Identifying the Relationship Between Crime and Unemployment in United States for the Period 1985-2022

Horoja Sambou

Submitted to the
Institute of Graduate Studies and Research
in partial fulfillment of the requirements for the degree of

Master of Science
in
Economics

Eastern Mediterranean University
January 2024
Gazimağusa, North Cyprus

Approval of the Institute of Graduate Studies and Research

Prof. Dr. Ali Hakan Ulusoy
Director

I certify that this thesis satisfies all the requirements as a thesis for the degree of Master of Science in Economics.

Prof. Dr. Vedat Yorucu
Chair, Department of Economics

We certify that we have read this thesis and that in our opinion it is fully adequate in scope and quality as a thesis for the degree of Master of Science in Economics.

Asst. Prof. Dr. Yenal Süreç
Supervisor

Examining Committee

1. Assoc. Prof. Dr. Çağay Coşkuner

2. Assoc. Prof. Dr. Demet Beton Kalmaz

3. Asst. Prof. Dr. Yenal Süreç

ABSTRACT

This research paper explored the connection between unemployment and property crime in United States utilizing annual time series data ranging from 1985 to 2022.The other explanatory variables such as poverty rate, real minimum wage was used along with unemployment to analyze their impact on property crime rates. The study adapted the autoregressive distributed lag cointegration (ARDL) method to test the hypothesis of long-term relationship between unemployment and property crime. The results obtained from this study were also supported by the economic theory of crime which revealed that an increase in unemployment rate will increase the rate of property crime. The ARDL method used revealed that there exists a long run relationship between property crime and unemployment. The study also employed different unit root test approaches such as ADF (Augmented Dickey-Fuller), PP (Phillips-Perron) and KPSS (Kwiatkowski-Phillips-Schmidt-Shin) to check for robustness in the results. The results obtained from the unit roots test showed that the variables are stationary at different order of integration I (0) and I (1). The model of this study was also free from autocorrelation and heteroskedasticity problems. The error correction model (ECM) demonstrated the speed of adjustment of the model when it is disequilibrium in the short run to the long run equilibrium. The ECM result showed that there is a speed of adjustment of about 60%.

Keywords: Property Crime, Unemployment, ARDL Model, Time Series Data

ÖZ

Bu çalışma, 1985-2022 yılları arası verileri kullanarak Amerika Birleşik Devletlerinde işsizlik ile mülke karşı işlenen suçlar arasındaki ilişkiyi analiz etmektedir. İşsizlikle birlikte yoksulluk oranı ve reel asgari ücret seviyesi de mülke karşı işlenen suçlar da açıklayıcı değişken olarak kullanılmıştır. Çalışmada işsizlik ve suç arasında uzun dönemli ilişki bulunduğu hipotezini test etmek için otoregresif dağıtılmış gecikme eşbütünleşme (ARDL) yöntemi kullanıldı. Çalışmada elde edilen sonuçlar, iktisadi teoride açıklandığı şekilde işsizlik oranının arttıkça mülke karşı işlenen suçların da arttığı tezini doğrulamaktadır. ARDL yöntemine göre işsizlik ile mülke karşı işlenen suçlar arasında uzun dönemli bulunduğu görülmüştür. Ayrıca çalışmada, elde edilen parametre tahminlerinin sağlamlığını test etmek amacıyla ADF (Augmented Dickey-Fuller), PP (Phillips-Perron) ve KPSS (Kwiatkowski-Phillips-Schmidt-Shin) gibi farklı birim kök testleri kullanılmıştır. Farklı birim kök testlerinden elde edilen sonuçlar göstermiştir ki, modelde kullanılan değişkenler I(0) ve I(1) farklı entegrasyon derecelerinde de durağandırlar. Çalışmada kullanılan model otokorelasyondan ve değişen varyans sorunundan arındırılmıştır. Hata düzeltme modeli (ECM) de kullanılan modelin kısa vadedeki dengesizlik halinden uzun dönemde dengeye uyumlaşma hızını da göstermiştir. Hata düzeltme modeli uyumlaşma hızı %60 olarak hesaplanmıştır.

Anahtar Sözcükler: Mülke Karşı İşlenen Suçlar, İşsizlik, ARDL Modeli, Zaman Serisi Verileri

DEDICATION

To my late baby sister, Yassin Sambou

(May Jannatul Firdaus be your final abode).

24/12/2012

ACKNOWLEDGMENT

I will like extend my sincere gratitude and appreciation to my supervisor, Yrd. Doç. Dr. Yenal Süreç for the priceless guidance, support, and encouragement he gave me throughout my thesis journey. My sincere gratitude also goes to my parents, Mr. Ebrima Sambou and Mrs. Mariama Kujabi for their constant support, advice and encouragement throughout my academic studies. I am very thankful to my wonderful brother Momodou Lamin Sambou, who have worked tirelessly to see me through the completion of my studies. I will like to give special thank you to my partner who have supported me mentally and emotionally through this journey. Also, a big thank you to my friends and colleagues who continued to exceed my expectations.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF SYMBOLS AND ABBREVIATIONS

βs	Betas
ε	Error Term
2SLS	Two Stage Least Square
ADF	Augmented Dickey-Fuller Unit Root Test
ARDL	Autoregressive Distributed Lag
ECM	Error Correction Model
ECT	Error Correction Term
FBI	Federal Bureau of Investigation
H_0	Null Hypothesis
H_1	Alternative Hypothesis
I (0)	Integrated at Level
I (1)	Integrated at Order one
LM	Lagrange Multiplier
Ln	Natural Logarithm
MAX	Maximum Value
MIN	Minimum Value
NS	Non-Stationary
OLS	Ordinary Least Square
PCR	Property Crime
POV	Poverty
PP	Phillips-Perron
RMW	Real Minimum Wage
S	Stationary

UCR	Uniform Crime Report
UNEM	Unemployment
U.S.A	United States of America
VIF	Variance Inflation Factors

Chapter 1

INTRODUCTION

1.1 Research Background and Problem Statement

The purpose of this study was to reinvestigate the relationship between crime (mostly property crime) and unemployment. This hypothesis became a centre of debate for most pioneering economist since the work of Gary Becker (1968) who wrote about the economic approach of crime and punishment. Unemployment which is defined as the percentage of total workforce of people who are not employed but are willing to work. Unemployment is an economic condition that deteriorates the health of an economy and creates other economic or social challenges such as criminology. It is believed that an increase in unemployment rate is expected to increase the rate of crime most especially property crime. Moreover, when there is a high rate of unemployment, it also causes extra expenses (cost) to the government by paying unemployment benefits to the unemployed. Payment of unemployment benefits does not only affect the economy by increasing the cost to government but also it affects the productivity of the labour force as people will be motivate to not put efforts in their work. In previous studies such as Cantor and Land (1985) and Raphael and Ebmer (2001) focused on property crime and they support the hypothesis that unemployment has a positive impact on property crime.

Studies that support the findings in this research were Raphael and Ebmer (2001), who explored on the hypothesis of discovering the connection between crime and

unemployment using panel data ranging from 1971 to 1997. They used ordinary least square method (OLS) and two stage least square (2SLS) to run their regression model and the results they obtained showed that unemployment has very strong effect on property crime. Additionally, other studies such as Lin (2008) also reinvestigated on the study using U.S data from 1974 to 2000 and found supportive results to the hypothesis of unemployment having a positive effect on property crime. In his study, he obtained results using OLS regression method that conclude that ceteris paribus when unemployment rate grows by 1% property crime was expected to grow by 1.8%. In the study of Raphael and winter's, they used U.S data on 49 states between 1974 to 2004 and they also found unemployment to have a positive effect on property crime. The results obtained in their study revealed that a 1% increase in the rate of unemployment will eventually lead to 4% growth in property crime rate.

1.2 Aim and Objective of the Study

The aim and objective of this study is to inspect the link unemployment on property crime. The a priori expectation of this hypothesis is that unemployment is expected to affect property crime positively. Meaning an increase in unemployment must be followed by an increase in property crime. The study did not just aim to look into effect of unemployment on property crime alone but it also dealt with the impact of other variables such poverty rate and real minimum wage. Real minimum wage is wage per hour set officially by the government for the workers. Therefore, minimum wage is expected to have a negative effect on property crime in the long run as when the government increases the real minimum wage this is expected to make workers well off and not be motivated to involve in any form of criminal activities. On the other hand, poverty rate is also expected to have a positive effect on property crime as when the rate of poverty increases meaning there is low income in a family it motivates

people to involve in criminal activities such as property crime to earn some finances. It is stated that ceteris paribus a decline in an individual's income earnings through involuntary unemployment usually results in high criminal activities. The study also aimed to investigate both the short run and long run relationship of each of these variables with property crime.

1.3 Research Hypothesis/Methods

The purpose of the study is look in to the effect of unemployment on property crime therefore, main hypothesis of this research is stated as follows;

H_0: Unemployment has no positive effect on property crime

H_1: Unemployment has positive effect on property crime

In addition, the methodology employed in this study focused on the ARDL (autoregressive distributed lag) model. Secondary time series data was used for USA ranging between the period from 1985 to 2022. The data used were collected from the U.S Federal Bureau of Investigation, US Federal Bureau of Labour Statistics and World Bank 2023. For the co integration test, the study employed the error correction model (ECM) to test for the short run dynamic co integration and the autoregressive distributed lag model (ARDL) was used to test for the long run relationship between unemployment and property crime. Various methods of unit root approach were also conducted to compare the results obtained to avoid robustness in the model. The study employed the ADF (augmented-Dickey-Fuller) unit root test, PP(Phillips-Perron) unit root test and finally the KPSS (Kwiatkowski-Phillips-Schmidt-Shin) unit root test. Moreover, the study further looked in to the diagnostic and stability check of the regression model to see if there exist any form of autocorrelation, heteroskedasticity, multicollinearity problems.

