority of the samples lived in the south region of the USA. 79 percentages of the individuals involved in a big crime while 21 percentages of the samples involved in a small crime in the survey year. After the descriptive statistics side-by-side box plots are represent in Figure-1, Figure-2, Figure-3 and Figure-4. In these box plots draw based on education, race, census region and residence area (urban-rural) respectively.

Table 1. Descriptive Statistics

Variable	Mean	Std Dev	Lower Quartile	Median	Upper Quartile
lnI	9.525	1.0526	9.2103	9.5468	10.2035
Gender	0.536	0.4997	0	1	1
Age	34.315	18.1034	22.000	33.000	50.000
E1	0.178	0.3832	0	0	0
E2	0.611	0.4874	0	1	1
E3	0.192	0.3940	0	0	0
Employment Status	0.589	0.4919	0	1	1
Black	0.201	0.4011	0	0	0
White	0.209	0.4073	0	0	0
Hispanic	0.011	0.1028	0	0	0

Variable	Mean	Std Dev	Lower Quartile	Median	Upper Quartile
North East	0.164	0.3705	0	0	0
North Central	0.233	0.4228	0	0	0
South	0.364	0.4812	0	0	1
Urban	0.224	0.3960	0	0	0
Big crime	0.791	0.3107	1	1	1
Small crime	0.378	0.4851	0	0	1

*lnI symbolizes log_Income, E1-E3 are different education levels which are less than a high school diploma, a high school diploma and collage (or university) degree in sequences. EmpS is employment status.

According to Figure-1, a graduate degree (or specialist) has the highest mean and median based on income, while the lowest one is the first one which is less than a high school degree. Every group has some outliers and the second group (high school degree) has the largest range. From the Figure-2, third group (Hispanic) has the largest income range and almost normally distributed, even it has a few outliers. On the other hand, other groups have many outliers and shows some skewness, such as second group (white people) has some outlier, which is smaller than 1. Therefore, it is hard to define as these four groups have normal distribution. In the figure-3, for types of settlement are almost normally distributed even though two groups show some outlier. In the figure-4, the maximum and minimum values of the difference are 11.8 and 0.8, respectively. The medians of these four groups are approximately 10. All of the groups have some outliers and minor skewed.

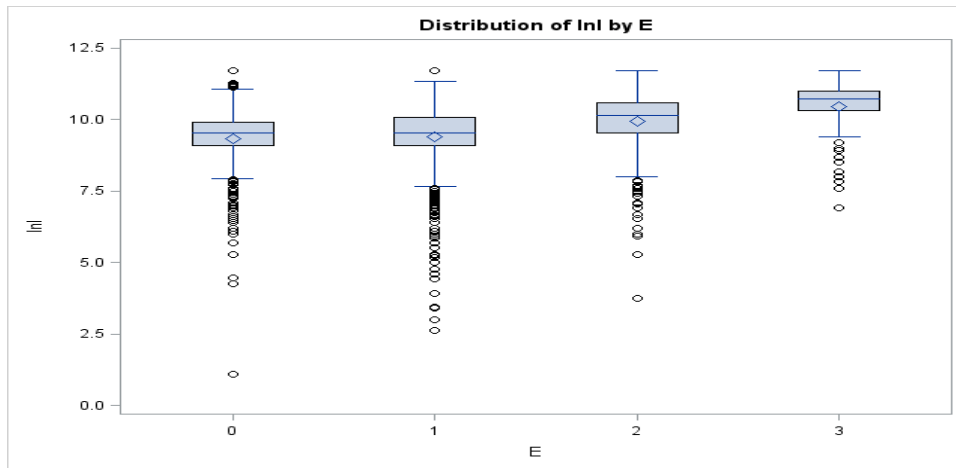


Figure 1. Distribution of log Income by Education (0- less than a high school degree, 1- high school degree, 2-Bachelor degree, 3- Graduate degree or Specialist)

