An Empirical Analysis Exploring the Relationship between Unemployment Rates and Crime

Nicole Peltier
npeltier@tamu.edu

November 23, 2021

Abstract

The study serves to analyze the unemployment rate and crime relationship in the United States using panel data from 2011-2018 over all fifty states. A multiple regression analysis is performed over an ordinary least squares regression model. Specific variables are determined and tested along with the unemployment rate to see their effects on crime. The results show that there is a positive linear relationship between the unemployment rate and crime. Therefore, it can be determined that the unemployment rate positively affects crime but not necessarily that higher unemployment rates cause higher crime rates.

1 Introduction

In 2019 alone, the United States had a total of 10,085,207 arrests for criminal activity. If it was known that higher unemployment rates lead to an increase in criminal activity, the government or federal reserve could encourage a stable economy so that citizens could live in a safer environment. This study investigates the effects of unemployment rates on crime in the United States using panel data from 2011-2018 from all fifty states. More specifically, the goal of this paper is to determine whether unemployment rates have an effect on the number of crimes committed. The expected result of this study would be that higher unemployment rates does lead to a higher number of crimes. It can be assumed that when people are unemployed, they can no longer provide for themselves or their families which leads to higher stress levels than normal. Thus violent crimes against others or property crimes such as stealing from people or businesses would become more prevalent. Therefore this research can help give conclusions on whether this assumption has some truth to it. The next section of this paper will go through a literature review of other similar studies and will lead into a model specification followed by the empirical results from this study which will end up showing a positive relationship between unemployment rates and crime.

2 Literature Review

A conclusive theoretical and empirical analysis by Cantor and Land (1985) is widely known and recognized for its contribution to the relationship between unemployment and crime rates. This study examines unemployment and crime rates in the post World War II United States. The central question this article is trying to answer is: Does aggregate unemployment have a positive, negative, or null effect on levels of crime in capitalist societies? The analysis was done with the dependent variable being specific types of crimes and the independent variable being unemployment rates. The regression was computed using first differences to address the problems of omitted variables in panel data. The result of this study was that the relationship between unemployment and crime can be positive, negative, or null depending on the specific type of crime.

In an empirical study examining whether there is a connection between unemployment and crime, Edmark (2005) studied a panel of Swedish counties from 1988-1999 mainly focusing on the effects of property crime. When setting up the regression equation, Edmark used a log-log specification and derived the following parameters to be included in the model: crime rates, unemployment, honest income, and risk of getting caught. Edmark found that unemployment has a positive effect on certain property crimes but violent crimes are not found to be significantly related to unemployment.

In a similar study, Lee and Holoviak (2006) examined the relationship between labour market conditions and various crime series in Australia, Japan, and South Korea. This study focused specifically on young men. When exam-

ining the relationship between unemployment and crime, Lee and Holoviak used a method of maximum likelihood of cointegration. These results showed that deteriorating labour market conditions can have an escalating effect on property crime and violent offences, particularly in young men.

Unlike the other two studies, Fredrick and Jozefowicz (2018) focus on analyzing the unemployment-crime relationship in urban and rural Pennsylvania counties. A 20-year panel of Pennsylvania counties were examined to identify the extent to which unemployment explains urban and rural crime. The empirical model used variables such as crime rate, unemployment rate, percent of the population that is not Caucasian, percent of the population between ages of 18 and 24, percent of the population below the poverty threshold, number of arrests, number of crimes cleared by charges, and the number of police officers divided by population. The results indicated that urban counties experienced a criminal opportunity effect and criminal motivation effect, but there was no evidence of either in rural counties.

In all of these articles, there were different parameters, control variables, and ways of setting up regression, but overall they examine the same idea of determining the relationship between unemployment and crime. This paper will attempt to examine the relationship of unemployment rate and crime using panel data and a method of OLS to estimate the parameters for control variables such as percentage of police officers in the population, per capita personal income, and imprisonment rate per state to determine the effects on unemployment rate on crime.