Crime and unemployment are social and economics terminologies which both affect the society financially, socially and even psychologically. Crime in United States was increasing but according to FBI's report the rate of crime has been declining gradually. The results and conclusion along with the policy recommendations suggested at the end of this study will serve as a very guide for future studies. This study focused mostly using ARDL method which many studies failed to use.

1.4 Structure of the Study

The structure of the study is divided into five different chapters for easy navigation. In chapter one, it entails the introduction part of this study which dealt with objectives or aims of the study, significance, and the hypothesis methods used. In chapter two, it focused more on the literature review of unemployment and crime on previous studies to support the hypothesis statement of this study. Chapter three, is the most important chapter as it entails the methodology section discussing the methods employed to carry out this study successfully. In addition, chapter four represented the empirical results obtained using the methodology displayed in chapter three. Finally, chapter five focused on the concluding remarks of the study with policy recommendations for future studies.

The constraints and challenges faced during the period of this study involves determining or choosing the appropriate explanatory variable for the model to avoid multicollinearity. Without determining the relevant variable, it made the study difficult as most of the time it does not show the relationship in line with the literature of this topic. Some variables were having lagged years where there is no information of the data were given which was challenging. The availability of data with specific time frame were also not available which limited the study to use limited number of

observations. The other most important limitation on this study was that there were insufficient articles or journals on the topic that used times series data and ARDL model therefore it made the journey hectic. In order not to undermine this research many articles were utilized to compare the validity of the information.

Chapter 2

LITERATURE REVIEW

2.1 Introduction

This study is designed to reinvestigate the hypothesis of analyzing the relationship or effect between crime and unemployment for the United States for the period 1985-2022. Between the years 1993 to 1999, the United States experienced a huge decline in the rate of property crime for approximately 32% which happened simultaneously with the massive decline in unemployment rate at the time specified. Mostly, this chapter is going to further discuss on the literature of previous studies along with the methods used, the data employed, the variables and the concluding results obtained in their various studies. In addition, this chapter also contains some review on the theoretical framework or model developed by researchers such as Cantor and Land (1985). For simplicity, this part of the research is divided into sub sections including the literature review of the key terminologies Crime and Unemployment separately and then the literature on the effect of unemployment on crime rates most especially property crime for this study.

2.2 Theoretical Framework of Crime and Unemployment

For the past decades, a significant number of researchers tried to identify the study on the effect of unemployment on crime. In this study our main focus is going to be the effect that involuntary unemployment has on aggregate property crime such Burglary, motor vehicle theft, larceny and arson. Using time series data between 1985 to 2022 in United States we have looked into previous studies such as Raphael and Ebmer

(2001), Cantor and Land (1985) who mainly focused on identifying the relationship between crime and unemployment. Cantor and Land (1985) in their study developed the theoretical model through which economic activity such as unemployment could affect crime rate. The two main hypotheses they developed were: Criminal motivation and criminal activity opportunities. The motivational crime theory emphasizes on the impact of the changes in the economic constraints such as unemployment have on the offender's social strains. It simply means that people who are unemployed and facing financial constraints are most likely or motivated to involve in criminal activities when the incentives gain is greater than the cost such as punishment when caught.

On the other hand, the second hypothesis which is the criminal opportunities states that the opportunities to commit crimes are affected by the availability and liability of targets. It means that individuals are most likely to be at home than to be at work when the economic conditions starts to decline causing most people to be unemployed and therefore stays at home to guard their properties which will eventually reduce the opportunities of criminal activities. In summary the second hypothesis is also referred to as the guardianship theory.

2.2.1 Concepts and Definitions

Unemployment and crime are major issues to the health of an economy. Defining these terminologies will give a clear picture of the severity it has on a society. According to the U.S Federal Bureau of Labour Statistic unemployed are individuals who are currently not working for about four weeks during the survey reference week and are available and willing to work. Therefore, this shows that these individuals are unemployed involuntarily due to economic deterrence. For crime, it is categorized in two categories: property crime and violent crime. The former type of crime comprises

of different offenses such as burglary, motor vehicle theft, larceny and arson according to Federal Bureau of Investigation (FBI)'s Uniform Crime Report (UCR). Property crime are the type of offenses that usually involves the taking of victim's money or personal belongings like their properties without the use of force or violent threat. FBI's Uniform Crime Report included arson as an offense to property crime even though when such an offense is committed it uses force and destruction of property by setting it on fire which causes fear against the victims. The arson offense has a limited rate of participation, making the availability of the data to be limited as it is not mostly occurring. The latter category of crime which is violent crime includes offenses such as robbery, murder, rape and aggravated assault. According to FBI's Uniform Crime Report it defined violent crime as the type of offenses that usually involve the use of force or threats against the victims by putting them in distress and fear. The focus in this study is mainly analyzing the effect of labour market condition (unemployment) on property crime in the United States. Therefore, each of the four types of property crime offenses listed above will be define separately to unfold the meaning of each and what it entails.

FBI's Uniform Crime Report (UCR) Definitions

Larceny Theft: It can be defined as the illegal way of taking, or stealing away of the personal property or belonging from the possession of the owner with the intention of permanently depriving them of it. Larceny theft examples include bicycles, parts of a motor vehicle such as car batteries, shoplifting or even pick pocketing. All these examples are categorized as larceny theft as it does not involve the use of threat or force against the victims. Note that robbery is considered a violent crime according to UCR because robbery offenses are mostly confused with larceny. Robbery is also similar to larceny theft as it involves the taking of valuable properties from the

possession of their owners but the only difference is that it involves the use of weapons which puts victims in fear. According to UCR in 2019 the larceny theft accounted for about 73.4% of the total property crime reported in the United States.

Burglary: UCR definition of burglary is the illicit entrance of the victims' premises solely to commit theft or a felony. UCR states that for a crime to be categorized as a burglary offense then the need for force entry should not happen. There are different ways of entry: force entry, illicit entry and for a crime to be categorized as a burglary then it must have to be an unlawful or illicit entry into the property or building of the victim. In 2019 burglary is said to account for only 16.1% of the total property crime.

Motor-Vehicle Theft: It is simply defined as the taking away or theft of a person's motor vehicle. This type of offense happens when the offender break into a person's motor vehicle and drove away with it.

Arson: The act of willfully setting or attempting to set fire on a property or building with or without the aim to defraud. Most studies focused on the above types of property crime therefore we will on the aggregate property crime which included the arson crime in the data. Base on previous studies they have looked into the effect of unemployment on each of these three types of property crime namely Burglary, Motor vehicle theft and larceny as they are most used property crime. They suggested that arson is a small type of property crime which might cause inconsistency in the results obtained due to the unavailability of data on arson.

Finally, we are using property crime as proxy to crime and not violent crime and many studies had promising significant results for showing the relationship between unemployment and property crime to be positive. But in contrast the results found on violent crime seem to be insignificant or have a weak significance in showing the

relationship and mostly they are violent crime and found to be negatively related unemployment.

2.2.2. The Economics of Crime and Punishment (Becker) Model

Crime which is related to sociology does not have a universal definition attached to it. The sociology concept can be easily defined as an act of wrongful doing of an individual to harm or induce fear to thesis or her victims. Crime can simply be categorized into two: Property and Violent. According to FBI's uniform crime report they categories offenses such as burglary, larceny, motor vehicle theft and arson as property crime. Crimes considered as violent crime were aggravated assaults, rape, murder and homicide. The theory of economics of crime developed by Becker was the first seminal work presented to change the way that potential offenders think and make decisions to engaged in crimes.

2.3 Economics Theory of Crime (Gary Becker 1968; Ehrlich 1996)

Unemployment affects potential offender's decision by reducing the fear in them to engage in any criminal activity to generate income. Unemployment is not only harmful to the individual but to the economy of that county. As unemployment benefits is one of the sources of cost to unemployment in any society beside that there is other type of cost to unemployment which is property crime. Crime is also harmful to the society as it inflicts both monetary and psychological cost in the society by putting the victims or everyone in fear. Most empirical studies always aim at testing the economics theory of crime developed by the Gary Becker due to his seminal work. Ehrlich (1996) also contributed to the theory by mostly focusing on the cost side of criminology. The theory by Becker (1986) emphasized on the rational choices between the cost and benefit side of engaging into illegitimate work. He stated that potential lawbreaker simply takes that into consideration when making a decision to commit crimes. That

is to say they compare the expected benefits with the expected cost. When the expected benefit is greater than the expected cost of committing a crime cost (probability of getting caught and incarceration) including the opportunity cost of the legitimate work then the rate of crime is expected to rise. The economics theory of crime is only appropriate for property crime and not violent crime. He stated that as long as the offender's marginal benefit is greater than the marginal cost, they will commit the crime. Meaning that rational choices are said to be forward looking by the offenders and it is said to be consistent. Becker also stated that incentives play a role in motivating individuals to commit crime.

Besides that, unemployment also plays a role in inducing criminal behavior. Ceteris paribus, a decline in the rate of income of an individual through involuntary unemployment increase the incentive of the he or she to involve more into illegal activities.

