2011

Essays on the economics of crime

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ESSAYS ON THE ECONOMICS OF CRIME

A Dissertation

Submitted to the Graduate Faculty of the
Louisiana State University and
Agricultural and Mechanical College
in partial fulfillment of the
requirements for the degree of
Doctor in Philosophy

in

The Department of Economics

by

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August 2011

ACKNOWLEDGEMENTS

I am graduating with the Doctorate of Philosophy degree, and I have completed several research papers some of which are presented in this dissertation. However, none of these would have been possible without the help of very wonderful people.

First, I would like to thank my advisor, dissertation committee chair, mentor and life coach, Dr. Naci Mocan, for his patient guidance, for his continuous support and for the massive amount of resources he has invested on me. Without having him on my side, neither could I produce any high quality research, nor could I be as successful as I was in the job market. I owe him my right arm. In addition, I am indebted to Madeline Mocan for her advice on how to act in situations that require professional etiquette and formal dressing.

I also thank the other members of my dissertation committee, Dr. Kaj Gittings, Dr. Robert Newman and Dr. Bulent Unel for their advice on my research. They were as excited as I was throughout the process. In addition to the members of my dissertation committee, the faculty and at the Department of Economics in Louisiana State University provided excellent comments on my research.

Further, I extend my appreciation to my parents, Bekir and Selma Altindag, to my sister, Ulku Altindag, and to my aunt, Dr. Seher Sofuoglu for their love and inspiration, and mental and financial support they have provided. Fellow graduate students and the administrative staff in the Department of Economics at Louisiana State University always had a friendly attitude towards me. They have built a very collegial environment in which my research and personality prospered.

I believe in the "Butterfly Effect." Every little thing that happened, every person that I met contributed to forming the person who I am now. Therefore, even if I may have forgotten (to include) their names, I send my thanks to every person that have somehow entered in my life and helped shape me to the person I am today.

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ABSTRACT

This dissertation includes three essays on the application of economics to various aspects of crime and criminal activity. The research presented in this dissertation points out a cause and a consequence of crime as well as the possible influence of a law on criminal activity. The first chapter provides an introduction to the ways that economic reasoning can be used to analyze criminal activity. The second chapter examines individuals' gun carrying activity in the presence of concealed weapon laws. The results suggest that allowing law-abiding individuals to carry concealed handguns is more likely to reduce crime than to increase it. Chapter 3 investigates the effect of joblessness on criminal activity using an international panel data set. The results indicate that increase in unemployment causes more property crimes. The fourth chapter presents evidence for the existence of a negative externality of crime. Countries that have higher crime rates suffer from the loss of international tourists and tourism revenue. Chapter 5 summarizes the findings of the dissertation, provides concluding remarks, and discusses opportunities for future research in the economics of crime.

CHAPTER 1. INTRODUCTION

According to the statistics presented in FBI's Uniform Crime Reports, in 1960s, on average twenty five in every one thousand U.S. residents were victims of a crime.[1] About two of those thirty five victims were victims of a violent crime (murder, rape, robbery or assault). Such high crime rates terrorized the potential victims and bring about fear of crime. Motivated by the high incidence of crime, economists have started investigating the topic. It became clear that crime can be analyzed with the tools of economics with Becker (1968) who proposed the idea that individuals respond to incentives when they decide about participating in criminal activity. Becker (1968) suggested that individuals compare the possible costs and benefits of committing a crime, and they (do not) engage in criminal activity if their expected benefits are (smaller) greater than costs. As crime rates have gotten worse over time, economists have studied criminal activity more extensively. The national violent crime rate increased from 363 per 100,000 individuals in 1970 to 429 per 100,000 individuals in 2009. Several authors have investigated different aspects of criminal activity contributing to the economics of crime literature.

The three pieces of my research presented in three chapters of this dissertation contribute to the economics of crime literature. Specifically, in the next chapter I investigate the contentious issue of the impact of shall-issue laws on crime. Although previous research has investigated this question extensively, there is no consensus on the impact of shall-issue laws on crime. A shall-issue law allows law-abiding individuals to obtain a license to carry concealed handguns provided that they satisfy some requirements indicated by the law. Previous researchers have overlooked the fact that such a law may or may not influence crime depending on the *type* of the individuals that respond to the shall-issue law by carrying handguns more frequently. For example, if potential victims start carrying guns more frequently when a shall-issue law is enacted, then they can better protect themselves and others. In this case, the shall-issue law can have a crime-reducing effect. However, if potential criminals start carrying handguns more frequently after a shall-issue law is enacted, then the shall-issue law may have a crime-facilitating effect. Recognizing the mechanisms through which the shall-issue laws may influence crime, the study presented in the second chapter acknowledges the fact that shall-issue laws cannot influence crime unless individuals start carrying guns more frequently as a response. Consequently, the investigated research questions are twofold. First is whether individuals respond to shall-issue laws by carrying handguns more frequently. The second research question involves whether potential victims or criminals respond to these laws. This approach is novel in the literature.

The third chapter of this dissertation investigates the impact of unemployment on crime using a country-level panel data set from Europe that contains consistently-measured crime statistics. As indicated above, criminal activity is primarily motivated by net relative benefits to illegal activities. One implication of this idea is that individuals with potentially better current and future opportunities in the legal labor market are less likely to commit crime. One determinant of these opportunities in the labor market is the unemployment rate, which fluctuates over the business cycle. During a recession, when the unemployment rate goes up, employment chances in the legal labor market diminish. During times of high unemployment, the relative benefit of working in the legal labor market for an individual decreases on the margin, increasing the crime rate in the country. Using data from one single country, several studies confirm that

[1] Average of 1960-1969. Only the victims of FBI's Index I crimes are counted.

unemployment increases crime. However, in an international context, the impact of unemployment on crime has not been studied extensively. Moreover, there are only a handful of studies which investigate other aspects of crime using country-level data sets. The primary reason for the paucity of research based on international data is the absence of comparable crime statistics across countries. Legal practices, such as definitions and recording methods of crimes differ across countries.

In the study presented in the third chapter, differences in legal practices such as the differences in crime definitions across countries are accounted for. The employed crime data have the advantage of having consistent measures of crime across countries as explained in more detail below. Consequently, one of the contributions of this research is the introduction of a panel data set that can be used to study crime in an international context. In addition, the third chapter contributes to the economics of crime literature by being the first to investigate the impact of unemployment on crime by employing a uniformly collected international data set from European countries. Further, recognizing the fact that the unemployment rate may be endogenous, the third chapter uses IV models which employ novel instruments. Specifically, the exchange rate movements, industrial accidents and earthquakes are used as instruments for the unemployment rate.

The fourth chapter of this dissertation provides evidence for the existence of one of the several possible negative externalities associated with crime. Specifically, using the international crime data set that has been introduced in the third chapter, the fourth chapter demonstrates that the countries that have higher crime rates suffer from greater losses of international tourism revenue and number of international tourists. This finding suggests that international tourists consider the risk of victimization when choosing a location to visit. Violent crimes (murder, rape, robbery, and assault), but not property crimes (burglary, larceny, and motor vehicle theft), are negatively associated with incoming international tourists and international tourism revenue. The influence of crime on tourism activity is smaller in magnitude in Southern European countries with a coastline which are generally more attractive tourist destinations in terms of sea tourism, suggesting that victimization risk and attractiveness of the destination may be substitutable traits.

The fifth chapter provides a summary of the research presented in this dissertation and concludes.

CHAPTER 2. SHALL-ISSUE LAWS AND CARRYING HANDGUNS

2.1 Introduction

A shall-issue law allows any individual, who meets state-specified requirements, to obtain a license to carry concealed handguns.[2] Previous research has identified two main effects of shall-issue laws on crime. The crime-reducing effect predicts that shall-issue laws will increase a potential criminal's cost of committing a crime. For example, potential victims in states with shall-issue laws (shall-issue states) are more likely to carry concealed weapons. As a result, they can more easily protect themselves against offenders compared to the potential victims in states without shall-issue laws (non-shall-issue states).[3] Because potential criminals cannot observe who is carrying a gun, they cannot be sure if their potential victims will fight back with force. Consequently, a potential criminal's cost of committing a crime increases due to greater possibility of armed resistance.

Some studies have found evidence that shall-issue laws can increase crime because of the crime-facilitating effect. Numerous mechanisms can generate the crime-facilitating effect. A shall-issue law may increase the availability of guns to criminals if, for example, a gun in good hands is transferred to a criminal through theft. It could also be the case that a potential victim may "convert" into a criminal because carrying a gun reduces the cost of committing a crime. In addition, potential criminals who observe that potential victims carry guns more frequently may start carrying guns more often. Consequently, if the victim retaliates, the probability of a fatal injury increases. This leads to an increase in the number of more-violent crimes (Levitt and Donohue, 1998).

As both the crime-reducing and crime-facilitating effects of shall-issue laws are plausible, it is an empirical issue to estimate the net effect of shall-issue laws on crime. Despite the investigation this effect by numerous studies, no consensus has emerged on the issue. For example, Lott and Mustard (1997), Lott (1998a, 1998b), Polsby (1995), Olson and Malt (2001), Moody and Marvell (2009) and Moody (2001) have argued that the enactment of shall-issue laws decreases crime. Conversely, several other researchers, such as Black and Nagin (1998), Ludwig (1998), Rubin and Dezhbakhsh (2003) and Ayres and Donohue (2003, 2009) suggest that shall-issue laws do not reduce crime, and that they actually increase crime. Differences in the estimated net effect of shall-issue laws on crime are shown to depend on the researchers' choices of econometric method, model specification and the particular data set employed.

These studies have not investigated the presumed mechanisms underlying the net effect of shall-issue laws on crime, which is vital to proving causality. If the conditions necessary for the crime-reducing and crime facilitating effects are not satisfied, then the existence of these

[2] These criteria include satisfying the minimum age requirement, having no arrest record, no history of alcohol addiction or drug abuse as well as no signs of mental incapacitation.