3 Model Specification

This research consists of data from five different variables for the fifty states from 2011 to 2018. The dependent variable, or the response variable, that we are observing is the total number of crimes per 100,000 inhabitants. Crime rates from 2011 to 2018 were gathered for each state from the Federal Bureau of Investigation (2019). The independent variable, or main explanatory variable, being observed is the unemployment rate. The unemployment rates from 2011 to 2018 were acquired for each state from the United States Bureau of Labor Statistics (2021). The other independent (or control) variables of interest are percent of police officers in population, per capita personal income, and the imprisonment rate per state, again for all fifty states from 2011 to 2018. The percent of police officers in population was retrieved from the Federal Bureau of Investigation (2019). The per capita personal income level was gathered from the United States Bureau of Economic Analysis (2019). Lastly, the imprisonment rate per state was acquired from the United States Bureau of Justice Statistics (2012). Table 1, shown below, includes a summary of the data for all five variables. The first column lists the five variables: crime, unemployment rate, percentage of police officers, per capita personal income, and imprisonment rate. The second column lists the number of observations for each variable, which happens to be 400 for every variable because data points were taken for each state over 8

years for all five variables. The third and fourth column lists the minimum and maximum data point for each variable. The fifth column lists the mean, where the mean for each variable can be described as

$$\mu = \frac{\text{sum of variable data points}}{400}$$

Lastly, the sixth column lists the standard deviation, where the standard deviation for each variable can be described as

$$\theta = \sqrt{\frac{\sum(x_i - \mu)^2}{400}}$$

Table 1: Summary of Variables

Variable	Number of Obs.	Minimum	Maximum	Mean	Standard Deviation
Crime	400	2843.4	9450.5	5842.43	1400.13
Unemployment	400	2.2	13.3	5.66	1.99
Police Officers	400	0.2	0.73	0.32	0.07
Personal Income	400	32163	76456	46743.81	8011.65
Imprisonment	400	120	893	386.7	142.5

To observe the relationship between unemployment rate and crime, a multiple regression analysis will be done over an ordinary least squares (OLS) regression model. The regression equation can be written as the following:

$$Crime_i = \beta_0 + \beta_1 * Urate_i + \beta_2 * Police_i + \beta_3 * Income_i + \beta_4 * Prison_i + u$$

Where $Crime_i$ is equal to the total number of crimes per 100,000 inhabitants in state i, such that $Crime_i$=3,000 means 3,000 crimes per 100,000 people in state i. $Urate_i$ is equal to the unemployment rate for state i, such that $Urate_i$=2.2 means that the state i has a unemployment rate of 2.2%. $Police_i$ is equal to the percent of police officers in the population in state i, such that $Police_i$=0.1 means that 10% of the population is police officers. $Income_i$ is equal to the per capita personal income (i.e. the personal income level of a state divided by the states population) in dollars for state i, such that $Income_i$=52,000 means that $\$52,000$ is the per capita personal income in state i. $Prison_i$ is equal to the imprisonment rate in state i per 100,000 inhabitants, such that $Prison_i$=120 means that 120 per 100,000 residents were imprisoned in state i. Lastly, the u is the unobservables which represents all the other factors that affect crime besides what is represented in the equation.

This data is a collection is a collection over eight years from fifty different states. Since different states have different populations and demographics it is necessary to include other variables besides the unemployment rate to help eliminate biases. In states with higher population, it would be expected that there would be a higher percentage of police and therefore a higher crime rate. This would be assumed since a higher percentage of police officers should be

able to catch more criminal activities than that of a state with a lower percentage of police officers, thus leading to β_2 (i.e. the coefficient of $Police_i$) to be positive. Therefore by including $Police_i$, the bias of larger crime numbers in higher populated areas can be omitted. It is also expected that states with a higher per capita personal income level would have lower crime rates. This would be expected because people with lower incomes become more desperate for money and therefore more willing to commit crimes, meaning that β_3 (i.e. the coefficient of $Income_i$) would be negative. Therefore by including $Income_i$, this bias can be eliminated. Lastly, states that have a higher imprisonment rate have a higher deterrence factor of citizens committing crimes, therefore $Prison_i$ needs to be included so that this bias can be omitted. We would expect a higher imprisonment rate to decrease crime and so β_4 (i.e. the coefficient of $Prison_i$ would have a negative coefficient.