2.4 Literature on Property Crime and Unemployment

It might come to the revelation that many studies on the consequences of unemployment on property crime had so many similarities. Different studies rely on different methods mostly panel data and different time frames as well. In a nutshell, this part of the study explores on the literature of the previous studies on the topic of this study which is examined the link connection between property crime and unemployment. Most of the papers reviewed supported the hypothesis of this study which states that unemployment has an effect on property crime. The results obtained in the empirical part of this paper shows that the effect on property crime is positive meaning an increase or growth in the rate of unemployment will also lead to the rise in the rate of property crime in the United State using time series data. This analysis at

least was able to cite five pioneering papers to compare their methodology, empirical studies with the methodology and empirical study of this study. Many studies were all having similar results and repeating the results obtained from previous literatures.

Raphael and Ebmer (2001), carried out a study on United States between 1971 to 1997 using panel data including states and year effect with time trends. OLS (Ordinary least square) and two-stage least square (2SLS) methods were applied in their research on seven different types of felony offenses. In order to avoid any robust result, they encountered using OLS estimation of omitted variable bias they used controlled demographic and economic variables. They also used the 2SLS method with the use of military contracts and exposure of oil shocks as instrument for unemployment to avoid robust estimated result and they discovered that unemployment has a strong positive effect on property crime which is in line with the economic crime theory of crime of Gary Becker. The study discovered unemployment to be positively related with property crime using 49 U.S state data (excluding Washington and D.C) ranging between 1974 to 2004.

Based on the results obtained by applying the OLS method, they discovered that there was a significant positive effect of unemployment on property crime. But the magnitude of the effect shows that when unemployment drops by 1% causes property crime to decline by 1.6% using OLS. The results derived from the 2SLS method exceeds the OLS results by double and it proved that unemployment have an effect on property crime with a magnitude effect ranging from 2.8% to 5% They found a change in the elasticity of property crime by a 5% simply translates that when unemployment rises by 1% we expect a rise in property crime by 5%. Finally, it was noted in their

study that the OLS results shows the strongest effect of unemployment on property crime.

In addition, Raphael and Ebmer (2001), also found a significant positive effect on the individual types of property crime such burglary, larceny and auto theft but they failed to find similar results on general crime rate (property and violent) because they failed to control for variables that downwardly puts crime rate down such as the consumption of alcohol and weapon possession. These were the reasons why their study failed at finding a strong effect on the aggregate crime but in general the study found a strong positive effect on property crime which is the focus of this study.

According to Cook and Zarkin (1985), they suggested factors that can empirically link unemployment to crime which they have categorized into four different categories. The first two categories are the legitimate employment and criminal opportunities. The former is to expand the rate of criminal activities when the opportunities of legitimate employment are limited. They stated that the latter increases crime rate as the incentives to commit crime becomes more attractive to offenders. Finally, the last two categories were the consumption of criminogenic good and responds to criminal justice.

These two categories are self-explained as the consumption of criminogenic goods such as drugs, alcohol mostly can lead to engaging into criminal activities mostly violent crimes. On the other hand, category of responds to justice suggested that when

there are more police or officers of the law around, that tend to reduce the crimes committed.

In the study of Edmark (2005), she studied the relationship between labor market condition and property crime in Sweden using fixed effect model estimation between the year 1988 to 1999. The study also included time and Swedish county data. She also carried out the study by including economic and demographic variables such as income, education etc. During the period of study chosen, Sweden experienced the worst economic crisis since the great depression. Sweden unemployment rate quadrupled from 2% to 10.4% during the first 5 years of the study and gradually decline to 6.4% in the last year. The study also found unemployment to have an impact on property crime positively. Mostly on property crimes such as burglary, car theft, bike theft.

Cantor and Land (1985) investigated the theoretical and empirical analysis on the linkage between unemployment and crime after the world war two in United Sates. They explored the effect with the use of annual time series data for seven crime offense including four violent crimes and three property crime which excluded arson because it was a rare case of crime. They have tested unemployment effect with two hypothesis they developed namely the criminal motivation effect and criminal opportunity effect. They also suggested that to account for a strong effect of unemployment on crime, studies have to include both these factors because when omitted can lead to inconsistent empirical results. Unemployment is considered as the summation of positive criminal motivation and negative criminal opportunity impact. Studies that focused only on the criminal motivational effect (which focus on likelihood of the offender to be motivated to commit a crime) fail to look at the victims or targets with

their properties. Cohen and Felson (1979) stated that when for a crime to happen their most be presence of both the victims and the criminals or offenders and finally there should be absence of guardianship which is also the called the criminal opportunity effect. The opportunity effect simply means that when victims are unemployed, it gives them the chance to stay home to guard their properties therefore reducing the opportunities of the lawbreaker to engage in criminal activities. In addition, the empirical results of their study show that there is a significant but small impact of unemployment on five out of the seven crime offense tested including all the property crimes which supports this research.

In the study of Ming-Jen Lin (2008) who also studied the relationship between unemployment and crime using US state panel data of 49 U.S states from 1974 to 2000. In his study he employed a 2SLS model to estimate his model and his main aim was to break the endogeneity between crime and unemployment suggesting that most studies focused on the average unemployment rates. In recent literature, they pointed out the appropriate measure of unemployment effect on crime is the use of average unemployment rate because of endogeneity. The results they acquired also supported the uncertainty of Raphael and Ebmer (2001) that 2SLS estimated results are twice the size of OLS results based on the omitted variable bias which therefore understate the unemployment effect on crime rates. The study mainly centered on property crime and their empirical results also was in line with the economic theory of crime. Under the 2SLS method, the results show that when unemployment rate goes up by 1% therefore it also causes property crime to between 4% to 6%. That shows the elasticity of the magnitude of unemployment effect. For the OLS method the results were that a 1% increase in unemployment can lead to 1.8% increase in property crime. Notice that the

results in the 2SLS is twice the size of the OLS results stated that unemployment serves as an important supply function of crime. In summary, Lin (2008) study also found a significant positive relationship between unemployment and property crime in United States using time series data between 1974 to 2000. Levitt (2001) argued that when a study uses panel data it should use instrumental variables as it is most preferable in identifying the impact unemployment cause on crime since the risk of omitted variables can cause bias when OLS is employed for the econometric estimations.

According Gary Becker (1968) who presented the model of economics theory of crime stated that a decline in labor market or unemployment will eventually lead to an increase in crime. The reason been because worsening opportunities in the legal employment sectors makes committing crimes more attractive. Simply he meant people commit crime when they are unemployed and the benefits, they gain from committing crime are actually higher than the cost which is been caught and punish therefore it makes it more attractive to commit crimes. According to Gary Becker's theory (crime and punishment) in an economic approach, he stated that criminals compare the cost and benefits of a crime before committing it. He added that individuals (criminals) have rational behavior that is they are more tempted to commit a crime when the benefits are higher than the cost (punishment such as incarceration).

Another study by Ajimotokin, Haskins and Wade (2015) on the effects of unemployment on crime rates in US and found an increase in unemployment also leads to an increase in crime rates. They also found that most of these crimes are highly committed by the majority of the population who live under poverty rate in U.S found to be 38.1%. They used two models simple and multiple regression models and the results they acquire shows that there is a positive correlation between unemployment

and crime rates for both property crime and violent crime with the simple regression model but a surprising negative result on property crime and a small insignificant relationship on violent crime using the multiple regression model. This was as result of the high correlation of the variable (Poverty rate) which made them to reject the null hypothesis.

In summary, studies that focused on property crime for different countries mostly United State have similar result which is unemployment rate have a positive effect on property crime. Studies such as (Lee (2006), Janko and Popli (2015), Greenberg (2001) Levitt (2001), Phillips and Land (2012) et al…).

Chapter 3

METHODOLOGY AND DATA

3.1 Introduction

This chapter described the methods and data used in this research study to analyze the relationship between unemployment and property crime in the United States by using secondary data. To obtain the principle aim of this study, a time series analysis data was employed between the years 1985 to 2022. The data collected were all in yearly basis because some of the data were not available in quarterly or monthly basis. Yearly basis data were also easier to run without any complications. The data for property crime was mainly collected from United States Federal Bureau of Investigation's (FBI) Uniform Crime Reports (UCR). The data series of poverty rates was obtained from World Bank 2023. The methodology used in this study to test the data collected were the unit root test which explains the stationarity of the variables in the model. A descriptive statistics analysis was also conducted to summarize descriptive statistical results of all the variables. In addition to all the test mentioned, a cointegration test was also employed to inspect for the presence of cointegration in the model variables. By using autoregressive distributed lag (ARDL) to show the long run relationship between the Dependent variable (Property crime) and independent variables (Unemployment, poverty rate and real minimum wage). This study main method used is the autoregressive distributed lag (ARDL) as it plays vital role in analyzing the changes in any economic condition both short run and long run.

3.2 Data Series and Sources

The following variables mentioned below are the main variables to be looked in to in this study. As the study is focusing on analyzing the effect or relationship between crime and unemployment. Aggregate property crimes which includes (burglary, larceny, motor vehicle theft and arson) were used to serve as proxy to crime rates. The study focused more on property crime than violent crime as the hypothesis or prior studies tend to find unemployment to have a positive effect on property crime than violent crime. Such results motivated this study to further look in to model to check for any discrepancies.

Property Crime: This category of crime includes (burglary, larceny, motor vehicle theft and arson) simply refers to the unlawful taking or stealing of personal belongings of other according to Uniform Crime Reports. Aggregate property crime was used as a proxy to crime rates in order to analyze the link between unemployment and crime. In previous studies such as Cantor and Land (1985) and Raphael and Ebmer (2001) focused on property crime and they support the hypothesis that unemployment has a positive impact on property crime. That is an increase in the rate of unemployment will increase property crime rates proportionally.