[3] Some states employ may-issue laws (may-issue states), which grant concealed weapon licenses only at the discretion of the license-issuing authority to individuals who satisfy the criteria mentioned. Vermont has no restrictions on gun carrying. Illinois and Wisconsin are referred to as no-issue states as they prohibit concealed carrying. Those states which have shall-issue laws or no restrictions for carrying a handgun will be referred to as Shall-Issue States. The remaining states (states which have may-issue laws in effect and no-issue states) will be referred to as Non-Shall-Issue States. The Appendix lists state-specific information pertaining to shall-issue status of the states, time of the enactment of their concealed weapon laws (if one is ever enacted), the laws or statues of the states which form the basis of their shall-issue statuses and the minimum age requirements.

effects is questionable. For example, if individuals do not respond to shall-issue laws by carrying guns in the first place, neither the crime-facilitating nor crime-reducing effects can be observed.

To make the point using a different domain, as an example, consider the case of highway speed limits. The research question is whether an increase in speed limits increases traffic fatalities. Here, the first-order question is whether an increase in speed limits induces people to drive faster. If the answer is affirmative, then the second order question is whether driving faster leads to more traffic fatalities. The number of fatalities may go up or down depending on the number of individuals who start driving more carefully to protect themselves when they observe others who drive fast. However, if initially no driver changes his/her driving speed, no change in the number of accidents is expected. In other words, if the first-order effect does not take place, the second-order effect will not be observed and therefore the net effect of the law should be zero.

Similarly, shall-issue laws intend to change the gun carrying behavior of individuals. Consequently, the first-order question is whether shall-issue laws increase the number of individuals who carry handguns. If individuals do not change their behavior, then neither the crime-facilitating effect nor the crime-reducing effect can exist. Acknowledging this possibility, this study investigates whether individuals respond to shall-issue laws by carrying handguns more frequently in the first place.

Unlike the previous research that employed county or state-level data sets, I use an individual-level panel data set obtained from NLSY97, which consists of young individuals who are observed annually between 1997 and 2007. Using NLSY97 allows me to investigate the first-order question of whether individuals respond to shall-issue laws by carrying handguns more frequently. I begin with an analysis of whether a law abiding individual's probability of carrying a gun increases when he/she becomes eligible to carry a handgun because of shall-issue laws. Secondly, I investigate whether a potential criminal's tendency to carry a gun changes as a consequence of shall-issue laws. If potential criminals become more likely to carry guns in the presence of shall-issue laws, then a crime-facilitating impact of shall-issue laws is possible. Recognizing that individuals are likely to be different based on the severity of crimes they commit (serious crimes such as murder, rape and robbery versus misdemeanors such as drug possession, public order and traffic offenses), I further analyze whether potential criminals who are likely to commit serious crimes and misdemeanors respond to shall-issue laws differently in terms of carrying a gun. Finally, using a state-level data set, I investigate whether shall-issue laws are associated with increases in the number of stolen guns, because gun theft is one of the main mechanisms through which potential criminals have access to guns.

Estimation of the influence of becoming eligible to carry concealed weapons on individuals' probability of carrying handguns is not straightforward. It is plagued with empirical difficulties due to individuals' unobservable characteristics. Specifically, individuals who have greater criminal human capital are more likely to have an arrest record and therefore be ineligible to legally carry a concealed weapon. At the same time they have a greater tendency to carry a gun. As a result, the unobservable individual characteristics may drive both being eligible and the tendency to carry a handgun. This leads to biased estimates.

To overcome this hurdle, I separate the estimation samples based on individuals' arrest records similar to Grogger (1995). Individuals with an arrest record as of the last wave of NLSY97 (in 2007 when they are 25 years old on average) are considered to have a greater level of criminal human capital. The remaining individuals who have never been arrested have a smaller level of criminal human capital. Conducting the estimation separately on these groups

reduces bias due to unobserved characteristics of individuals. This is because, the unobservable characteristics will have similar influences on individuals' gun carrying probability within these groups. Therefore, this strategy will yield a comparison of eligible and ineligible individuals' gun carrying probabilities which are similarly influenced by their unobservable characteristics.

As a further classification, individuals who have an arrest record are categorized according to the severity of the crimes they commit. This categorization generates more homogenous estimation samples. Individuals who have committed serious crimes (FBI's Index I crimes) are considered to have greater level of criminal human capital than those who commit minor crimes (misdemeanors). Later in the paper, I investigate whether individuals who commit serious and minor crimes are different from those who do not commit any crimes in terms of their observable outcomes. The observable outcomes considered include education level, labor market experiences, family characteristics, marriage choices and mental health.

As explained in more detail below, the findings in this paper provide evidence for the possible existence of only the crime-reducing effect of shall-issue laws. Specifically, the findings indicate that the presence of a shall-issue law increases the probability of carrying a handgun for an individual who is unlikely to commit serious crimes such as manslaughter, rape and robbery. Conversely, the probability of carrying a handgun for an individual who is likely to commit serious crimes does not change because of shall-issue laws. Lastly, the findings obtained from a state panel data set reveal that gun thefts are not related to shall-issue laws. Taken together, these results imply that some of the conditions for the crime-facilitating effect of shall-issue laws are not satisfied. Therefore, the existence of a crime-facilitating effect is questionable.

2.2 Individual-Level Data

The main data set used for the individual-level analysis is obtained from National Longitudinal Survey of Youth 1997 cohort (NLSY97). The NLSY97 consists of a nationally representative sample of approximately 9,000 youths who were 12 to 16 years old as of December 31, 1996. The first round of the survey took place in 1997, with annual interviews until 2007 (the last year used in this analysis). As of the last wave, the oldest individual is 27 years old and the average age is 25. The survey contains detailed information on a variety of topics including an individual's criminal activity and gun carrying behavior.

The key outcome variable in this paper is constructed based on individual responses to the yes/no question "*Have you carried a handgun since the last interview? When we say handgun, we mean any firearm other than a rifle or shotgun.*" The indicator variable *Gun* takes the value of one if the individual has reported that he/she has carried a handgun. This question is appropriate in the context of studying the impact of shall-issue laws, since these laws only involve handguns that can be carried in a concealed fashion.[4] As presented in Table 2.1, five percent of the sample reports having carried a gun.

In each wave of the survey the respondents are asked whether they have been arrested since the date of the last interview.[5] If an individual has been arrested, they are asked to provide additional information about the offense they were arrested for. An individual can report having been charged with 11 possible offenses.[6] A dichotomous variable is created for each of these

[4] Shot guns and rifles are too large to be carried in a concealed fashion.
[5] In the first wave, the respondents are asked whether they have ever been arrested.
[6] These categories are limited by the questions posed to the respondents.

offenses to indicate whether an individual has been arrested for the specified crime. *Violence* covers all assaults such as such as battery, rape, aggravated assault, and manslaughter. *Robbery* is defined as taking something from someone using a weapon or by force. Stealing without force (auto thefts, larcenies, or shop-lifting) is categorized as *Theft*. Any offense which involves breaking into private property, without permission, in an attempt to steal is counted as a *Burglary*. *Destruction of Property* covers offenses such as vandalism, arson and malicious destruction. Offenses of fencing (knowingly buying stolen property for later re-sale), receiving, possessing or selling stolen property are considered *Other Property Offenses*. Possession or use of illicit drugs and sale or trafficking of illicit drugs are included in *Drug Possession* and *Drug Sale*, respectively. *Major Traffic Offenses* are those such as driving under the influence, reckless driving, or driving without a license. *Public Order Offenses* include drinking or purchasing alcohol under age, disorderly conduct and sex offenses. The remaining offenses are grouped into *Other Offenses*. Consistent with the national distribution of crimes, a quick glance at Table 2.1 reveals that individuals in the sample are associated with committing more misdemeanors such as drug possession, public order and major traffic offenses compared to felonies.

The variables of interest in this study are *Law*, *Adult* and *Ever Arrested*. *Law* is an indicator for a shall-issue state in a given year. It is obtained from Ayres and Donohue (2009) and merged with the individual-level data set.[7] More than half of the observations are in shall-issue states (59 percent). *Adult* denotes whether an individual is at least as old as the minimum required age in their state of residence. The minimum required age ranges between 18 and 23.[8] The ages of the individuals in the sample range between 12 and 18 in the first wave of the survey and 22 and 27 in the last wave. Overall, in 45 percent of the observations, individuals satisfy the minimum age requirements of the states where they reside. Finally, *Ever Arrested* is an indicator for whether an individual has ever been arrested as of the interview date.

The estimation strategy employed in the paper groups individuals according to their arrest records as of the last available survey date (2007 wave).[9] *Law Abiding Individuals* are defined as those who have never been arrested as of the last available interview date. *Arrestees*, on the other hand, have an arrest record as of the last available interview date and make up about 30 percent of the whole sample.[10] *Arrestees* are further categorized according to the severity of the crimes they have committed: those who have an arrest record for at least one of the offenses listed as Index-I crimes by FBI (Murder, Rape, Robbery, Assault, Burglary, Larceny, Motor Vehicle Theft and Arson) are classified as *Serious Crime Arrestees*. The individuals who have committed less severe crimes such as misdemeanors (public order offenses, major traffic offenses, drug possession and sale and so on) are grouped into *Minor Crime Arrestees*. The majority of the sample of *Arrestees* is composed of *Minor Crime Arrestees* (60 percent). Those *Arrestees* who have committed both serious and minor crimes are included in *Serious Crime Arrestees* group.

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[7] http://works.bepress.com/john_donohue/66/. Ayres and Donohue (2009) treat may-issue states which are *de facto* shall-issue state as a shall-issue state. Alabama is one example. Further, Vermont has no restrictions on carrying guns. Consequently, it is considered a shall-issue state.