The goal of this research is to determine whether unemployment has an effect on the number of crimes in the state. The first step to determining this is computing an F test to see if there is a linear relationship between crime and any of the predictors (i.e. β_i) Therefore, our null hypothesis is

$$H_o : \beta_1 = \beta_2 = \beta_3 = \beta_4 = 0$$

And our alternative hypothesis is

$$H_a : \beta_i \neq 0 \text{ for } i = 1, 2, 3, 4$$

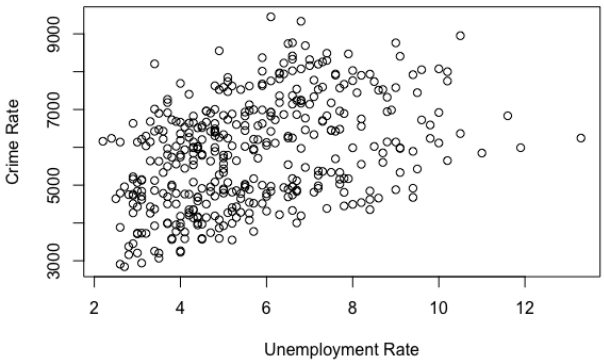
The F statistic can be written as

$$F = \frac{(RSS_r - RSS_{ur})/q}{RSS_{ur}/(n-k-1)}$$

Then using this equation, one would reject the null hypothesis at the five percent level if the computed value of the F statistic exceeds 2.76. This would then imply that the Xs under restrictions are jointly statistically significant.

4 Empirical Results

To first observe the data, the scatter plot shown below shows unemployment rate (x), versus the total number of crimes per 100,000 inhabitants (y).



Looking at the plot above, there appears to be some positive linear relationship between unemployment rate and the number of crimes. Furthermore, we can look at the residual vs the fitted values scatter plot. This plot appears to show a linear relationship between crime and unemployment rates. As for the data points, they appear to be randomly distributed with no discernible non-linear trends which means the OLS regression is a good fit for a model.

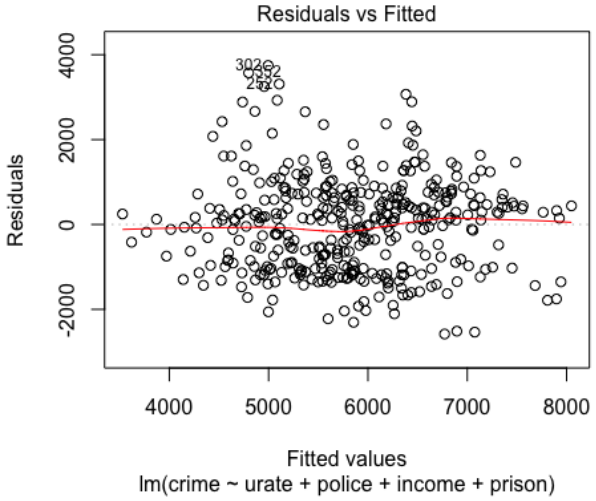


Table 2: Regression Results

Number of Crimes	(1)	(2)
Unemployment Rate	284.909***	145.997***
	(32.271)	(30.932)
Percent of Police Officers in Population		1,998.118**
		(935.117)
Per Capita Personal Income		−0.055***
		(0.009)
Imprisonment Rate		2.366***
		(0.497)
Constant	4,229.918***	6,014.145***
	(193.569)	(580.493)
Observations	400	400
R^2	0.164	0.378
Adjusted R^2	0.162	0.372
F Statistic	77.94	60.1
Note:		*p<0.1; **p<0.05; ***p<0.01