Unemployment Rate: It refers to the percentage of the total labour force who are not employed but are willing and looking for a job. There are different types of unemployment but in this study the data collected was based on the aggregate unemployment rate provides by the World Bank and the US Federal Bureau of Labour Statistics.

Poverty: It defines the percentage of citizens living on less than $6.85 daily at 2017 international prices.

Real Minimum Wage: Meaning the minimum wage after been adjusted for inflation in terms of good and services that an individual can purchase. According to the Bureau of labour Statistic, United States Department of Labour reported that the federal minimum wage in 2023 was forty percent 40% lower than the minimum wage in 1970. Real minimum wage was used instead of the nominal minimum wage in order not to account for the inflation at that particular year. Decreasing wages can cause a huge impact on crime which makes it an important determinant in this study. The table below shows the description and various sources of the data collected.

Table 1: Data Series and Sources

Variables	**Variable Codes**	**Unit of Measurement**	**Source**
Property Crime	PCR_t	Rate per 100,000 people per year	U.S Federal Bureau of Investigation
Unemployment	$UNEM_t$	Percentage of Labour force	US Federal Bureau of Labour Statistics
Poverty	POV_t	$6.85 a day (PPP 2017) (Percentage of Population)	World Bank 2023
Real Minimum Wage	RMW_t	Real U.S Dollars $	U.S Bureau of Labour Statistics

3.3 Model Specification

The a priori expectation of the relationship between property crime (PCR_t) and unemployment ($UNEM_t$) is positive meaning an increase in unemployment rate is expected to lead to an increase in property crime rate.

The functional representation of this research model is shown below;

$$PCR = f(UNEM, POV, RMW \quad (1)$$

In order to acquire homoscedasticity in this study all variables were transformed to logarithm form for easy interpretation of the result. The econometric form of the model is represented below as;

$$LnPCR_t = \beta_0 + \beta_1(LnUNEM_t) + \beta_2(LnPOV_t) + \beta_3(LnRWM_t) + U_t \quad (2)$$

Where, (PCR) is the aggregate property crime consisting; burglary, motor vehicle theft, larceny and arson. (UNEM) is the unemployment rate, (POV) is the Poverty headcount ratio of people living under $6.85 a day and finally (RMW) is the real minimum wage. Where β_0 indicates the intercept and β_1, β_2, β_3 are the slope coefficient parameters in the econometrics model. (Ut) is the error term which indicates the variables that are unaccounted for or not included in the model.

3.4 Methodology

In this section different methods were utilized to conduct the test on the model. The first test conducted was the unit roots test of all the variables to examine the presence of unit root or nonstationary, and to identify their order of stationarity. By using the three well know unit root test approaches such as Augmented Dickey-Fuller (ADF) Test, Phillips-Perron (PP) Test and Kwiatkowski-Phillips-Schmidt-Shin (KPSS) Test. These Three-unit root test approaches were adapted to compare the results obtained and to check the robustness of the results. Secondly, to test for the cointegration between the dependent variable (property crime) and explanatory variables (unemployment), Autoregressive Distributed Lag (ARDL) approach was adapted. To estimate the short run and long run effect or relationship between all variables Error Correction Model (ECM) was employed to determine the relationship. Finally, different diagnostic test approaches were also used to check for the stability of the variables such as, normality test, Ramsey Reset Test, Cusum test and Cusum of squares test.

3.4.1 Unit Root Tests Approach

It is essential to test for the stationarity of all the variables when carrying out a time series analysis, by using unit root test approaches such as ADF, PP and KPSS. Unit root test are carried out when we suspect that the time series variables are nonstationary

in a regression model. With time series, a variable is stationary if the mean, variance and covariance are constant over a period of time. When either one these (mean, variance and covariance) change with time or not constant then the variable will be non-stationary and that creates a spurious result. When a time series variable is non stationary, the F statistics, t statistics and Chi square statistics could not be utilized as it will result in a spurious result. The words unit root and nonstationary were used interchangeable in this context. The Dickey-Fuller Test hypothesis for unit root states that;

Null hypothesis: H_0: $\beta_1=0$ (Unit root or Nonstationary)

Alternative hypothesis: H_1: $\beta_1<0$ (Stationary).

3.4.1.1 Augmented Dickey-Fuller (ADF)Unit Root Test

The first unit root test approach that was used was the Augmented Dickey-Fuller (ADF) Test to test for the stationarity of the variables. The ADF unit root test is the adjusted model of the Dickey-Fuller unit root test which supposed that the error term U_t is not serially correlated. The ADF version assumed that when the Ut is serially correlated the test conducted is to augment the equation by adding the lagged values of the regressand variable ΔY_t. The Augmented Dickey-Fuller unit root test is to estimate the higher order of autoregressive by including a larger lagged length. Given the ADF unit root test estimate consist of the following regression:

$$\Delta Y_t = \beta_0 + \beta_1 t + \gamma Y_{t-1} + \sum_{h=1}^{\rho} \delta h \triangle Y_{t-1} + \varepsilon_t \quad (3)$$

Where $\beta_2 = \rho-1$.

The ADF test includes a constant trend term in the equation. The Null hypothesis states H_0: $\beta_1=0$ (Unit root or Nonstationary) and the alternative hypothesis states H_1: $\beta_1<0$

(Stationary). The decision rule states that when β_1 is less than 0 we can reject the reject the null hypothesis of nonstationary and conclude the variable is stationary.

3.4.1.2 Phillips-Perron (PP) Unit Root Test

Since the Dickey-Fuller (DF) Test suggest that the error term is serially uncorrelated and the modified version of DF which is the Augmented Dickey-Fuller (ADF)unit root test assumed that the error term is correlated by adding lagged terms to the dependent variable. The Phillips-Perron (PP) unit root test that uses nonparametric method is similar to ADF but the only difference is that the PP takes care of correlation of the error term without necessarily including lagged difference term to the dependent variable. The PP unit root test also states the same hypothesis testing for unit root;

H_0: $\rho=0$ (Unit root or nonstationary)

H_1: $\rho<0$ (Stationary)

If the test statistics is less than the critical value, the null hypothesis of nonstationary or unit root is rejected and the alternative hypothesis is accepted that the time series is stationary. The purpose of using both PP unit root test along with ADF unit root test was to examine any presence of robustness in the regression model.

3.4.2 Cointegration Test Approach

Following the completion of the unit root test, cointegration test approach was also conducted to predict the relationship between the dependent variable (property crime) and independent variables such as (Unemployment, poverty rate and real minimum wage) time series variable. When the error term is stationary then the unit root in the dependent variable (property crime) and independent variable(unemployment) have cancelled out and then they are said to be cointegrated. Autoregressive Distributed Lag Model (ARDL) bound test and error correction model were employed in this research

to conduct the cointegration showing both the long run and short run relationship between the variables respectively. When two or more of the time series variables are cointegrated then we can say that there is a long run relationship between the variables.

3.4.2.1 Error Correction Model (ECM)

The error correction model (ECM) is usually used when two time series variables are found to be cointegrated. Cointegration that exist between two or more time series variables can suggest that a long run equilibrium relationship exist between the variables. The Error correction model (ECM) estimates the short run dynamic relationship between the cointegrated time series variables. It also estimates the speed of adjustment when there is a disequilibrium in the short run to long run equilibrium. It simply means how fast the model can adjust from been in disequilibrium in the short run to long run equilibrium.

3.4.2.2 ARDL Bound Test Model

The bound test is used to estimate the existence of long run relationship between the dependent (property crime) and independent variable(unemployment). When a long run equilibrium is said to exist between the series, it indicates that the variables are cointegrated and cointegrated variables shows that there is absence of spurious regression among the regressand and regressors. The cointegration model is represented as;

$$Y_t = \beta_0 + \beta_1 X_t + \varepsilon_t \quad (4)$$

The hypothesis test cointegration is stated below;

H_0: There is no Cointegration

H_1: There is Cointegration

The cointegration hypothesis test states that the null hypothesis is rejected when the F-statistics is greater than both the lower I (0) and upper I (1) bound test and thus therefore there is cointegration in the model.

3.4.3 Diagnostic and Stability Test

The diagnostic test employed in this study was mainly used to check for the problems such as presence of heteroskedasticity, misspecification of the functional form and autocorrelation in our model. For Heteroskedasticity Breusch-Pagan-Godfrey test was used to check if there exist a problem of heteroskedasticity. Heteroskedasticity happens when the error term has no constant variance. The hypothesis for heteroskedasticity states that;

H_0: $\delta = 0$ (No heteroskedasticity)

H_1: $\delta \neq 0$ (There is heteroskedasticity problem)

The decision rule to reject or fail to reject the null hypothesis is when the p-chi square is greater or less than all significance levels. For autocorrelation, serial autocorrelation LM test was employed to test if the observations of the error term are correlated. The hypothesis statement for autocorrelation is similar to heteroskedasticity as well and its given as;

H_0: $\rho = 0$ (No autocorrelation)

H_1 $\rho \neq 0$ (There is autocorrelation problem)

The decision rule to reject or fail to reject the null hypothesis is when the p-chi square is greater or less than all level of significance. The tests employed to test for the stability diagnostic of the estimated regression were Ramsey reset test, cusum and cusum of squares and finally normality test. The main motive of the Ramsey reset test

was estimate if there was any misspecification (omitted variables) in the functional form of the model. The hypothesis test for the Ramsey reset test states that;

H_0: No omitted variables

H_1: There is omitted variable

The decision rule to reject the null hypothesis is when the p value is less than 5% significance level and therefore conclude there is no omitted variables or misspecification in the model.