[8] The states that do not have a shall-issue or may-issue law have not defined a minimum required age. In such cases, the minimum required age for other gun laws such as those regulate owning and purchasing guns are employed in the empirical analysis. The details are provided in the Appendix.

[9] The last available interview is used for those individuals whose information was missing in the 2007 wave (due to non-participation).

[10] This is consistent with Grogger (1998) who reports that one-fourth of the sample he obtained from NLSY 79 Cohort report having committed a property crime. In the same paper, it is argued that about a third of the individuals in California and Philadelphia have been arrested at least once before their thirties.

Table 2.1 Means of the Variables Employed in Individual-Level Analysis

	Whole Sample N=84,932	Law-Abiding Individuals[a] N=58,010	Arrestees[b] N=26,922	Serious Crime Arrestees[c] N=10,701	Minor Crime Arrestees[d] N=16,221
Dependent Variables					
Gun	0.047	0.030	0.086	0.107	0.072
Violence	0.008		0.024	0.060	
Robbery	0.003		0.011	0.027	
Burglary	0.004		0.012	0.030	
Theft	0.007		0.021	0.052	
Destruction of Property	0.005		0.014	0.036	
Other Property Offenses	0.003		0.008	0.017	0.002
Drug Possession	0.010		0.032	0.044	0.024
Drug Sale	0.003		0.011	0.017	0.007
Major Traffic Offenses	0.009		0.030	0.035	0.026
Public Order Offenses	0.008		0.024	0.030	0.021
Other Offenses	0.012		0.037	0.051	0.028
Variables of Interest					
Law	0.590	0.577	0.618	0.603	0.628
Adult	0.455	0.451	0.465	0.462	0.466
Ever Arrested	0.222		0.700	0.793	0.638
Individual-Level Control Variables					
Age	19.624	19.593	19.693	19.675	19.704
Female	0.496	0.580	0.314	0.273	0.342
Black	0.264	0.247	0.300	0.334	0.278
Hispanic	0.210	0.212	0.205	0.200	0.209
Mixed	0.010	0.009	0.011	0.009	0.013
Can't Marry	0.201	0.204	0.196	0.197	0.195
Cohabiting	0.099	0.085	0.129	0.133	0.126
Married	0.088	0.096	0.072	0.078	0.068
Separated	0.008	0.007	0.012	0.014	0.010
Marital Status Missing	0.004	0.004	0.004	0.005	0.004
School Enrollment	0.524	0.575	0.414	0.370	0.443
School Enrollment Missing	0.001	0.001	0.002	0.001	0.002
Highest Grade Comp.	11.204	11.551	10.457	10.047	10.727
HGC Missing	0.009	0.007	0.013	0.016	0.010
Household Size	3.846	3.856	3.824	3.833	3.818
Household Income	33673	35681	29345	26399	31288
Household Size Missing	0.000	0.000	0.000	0.000	0.000
Household Income Missing	0.368	0.372	0.359	0.347	0.367
Heavy Drinking	1.292	0.936	2.061	2.031	2.081
Heavy Drinking Missing	0.010	0.008	0.014	0.014	0.015

Table 2.1 continued

	Whole Sample N=84,932	Law-Abiding Individuals[a] N=58,010	Arrestees[b] N=26,922	Serious Crime Arrestees[c] N=10,701	Minor Crime Arrestees[d] N=16,221
Marijuana	1.794	0.939	3.639	3.944	3.437
Marijuana Missing	0.002	0.001	0.004	0.004	0.004
Burglarized	0.152	0.136	0.187	0.196	0.181
Burglarized Missing	0.017	0.009	0.036	0.047	0.029
Bullied	0.194	0.172	0.242	0.249	0.238
Bullied Missing	0.016	0.007	0.035	0.047	0.027
Saw Someone Shot	0.110	0.077	0.180	0.216	0.157
Saw Someone Shot Missing	0.016	0.007	0.035	0.046	0.027
State-Level Control Variables					
Crime Rate[e]	4,164	4,151	4,193	4,167	4,209
Unemployment Rate	4.960	4.970	4.938	4.947	4.932
Victimization Probability	20.092	18.376	23.791	24.687	23.199
Hunters' Share in State Pop.	0.157	0.140	0.192	0.195	0.190

Notes to Table 2.1:

[a] Law Abiding Individuals do not have an arrest record as of the 2007 wave of NLSY97 when the average age is 25.

[b] Arrestees have an arrest record as of the 2007 wave of NLSY97 when the average age is 25. Arrestees sample is composed of Minor Crime Arrestees and Serious Crime Arrestees.

[c] Serious Crime Arrestees, as of the 2007 wave of NLSY97, have committed at least one of the Index-I crimes of FBI (murder, rape, robbery, assault, burglary, larceny and motor vehicle theft).

[d] Minor Crime Arrestees, as of the 2007 wave of NLSY97, have committed at least one misdemeanor but none of the Index-I crimes of FBI.

[e] Total number of Index-I crimes per 100,000 individuals.

The individual-level control variables include the *Age* of the individual, indicators for individual's gender (*Female*), race and ethnicity (*Black, Hispanic, Mixed* and *Non-Black* [omitted]), marital status (*Can't Marry*, *Single* [omitted], *Cohabiting, Married* and *Separated*) and *School Enrollment s*tatus.[11,12] Other control variables are individual's *Household Size*, *Household Income* and *Highest Grade Completed* in addition to the number of days in the last month the individual has drunk 5 or more drinks (*Heavy Drinking*), the number of days in the last month he/she used *Marijuana*, whether the individual was a victim of burglary (*Burglarized*) or bullying before the age of 12 (*Bullied*) and whether the individual witnessed someone getting shot before the age of 12 (*Saw Someone Shot*). The means of these variables are presented in Table 2.1.

[11] Those individuals who are younger than 16 years old are not asked the marital status questions. They are identified with the indicator *Can't Marry*. The reason for that is the fact that such individuals live with their parents and they have not satisfied the minimum age requirement to get married.

[12] While creating the race-ethnicity categories, ethnicity is given priority. That is, all individuals who are of Hispanic or Latino ethnicity are classified into *Hispanic* category regardless of their races. Consequently, the remaining race categories include individuals who are non-Hispanic. The possible race categories the respondents could choose from include White; Black or African-American; American Indian, Eskimo, or Aleut; and Asian or Pacific Islander. *Mixed* race category includes individuals who identified themselves with more than one race.

The empirical analyses also control for state-specific characteristics. Particularly, the *Crime Rate*, *Unemployment Rate*, race and gender specific Homicide *Victimization Probability* and the *Hunters' Share in the State's Population* are state-level control variables. The *Crime Rate* is obtained from the FBI's Uniform Crime Reports and is defined as the total number of felony crimes committed in individual's state of residence. The *Unemployment Rate* is the ratio of the number of unemployed people to the number of people in the labor force aged 16 and over. It is obtained from the Bureau of Labor Statistics. The race and gender specific Homicide *Victimization Probability* is the share of homicide victims in the race and gender group that the individual belongs to in the total number of homicide victims in the individual's state of residence. It is obtained from the FBI's Supplemental Homicide Reports, and is an average of the period between 1997 and 2005. This construction results in a Homicide *Victimization Probability* which is time invariant, but there is variation among the states and race-gender groups within states. *Hunter's Share in the State's Population* is the share of individuals who have reported that they have gone hunting at least once in their lives. This variable is the average of 1996, 2001 and 2006. It is obtained from the 1996, 2001 and 2006 waves of the National Survey of Fishing, Hunting, and Wildlife-Associated Recreation conducted by the Census Bureau.[13] The means of the state-level variables are also presented in Table 2.1.

As demonstrated in column II of Table 2.1, Law Abiding Individuals (who are never arrested) are mostly married females with slightly higher education levels compared to the Arrestees (who have at least one arrest record as of the last interview). Law-Abiding Individuals' household incomes are greater and their alcohol and marijuana consumption levels are less frequent than Arrestees. Further, Law Abiding Individuals are less likely to be victimized. Within the group of Arrestees, Minor Crime Arrestees possess fewer unfavorable characteristics than the Serious Crime Arrestees. Minor Crime Arrestees and Law-Abiding Individuals have common characteristics.

Table 2.2 provides the means of the variables employed in the empirical analyses sorted by whether the individual has carried a gun since the last interview. The individuals who have carried guns committed more crimes (both misdemeanors and felonies) than those who have not. Mostly married males with fewer years of schooling have carried guns. They reported consuming more than five alcoholic beverages in a row and using marijuana more frequently in the last month than did their counterparts who have not carried guns. The individuals who have carried guns are more likely to have been a victim of burglary or bullying and more likely to have witnessed someone getting shot in their childhood. They also belong to age-race categories which are at greater risk for homicide in their states. Carrying a gun is more common for those individuals who live in states in which the share of hunters in state's population is greater. Some of the previous studies, such as Glaeser and Glendon (1998) and Cook and Ludwig (1997), have investigated the determinants of gun ownership and gun carrying descriptively. The data employed in this paper provide a similar descriptive picture of gun carrying. For example, Cook and Ludwig (1997) argued that 14 million adults have carried firearms at least once in the last

[13] http://www.census.gov/prod/www/abs/fishing.html

year. 14 million individuals made up about 7 percent of the adult population in 1994.[14] This is consistent with the fact that five percent of the NLSY97 sample reported carrying a gun.[15]

Ownership of guns does not necessarily mean carrying guns, but owning and carrying a gun are highly correlated. In fact, Cook and Ludwig (1997) argued that one third of the individuals who own a gun also reported carrying a gun at least once in the previous year. Glaeser and Glendon (1998) provide a list of determinants of owning a gun. As a result of the high correlation of owning and carrying, Glaeser and Glendon (1998)'s findings may help check the validity of the data set used in this study. Glaeser and Glendon (1998) employed the 1972-1994 waves of General Social Survey in their study. The summary statistics mentioned above and presented in the Table 2.2 of this paper are consistent with Glaeser and Glendon (1998). For example, Glaeser and Glendon (1998) reports that gun owners are less educated, married and older males who are likely to live in the South. These characteristics are similar to the individuals who have carried a gun in my sample. However, their report that higher probabilities of victimization and arrest are associated with smaller tendencies to own a gun contradicts the descriptive statistics reported in this paper obtained from NLSY97. Specifically, in my sample, individuals who have carried guns are more likely to have been victims of burglary, bullying, or to have witnessed someone getting shot before the age of 12.