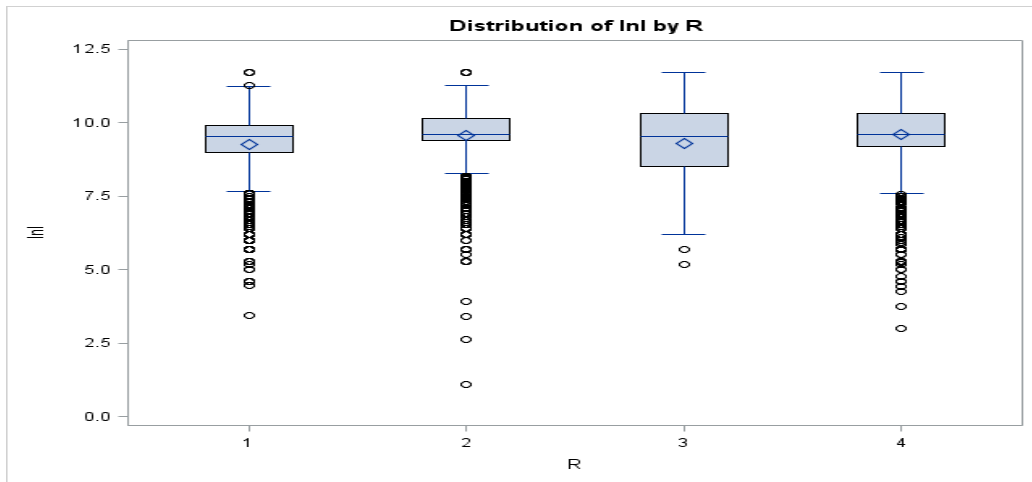


Figure 2. Distribution of log Income by Race (1- Black, 2-White, 3-Hispanic, 4- Non-Hispanic and non-black)

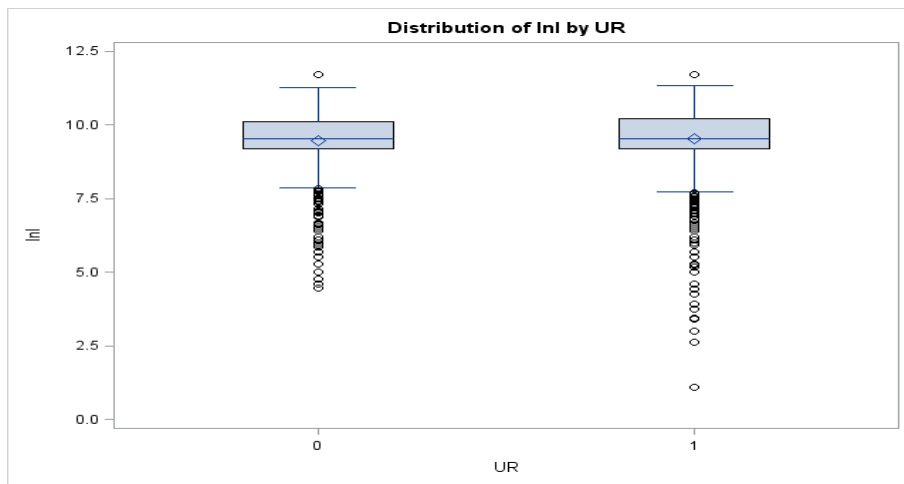


Figure 3. Distribution of log Income by type of settlement (0-Rural, 1-Urban)

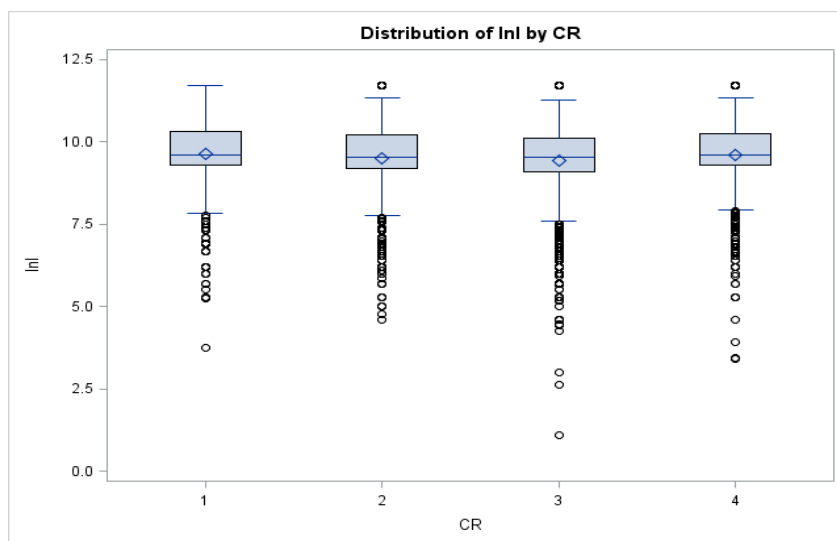


Figure 4. Distribution of log Income by Census Region (1-Northeast, 2-North central 3- South 4-West)

The quantile regression results are representing in the Table-2. For educational attainment all quantiles level parameters (E1, E2, E3) are statistically significant. Individuals who have a high school degree (E2) and a college degree (E3) have positive effect on income level. On the other hand, individuals who have less than a high school degree has negative impact on the income level and the biggest impact of it can be seen in the first quartile.