For the stability diagnostic test, Cusum and Cusum of squares approaches were used to check for the stability of the parameters in the estimates. This simply means that, for the stability of the parameters it the line should lie between the upper and lower bound to be stable at 5% significance level.

Finally, the normality test was basically used to examine if the variables are normally distributed. The decision rule for normality test considers the estimated Jacque Bera. It states that when P value of the Jacque Bera is greater than the level of significance 5%, we can then conclude that the variables are normally distributed.

Chapter 4

RESULTS AND INTERPRETATIONS

4.1 Introduction

In this part of the study, the test results obtained from using the methods mentioned in the previous chapter were presented and interpreted in this chapter. First, the descriptive results of the variables are reported and interpreted below. Followed by the preliminary results which are the type plots of each of the variables. Unit root test and cointegration was also conducted and results were interpreted below as well.

4.2 Preliminary Results (Time Series Plots)

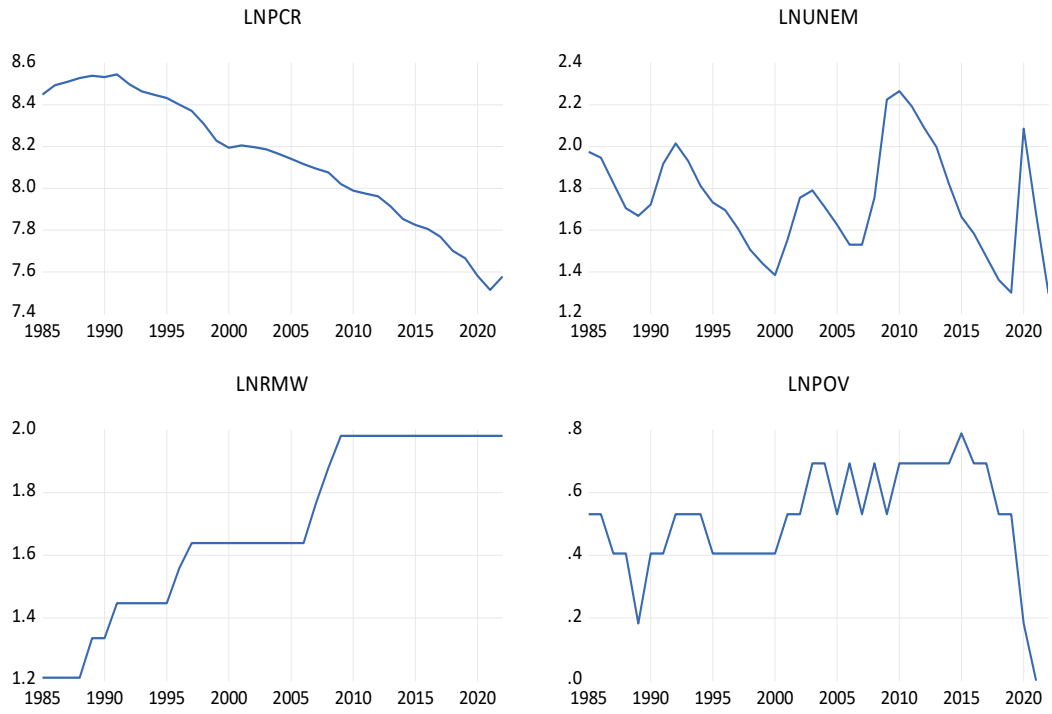

Figure 1: Time Series Plots

The figure above depicts the time series plots of the variables. From the time series plots we noticed that LNPCR series have a downward negative trend and LNRMW have an upward positive trend. While LNUNEM and LNPOV have no trend but they are stable.

4.3 Descriptive Statistics

The table below illustrates the estimated overall descriptive statistics of all the variables to explain how they are distributed. Our focus on the table will be based on the mean, median, maximum, minimum, standard deviation, skewness, kurtosis and Jacque-Bera.

Table 2: Descriptive Statistics

	PCR	**UNEM**	**POV**	**RMW**
Mean	8.153453	1.752980	0.518916	1.678040
Median	8.186242	1.722767	0.530628	1.638997
Maximum	8.544847	2.264883	0.788457	1.981001
Minimum	7.513327	1.300192	0.000000	1.208960
Std. Dev.	0.301491	0.244631	0.169378	0.271508
Skewness	-0.387543	0.281392	-0.885656	-0.263503
Kurtosis	2.090805	2.437827	3.997813	1.823466
Jarque-Bera	2.200567	0.975510	6.371977	2.562199
Probability	0.332777	0.614003	0.041337	0.277732
Sum	301.6778	64.86028	19.19991	62.08748
Sum Sq. Dev.	3.272290	2.154388	1.032797	2.653798
Observations	37	37	37	37

Source: Author's computation using E views 12

Interpretation

The computation of the mean, median and mode are the measures of central tendency (location) and the standard deviation measures the dispersion of our data from the mean. On the other hand, the kurtosis is used to measure the outlier of the distribution and skewness also measures the shape of the distribution if its asymmetric or symmetrical. Finally, Jacque-Bera measures the goodness of fit of our model.

From table 2, we noticed that PCR has both the highest Mean (8.153453), Median (8.186242), maximum (8.544847) and Minimum (7.513327). In summary PCR, POV and RMW computed mean values are less than their computed median values which shows a negative skewness of (-0.387543), (-0.885656) and (-0.263503) respectively. While UNEM calculated mean value is greater than the computed median value which demonstrates a positive skewness of (0.281392). The table also exhibits measures of the standard deviation of each of the series demonstrating the variation or dispersion of the data from their mean. For the kurtosis distribution it measures the outliers of the distribution to indicate how thick the tails of the distributions are. A positive kurtosis indicates that the distribution is at its highest, whereas a negative kurtosis indicates that the distribution is flatter than the normal distribution. When a kurtosis is said to be higher than three then it is said to have a heavier and thicker tail than the random variables. While when the kurtosis is below three then it is said to have a less weight on the tail than the normal random variable. From the above table the estimated kurtosis for PCR, UNEM and RMW are less than 3, which means that we can conclude that the tails of the distribution for those variables are less thick than the random variables. In the case of POV the estimated kurtosis is greater than 3 therefore the tail of the distribution is thicker and heavier than the random variable.

Finally, the Jacque Bera indicates the normality of the distribution or the goodness of fit and the hypothesis test states that; The null hypothesis (there is normal distribution) is rejected when the probability value is less than the 5% level of significance and conclude that there is no normal distribution. But when it is greater than 5% level of significance, we fail to reject the null hypothesis of (Normal distribution).

H_0: ρ < 5% (Normal distribution; H_0 is rejected)

H_1: ρ > 5% (No normal distribution; fail to reject H_0).

4.4 Summary of Empirical Results

This section reports the results of the different unit roots test approaches, cointegration test, diagnostics test, stability test results, error correction model and (ARDL) Autoregressive Distributed lag results of all the time series variables.

4.4.1 Unit Roots Test Approach

To test for the stationarity of each variable three different unit root test were employed in order to compare and check for robustness of the results obtained. ADF (Augmented Dickey Fuller), PP (Phillips- Perron) and KPSS (Kwiatkowski-Phillips-Schmidt-Shin) unit root tests were used.

Table 3 displays the results obtained by using the ADF unit root test approach. Whereas table 4 and table 5 expressed the results derived using PP and KPSS unit roots test approaches respectively.

Table 3: ADF (Augmented Dickey-Fuller) Unit Root Test

Forms	**Methods**	**$LNPCR_t$**	**$LNUNEM_t$**	**$LNPOV_t$**	**$LNRMW_t$**
Constant	At Level	0.5191	-2.4391	-1.5005	-1.6472
		(0.9850)	(0.1385)	(0.5213)	(0.4487)
Constant and Trend	At Level	-3.1968	-2.4599	0.6882	-2.0536
		(0.0403) **	(0.3449)	(0.9994)	(0.5531)
Remarks		**S**	**NS**	**NS**	**NS**
Constant	1_{st} Diff. Δ	-3.63631	-5.0485	-1.5620	-4.4622
		(0.0099) ***	(0.0002) ***	(0.0496) **	(0.0011) ***
Constant and Trend	1_{st} Diff. Δ	-3.5573	-4.9667	-1.8733	-4.61522
		(0.0486) **	(0.0015) ***	(0.6462)	(0.0038) ***
Remarks		**S**	**S**	**S**	**S**
Oder of Integration		I(0)	I(1)	I(1)	I(1)

Source: Self-computation using EViews 12

Note: where (*, **, ***) denotes 1%,5%,10% levels of significance respectively. The probability values (p-values) are in parenthesis (…). The abbreviation S (stationary) and NS (nonstationary).

Interpretation: Table 3

Table 3 presents the results obtained after conducting the unit root test for each of the time series variables in this model. The results revealed that the variables are all nonstationary at levels except for $LNPCR_t$ which was found to be stationary at levels. The rest of the variables such as $LNUNEM_t$, $LNPOV_t$, $LNRMW_t$ all became stationary after taking the first difference Δ of the series. According to the results in table 3, $LNUNEM_t$ and $LNPOV_t$ are both stationary at first difference Δ with constant (intercept only) while $LNPCR_t$ is stationary at levels with constant and trend. Meanwhile, $LNRMW_t$ is also stationary at first difference Δ but with constant and trend. Therefore we can conclude from these results using ADF method that the variables are integrated at order I(0) and I(1) at 5% level of significance meaning we have a mix order of integration which will permit us to use ARDL (Autoregressive Distributed Lag) model to check for long run cointegration between the variables.