2.3 Individual-Level Analysis

I propose that an individual's probability to carry a handgun is determined by his/her eligibility to obtain concealed weapons licenses, personal characteristics and demand for protection as well as the conditions in the area that he/she lives. According to criteria set by the shall-issue laws, in order to be eligible to obtain a concealed weapon license, an applicant must satisfy various requirements which are discussed below. I use the findings of Cook and Ludwig (1997) and Glaeser and Glendon (1998) to identify the individual determinants of gun carrying activity. Findings of Cook and Ludwig (1997) and Glaeser and Glendon (1998) suggest that individual's age, gender, education level, income and marital status are correlated with his/her probability of carrying a gun. Further, an individual is more likely to carry a gun to protect himself/herself, if his/her probability of being victimized is greater. Lastly, the economic conditions, criminal activity and gun carrying culture in his/her state further influence his/her tendency to carry a gun.

[14] Cook and Ludwig (1997) employed the National Survey of Private Ownership and Use of Firearms in their analysis. That survey was conducted in 1994. National adult population (18 and over) in 1994 was about 190 million. Source: Census Bureau.

[15] This difference between Cook and Ludwig (1997)'s 7% and NLSY's 5% may be due to the differences in the samples employed. Cook and Ludwig (1997)'s sample is older and wealthier than the sample of NLSY97. Individuals' ages and their income may be significant determinants of carrying and owning guns. For example, a wealthier individual is more likely to demand greater protection than a poorer individual does. Similarly, an older individual is weaker than a younger individual in terms of resistance to offenders. As a consequence, an older individual may demand carry guns more than a younger individual does. Further, the 14 million (7%), reported by Cook and Ludwig (1997), is the share of individuals who is estimated to be carrying firearms, whereas 5% reported in this paper is the share of individuals who carry handguns.

Table 2.2 Means of the Individual-Level Variables Conditional on Carrying a Gun

	Have Carried a Gun[a] N=4,031	Have Not Carried a Gun N=80,901
Variables of Interest		
Law	0.661	0.586
Adult	0.436	0.456
Ever Arrested	0.416	0.212
Crimes Committed		
Violence	0.044	0.006
Robbery	0.030	0.002
Burglary	0.027	0.003
Theft	0.037	0.005
Destruction of Property	0.032	0.003
Other Property Offenses	0.022	0.002
Drug Possession	0.048	0.008
Drug Sale	0.024	0.002
Major Traffic Offenses	0.037	0.008
Public Order Offenses	0.026	0.007
Other Offenses	0.052	0.010
Personal Characteristics		
Age	19.380	19.637
Female	0.147	0.514
Black	0.268	0.264
Hispanic	0.210	0.210
Mixed	0.007	0.010
Can't Marry	0.223	0.200
Cohabiting	0.097	0.099
Married	0.105	0.088
Separated	0.012	0.008
Marital Status Missing	0.005	0.004
School Enrollment	0.442	0.528
School Enrollment Missing	0.003	0.001
Highest Grade Completed	10.607	11.234
HGC Missing	0.010	0.009
Household Size	3.812	3.848
Household Income	34,415	33,636
Household Size Missing	0.000	0.000
Household Income Missing	0.362	0.368
Heavy Drinking	2.815	1.217
Heavy Drinking Missing	0.015	0.010
Marijuana	4.572	1.656

Table 2.2 Continued

	Have Carried a Gun[a] N=4,031	Have Not Carried a Gun N=80,901
Marijuana Missing	0.003	0.002
Burglarized	0.189	0.151
Bullied	0.242	0.192
Saw Someone Shot	0.215	0.105
Burglarized Missing	0.025	0.017
Bullied Missing	0.024	0.016
Saw Someone Shot Missing	0.024	0.016
State Characteristics		
Crime Rate[b]	4,286	4,158
Unemployment Rate	4.913	4.963
Victimization Probability	27.271	19.734
Hunters' Share in State Pop.	0.251	0.152

Notes to Table 2.2:

[a] Reported having carried a handgun since the date of last interview. The original question that this variable is built on is "*Have you carried a hand gun since the last interview? When we say hand gun, we mean any firearm other than a rifle or shotgun.*"

[b] Total number of Index-I crimes per 100,000 individuals.

Along these lines, the equation depicted below is employed in the empirical analysis:

$$(2.1)\quad Gun^{*}_{ist} = B_1 Law_{st} + B_2 Adult_{ist} + B_3 Ever\ Arrested_{ist} + B_{12} Law_{st} Adult_{ist} + B_{13} Law_{st}\ Ever\ Arrested_{ist} + B_{23} Adult_{ist} Ever\ Arrested_{ist} + B_{123} Law_{st} Adult_{ist} Ever\ Arrested_{ist} + B_4 X_{ist} + v_{ist}$$

where Gun^{*}_{ist} measures propensity to carry a gun of individual i who lives in state s in period t. An individual's propensity to carry a gun is unobservable, but an indicator variable, Gun_{ist}, for carrying a gun, is equal to one when $Gun^{*}_{ist} > 0$.[16] If the error term v_{ist} is normally distributed, then the result is a single-equation probit specification.

Law_{st} is a dichotomous variable that indicates whether the state where the individual resides is a shall-issue state in period t.[17] $Adult_{ist}$ indicates whether the individual i is old enough to satisfy the minimum age requirement to obtain a concealed weapon license in state s in year t. The minimum required age varies between 18 and 23 across states.[18] $Ever\ Arrested_{ist}$ is an indicator variable for whether the individual i has ever been arrested as of the interview date at year t. The vector X_{ist} includes both individual-level control variables (age, gender, race/ethnicity, marital status, education, household income and size, alcohol and marijuana consumption, whether the individual was victimized by burglary or bullying before the age of 12 and whether the individual witnessed someone getting shot before the age of 12) and state-level

[16] The *Gun* variable is constructed based on the answers of the individuals to the following question: "*Have you carried a hand gun since the last interview? When we say hand gun, we mean any firearm other than a rifle or shotgun.*"

[17] States' Concealed Weapon Law statuses are obtained from Ayres and Donohue (2009). The details are discussed in the Individual-Level Data and the Appendix.

[18] See the Individual-Level Data and Appendix for further details.

control variables (Crime Rate, Unemployment Rate, race and gender specific Homicide Victimization Probability and the Hunters' Share in the State's Population). The descriptions of these variables are discussed in the Individual-Level Data section.

An individual is eligible to obtain a concealed weapon license only if he/she (a) lives in a shall-issue state, (b) meets the minimum age requirement and (c) has no arrest record, history of alcoholism, drug addiction or mental incapacity.[19] In equation (2.1) all of these criteria are taken into consideration. Individual's alcohol consumption and drug use (proxied by marijuana use) are also included as control variables.

Estimation of equation (2.1) allows for a test for whether an individual becomes more likely to carry a handgun when he/she becomes eligible to obtain a concealed weapon license. The gun carrying probability of an individual is expected to go up in the presence of a shall-issue law. This is because, a shall-issue law in effect is the first condition for being eligible, and it reduces the cost of carrying a gun. However, a shall-issue law may also increase the probability of carrying a gun even if an individual is not eligible.[20] That is, ineligible individuals who are minors (those who have not completed minimum required age) or those who have criminal records may have greater access to handguns when a shall-issue law is enacted. The specification above is flexible enough to allow for a test of these hypotheses. Inclusion of two-way and three-way interactions of Law_{st}, $Adult_{ist}$ and $Ever\ Arrested_{ist}$ allows eligible and ineligible individuals to have different gun carrying behaviors.

Estimation of equation (2.1) may suffer from a potential endogeneity problem due to inclusion of the *Ever Arrested* variable.[21] Because individuals with greater criminal human capital are more likely to have arrest records, they are less likely to be eligible. At the same time, individuals with high criminal human capital are more likely to carry a gun. Since criminal human capital is not observable, and it is likely to drive both individual's tendency to carry a gun and his/her eligibility status (through arrests), the estimation will be biased.

To overcome this hurdle, I employ the identification strategy of Grogger (1995) who investigated the influence of arrests on wages. Since having an arrest record is not random and it is determined simultaneously with wages, Grogger (1995) was confronted with an endogeneity problem similar to the one in the context of gun carrying and being ineligible.

The solution proposed by Grogger (1995) was to estimate a wage regression for a sample composed of individuals who were arrested at least once in the sample period. The individuals in that sample have similar unobservable characteristics, i.e. criminal human capital. Consequently, even if the omitted individual characteristics drive wages and arrests, their influence is similar

[19] The minimum age requirement is defined by the concealed weapon law of the state. Therefore, shall-issue states and may-issue states (which are included in non-shall-issue states) have defined a minimum age requirement. However, in no-restriction states (Vermont) and no-issue states (Illinois and Wisconsin) there are no concealed weapon laws by definition. I assign the minimum age requirements for owning a gun to the minimum age requirements of the states which do not have a concealed weapon law. The details are in the Appendix.

[20] Pointed out by, for example, Ayres and Donohue (2009), Black and Nagin (1998) and Rubin and Dezhbakhsh (2003).

