

The Effect of Crime on Economic Growth in Oregon

Monica Yu

Supervisor: Caroline Weber

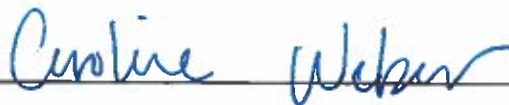
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ABSTRACT

The study evaluates the effect of different types of crime on economic growth. By using time series analysis over the period of 1976-2015 in nominal values and the period of 1987-2015 in real values, this research found that total crime has no significant effect on the long-run economic growth in Oregon.

Approved: _____



Professor Caroline Weber

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I. INTRODUCTION

The impact of crime on economic growth have long been discussed in the published literature and affected the decision-making of policy makers. While previous literatures typically focus on evaluating economic cost and crime control in the United States or a larger area, this study aims to contribute to local economic research and brings up the awareness of crime impact in the area. Although numerous research papers point out different views of crime on economic growth (see e.g. Goulas et al. (2012) , Detotto et al.(2010)), researchers have not found a clear relation in every region around the world. For example, in research conducted at Erasmus University within the European Union, Ojog found that crime has significant negative impact on economic growth during 2004-2012 (Ojog,2014). On the other hand, in a case study focusing on the crime and economic growth relationship in Italy, Dettoto & Otranto found that crime only has a small reduction or nearly no effect on the real GDP growth during 1979-2005.

Other literatures focusing on economic loss and crime are also part of the relevant sources in determining the impact of crime on economic growth (see e.g. McCollister et al. (2010) , Chalfin (2016)). Even though government spending on crime control can increase GDP, there is evidences in the literature that increased government spending can in fact decrease economic growth. For example, in Robert's article, he states "if we stipulate the extra government spending that is financed through higher taxes, this can destroy more private after-tax income than they raise in extra revenue" (Robert, 2014). This statement reveals an important fact that citizens can decrease consumption or investment when facing higher tax burden, which is the extra government spending allocated for crime control. This idea is also proved in Detotto's article that "criminal activity acts as a tax on entire economy and increase the burden of tax payer" (Detotto,2010). In addition to the above literatures, most research related to crime

control cost topic generally indicates that a large portion of government resources goes toward crime control (McCollister, 2010). In one of the extract of McCollister's paper points out "More than 23 million criminal offenses were committed in 2007, resulting in approximately \$15 billion in economic losses to the victims and \$179 billion in government expenditures on police protection, judicial and legal activities." In Detotto's article also found relevant articles points out that annual cost of criminal activity in United States accounts for 11.9% of GDP (Detotto et al., 2010). Since economic growth substantially relates to GDP growth and the increasing tax burden, the above literature leads to a hypothesis that criminal activity reduces the economic growth. However, whether or not Oregon crime has impact on economic growth is still not clear in published literature.

An approach to evaluate the impact of crime on economic growth is to regress GDP growth on the total volume of crime each year, controlling for different relevant explanatory variables. This method requires searching for relevant control variables and the deflator to account for inflation-adjusted GDP values over many years.

The dataset used in this research is from the following websites: U.S. Department of Justice, Uniform Crime Reporting statistics, the St Louis Fred statistics and other detailed information from the Bureau of Economic Analysis, U.S. Department of Commerce. Additionally, different types of crime are also presented in the websites, including violent crime, property crime, murder, forcible rape, robbery, aggravated assault, burglary, larceny theft and vehicle theft. This paper is expected to explain the magnitude of the impact of overall and various type of crime on economic growth in Oregon.

II. LITERATURE REVIEW

This section of the article presents the importance of the two determinants of economic growth and an overview of different aspects of the relationship between these two variables. Though there is no current research focusing on Oregon's crime impact on economic growth, the existing literature related to this topic provides a basic framework of completing this research. In order to evaluate the potential relationship between the two variables, this paper will present the research findings and the most important aspects will be developed into hypotheses at the end of this section.