Table 4: PP (Phillips-Perron) Unit Root Test

Forms	**Methods**	**$LNPCR_t$**	**$LNUNEM_t$**	**$LNPOV_t$**	**$LNRMW_t$**
Constant	At Level	1.4451	-2.5843	-0.9766	-1.4550
		(0.9988)	(0.1052)	(0.7511)	(0.5448)
Constant and Trend	At Level	-3.6357	-2.6211	-0.2124	-1.5234
		(0.0403) **	(0.2738)	(0.9903)	(0.8031)
Remarks		**S**	**NS**	**NS**	**NS**
Constant	1_{st} Diff. Δ	-3.2068	-5.0771	-7.1543	-4.4643
		(0.0278) **	(0.0002) ***	(0.0000) ***	(0.0011) ***
Constant and Trend	1_{st} Diff. Δ	-2.3729	-4.9678	-7.3787	-4.4819
		(0.3867)	(0.0015) ***	(0.0000) ***	(0.0054) ***
Remark		**S**	**S**	**S**	**S**
Oder of Integration		I(0)	I(1)	I(1)	I(1)

Source: Self-computation using EViews 12

Note: where (*, **, ***) denotes 1%,5%,10% levels of significance respectively. The probability values (p-value) are in parenthesis (…). The abbreviation S (stationary) and NS (nonstationary).

Interpretation: Table 3

The PP unit root test approach hypothesis test states that the null hypothesis has a unit root or is nonstationary and the alternative hypothesis is stationary. When the probability value is less than 5%, we reject the null hypothesis and series are said to be stationary. Whereas when the probability value is greater than 5%, we fail to reject null hypothesis of unit root and conclude series are nonstationary.

H_0: $\rho=0$ (Unit root or nonstationary)

H_1: $\rho<0$ (Stationary).

Therefore, from the results presented in table 3, it shows that the variables $LNUNEM_t$, $LNPOV_t$, and $LNRMW_t$ are all nonstationary or have a unit root at levels while the variable $LNPCR_t$ was stationary at level. The order of integration obtained using ADF unit root test is similar to the order of integration we obtain in the PP unit root test approach.

4.4.2 Cointegration Test Approach

Since all variables are stationary, it is then necessary to check for the cointegration between the time series variables. By using the Error Correction Model (ECM) to test for the short run dynamic cointegration relationships and the speed of adjustment from disequilibrium in the short run to long run equilibrium relationship. Then it was followed by employing the ARDL bound Test Model to test for the long run equilibrium relationship.

4.4.2.1 Error Correction Model (ECM)

The error correction model (ECM) is usually used when two time series variables are found to be cointegrated. Table 6 was obtained by the author's computation using EViews 12 to test for short run cointegration relationship.

Table 5: Short run cointegration relationship (ECM) estimates

Variables	Coefficients	Std. Error	t-Statistic	Prob.
ECT(-1)	-0.621164	0.023399	-6.930476	0.0000***
D(LNPCR(-1)	0.324200	0.142805	2.270221	0.0329**
D(LNPCR(-2)	-0.429518	0.136433	-3.148209	0.0045***
D(LNUNEM)	-0.008583	0.014965	-0.573538	0.0571**
D(LNPOV)	0.134342	0.024562	5.469558	0.0000***
D(LNPOV(-1)	0.049215	0.022784	2.160024	0.0414**
D(LMRMW)	0.122534	0.056492	2.169045	0.0407**
R-square	0.738574			
Durbin-Watson stat	2.079404			

Source: Self-computation using EViews 12

Note: where (*, **, ***) denotes 1%,5%,10% levels of significance respectively.

Interpretation:

The results from table 6 reveals that the error correction term ECT (-1) shows the speed of adjustment of short run disequilibrium to long run equilibrium relationship. Notice that all variables are statistically significant at 1%,5%,10% except for D(LNUMEM) which is significant at 1% and 5% levels of significance. The error correction term 0<ECT<-1 should always be a negative and less than 1. The ECT (-1) in this model -0.621164 which is also significant at all levels of significance. There is a fast speed of adjustment of about 62% when there is a disequilibrium in the short run to long run equilibrium. An increase in rate of UNEM will cause a decrease in PCR by an average of 0.008583% ceteris paribus. Whereas, ceteris paribus an increase in POV rate will lead to increase in PCR by average of 0.049215%. When RMW increases by 1-dollar ceteris paribus results in an increase in PCR by an average of 0.122534. The calculated R-square of about 74% shows that the model has a good fit and Durbin-Watson stat of 2.079404 also indicates that our model is not suffering from serial Autocorrelation problem.

4.4.2.2 ARDL Bound Test Model

The hypothesis test for long run cointegration is stated below;

H_0: No Cointegration

H_1: Cointegration

The cointegration hypothesis test states that the null hypothesis is rejected when the F-statistics is greater than both the lower I (0) and upper I (1) bound test.

Table 6: F-Bounds test and Long Run Relationship

Test Statistics	**Value**	**Signif.**	**I(0)**	**I(1)**
		Asymptotic n=1000		
F- statistics	8.183145	10%	2.37	3.20
k	3	5%	2.79	3.67
		2.5%	3.15	4.08
		1%	3.65	4.66
Actual Sample Size	34	Finite Sample: n=35		
		10%	2.618	3.532
		5%	3.164	4.194
		1%	4.428	5.816
Long Run Relationship				
Variables	Coefficients	Std. Error	t-Statistic	Prob.
LNUNEM	0.256751	0.085099	3.017092	0.0061***
LNPOV	0.272720	0.225270	1.210640	0.0238**
LNRMW	-1.433991	0.170272	-8.421769	0.0000***
C	9.801200	0.181799	53.91214	0.0000***

Source: Author's computation using E views 12

Interpretation

In table 7, the computed F-bound test of 8.183145 is greater than both the upper I(1) and lower I(0) bounds at all levels of significance (1%,5%,10%). The null hypothesis states that if the F-test figure is less than the upper and lower bound we fail to reject the null hypothesis and conclude there is no cointegration. In this case the F- test estimated figure is 8.183145 at 5% is greater than lower bound of 3.164 and upper bound of 4.194 therefore we conclude that there is a long run cointegration relationship.

The Long run relationship equation is given as:

$$LNPCR_t = 9.8012 + 0.2568(LNUNEM_t) + 0.2727(LNPOV_t) - 1.4340(LNRMW_t) \quad (4)$$

From the above estimates, we conclude that UNEM (unemployment) and PCR (property crime) have a positive long run relationship and they are also statistically significant at 5% level of significance. Meaning a 1% increase in UNEM will lead to a 0.2568% in PCR ceteris paribus. Whereas POV (Poverty rate) also have a positive relationship with PCR (property crime) and it is statistically significant at 5% significant level. It indicates that ceteris paribus an increase in POV by 1 % will lead to an increase in PCR by 0.2727%. On the other hand, RMW (real minimum wage) has a negative relationship with PCR (property crime) and it is found to be statistically significant at 5% significant level. This simply means that a rise in RMW by 1 dollar will results in a decrease in PCR by 1.4340.

4.4.3 Diagnostic and Stability Test

After the completion of the ARDL model estimation, we will then employ some residual diagnostic and stability test to verify whether the model is suffering from problems such as; serial autocorrelation, heteroskedasticity, normality test, multicollinearity. Followed by conducting the stability test which includes the functional misspecification test (Ramey reset), Cusum, and Cusum of Squares.

For Serial Autocorrelation:

The Breusch-Godfrey Serial Correlation Lagrange Multiplier Test was employed to check for autocorrelation and the results obtain are presented Table 8 below:

Table 7: Serial autocorrelation

Breusch-Godfrey Serial Correlation LM Test: Null hypothesis: No serial correlation at up to 2 lags			
F-statistic	0.179351	Prob. F(2,21)	0.8371
Obs*R-squared	0.571003	Prob. Chi-Square(2)	0.7516

Source: Author's self-computation using EViews 12

Interpretation

The hypothesis test of autocorrelation states that, when the Prob.Chi-Square is less than 5% level of significance we can reject the null hypothesis and therefore conclude that it shows the existence of serial autocorrelation. Whereas, when the Prob.Chi-Square is greater than 5% significance level, we fail to reject the null hypothesis and conclude that there is no serial autocorrelation in the regression. Serial autocorrelation test is conducted to check if the observations of the error term are correlated (There is serial autocorrelation) or if they are uncorrelated (No serial autocorrelation).

H_0: $\rho = 0$ (No serial autocorrelation)

H_1 $\rho \neq 0$ (There is serial autocorrelation problem)

Table 8 displays the results obtained from conducting a serial autocorrelation check using Breusch-Godfrey Serial Correlation LM Test. It reveals that our Probability Chi-Square of 0.7516 is greater than 5% significant level, which therefore concludes that we do not reject the null hypothesis. Thus, this shows that the regression model does not have serial autocorrelation problem.