[21] The variable Law may also be endogenous. It is possible for an individual who wants to carry a weapon to move to a shall-issue state and start carrying a gun there. However, this is unlikely in this data set. A total of 3,851 observations (4.5 percent of the whole sample) have indicated a change in the state of residence during the survey years. Most of these moves are due to finding a job in another state and going to college in another state. Among those observations, in 131 cases individuals reported not carrying a gun before the move and started carrying after the move. Among these 131 cases only a total of 34 involve a move from a non-shall-issue state to a shall-issue state. Removing such individuals from estimation samples does not change any of the results throughout the paper.

for all individuals in the sample. Therefore, the influence of unobservable characteristics is eliminated when outcomes of two individuals in that sample are compared. Furthermore, because of the variation in the timing of first arrest, Grogger (1995) is able to identify the effect of arrests on wages. The wages of the individuals who do not have an arrest record but who will be arrested in future are not affected by their arrests. On the other hand, the wages of individuals who already have an arrest record at the time of the observation are influenced by their arrest records. In other words, individuals who do not have an arrest record but will be arrested eventually constitute the counter-factual for those who have been arrested previously.

Following Grogger (1995), I estimate equation (2.1) on separate samples which consist of individuals that should be similar in terms of their unobserved criminal human capital. One sample includes only those individuals who have never been arrested up to the last survey (2007). The other sample is composed of only the individuals who have been arrested at least once as of the last survey date. The influence of the unobservable factors on the probability of carrying a gun and on being eligible to obtain a concealed weapon license is similar for the individuals within these groups. Consequently, the estimation of the impact of eligibility on gun carrying tendency of individuals is less likely to suffer from the endogeneity problem mentioned above. Moreover, there is still variation in individuals' eligibility status which allows for identification of the influence of becoming eligible on the probability of carrying a gun. There are various sources of the variation in eligibility. These sources include becoming eligible by enactment of a shall-issue law or aging to satisfy the minimum age requirement, and getting arrested, which makes an individual ineligible.

2.3.1 Individuals Who Have Never Been Arrested

Individuals who do not have an arrest record as of the last interview date are referred to as "Law Abiding Individuals." When equation (2.1) is estimated for Law Abiding Individuals, the variable *Ever Arrested* and its interactions with *Law* and *Adult* are dropped since there is no variation in *Ever Arrested* for this sample. Consequently, the experiment in this section involves comparing the gun carrying probabilities of two observationally identical individuals except for their eligibility in terms of obtaining a concealed weapon license, who have never been arrested as of the last survey date (in 2007 when they are 25 years old on average).

A Law Abiding Individual can become eligible to obtain a concealed weapon license through two ways: (a) enactment of a shall-issue law given he/she has satisfied the minimum age requirement and (b) satisfying the minimum age requirement given he/she lives in a shall-issue state. The model specified by equation (2.1) allows for identification of both influences on a Law-Abiding Individual's probability of carrying a gun. There is variation in both aspects of becoming eligible in the sample. Some states have changed their shall-issue statuses in the sample period of 1997-2007.[22] Furthermore, ages of the respondents range between 12 and 27. As a result of the variation in the states' minimum age requirements, the sample includes two same-aged shall-issue state residents one of whom is eligible and the other is not.[23]

[22] These states and the years in which they become shall-issue states are as follows: Colorado-2004, Kansas-2007, Michigan-2002, Minnesota-2004, Missouri-2004, Nebraska-2007, New Mexico-2004, and Ohio-2005.

[23] Minimum age requirement ranges between 18 and 23. Appendix provides more details on states' status on shall-issue laws.

The marginal effects that are obtained from estimation of equation (2.1) on the sample of Law Abiding Individuals (those who do not have an arrest records as of the last interview date) are presented in the first columns of Tables 2.3 and 2.4. Column I in Table 2.3 presents the influence of the enactment of a shall-issue law and column I in Table 2.4 presents the impact of satisfying the minimum age requirement on the probability of carrying a gun for Law Abiding Individuals. The rows pertain to the responses estimated in different subsamples. For example, the row 2 and column 1 of Table 2.3 presents the average marginal effect of the enactment of a shall-issue law on the gun carrying probabilities of Law Abiding Individuals who are as old as the minimum required age (i.e. *Adult*=1). The marginal effects presented in Table 2.3 (Table 2.4) are obtained by calculating the average change in the probability of carrying a gun when *Law* (*Adult*) is increased from zero to one while other variables are kept at their observed values.

Enactment of a shall-issue law increases the probability of carrying a handgun for Law Abiding individuals on average (column I of Table 2.3). As displayed in row 1, enactment of a shall-issue law translates into an increase of 0.7 percentage points in a Law-Abiding Individual's probability of carrying a handgun. As observed in row 2, a Law Abiding Individual's probability of carrying a handgun increases by 1.3 percentage points in response to the enactment of a shall-issue law, conditional on having satisfied the minimum age requirement. Row 3 shows that the average impact of the enactment of the law on minors (those who are younger than the minimum required age) is insignificant.

Column I of Table 2.4 presents the average influence of satisfying the minimum age requirement on a Law Abiding Individual's probability of carrying a handgun. The average marginal effect of satisfying the minimum age requirement is not statistically different than zero (row 1). However, when a Law Abiding Individual in a shall-issue state turns sufficiently old enough to satisfy the minimum age requirement, his/her probability of carrying a handgun increases by 0.9 percentage point on average and this effect is significant at 1% level (row 2). The same impact does not significantly influence the handgun carrying probability of a Law Abiding Individual who resides in a non-shall-issue state (row 3).

2.3.2 Individuals with At Least One Arrest Record

In this section, I investigate the question of whether Current Arrestees and Eventual Arrestees carry guns more frequently because of shall-issue laws. A "Current Arrestee" is defined as an individual who has an arrest record as of the interview date. An "Eventual Arrestee" refers to an individual who does not have an arrest record at the current interview date, but will eventually be arrested. The sample consisting of Current and Eventual Arrestees is called "Arrestees."[24]

[24] All of the individuals in the Arrestees sample had arrest records when they were interviewed in the 2007 wave of the survey. Among the 2,796 individuals who had at least one arrest record as of the 2007 wave, 2,067 (74%) did not have an arrest record as of the first interview wave (1997).

Table 2.3 Influence of Enactment of Shall-Issue Law on Probability of Carrying a Handgun

		I	II
		Law Abiding Individuals	Arrestees
	Marginal Effect is calculated for		
1	Whole sample	0.007***	0.007
		(0.002)	(0.006)
2	Individuals Over Min. Age[a]	0.013***	0.011
		(0.003)	(0.007)
3	Individuals Under Min. Age[b]	0.002	0.004
		(0.002)	(0.007)
4	Eventual Arrestees, Over Min. Age[a,c]		0.038**
			(0.015)
5	Current Arrestees, Over Min. Age[a,d]		0.008
			(0.008)
6	Eventual Arrestees, Under Min. Age[b,c]		0.009
			(0.008)
7	Current Arrestees, Under Min. Age[b,d]		-0.001
			(0.009)
	Observations	58,023	26,919

Notes to Table 2.3: Columns I and II present the average marginal effects of the variable *Law* based on estimation of equation (2.1) on samples listed at the top. Law Abiding Individuals are those who do not have an arrest record as of the 2007 wave of NLSY97. Arrestees have an arrest record as of the 2007 wave. The first row provides the average marginal effects evaluated for the whole sample. Other rows pertain to marginal effects evaluated for different subsamples as following: [a] *Adult*=1, [b] *Adult*=0, [c] *Ever Arrested*=0, [d] *Ever Arrested*=1
The dependent variable, *Gun*, is constructed based on the individuals' answers to the question "*Have you carried a handgun since the last interview? When we say handgun, we mean any firearm other than a rifle or shotgun.*" The marginal effects are obtained by calculating the average of the change in individuals' probabilities of carrying a handgun when the variable *Law* is changed from 0 to 1 while other variables are kept at their observed values. ***, ** and * indicate significance at 1%, 5% and 10%, respectively.

Estimating equation (2.1) using the sample of Arrestees will reveal whether the Eventual Arrestees and Current Arrestees respond to shall-issue laws by carrying guns more frequently. Notice that the individuals in the Arrestees sample are similar in terms of their unobserved criminal human capital, i.e. they will commit a crime at least once at some point in their lives. However, Eventual Arrestees may be eligible to carry concealed weapons while Current Arrestees cannot be. These groups make up the counter-factual for each other. Specifically, the experiment in this section involves a comparison of the change in an Eventual Arrestee's probability of carrying a gun when he/she becomes eligible (through enactment of a shall-issue law or satisfying the minimum age requirement) with that of a Current Arrestee who receives the same treatment and would have become eligible if he/she did not have an arrest record.

Table 2.4 Influence of Meeting the Minimum Required Age on Probability of Carrying a Handgun

	I	II
	Law Abiding Individuals	Arrestees
Marginal Effect is calculated for		
1 Whole sample	0.004	-0.004
	(0.003)	(0.007)
2 Individuals in a Shall-Issue state[a]	0.009***	0.003
	(0.003)	(0.008)
3 Individuals in a Non-Shall-Issue state[b]	-0.002	-0.015*
	(0.003)	(0.009)
4 Eventual Arrestees in Shall-Issue state[a,c]		0.024*
		(0.015)
5 Current Arrestees in Shall-Issue state[a,d]		-0.006
		(0.008)
6 Eventual Arrestees in Non-Shall-Issue state[b,c]		-0.016
		(0.015)
7 Current Arrestees in Non-Shall-Issue state[b,d]		-0.015
		(0.009)
Observations	58,023	26,919

Notes to Table 2.4: Columns I and II present the average marginal effects of the variable *Adult* based on estimation of equation (2.1) on samples listed at the top. Law Abiding Individuals do not have an arrest record as of the 2007 wave of NLSY97. *Arrestees* have an arrest record as of the 2007 wave. The first row provides the average marginal effects evaluated for the whole sample. Other rows pertain to marginal effects evaluated for different sub-samples as following: [a] *Law*=1, *Law*=0, [c] *Ever Arrested*=0, [d] *Ever Arrested*=1

The dependent variable, *Gun*, is constructed based on the individuals' answers to the question "*Have you carried a handgun since the last interview? When we say handgun, we mean any firearm other than a rifle or shotgun.*" The marginal effects are obtained by calculating the average of the change in individuals' probabilities of carrying a gun when the variable *Adult* is changed from 0 to 1 while other variables are kept at their observed values. ***, ** and * indicate significance at 1%, 5% and 10%, respectively.