2-1 Determinants of Economic Growth

The determinants of economic growth are crucial when evaluating the individual effect between crime and economic growth. Due to the fact that researchers considered determinants of economic growth exogenous to this economic model, this paper controls the effect of those determinants on growth while evaluating the relationship of crime and economic growth. The thesis proposes two variables, which is unemployment rate and personal income level where those determinants are correlated with crime and have an impact on economic growth. The reason for choosing these variables and the importance of each variable are presented below.

Unemployment Rate represents how much output loss depends on the labor supply. In the Investopedia website also explains "Unemployment rate is intended to tell us how much of a country's GDP may be lost when the unemployment rate is above its natural rate" (Investopedia, 2017). This explains the decline of GDP growth that affected by the level of unemployment rate. One of the public posts in WiseGeek emphasizes the relationship between unemployment rate and economic growth. The author indicates "If economic growth is to be sustained, the general level of employment must not fall below a determined level. The moment the level of

unemployment falls beyond the desired level, it becomes a determinant of economic growth” (WiseGeek, 2003). Therefore, we choose to include Unemployment rate as controlled variable in the article. Another determinant, *Income*, provides an index of the purchasing power of this area, which directly relates to the investment and the consumption of Oregon State. Because consumption is one of the GDP components, an increase consumption can lead to GDP growth eventually. This idea is proved in the article from New York Times where the author states “Economic growth begins with investment and ends with consumption spending” (Casey, 2013). Another recent report from Oregon Office of Economic analysis reveals “Oregon is outpacing the typical state by a considerable margin today for both job and income gains”(George et al., 2016). It is clear from the statement that Oregon’s economic growth exceed other states by a considerable income and job gains, which makes income tightly associated with economic growth. Therefore, since it is correlated with crime and also have an impact on economic growth, we include this variable as control variable. The study of how these two determinants affect crime is beyond the research of our topic. Through analyzing the relationship between the determinants and economic growth, this research can provide a more accurate way of evaluating the crime impact on economic growth.

2-2 Crime Impact on Economic Growth

Researches have attempted to step further by studying the relation between crime and economic growth but have not found a consistent result in the literature. A research study aimed to explain the relation between terrorism in 18 Western Europe countries and economic growth confirmed that terrorism attacks reduces foreign direct investment as investors seek for less violence-prone countries (Todd et al., 2008). They also observed that terrorism could increase the cost of doing business especially by increasing insurance premiums and higher salaries. In a

more direct way, terrorism can lower growth by impacting the key factors of trade, such as transportation, tourism and trade (Todd et al., 2008). Another research study focusing on Colombia's economic growth and crime relationship also reveals that crime has a negative impact on economic growth. The author indicates that the source of growth comes from the change in productivity loss which results from the increase of crime in drug-trafficking activities (Cardenas, 2007). The main mechanism of losing the productivity is when crime diverted capital and labor to unproduced activities (Cardenas, 2007). In a case study focusing on Italy's economic growth and crime relationship found strong evidence that the presence of organized crime is associated with low economic development, even after controlling for other economic and geographic factors (Peri, 2004).

In contrast to the previous studies, which reveal that crime has a negative effect on growth, there is literature showing an unclear relationship between two variables. For example, Goulas and Zervoyianni found that increasing crime has no negative effect on growth during favorable economic conditions, while crime will worsen the economic conditions by making their investment less secure during bad economic times (Goulas & Zervoyianni, 2012). Another research study conducted by American University explores the relationship between inner-city crime patterns and suburban income growth, using data of selected metropolitan areas of 32 states in United States. The findings suggest that only violent crime have a negative impact on close-in suburbs but nearly no effect farther away from the central city. This study concludes that overall crime does not have a relationship on economic growth (Ray et al., 2004). In one related research study focusing on Latin America, the evidence indicates that crime and corruption substantially reduce a firm's competitiveness (Gaviria, 2002), endangering growth prospects.

However, some research also indicates that there is no significant effect between two variables, which yield the same results with the research conducted within Oregon state area. For example, Mauro and Carmeci explore the links between crimes, unemployment and growth by using data during the period of 1963 to 1995 in 19 Italian regions. This research yields results that crime and unemployment rate does not have long-run economic growth effects in the exogenous model but have significant negative effects on income levels (Luciano and Gaetano, 2007). Another research done at Monash University analyzes the large cross-country data set to compare the determinants of crime and their effects on economic growth. This study specifically using IV estimation and reduces the significant effect between two variables. The author concludes that this study finds no evidences either between crime and growth rates or between corruption and growth rates (Luciano and Gaetano, 2007).