For Heteroskedasticity Test:

The Breusch-Pagan-Godfrey test was employed to test for heteroskedasticity and results are shown below;

Table 8: Heteroskedasticity

Heteroskedasticity Test: Breusch-Pagan-Godfrey Null hypothesis: Homoskedasticity			
F-statistic	0.528773	Prob. F(10,23)	0.8522
Obs*R-squared	6.355508	Prob. Chi-Square (10)	0.7846
Scaled explained SS	2.580976	Prob. Chi-Square(10)	0.9896

Source: Author's self-computation using EViews 12

Interpretation

The hypothesis test for heteroskedasticity, states that:

H_0: $\delta = 0$ (No heteroskedasticity) meaning homoskedasticity: equal variance

H_1: $\delta \neq 0$ (There is heteroskedasticity problem)

The hypothesis states that we reject the null hypothesis when the Prob.Chi-Square is less than 5% level of significance and thus conclude there is a presence of heteroskedasticity problem. But when the Prob.Chi-Square is greater than 5% significance level we fail to reject the null hypothesis and conclude that our model is free from heteroskedasticity problem. The estimated Prob.Chi-Square of 0.7846 in table 9 is greater than 5% significance level we then fail to reject the null hypothesis and conclude that there is no heteroskedasticity problem in this regression model.

For Normality Test:

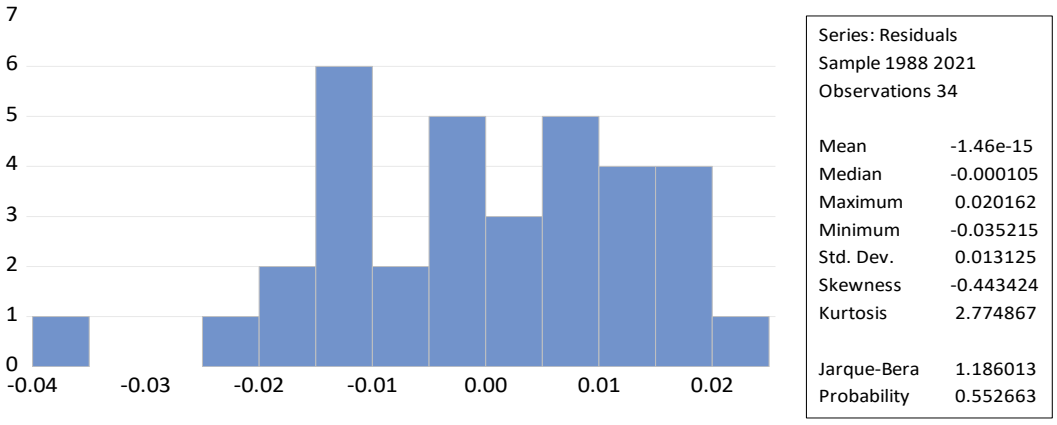

Figure 2: depicts the normality test results of our model estimates.

Interpretation

A normality test was to examine whether the residuals term is normally distributed. To interpret the results, we rely on the Jacque-Bera and its probability. When Jacque-Bera

and its probability figures are greater than 5% level of significance, we say the error term is normally distributed. But when the Probability and Jacque-Bera values are less than 5% significance level, then the residual value is not normally distributed. From the results obtained above, it shows that both Jacque-Bera (1.1860) and probability (0.5523) are greater than 5% level of significance thus we can conclude that error term or residual value of this econometric model are normally distributed.

For Multicollinearity:

We test for multicollinearity in a model to make sure we do not have a case where one or more of our independent variables are said to be strongly correlated to each other. We employed the VIF (Variance Inflation Factors) approach which states that when VIF is greater than 10 or 20 means that one or more of the explanatory variables are said to be highly correlated to each other. The table below shows the results obtained using the VIF:

Table 9: Multicollinearity test (VIF Approach)

Variables	Coefficient Variance	Uncentered VIF	Centered VIF
$LNUNEM_t$	0.006364	54.89095	1.020744
$LNPOV_t$	0.014870	12.17356	1.143404
$LNRMW_t$	0.005678	45.16649	1.121900
C	0.033471	92.20316	NA

Source: Author's self-computation using EViews 12

Interpretation

Table 9 displays the results obtained from EViews conducted to check for multicollinearity problem between the explanatory variables using VIF approach. From the results above it shows that the independent variables in this model are all free from multicollinearity, meaning they are not correlated with each other. Since the Centered VIF of all explanatory variables: LNUNEMt (1.020744), $LNPOV_t$

(1.143404) and $LNRMW_t$ (1.121900) are less than 10 therefore, we can conclude that the explanatory variables are not correlated with each other.

For Functional Misspecification:

Table 10: Test for omitted variables (Ramsey RESET Test)

Ramsey RESET Test			
Equation: UNTITLED			
Omitted Variables: Squares of fitted values			
Specification: LNPCR LNPCR(-1) LNPCR(-2) LNPCR(-3) LNUNEM LNUNEM(-1) LNRMW LNRMW(-1) LNPO(-1) LNPOV(-2) C			
	Value	df	Probability
t-statistic	0.782938	22	0.4420
F-statistic	0.612992	(1,22)	0.4420
Likelihood ratio	0.934393	1	0.3337
F- test summary:			
	Sum of Sq.	df	Mean Squares
Test SSR	0.000154	1	0.000154
Restricted SSR	0.005684	23	0.000247
Unrestricted SSR	0.005530	22	0.000251
LR test summary:			
	Value		
Restricted LogL	99.59451		
Unrestricted LogL	100.0617		

Source: Author's self-computation using EViews 12

Interpretation

Ramsey RESET Test was conducted in this study to check for any sign of functional misspecification such as omitted variables. The hypothesis test statement is given as:

H_0: No omitted variables

H_1: There is omitted variable

It states that when the Probability value of the F-statistic is greater than 5% level of significance, we fail to reject null hypothesis and conclude that there are no omitted variables in the regression model. But when the probability value of the F-statistic is less than 5% significance level, we can then reject null hypothesis and conclude we have omitted variables in this model. From the above estimation results obtained, it

reveals that the F-statistics probability value (0.4420) is greater than 5% significance level we then fail to reject the null hypothesis. Thus, we can therefore conclude that there are no omitted variables in this regression model.

For Cusum and Cusum of Squares: Stability Diagnostic Tests

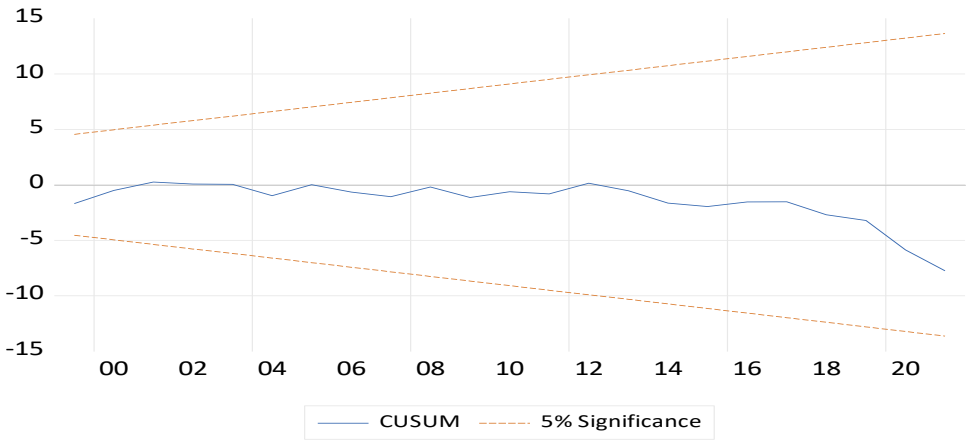

Figure 3: CUSUM Diagram

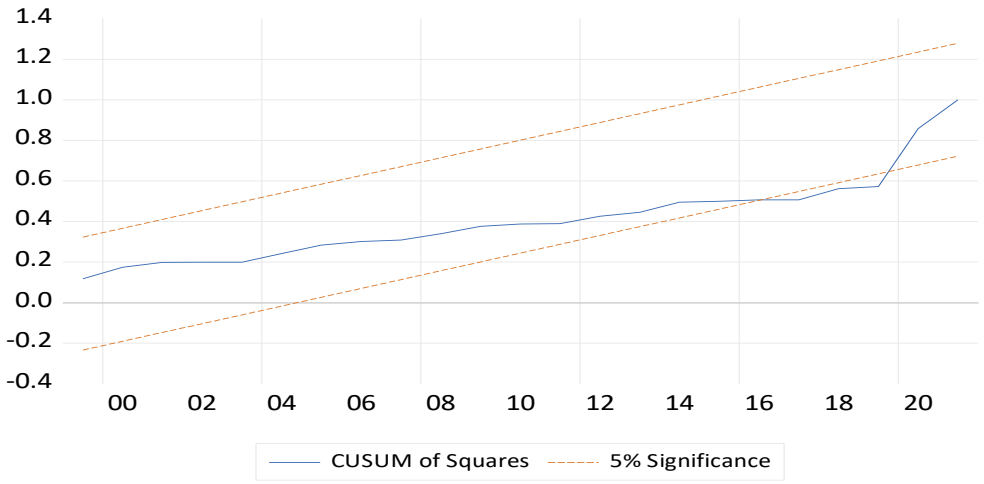

Figure 4: CUSUM of Squares

Interpretations

Figure 3 and 4 depicts the recursive estimations of the fitted model to check for stability of the parameters. CUSUM (Cumulative Sum) CUSUM of Square (Cumulative Sum of Squares) are test used to check for the stability. For the parameters

to be stable the blue dotted line must lie between the upper and lower bound (red dotted lines) at 5% significance level. Therefore, from the plotted graphs above, it reveals that both the CUSUM and CUSUM of Squares shows stability of the parameter as the blue dotted line lies between the lower and upper bound at 5% level of significance.