The average marginal effects obtained from estimation of equation (2.1) are presented in the second columns of Table 2.3 (the influence of the enactment of a shall-issue law) and Table 2.4 (the influence of completing the minimum age requirement). The rows pertain to the responses estimated in different subsamples. For example, the fourth row in Table 2.3 presents the average marginal effect of the enactment of a shall-issue law on the gun carrying probabilities of Eventual Arrestees who are older than the minimum required age (i.e. *Adult*=1 and *Ever Arrested*=0). The marginal effects presented in column II of Table 2.3 (Table 2.4) are obtained by calculating the average change in the gun carrying probabilities of Arrestees when the *Law* (*Adult*) variable is increased from zero to one while other variables are kept at their observed values.

As presented in row 1 column II of Table 2.3, the enactment of a shall-issue law does not significantly increase the probability of carrying a handgun on average for Arrestees (individuals who are arrested or will be arrested eventually). However, an Eventual Arrestee who has satisfied the minimum age requirement is expected to carry handguns more frequently when a

shall-issue law is enacted (row 4). The same impact does not significantly change the probability of carrying a handgun for his Current Arrestee counterpart (row 5). A statistically significant response is not observed for the Eventual or Current Arrestees who have not satisfied minimum age requirement, when a shall-issue law is enacted (rows 6 and 7).

The impact of satisfying the minimum age requirement on Eventual and Current Arrestees' probabilities of carrying handguns is weak. For example, as presented in column II of Table 2.4, the average impact of becoming eligible through fulfilling the minimum age requirement is insignificant in the sample of Arrestees on average (row 1). Nevertheless, in a shall-issue state, when an Eventual Arrestee becomes old enough to satisfy the minimum age requirement, his/her probability of carrying a handgun increases by 2.4 percentage points on average (row 4).[25] This marginal effect is larger compared to Current Arrestees who live in shall-issue states (row 5).

2.3.3 Serious and Minor Crime Arrestees

The previous section considers all individuals who have committed or will commit a crime to have similar unobservable criminal human capital. However, individuals' levels of criminal human capital may vary with the severity of crimes they commit. For example, writing graffiti is very different than committing a burglary. Furthermore, the results of the analysis in section "Can the Eligibility Criteria Successfully Determine Future Uses of Guns?" below reveal that Eventual Arrestees are less likely to be associated with violent crimes than are Current Arrestees. This difference in the criminal human capital of individuals may be reflected in their tendency to carry a gun.[26]

In this section, the arrestees are categorized into two groups in order to conduct the estimation on more homogeneous samples. The categorization takes into consideration the severity of crimes committed. Specifically, individuals whose arrest records include offenses of *Violence*, *Robberies, Burglaries, Thefts and Destruction of Property* as of the last available survey date (2007) are grouped into "Serious Crime Arrestees."[27] Their counterparts who have been charged with *Illicit Drug Possession and Sale, Major Traffic Offenses, Other Property Offenses* and *Other Offenses* are categorized as "Minor Crime Arrestees." If an individual has committed both a minor crime and a serious crime as of the last interview date, that individual is considered as a Serious Crime Arrestee.

For the analysis, equation (2.1) is estimated separately over the samples of Serious and Minor Crime Arrestees. Similarity in the criminal human capital of the individuals in these samples reduces the possibility of bias due to unobservable characteristics which may affect both gun carrying probability and eligibility of individuals. Since this influence is similar within these groups, however, it will not lead to a bias in estimation. Further, the variation in the timing of first arrests within the Serious and Minor Crime Arrestees subsamples allows for identifying the impact of eligibility to obtain a concealed weapon license on carrying a handgun. That is, the

[25] However, this impact is borderline significant.

[26] Moreover, individuals who have committed minor crimes such as traffic offenses, drug use or public order offenses may be eligible to obtain a concealed weapon license according to some of the states' laws.

[27] This categorization of crimes follows the FBI which lists assaults, rapes, robberies, burglaries, thefts and arsons as Index I crimes in its Uniform Crime Reports. Index I crimes are costlier to the society and they occur more frequently. *Destruction of Property* offenses are also included in serious crimes since arson is a property destruction offense and it has been considered as an Index I crime by FBI since 1979.

individuals who are arrested in the later rounds of the survey make up the counterfactual for those who have been arrested previously. Those Eventual Arrestees (who do not have arrest records at the time of an interview but will be arrested in the future) are eligible, like Law Abiding Individuals, in the estimation sample. However, they are similar to the Current Serious or Minor Crime Arrestees in terms of their criminal human capital.[28]

The results are provided in the Tables 2.5 and 2.6 which present the impact of enactment of a shall-issue law and satisfying the minimum age requirement on the probability of carrying a handgun, respectively. The first and second columns in each table show the results for the samples of Serious Crime Arrestees and Minor Crime Arrestees, respectively. The marginal effects presented in the first row of Table 2.5 (Table 2.6) are obtained by calculating the average change in the probability of carrying a handgun for the whole serious and minor crime arrestees samples when the variable *Law* (*Adult*) is increased from zero to one while other variables are kept at their observed values. The marginal effects shown in the other rows pertain to the responses estimated in different subsamples. For example, row 4 and column I of Table 2.5 s the marginal effect of the enactment of a shall-issue law calculated for the Eventual Serious Crime Arrestees who are older than the minimum required age (*Adult*=1 and *Ever Arrested*=0).

Enactment of a shall-issue law does not increase the probability of carrying handguns for Serious Crime Arrestees (column 1 of Table 2.5). The only statistically significant impact is found for the Eventual Serious Crime Arrestees who are younger than the minimum required age at the time of the enactment. This impact is negative. However, the marginal effect presented in the row 1 and column II of Table 2.5 shows that the enactment of a shall-issue law increases a Minor Crime Arrestee's probability of carrying a handgun by about 1.7 percentage points. This influence is mainly due to the responsiveness of Eventual Arrestees to shall-issue laws. An Eventual Minor Crime Arrestee, who meets the minimum required age, is 4.5 percentage points more likely to carry a handgun in the presence of a shall-issue law compared to absence of the law (row 4 of column II). This is similar for an Eventual Minor Crime Arrestee who has not satisfied the minimum age requirement (row 2 column II).[29] Among the Minor Crime Arrestees who have satisfied the minimum age requirement, the probability of carrying a gun for an Eventual Arrestee gun increases more than that for a Current Arrestee when a shall-issue law is enacted (rows 4 and 5 of column II). However, as presented in Table 2.6, satisfying the minimum age requirement does not significantly influence the probability of carrying a gun for Serious or Minor Crime Arrestees.

The previous section's results suggest that Eventual Arrestees are more likely to carry handguns when they become eligible. The findings in this section imply that the increase in the handgun carrying probability of Eventual Arrestees is observed because of Eventual Minor Crime Arrestees. Unlike their Serious Crime Arrestee counterparts, Eventual Minor Crime Arrestees are very responsive to the shall-issue laws. The probability of carrying a handgun does not change for individuals who have committed or will commit serious crimes in the future when a shall-issue law is enacted. Only the Eventual Serious Crime Arrestees who are younger than the minimum required age reduce their frequency to carry guns in response to the enactment of

[28] In the rest of this section, definitions from the previous sections are used. That is, an individual who does not have a serious (minor) crime offense charge in his/her arrest record as of the current interview date is referred to as an Eventual Serious (Minor) Crime Arrestee. An individual who already has a serious (minor) crime offense charge in his/her arrest record is considered a Current Serious (Minor) Crime Arrestee.

[29] An individual who has not satisfied the minimum age requirement may have greater access to handguns even if he/she is not eligible to obtain a concealed weapon license. For example, such an individual may borrow or secretly obtain a handgun which is legally obtained by his/her parents with the enactment of shall-issue laws.

shall-issue laws.[30] On the other hand, a shall-issue law increases the tendency to carry a gun for an individual who will commit a minor crime in the future. Although this effect is undesirable, when compared to serious crimes, these minor crimes are less costly to society.

2.4 Extensions and Robustness Checks

2.4.1 Can the Eligibility Criteria Successfully Determine Future Uses of Guns?

According to the criteria to obtain a concealed weapon license, individuals with arrest records (Current Arrestees) are considered to be ineligible. This is because past criminal activity is a determinant of future criminal activity. Current Arrestees would have been likely to use handguns in future criminal activity, if they were allowed to carry one. However, it is possible for an individual without arrest record to obtain a concealed weapon license, to start carrying a gun legally, and commit a crime in the future. This is because of the fact that license-issuing authorities cannot distinguish future criminals from the entire pool of eligible individuals. In other words, license-issuing authorities cannot differentiate between a Law Abiding Individual and an Eventual Arrestee, and thus concealed weapon licenses may be granted to future criminals. In support of this possibility, the findings of the section "Individuals with At Least One Arrest Record" suggest that Eventual Arrestees become more likely to carry handguns when they become eligible to obtain a concealed weapon license, unlike the Current Arrestees. As a consequence, these criteria can be criticized for the possibility that they may (unintentionally) provide concealed weapon licenses to individuals who may involve in criminal activity in the future.

If Eventual and Current Arrestees commit similar crimes in the future, then granting concealed weapon licenses to the Eventual Arrestees may not be a sound policy. Alternatively, if the Eventual Arrestees do not commit crimes as severe as do the Current Arrestees, then allowing concealed weapons to this group may not be a critical problem.[31] Consequently, whether the Current and Eventual Arrestees commit similar crimes becomes important in the context of testing whether the criteria adopted by shall-issue states are successful in terms of identifying future criminal use of guns.