After taking into account the above arguments from different literature and the determinants of economic growth, two hypotheses are constructed based on the relationship between crime and economic growth in Oregon state area.

Hypothesis: Total Crime has a significant negative effect on economic growth in Oregon when we control for unemployment rate and income level.

In Ojog's case study in Italy analyzing the crime impact on economic growth indicates that taking only the total number of crimes including robberies, thefts , burglaries, rapes, assaults and completed international homicides will lead to an objective results (Ojog, 2014). Thus, this paper chooses to evaluate different types of crime impact on economic growth individually. The second hypothesis is presented below:

Hypothesis 2nd : Different types of crime have differential effects on economic growth.

III. DATA

In this section, we describe the variables used in the paper. This research uses Oregon GDP growth data from U.S. Bureau of Economic Analysis for 1976-2015 in nominal values and adjusts for inflation to calculate the real GDP values from 1987 to 2015 using the deflator from Bureau of Labor Statistics. According to the summary data in Table 1, this data set is composed of 39 observations for nominal GDP growth and 28 observations for real GDP growth.

3-1 The independent variables

The independent variable *Total Crime* is expressed as the natural logarithm of total amount of crimes recorded by the U.S. Department of Justice website. The reasons of using logarithm form and in per capita format is that this research proposed to reduce the fluctuations of this large number and also consider the population density while evaluating the relationship. Taking the natural logarithm will make the variable normally distributed, and in practice will decrease high outliers and allow the researchers to interpret using percentages. In one of the extracts in Kathryn's article also states "Different crimes generate different cost to society, thus using total crime will not be an accurate method in evaluating the relationship between crime and economic growth." As a result, we evaluate the impact of different types of crime on economic growth individually. The log of *Violent Crime*, *Property Crime*, *Murder*, *Forcible rape*, *Aggravated Assault*, *Burglary*, *Larceny Theft* and *Vehicle Theft* will be used as independent variables to evaluate this relationship. First of all, *Violent Crime* is defined as a crime in which an offender uses or threatens force upon a victim. *Property Crime* is explained as crimes against property, which divided into two groups: destroyed property and stolen property. When property is destroyed, it could be called arson or vandalism. *Murder* is expressed as unlawful killing of another human without justification or valid excuse. Another independent variable, *Forcible*

rape's definition is from FBI's Uniform Crime Reporting (UCR) Program is the carnal knowledge of a female forcibly against her will. For a more violent crime, *Aggravated assault*, is defined as a person is guilty of aggravated assault if he or she attempts to cause serious bodily injury. *Burglary* is explained as the unlawful entry into almost any structure (not just a home or business) with the intent to commit any crime inside (not just theft/larceny). *Larceny Theft* is defined as an unlawful taking, carrying, leading, or riding away of property from the possession or constructive possession of another from the U.S. Department of Justice Federal Bureau of Investigation. (FBI : UCR , 2010). On the other hand, the similar crime category, *Vehicle Theft* is explained as the theft or attempted theft of a motor vehicle. The above variables are considered crimes against a personal property or individuals. All the data on crime is expressed in units and retrieved from U.S. Department of Justice, Uniform Crime Reporting statistics. Because the research evaluates annual change effect of crime on economic growth, this is considered a short-run effect.

Additionally, control variable is a type of independent variable where we also put the variable on the right side of the regression. There are several determinants of economic growth, which is illustrated in previous research. We include two variables, *Unemployment rate* and *Income* as control variables to allow us to independently evaluate the impact of crime on economic growth. Description of each control variable is explained below:

Unemployment rate is expressed as annual percentage rate from the St Louis Fred statistics website while *Income* is expressed as logarithm of total Oregon state income divided by population.