Chapter 5

CONCLUSION

This study entailed a combination of limited resources and literature but beside that the key findings obtained were satisfactory. Main aim of the study was to identify the relationship between crime and unemployment adapting the ARDL model. The objective was to find the relationship and analyze how significant will be the effect. The empirical studies of this literature show that unemployment certainly has a significant effect on crime most especially property crime. Using U.S.A time series data between the year 1985 to 2022, the study found a positive long run relationship between unemployment and property crime. The results reveal that the error correction term ECT (-1) which shows the speed of adjustment of short run disequilibrium to long run equilibrium relationship. Notice that all variables are statistically significant at 1%,5%,10% except for D(LNUMEM) which is not significant at all levels of significance. The error correction term 0<ECT<-1 should always be a negative and less than 1. The ECT (-1) in this model -0.62164 which is also significant at all levels of significance. There is a fast speed of adjustment of about 62% when there is a disequilibrium in the short run to long run equilibrium. An increase in rate of UNEM also caused a decrease in PCR by an average of 0.008583% ceteris paribus. Whereas, ceteris paribus an increase in POV rate leads to increase in PCR by average of 0.049215%. When RMW increases by 1-dollar ceteris paribus results in an increase in PCR by an average of 0.122534. The calculated R-square of about 74% shows that the

model has a good fit and Durbin-Watson stat of 2.079404 also indicates that our model is not suffering from serial Autocorrelation problem.

From the above estimates, we conclude that UNEM (unemployment) and PCR (property crime) have a positive long run relationship and they are also statistically significant at 5% level of significance. Meaning a 1% increase in UNEM will lead to a 0.2568% in PCR ceteris paribus. Whereas POV (Poverty rate) also have a positive relationship with PCR (property crime) and it is statistically significant at 5% significant level. It indicates that ceteris paribus an increase in POV by 1 % will lead to an increase in PCR by 0.2727%. On the other hand, RMW (real minimum wage) has a negative relationship with PCR (property crime) and it is found to be statistically significant at 5% significant level. This simply means that a rise in RMW by 1 dollar will results in a decrease in PCR by 1.4340. Breusch-Godfrey Serial Correlation LM Test also reveals that our Probability Chi-Square of 0.7516 is greater than 5% significant level, which therefore concludes that we do not reject the null hypothesis.

The hypothesis states that we reject the null hypothesis when the Prob.Chi-Square is less than 5% level of significance and thus conclude there is a presence of heteroskedasticity problem. But when the Prob.Chi-Square is greater than 5% significance level we fail to reject the null hypothesis and conclude that our model is free from heteroskedasticity problem. The estimated Prob.Chi-Square of 0.7846 in table 9 is greater than 5% significance level we then fail to reject the null hypothesis and conclude that there is no heteroskedasticity problem in this regression model.The hypothesis states that we reject the null hypothesis when the Prob.Chi-Square is less than 5% level of significance and thus conclude there is a presence of heteroskedasticity problem. But when the Prob.Chi-Square is greater than 5%

significance level we fail to reject the null hypothesis and conclude that our model is free from heteroskedasticity problem. The estimated Prob.Chi-Square of 0.7846 in table 9 is greater than 5% significance level we then fail to reject the null hypothesis and conclude that there is no heteroskedasticity problem in this regression model.

Following the findings and results achieved from this research recommend future studies to take into account of the following;

- The U.S.A government must first update and provide data for a large life span for future researchers to achieve a clearer empirical result.
- The US government must also use Labour intensive approach by using more of human labour than capital to decrease the unemployment rate.
- Financial benefits must also be encouraging to help both release prisoners and the unemployed with unemployment benefits.
- In order to also reduce the level of unemployment discrimination on the youths, race and even from employees must also be looked in to.

This research is not without any defect because there were significant restrictions with the available of adequate data necessary for running the regression model. The constrained and scarcity of yearly data needed to expand the time span of the study was hindered. Due to that reason the availability of the crime rate data for US started from the year 1985 to 2022, there was no data for previous year which restricted the study to expand the time frame to allow flexibility as the study employed time series data. Beside the scarcity of data, there were also limited studies that used time series data in their analysis which also made the study difficult as it has limited guidance.

REFERENCES

Ajimotokin, S., Haskins, A., & Wade, Z. (2015). The effects of unemployment on crime rates in the US. *B. Sc project, Georgia Institute of Technology*.

Andresen, M. A. (2013). Unemployment, business cycles, crime, and the Canadian provinces. *Journal of Criminal Justice*, *41*(4), 220-227.

Becker, G. S. (1968). Crime and punishment: An economic approach. *Journal of political economy*, *76*(2), 169-217.

Britt, C. L. (1994). Crime and Unemployment Among Youths in the United States, 1958-1990: A Time Series Analysis. *American Journal of Economics and Sociology*, *53*(1), 99-109.

Cantor, D., & Land, K. C. (1991). Exploring possible temporal relationships of unemployment and crime: A comment on Hale and Sabbagh. *Journal of Research in Crime and Delinquency*, *28*(4), 418-425.

Cantor, D., & Land, K. C. (2001). Unemployment and crime rate fluctuations: A comment on Greenberg. *Journal of Quantitative Criminology*, *17*, 329-342.

Cappell, C. L., & Sykes, G. (1991). Prison commitments, crime, and unemployment: A theoretical and empirical specification for the United States, 1933–1985. *Journal of Quantitative Criminology*, *7*, 155-199.

Chamlin, M. B., & Cochran, J. K. (2000). Unemployment, economic theory, and property crime: A note on measurement. *Journal of Quantitative Criminology, 16*, 443-455.

Cohen, L. E., Felson, M., & Land, K. C. (1980). Property crime rates in the United States: A macrodynamic analysis, 1947-1977; with ex ante forecasts for the mid-1980s. *American journal of sociology*, *86*(1), 90-118.

Cook, P. J., & Zarkin, G. A. (1985). Crime and the business cycle. *The Journal of Legal Studies*, *14*(1), 115-128.

Edmark, K. (2003). *The effects of unemployment on property crime: evidence from a period of unusually large swings in the business cycle* (No. 2003: 14). Working Paper.

Edmark, K. (2005). Unemployment and crime: Is there a connection? *Scandinavian Journal of Economics*, *107*(2), 353-373.

Entorf, H., & Sieger, P. (2014). Does the Link between Unemployment and Crime Depend on the Crime Level? A Quantile Regression Approach.

Fallahi, F., Pourtaghi, H., & Rodríguez, G. (2012). The unemployment rate, unemployment volatility, and crime. *International journal of social economics*, *39*(6), 440-448.

Fallahi, F., & Rodríguez, G. (2014). Link between unemployment and crime in the US: A Markov-Switching approach. *Social science research*, *45*, 33-45.

Gao, G., Liu, B., & Kouassi, I. (2017). The contemporaneous effect of unemployment on crime rates: the case of Indiana. *Southwestern Economic Review*, *44*, 99-107.

Gillani, S., Khan, R. E. A., & Rashid Gill, A. (2011). Unemployment and property crimes in Pakistan. *Asian Economic and Financial Review*, *1*(3), 124-133.

Greenberg, D. F. (2001). Time series analysis of crime rates. *Journal of quantitative criminology*, *17*, 291-327.

Janko, Z., & Popli, G. (2015). Examining the link between crime and unemployment: A time-series analysis for Canada. *Applied Economics*, *47*(37), 4007-4019.

Kilishi, A. A., Mobolaji, H. I., Usman, A., Yakubu, A. T., & Yaru, M. A. (2014). The effect of unemployment on crime in Nigeria: A panel data analysis. *British Journal of Economics, Management & Trade*, *4*(6), 880-895.

Lee, D. Y., & Holoviak, S. J. (2006). Unemployment and crime: an empirical investigation. *Applied Economics Letters*, *13*(12), 805-810.

Lin, M. J. (2008). Does unemployment increase crime?: Evidence from US Data 1974–2000. *Journal of Human resources*, *43*(2), 413-436.

Lester, B. Y. (1995). Property crime and unemployment: a new. *Applied Economics Letters*, *2*, 159-162.

Levitt, S. D. (2001). Alternative strategies for identifying the link between unemployment and crime. *Journal of quantitative criminology*, *17*, 377-390.

Maddah, M. (2013). An empirical analysis of the relationship between unemployment and theft crimes. *International Journal of Economics and Financial Issues*, *3*(1), 50-53.

Maddah, M. (2013). The effect of unemployment and income inequality on crimes, a time series analysis. *International Journal of Economics Research*, *4*(2), 37-42.

Papps, K., & Winkelmann, R. (1998). *Unemployment and crime: New answers to an old question* (No. 2008-2017-4911).

Paternoster, R., & Bushway, S. D. (2001). Theoretical and empirical work on the relationship between unemployment and crime. *Journal of Quantitative Criminology*, *17*, 391-407.

Phillips, J., & Land, K. C. (2012). The link between unemployment and crime rate fluctuations: An analysis at the county, state, and national levels. *Social science research*, *41*(3), 681-694.

Raphael, S., & Winter-Ebmer, R. (2001). Identifying the effect of unemployment on crime. *The journal of law and economics*, *44*(1), 259-283.

Schleimer, J. P., Pear, V. A., McCort, C. D., Shev, A. B., De Biasi, A., Tomsich, E., ... & Wintemute, G. J. (2022). Unemployment and crime in US cities during the coronavirus pandemic. *Journal of urban health*, *99*(1), 82-91.

Speziale, N. (2014). Does unemployment increase crime? Evidence from Italian provinces. *Applied Economics Letters*, *21*(15), 1083-1089.

Timbrell, M. (1990). Does unemployment lead to crime?. *Journal of interdisciplinary economics*, *3*(3), 223-242.