[30] Notice that although insignificant, the influence of the enactment of a shall-issue law for Eventual Serious Arrestees who are older than the minimum required age is negative as well. However, the influence of the same change on Current Serious Crime Arrestees is close to zero. This overall picture may be explained by the possibility that Eventual Serious Crime Arrestees switch to crimes that do not require face-to-face contact with the victim and therefore the marginal benefit of carrying a gun is lower. On the other hand, Current Serious Crime Arrestees who are more experienced in committing crimes may not switch to such crimes. In fact, as will be shown in the next section, Eventual Arrestees are less likely to commit crimes of *Violence* and *Robbery* compared to the Current Arrestees.

[31] Although all crimes are costly, minor crimes and misdemeanors such as illicit drug use, reckless driving or theft are far less costly than severe crimes such as homicide, rape or robbery.

Table 2.5 Influence of Enactment of Shall-Issue Law on Arrestees' Probability of Carrying Handgun

		Serious Crime Arrestees	Minor Crime Arrestees
		I	II
	Marginal Effect is calculated for		
1	Whole sample	-0.008	0.017**
		(0.010)	(0.007)
2	Eventual Arrestees, Under Min. Age[b,c]	-0.037**	0.018*
		(0.015)	(0.010)
3	Current Arrestees, Under Min. Age[b,d]	0.004	0.010
		(0.015)	(0.012)
4	Eventual Arrestees, Over Min. Age[a,c]	-0.045	0.045**
		(0.033)	(0.018)
5	Current Arrestees, Over Min. Age[a,d]	0.002	0.016
		(0.013)	(0.010)
	Observations	10,685	16,219

Notes to Table 2.5: Columns I and II present the average marginal effects of the variable *Law* based on estimation of equation (2.1) on samples listed at the top. Serious Crime Arrestees have committed at least one of the Index-I crimes as of the 2007 wave of NLSY97. Minor Crime Arrestees have committed at least one misdemeanor but none of the Index-I crimes as of the 2007 wave of NLSY97. The first row provides the average marginal effects evaluated for the whole sample. Other rows pertain to marginal effects evaluated for different sub-samples as follows: [a] *Adult*=1, [b] *Adult*=0, [c] *Ever Arrested*=0, [d] *Ever Arrested*=1
The dependent variable, *Gun*, is constructed based on the individuals' answers to the question "*Have you carried a hand gun since the last interview? When we say hand gun, we mean any firearm other than a rifle or shotgun.*" The marginal effects are obtained by calculating the average of the change in individuals' probabilities of carrying a gun when the variable *Law* is changed from 0 to 1 while other variables are kept at their observed values. ***, ** and * indicate significance at 1%, 5% and 10%, respectively.

In this section, I investigate the types of future crimes individuals commit, conditional on their arrest records. Specifically, I estimate the following specification for the sample of Arrestees:

$$(2.2) \quad Crime^{*}_{ist} = B_1 Eventual_{ist-1} + B_2 Gun_{ist} + B_3 Eventual_{ist-1} Gun_{ist} + B_4 X_{ist} + v_{ist}$$

where $Crime^{*}_{ist}$ is the propensity to be charged with an offense of individual *i* who lives in state *s* in year *t*. Equation (2.2) is estimated using probit over the sample of Arrestees.

$Eventual_{ist-1}$ in equation (2.2) indicates whether the individual *i* was an Eventual Arrestee in the previous time period, *t-1*. In other words, $Eventual_{ist-1}$ takes the value of one if the individual *i* has never been arrested as of the previous survey wave at t-1, but he/she will experience his/her first arrest *after the date of his/her previous interview* (after t-1). Notice that since equation (2.2) is estimated for the sample of Arrestees, the variable *Eventual* identifies the difference between Eventual and Current Arrestees in terms of committing a crime. Gun_{ist}

measures whether an individual has carried a handgun since the previous interview date. The vector X_{ist} includes all of the control variables as in the equation (2.1).[32]

A variety of offenses are considered as outcome variables, which are defined in Individual-Level Data section. The outcome variable takes the value of one if the individual is charged with a specific offense. The charged offense can be one of the following: *Violence*, *Robbery*, *Burglary, Theft, Destruction of Property, Other Property Offenses, Drug Possession, Drug Sale*, *Major Traffic Offenses, Public Order Offenses* and *Other Offenses*.[33]

The estimated probability of committing a crime for Eventual Arrestees who have carried handguns is presented in Table 2.7. The comparison group is Current Arrestees who have carried a handgun. Although Table 2.7 only reports the average marginal effects estimated in the sample individuals who have carried a gun, equation (2.2) is estimated for the whole sample of Arrestees. The presented marginal effects are obtained by calculating the average change in the probability of committing a crime when the variable *Eventual* is increased from zero to one while other variables are kept at their observed values, for the Arrestees who have carried a handgun since the last interview date (*Gun*=1). Each row in Table 2.7 pertains to a regression where an indicator for the specified crime type is the dependent variable.

As presented in Table 2.7, among the group of individuals who have carried a handgun since the last interview date, those who have never been arrested as of the previous survey date but will be arrested after that date (Eventual Arrestees) are less likely to be associated with committing violent crimes and robberies compared to their counterparts who already had an arrest record as of the previous survey date (Current Arrestees). There is no statistical difference between these two groups in terms of committing other crime types.[34]

These results indicate that Eventual Arrestees *who carry a gun* are less likely to commit violent crimes such as assault, rape, manslaughter and robberies than are Current Arrestees *who carry a gun*, although the difference is not statistically significant for other crimes.[35] The results

[32] The full set of control variables includes both individual and state-level control variables. The individual-level control variables are the *Age* of the individual, indicators for individual's gender (*Female*), race and ethnicity (*Black, Hispanic, Mixed* and *Non-Black* [omitted]), marital status (*Can't Marry*, *Single* [omitted], *Cohabiting, Married* and *Separated*) and *School Enrollment s*tatus. Other control variables are individual's *Household Size*, *Household Income* and *Highest Grade Completed* in addition to the number of days in the last month the individual has drunk 5 or more drinks (*Heavy Drinking*), the number of days in the last month he/she used *Marijuana*, whether the individual was a victim of burglary (*Burglarized*) or bullying (*Bullied*) before the age of 12 and whether the individual witnessed someone getting shot before the age of 12. The state-level control variables are the *Crime Rate*, *Unemployment Rate*, race and gender specific Homicide *Victimization Probability* and the *Hunters' Share in the State's Population*.

[33] According to the definition of NLSY, the variable *Violence* includes battery, rape, aggravated assault and manslaughter.

[34] The results for those who have not carried guns are not reported, but they are available upon request. Briefly, among those Arrestees who have <u>not</u> carried a gun, the individuals who were Eventual Arrestees in the previous wave are more likely to be associated with violent crimes (at 10% significance), theft, drug possession, traffic and public order offenses compared to those who were Current Arrestees in the previous wave.

[35] The main findings in this section are not surprising. The results indicate that the individuals who get arrested early in their lives are more likely to commit highly-severe crimes, such as assault and robbery, and less likely to commit less-severe crimes, such as drug possession, traffic and public order offenses, than those who get arrested later. One reason for this may the differences in criminal human capital. For an individual who has accumulated a greater stock of criminal human capital early in his/her life, it may be harder to switch to the legal sector later (Mocan and Bali, *forthcoming*). Therefore, by staying in the criminal sector, such an individual continues accumulating even more criminal human capital and he/she is more likely to commit more severe crimes than another individual with a smaller initial criminal human capital.

in previous sections showed that some eligible individuals who may commit crimes in the future (Eventual Arrestees) carry guns more often in response to enactment of shall-issue laws. However, when they have carried guns, Eventual Arrestees are less likely to commit violent crimes compared to Current Arrestees who are considered ineligible for a concealed weapon license. Therefore, granting concealed weapon licenses only to the individuals who do not have arrest records at time of the application but not to the individuals with arrest records seems to be a successful method of excluding individuals who will be involved in future criminal activity, especially in violent offenses.

2.4.2 Observable Differences among Arrestees and Law Abiding Individuals

In the previous sections, individuals are categorized according to their arrest records. This categorization was based on possible differences between these individuals in terms of their criminal human capital. Arrestees are considered to have greater levels of criminal human capital than Law Abiding Individuals.

Along the same lines, Arrestees are expected to have lower levels of legal human capital than Law Abiding Individuals. In this section, I investigate whether Arrestees have common characteristics that are associated with low levels of legal human capital and whether these characteristics are different from Law Abiding Individuals. In this way, I test whether the categorization based on arrest records is an appropriate way of classifying individuals to form homogeneous groups within themselves. If Arrestees and Law Abiding individuals are significantly different from each other in their legal human capital, then the classification based on the existence of arrest records in individuals' lifetimes is a good proxy for categorizing individuals according to their unobservable characteristics. Consequently, unobservable characteristics of the Law Abiding Individuals and Arrestees can be thought to be similar within these samples.

Previous research has provided evidence supporting the classification based on arrest records. For example, Grogger (1995) has shown that the current wages of individuals who will be arrested in the future are not very different from the wages of those who already have an arrest record.[36] Further, Grogger (1995) argues that wages of those with arrest records are economically and statistically different than wages of individuals without arrest records. Other studies, such as Williams and Sickles (2002) and Marcotte and Markowitz (2009), have argued that individuals who have arrest records are differentially associated with unsuccessful marriage and mental health outcomes as compared to individuals with no arrest record.

To test whether Arrestees and Law Abiding Individuals differ in terms of their observable characteristics, the following equation is estimated for a sample that pools Law Abiding individuals with Serious and Minor Crime Arrestees:

$$(2.3) \quad Outcome_i = B_1 Serious\ Crime_i + B_2 Minor\ Crime_i + B_3 X_i + v_i$$

[36] Grogger (1995) finds that the difference is statistically significant but not economically.