3-2 The dependent variable

Economic growth expressed as GDP per capita growth is considered as the dependent variable in evaluating this relationship. GDP stands for Gross Domestic product and is defined as the monetary value of all the finished goods and services produced within a country's borders in a specific time period (Investopedia, 2014). GDP per capita growth is the annual percentage growth rate of GDP divided by the number of people in Oregon retrieved from U.S. Department of Justice, Uniform Crime Reporting statistics. This website is considered reliable because this department provides official data on crime in the United States, published by the Federal Bureau of Investigation (FBI) (Uniform Crime Reporting, 2015). This website provides crime data from 1960 to current, but due to the fact that unemployment rate has data only from 1976, we limit the data observation to 39 years in nominal values.

IV. METADODOLOGY

This paper intends to investigate the effect of crime on economic growth using time series methods. In order to analyze the relation between two variables, we build several models to evaluate the individual impact of crime on economic growth. The previous two hypotheses will be tested using the following models:

$$\mathit{EconGrowth}_t = \alpha + \beta_1 * \mathit{Total Crime}_t + \beta_2 * \mathit{Unemployment Rate}_t + \beta_3 * \mathit{Income}_t + e$$

The interpretation of each variable is stated below:

EconGrowth is expressed as logarithm of GDP per capita growth where we use the absolute value of GDP divided by population and put in logarithm format. *Total Crime* is explained as the natural logarithm of total crimes divided by population. *Unemployment rate* is expressed as the

annual percentage unemployment rate while *Income* variable is illustrated as

$\text{Log}(\text{Incomepercapita})$.

The sign and the coefficient β in the OLS regression model is specifically used to evaluate the relationship while the alpha represents the constant term. The indices for year are represented via t (1976-2015) and e being the error term. To ensure that the error term is not correlated with the crime rate, this research include two variables to avoid omitted variable bias. The two control variables, which mentioned in the previous paragraph, contains the unemployment rate and total personal income.

The second hypothesis where we test on different types of crime is going to be investigated using the same regression, but we will replace the logarithm of total crime with the logarithm of a particular type of crime.

V. RESULTS

The three tables are created to express the results of the relationship between two variables. First, Table 1 presents an interpretation list of different variables. Second, Table 2 examines the first hypothesis. The testing starts with a baseline regression, Model 1, where it can be observed that the relationship between Total Crime and Economic Growth has a coefficient of 0.05713 and is statistically significant at 1% significance level. Because the variable is the natural logarithm of *Total Crime*, a 1% increase in total crime leads to an increase of 5.7 percentage point increase in GDP per capita growth. Additional information is presented in the table where the R square is 0.18. In Model 2, this research evaluates the same regression and adds two determinants of economic growth: The unemployment rate and income level. The *Total Crime* variable become not statistically significant and has a β of 0.03. Next, Model 3 evaluates

the same regression, but calculate Newey-West Standard Errors to allow for autocorrelation. This is considered a more accurate model than the model 2 simply because it allows for autocorrelation. The last model in this table is Model 4, which includes both a linear and quadratic time trend to eliminate the change in GDP growth over time. Because the standard error of *Total Crime* in Model 4 is larger than in the Model 3, the Newey west regression of Model 3 is preferred to Model 4. Therefore, the preferred regression's interpretation is as follows: 1% increase in total crime leads to a 3.42 percentage point increase in GDP per capita growth and there is no significant relationship between two variables.

In Table 2, we follow the same regression type but all variables are in real values to adjust for inflation change. First, Model 5 contains only Total Crime and Economic Growth and the Model 6 uses the same regression and includes all the control variables. Second, Model 7 uses the Newey West regression and model 8 includes both linear and quadratic time variable. The results are similar to the first table but generate larger standard errors due to the shorter time span we can examine. Therefore, we choose Table 1 Column (3) as our preferred regression when evaluating the relationship between total Crime and economic growth.