Table-2. Parameter Estimation based on Quantile regression % (0.1, 0.25, 0.5, 0.75, 0.9)

Parameter	DF	0.1	0.25	0.50	0.75	0.9
Intercept	1	9.5377***	10.396***	10.971***	11.236***	11.511***
lnI	1	0.4541***	0.3680***	0.1717***	0.3427***	0.3645***
Gender	1	-0.0162***	0.0089***	0.0038***	0.0035***	-0.003***
Age	1	-1.1592***	-1.1638***	-1.1250***	-1.1102***	-1.0112***
E1	1	0.9079***	1.1216***	1.0607***	0.9805***	0.8657***
E2	1	0.3102	0.6827***	-0.5606***	0.4108***	0.3710***
E3	1	0.3346***	0.2632***	0.0796***	0.0790***	0.0675***
Employment Status	1	-0.3933***	-0.1132	0.0881***	0.2210***	0.2034***
Black	1	0.2581**	0.1981	0.0193	0.0026	0.0510**
White	1	-0.5148**	0.6441***	-0.1281	-0.1995**	-0.0809
Hispanic	1	0.0392	0.0510	0.0202	-0.0035	-0.0343
North East	1	-0.2365*	-0.1122*	-0.0566**	0.0910***	0.1201***
North Central	1	-0.3476***	-0.1096**	-0.0143	-0.0262**	0.0901***
South	1	-0.0973	0.0443	0.0030	-0.0050*	-0.0397**
Urban	1	-0.1420	0.2337***	0.2881***	0.2605***	0.2277***
Big crime	1	-0.1093	-0.0111	-0.0133*	-0.0582*	-0.0574*

*** Significant at the 1%, **significant at the 5%, and * significant at the 10%. lnI symbolizes logarithm income, E1-E3 are different education levels which are less than a high school diploma, a high school diploma and collage (or university) degree in sequences. EmpS is employment status.

Gender has a positive and statistically significant impact if the person is male on all of the quantiles level. Being male at the 0.1 level has the biggest impact on income level considering to other quantiles. In addition to employee status affects in a positive way if the person has full time job. However, age variable decrease income based on all quantiles levels and it is statistically meaningful. When the race of

individuals is evaluated, it has negative relationship with income variable if the person is black (or African American - R1). This impact represents at the 0.75 quantile, it is -22.10% negatively related. On the contrarily black people being white do not show any statistically significant relationship. Only at the 0.1 and 0.9 quantiles looks has some minor impact on income level. In regional dummy, if an individual resides in North Central (NC) and South (SO) have quite uniform impact over the whole distribution range.

When the crime dummies are considered, big crimes have some statistically significant effect on income level over whole quantiles range, while small crime only has minor effects through the 0.5 and 0.9 quantiles level. As a final, the types of the settlements (urban-rural) of individuals do not show any statistically significant effects. So, there are no differences living in a rural or an urban area at whole quantile range.

For better explanation of the quantile regression, the quantile graphs of all variable including dummy and categorical variables are given in the Figure 5,6, 7 and 8 respectively. These figures show the parameters which are calculated in different quartiles from 0.1 to 0.9. Since the estimated parameters by quantile regression analysis are already given in the Table-2 and explained previously, only some selected parameters clarify by using the figures. For instance, age variable has negative, statistically significant but very minor impact on income level for all quantile range.

All of the education levels are statistically significant effect on income level in all quantiles. While a college degree has positive impact, having a less than high school diploma has negative impact on logarithmic income from 0.1 to 0.9 quantile ranges. When the most crucial focused of the study which is crime levels impact are considered, small crime has very minor and negative impact on individuals income levels especially in the upper quantiles. On the contrarily small crime, individuals who commit a big crime has some major negative impact on income for almost all quantile levels.