Table 2 summarizes the results of the linear regression model, where model (1) is

$$Crime = \beta_0 + \beta_1 * Urate_i + u$$

and model (2) is

$$Crime = \beta_0 + \beta_1 * Urate_i + \beta_2 * Police_i + \beta_3 * Income_i + \beta_4 * Prison_i + u$$

For model (2), the F-statistic value is 60.1 which is greater than 2.76 therefore we can reject the null hypothesis at the 5% level. This means that the probability of the null hypothesis being true is less than 5%. However, it is possible that the predictor variables are not significant and yet the F-statistic says that the predictor variables when combined are jointly significant. Therefore, we look at the adjusted R^2 value to see if there is a relationship between the number of crimes and unemployment rates while taking into consideration the number of coefficients added to the original model. The adjusted R^2 value for model (1) is 37.2%. Since this is a relatively low adjusted R^2 value, meaning that it is closer to 0 than it is 1, the model is deemed difficult to predict individual outcomes of unemployment rates on crime with much accuracy. However, this model is a better predictor than model (1), which had a R^2 value of 16.4%. Therefore we can conclude that the added predictors helped improve the model's ability to predict the number of crimes. Then looking further at the beta coefficients, we can determine the effect of a one unit increase in the predictor variables, leads to an approximately 2,146.327 increase in the number of crimes.

Looking at model (1) and model (2), the β_1 coefficients are different. In model (1) β_1 is equal to 284.9 and in model (2) β_1 is equal to 145.997. This

β_1 coefficient did decrease from model (1) to model (2), but it is still positive and statistically significant. Therefore when holding other variables constant, it can be seen that there is a positive linear relationship between unemployment rate and the number of crimes. However, even though we have shown there is a positive linear relationship between unemployment rate and the number of crimes, we have not shown that a higher unemployment rate causes an increase in the number of crimes.

To improve this study, other variables can be added to omit certain biases to get a more accurate result. For example, with the imprisonment variable, the beta coefficient was expected to be negative because a state with a higher imprisonment rate would have more of a deterrence for citizens to commit crimes. However, when computing the regression this beta coefficient turned out to be positive. Also, this regression had a relatively low adjusted R^2 value, so it would not predict individual outcomes with much accuracy. To try and fix this result, one could try a different regression model setup like a two-stage least regression analysis with an instrumental variable since we are dealing with panel data over different time.

5 Conclusion

In this study, the relationship between unemployment rate and crime in the United States between 2011 and 2018 was examined. This relationship is relevant because both unemployment and crime affect the citizens of the United States. Knowing the effect of unemployment rate on crime will further help the importance of keeping out economy to keep everyone safe. Therefore, the goal of this article was to determine the effect of unemployment rate on crime. The first step in this process was determining other variables that also affect crime. These variables, percentage of police officers, per capita personal income, and imprisonment rate, were selected to help omit biases when computing the regression analysis. Table 1 represented a statistical summary of these variables. Moving forward a multiple regression analysis was done over an ordinary least squares regression model. The results of this regression could be found in Table 2. To analyze these results an F-test was performed to determine if the beta coefficients were significant. In computing the F-test, the null hypothesis was rejected meaning that all of the beta coefficients were significant. The adjusted R^2 value was also observed to be relatively low, therefore the model was deemed difficult to predict individual outcomes of unemployment rates on crime with much accuracy. Overall, it can be seen that there is a positive linear relationship between unemployment rate and the number of crimes. These results can be improved even further by trying different models and including more variables to get a more accurate representation of the increase in crime when unemployment levels are increased. However, the most important finding was that there is a positive linear relationship between unemployment rates and crime.

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