In order to test the second hypothesis, different types of crime will be used in models 9 to 16. We use the preferred regression from above, but substitute in different types of crime. *Log (Violent Crime)*, *Log (Property Crime)*, *Log (Murder)*, *Log (Forcible rape)*, *Log (Aggravated Assault)*, *Log (Burglary)*, *Log (Larceny Theft)*, *Log (Vehicle Theft)* will be used respectively as independent variables to evaluate the relationship. The results of these model shows that different types of crime do not have statistically significant impact on economic growth. However, one crime category, *Vehicle Theft* is statistically significant at 5% level where it has a coefficient of 0.063 and P value of 0.011. The possible interpretation is that with more economic

growth, there will be more rich cars in Oregon state and will possibly lead to more vehicle theft in the area. This suggests reverse casualty because it is economic growth that leads to crime and does not represent the caused effect of vehicle theft on GDP growth per capita.

VII. LIMITATIONS

Limitations of the research illustrate space for further improvement in investigating the effect of crime on economic growth. The first limitation is this research only presents short-run change, which is the annual change of crime impact on economic growth. Although the study contains a larger dataset of 39 observations, it did not consider the long-run change, such as 5-year change or 10-year change, to account for long-run crime impact on economic growth. The second limitation is the amount of determinants used when investigating this research topic. Because it is not yet clear which determinants have to be used in order to present the accurate impact of crime on economic growth, personal income and unemployment rate are considered as the determinants. These two determinants are the most relevant when evaluating the relationship. The third limitation will be the expression format of *Total Crime* variable in the research. This topic did not use the absolute value of total crime to evaluate the relationship, instead, total crime is expressed as absolute value of total crime divided by the population. This limitation can contain small errors if population have a large relationship with crime. However, in order to consider the population density effect of crime impact on economic growth, we decided to use total crime in per capita format. The fourth limitation will be the types of crime analyzed. On the U.S. Department of Justice, Uniform Crime Reporting statistics website, the data only contains eight categories, which include *Violent Crime, Property Crime, Murder, Forcible rape, Aggravated Assault, Burglary, Larceny Theft, Vehicle Theft* but left out important categories

such as Homicide, Fraud, and drug offenses. By investigating boarder types of crime, a more accurate analysis of the impact of crime on economic growth might be done.

VI. CONCLUSIONS

This research concludes that there is no statistically significant effect of crime on economic growth in the Oregon state area between 1974 and 2015. The results fail to support the hypothesis that total crime has statistically significant negative effect on economic growth when we control for unemployment rate and income level. However, even if crime does not have a statistically significant effect on economic growth, the results also contribute to the Oregon area showing that crime does not drive out economic growth in Oregon. Researchers can exclude crime as a force to decrease economic growth in Oregon when doing investigation in the future. The result also fails to support the second hypothesis that different types of crime has a statistically significant negative impact on economic growth. Although vehicle crime did impact economic growth (Coefficient of 0.06369), it has a reverse casualty issue, which makes it an inaccurate reflection of the impact on economic growth.

The aim of this thesis was to explain the effect of crime on economic growth with various types of crime. The findings from the regression analysis suggest that different types of crime do not have statistically significant effects on economic growth, but in general, they have a small effect (coefficient less than 0.1). The biggest effect on economic growth is vehicle theft (Coefficient of 0.063), followed by property crime (Coefficient of 0.03214) and aggregate assault (Coefficient of 0.02695).

VIII. APPENDIX

Table 1: Summary of the variables

VARIABLES	(1) N	(2) mean	(3) sd	(4) min	(5) max
NGDPgrowthpercapita	39	0.00117	0.00108	-0.00118	0.00383
Real GDPgrowth percapita	28	0.000642	0.00157	-0.00252	0.00371
Year	40	1,996	11.69	1,976	2,015
TotalCrime	40	330,035	45,464	249,496	412,346
unem	40	7.280	1.874	4.900	11.60
Nominal income	40	8.107e+07	4.750e+07	1.668e+07	1.764e+08
Population	40	3.186e+06	519,818	2.329e+06	4.029e+06
Crimepercapita	40	0.108	0.0258	0.0640	0.142
Real incomepercapita	40	23.73	10.82	7.163	43.78
Violent	40	12,459	2,154	9,536	16,408
Property	40	152,575	21,083	114,780	189,765
Murder	40	109.1	26.87	68	178
ForcibleRape	40	1,222	152.9	829	1,580
Robbery	40	3,521	989.1	2,146	5,555
Aggravatedassult	40	7,574	1,346	5,596	10,638
Burglary	40	33,346	10,569	18,336	53,062
LarcenyTheft	40	106,032	13,848	83,306	136,129
VehicleTheft	40	13,197	4,075	7,926	22,050
Deflator	29	179.6	39.68	110.9	244.2