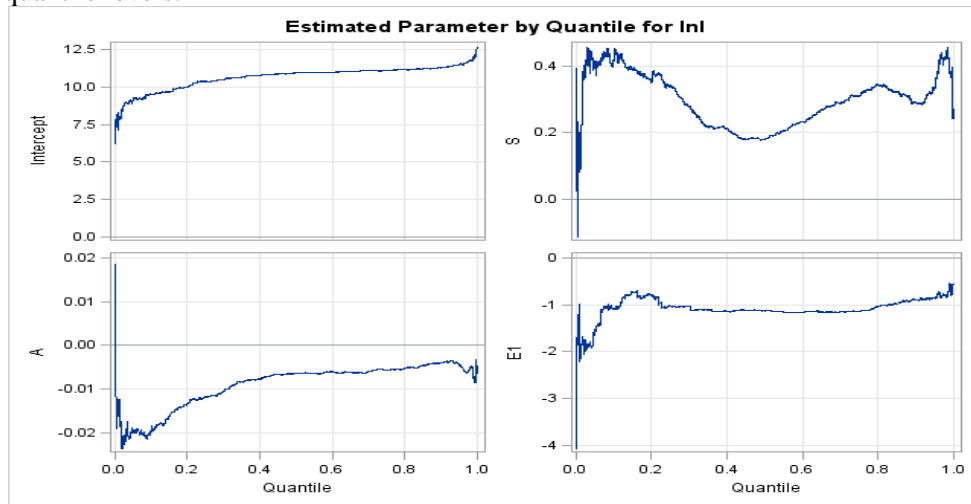


Figure 5. Estimated Parameter (Intercept, A, S and E1) by quantile for Logarithmic Income.

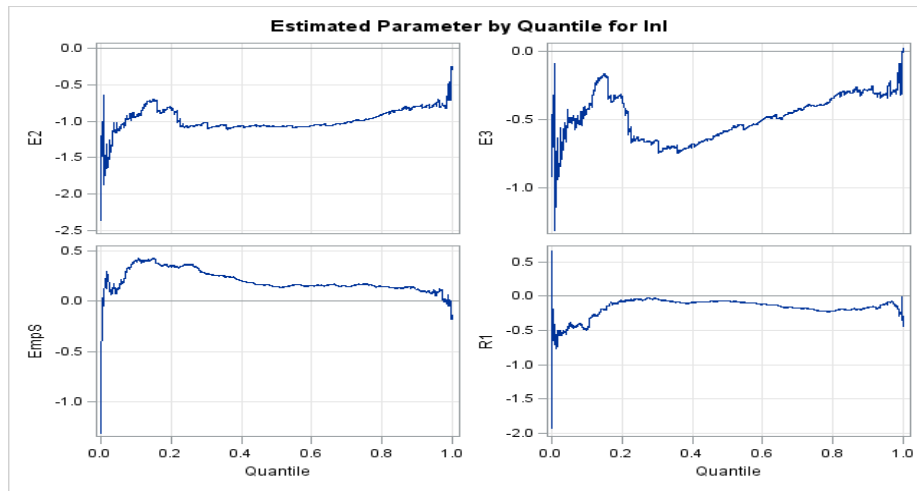


Figure 6. Estimated Parameters (E2, E3, R1, EmpS) by Quantile for Logarithmic Income.

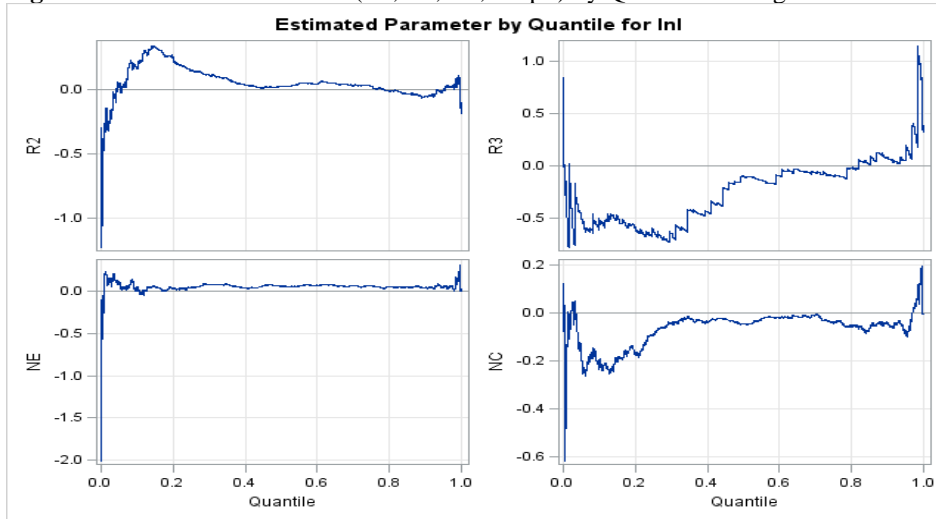


Figure 7. Estimated Parameters (R2, R3, NC and NE) by Quantile for Logarithmic Income.