Table 2 : The effects of Crime on Nominal GDP per capita growth

VARIABLES	(1) model1 logNgrowthpercap	(2) model2 logNgrowthpercap	(3) model3 logNgrowthpercap	(4) model4 logNgrowthpercap
logcrimepercap	0.05713*** (0.01944)	0.03425 (0.04127)	0.03425 (0.04296)	0.05115 (0.07009)
Total unemployment rate		-0.00017 (0.00347)	-0.00017 (0.00350)	-0.00574* (0.00310)
logincomepercap		-0.01425 (0.02204)	-0.01425 (0.02419)	-0.79393*** (0.17860)
t				0.05484*** (0.01305)
t2				-0.00053*** (0.00015)
Constant	0.17583*** (0.04414)	0.16882*** ^a (0.04713)	0.16882*** (0.04841)	1.82371*** (0.39782)
Observations	39	39	39	39
R-squared	0.17539	0.19042		0.44083

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 3: The Effect of Crime on Real GDP per capita Growth

VARIABLES	(1) Model5 loggrowthpercap	(2) Model6 loggrowthpercap	(3) Model7 loggrowthpercap	(4) Model8 loggrowthpercap
logcrimepercap	0.03746 (0.02330)	0.10270 (0.07103)	0.10270 (0.06898)	0.11894 (0.07762)
Total unemployment rate		0.00745 (0.00590)	0.00745 (0.00576)	-0.00638 (0.00859)
logrealincomepercap		0.13825 (0.18527)	0.13825 (0.17564)	-0.97937** (0.38733)
t1				0.02489***
t2				(0.00854)
Constant	0.10162* (0.05471)	-0.29994 (0.55065)	-0.29994 (0.51918)	-0.00026* (0.00014)
Observations	28	28	28	28
R-squared	0.08481	0.14322		0.34750

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 4: The Effect of Different Types of Crime on Nominal GDP per capita Growth

VARIABLES	(1) Model9 logNgrowthpercap logNgrowthpercap	(2) model10 logNgrowthpercap	(3) model11 logNgrowthpercap	(4) model12
logviolentpercap	0.02061 (0.03694)			
Total unemployment rate	-0.00057 (0.00330)	-0.00035 (0.00345)	-0.00128 (0.00300)	-0.00134 (0.00310)
logincomepercap	-0.01845 (0.02455)	-0.01544 (0.02357)	-0.02041 (0.02220)	-0.02646* (0.01497)
logpropertypercap		0.03214 (0.04313)		
logmurderpercap			0.01358 (0.02804)	
logforcible rape				0.01053 (0.02846)
Constant	0.22155 (0.13437)	0.19393** (0.07193)	0.25840 (0.23069)	0.22014 (0.19270)
Observations	39	39	39	39

Standard errors in parentheses
 *** p<0.01, ** p<0.05, * p<0.1

Table 4: The Effect of Different Types of Crime on Nominal GDP per capita Growth-Continued

VARIABLES	(1) model13 logNgrowthpercap	(2) model14 logNgrowthpercap	(3) model15 logNgrowthpercap	(4) model16 logNgrowthpercap
logaggravatedassault	0.02695 (0.03891)			
Total unemployment rate	0.00014 (0.00345)	-0.00151 (0.00318)	-0.00063 (0.00339)	0.00578 (0.00368)
logincomepercap	-0.01591 (0.02457)	-0.02423 (0.02916)	-0.02096 (0.01916)	-0.01883 (0.01175)
logburglarypercap		0.00552 (0.02847)		
loglarcencypercap			0.02598 (0.04403)	
logvehicleteftpercap				0.06369** (0.02358)
Constant	0.25729 (0.16063)	0.15718** (0.06072)	0.20354* (0.10307)	0.41297*** (0.10556)
Observations	39	39	39	39

Standard errors in parentheses
 *** n<0.01. ** n<0.05. * n<0.1

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