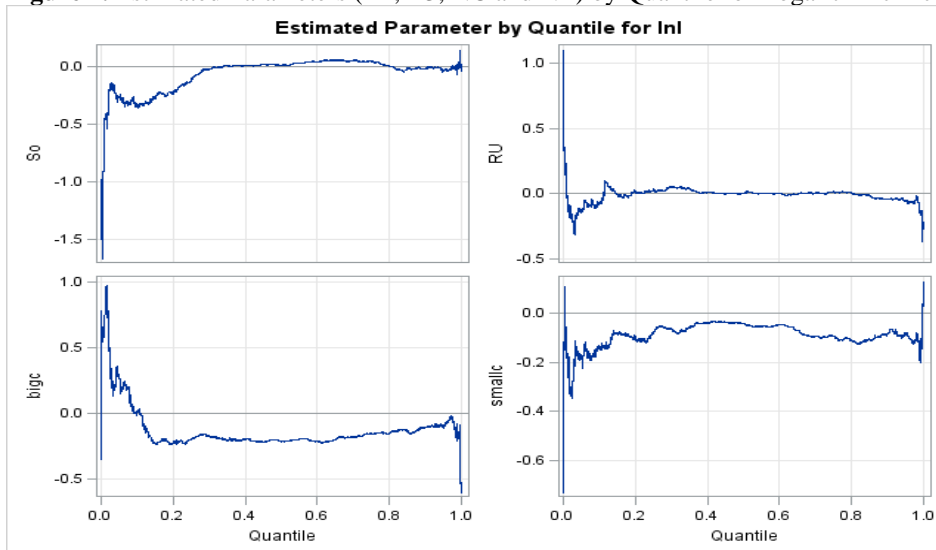


Figure 8. Estimated Parameters (SO, UR, BigC and SmallC) by Quantile for Logarithmic Income.

CONCLUSIONS

This study investigates the relationship between criminal activity and income level of the individuals in the recession period using a quantile regression approach. For this purpose, I obtained the data from the National Longitudinal Survey conducted by the U.S. Bureau of Labor Statistics. In all 16365 observations are applied with some dummy and categorical variable. Since the main focus of the study is to examine the crime variables effect on income, it is categorized as big and small crimes based on NLYS survey which are detailed in the data section. For analysis, I prefer to use a quantile regression instead of regular regression approach due to the crime variables are highly skewed properties. Quantile regression can appear quite complicated; however, the results turn out to be easy to summarize and interpret. Levin (2002) stated that the remarkable things about quantile regression that comparative statics exercises can be carried out by assuming a few values for one of the explanatory variables while keeping all other variables at their actual values.

According to the analysis results male individual has an advantage on logarithm of income comparison to other gender from 0.1 to 0.9 quantile ranges. If an individual involved in a big crime which described as some criminal activity like destroy a property, conviction, or guilty plea, and substance use by NLSY, it leads to sharp decline on individual's income level. Even small crime which is a criminal activity like, stole something less than 50\$ value, tends to be negative effect on income level for overall quantile range after the recession period.

Moreover, quantile graphs clarify the results that, educational attainment has clear positive impact in income level almost all quantile ranges. An especially individual who has an education level beyond high school degree is associated with a sharp increase in left hand side variable. Age variable has negative effect on logarithmic income in the all quantile range. An interesting result is related to race is that being black has negatively associated with income level of individuals. In this perspective, it may be claim that there is a bias being black versus to other races.

All in all, this study examines whether or not an increase crime level can cause a decrease income level (or opposite) during Great Recession period. Since any kind of crisis or stagnation in economy fundamentally impact on unemployment rate and also income inequality level. Some criminal studies in the literature gives similar results such as Cantor and Land (1985) and Phillips and Land (2012) studies proposed that a negative economic activity such as crisis and unemployment may affect the rate of criminal activity. Also, Loayzo et. al. (2002) study stated that crime rates and income inequality are positively associated for 37 countries. Finally, the current study shows that the relationship between big criminal activity lead negative impact on individuals income level during recession period in the US.

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