Table 2.6 Influence of Satisfying the Minimum Age Requirement on Arrestees' Probability of Carrying a Handgun

		Serious Crime Arrestees	Minor Crime Arrestees
		I	II
	Marginal Effect is calculated for		
1	Whole Sample	0.003	-0.010
		(0.011)	(0.008)
2	Eventual Arrestees in Non-Shall-Issue State[b,c]	0.020	-0.020
		(0.039)	(0.015)
3	Current Arrestees in Non-Shall-Issue State[b,d]	0.003	-0.018*
		(0.015)	(0.011)
4	Eventual Arrestees in Shall-Issue State[a,c]	-0.007	0.010
		(0.024)	(0.016)
5	Current Arrestees in Shall-Issue State[a,d]	0.002	-0.012
		(0.013)	(0.010)
	Observations	10,685	16,219

Notes to Table 2.6: Columns I and II present the average marginal effects of the variable *Adult* based on estimation of equation (2.1) on samples listed at the top. Serious Crime Arrestees have committed at least one of the Index-I crimes as of the 2007 wave of NLSY97. Minor Crime Arrestees have committed at least one misdemeanor but none of the Index-I crimes as of the 2007 wave of NLSY97.The first row provides the average marginal effects evaluated for the whole sample. Other rows pertain to marginal effects evaluated for different sub-samples as follows: [a] *Law*=1, [b] *Law*=0, [c] *Ever Arrested*=0, [d] *Ever Arrested*=1.
The dependent variable, *Gun*, is constructed based on the individuals' answers to the question "*Have you carried a hand gun since the last interview? When we say hand gun, we mean any firearm other than a rifle or shotgun.*" The marginal effects are obtained by calculating the average of the change in individuals' probabilities of carrying a gun when the variable *Adult* is changed from 0 to 1 while other variables are kept at their observed values. ***, ** and * indicate significance at 1%, 5% and 10%, respectively.

where *Outcome* stands for various education levels (whether the individual has at least *High School, Associate* or *Bachelor's degree* and *Highest Grade Completed*), labor market outcomes (*Hourly Wages, Hours Worked per Week*), family formation behaviors (being *Married, Cohabiting*, *Separated* and number of *Children*) and mental health issues (being *Nervous, Uncalm*, feeling *Blue, Unhappy* and *Depressed*). Equation (2.3) is estimated by probit (OLS) for binary (continuous) outcomes. Estimation is conducted using the 2007 wave (last available wave) for education, labor market and family formation outcomes. However, the 2006 wave is the last wave which asks about mental health, and is used for the mental health outcome variables.

Table 2.7 Eventual Arrestees' Probability of Committing a Crime Conditional on Carrying a Gun

Outcome	Marginal Effect	Standard Error
Violence	-0.030**	(0.012)
Robbery	-0.028***	(0.010)
Burglary	-0.004	(0.010)
Theft	-0.002	(0.012)
Property Destruction	-0.007	(0.011)
Other Prop.	0.000	(0.009)
Drug Possession	0.016	(0.013)
Drug Sale	0.014	(0.010)
Major Traffic Offense	0.019	(0.013)
Public Order Offense	0.007	(0.010)
Other Offense	-0.011	(0.014)

Notes to Table 2.7: The dependent variables, which are listed in the rows, are indicators for whether an individual is charged with the specified offense. Each row pertains to a different regression. Violence includes battery, rape, aggravated assault and manslaughter. The underlying coefficients are obtained from estimating equation (2.2) over the sample of Arrestees (who have an arrest record as of the 2007 wave of NLSY97). Reported marginal effects are the probabilities of committing the specified crime for the Eventual Arrestees who have carried a gun. The comparison group is Current Arrestees who have carried a gun. Eventual Arrestees do not have an arrest record at the time of the interview, but will be arrested in the future. Current Arrestees have an arrest record at the time of the interview. The marginal effects are obtained by calculating the average change in the crime committing probabilities for the individuals who have carried a gun (*Gun*=1) when the variable *Eventual* is increased from 0 to 1 while other variables are kept at their observed values. ***, ** and * indicate significance at 1%, 5% and 10%, respectively.

Serious Crime and *Minor Crime* are indicators for being a Serious Crime and Minor Crime Arrestee, respectively. That is, *Serious Crime* (*Minor Crime*) takes the value of one if the individual has an arrest record for rape, assault, manslaughter, robbery, burglary, theft and destruction of property (illicit drug possession and sale, major traffic offenses, other property offenses and other offenses) as of the last available survey date, 2007. The vector *X* includes appropriate control variables. Specifically, the vector *X* includes all control variables that were used in equation (2.1) except, for example, the education variables (*Highest Grade Completed*), when the outcome considered is *High School*, *Associate* or *Bachelor's* degrees and *Highest Grade Completed*.[37]

[37] The full set of control variables includes both individual and state-level control variables. The individual-level control variables are the *Age* of the individual, indicators for individual's gender (*Female*), race and ethnicity (*Black, Hispanic, Mixed* and *Non-Black* [omitted]), marital status (*Can't Marry*, *Single* [omitted], *Cohabiting, Married* and *Separated*) and *School Enrollment s*tatus. Other control variables are individual's *Household Size*, *Household Income* and *Highest Grade Completed* in addition to the number of days in the last month the individual has drunk 5 or more drinks (*Heavy Drinking*), the number of days in the last month he/she used *Marijuana*, whether the individual was a victim of burglary (*Burglarized*) or bullying (*Bullied*) before the age of 12 and whether the individual witnessed someone getting shot before the age of 12. The state-level control variables are the *Crime Rate*, *Unemployment Rate*, race and gender specific Homicide *Victimization Probability* and the *Hunters' Share in the State's Population*.

Tables 2.8, 2.9 and 2.10 provide the results for education and labor market, marriage and family, and mental health outcomes in the last available wave, respectively. For the regressions with *Highest Grade Completed* (column 4 in 2.8), *Hourly Wages* and *Hours Worked per Week* (Columns 5 and 6 in Table 2.8) and number of *Children* (Column 4 of Table 2.9) the marginal effects obtained from the estimation of equation (2.3) with OLS are presented. For the remaining outcomes the marginal effects are obtained from probit.[38] The reported marginal effects lay out the similarities and differences between Minor Crime Arrestees, Serious Crime Arrestees and the Law Abiding individuals as of the last wave of the survey.

As observed in Table 2.8, both Serious and Minor Crime Arrestees are less likely to have at least a high school, associate or bachelor's degree as of the 2007 wave compared to Law Abiding individuals. On average, Serious and Minor Crime Arrestees complete about two and one fewer years of schooling, respectively than Law Abiding Individuals. Compared to their counterparts who commit a minor crime, Serious Crime Arrestees are less likely to obtain a high school or higher education degrees. Serious Crime Arrestees work more hours per week than do the Law Abiding Individuals, although this marginal effect is borderline significant. Serious Crime Arrestees' hourly earnings are much less. [39,40] There is no statistical difference between Minor Crime Arrestees and Law Abiding individuals in terms of hours worked per week and hourly wages.

Table 2.9 presents the results of the regressions for family formation and marriage outcomes as of the 2007 wave interviews. Minor Crime Arrestees are less likely to be married and more likely to be cohabiting with a partner than Law Abiding Individuals. Serious Crime Arrestees are less likely to be married but they are as likely to be cohabiting as Law-Abiding Individuals. Additionally, Serious Crime Arrestees are less successful in maintaining their marriages than are Law Abiding individuals, because Serious Crime Arrestees are more likely to be separated or divorced from their spouses. Except for being separated, there is no statistical difference in family formation outcomes of Serious versus Minor Crime Arrestees. Serious Crime Arrestees have more children than Minor Crime Arrestees and Law Abiding Individuals. Further, Minor Crime Arrestees have more children than do Law Abiding Individuals as of the 2007 wave.

As displayed in Table 2.10, Serious Crime Arrestees have the worst mental health conditions on overage among all subgroups as of the 2006 wave (last available survey for these outcomes). They are more likely to feel blue, be nervous, unhappy, uncalm and depressed than the Law Abiding individuals. Minor Crime Arrestees share these unfavorable mental health outcomes with Serious Crime Arrestees, but they experience these negative outcomes at a smaller magnitude. Minor Crime Arrestees are as likely to feel blue or depressed as Law Abiding individuals, yet they are more likely to be nervous, uncalm and unhappy.

[38] The marginal effects obtained from probit are calculated as the average change in the probability of the outcome when the indicator variables Minor Crime and Serious Crime are increased from zero to one while other variables are kept at their observed values. The marginal effects obtained from OLS are the coefficient estimates. The marginal effects presented in Tables 2.8, 2.9 and 2.10 are estimated for the whole sample observed in the last wave of the survey.

[39] Hourly Wage Rate is scaled by 0.01. This implies the coefficient of -93 for the Serious Crime Arrestees in Column 5 of Table 2.8 indicate a difference of 93 cents/hour.

[40] Hours worked per week and hourly wage regressions are conducted for the sample of individuals who reported participating in the labor market.

Table 2.8 Comparison of the Law Abiding Individuals and Arrestees: Education and Labor Market Outcomes (2007 wave)

	(1)	(2)	(3)	(4)	(5)	(6)
	High School +	College +	Bachelors +	Highest Grade	Hourly Wage Rate	Hours /Week
Serious Crime Arrestees	-0.386***	-0.206***	-0.160***	-1.981***	-92.727***	1.945*
	(0.020)	(0.010)	(0.007)	(0.081)	(27.145)	(1.153)
Minor Crime Arrestees	-0.193***	-0.142***	-0.106***	-1.192***	-33.709	0.302
	(0.015)	(0.010)	(0.009)	(0.070)	(23.034)	(0.898)
Observations	7,345	7,345	7,345	7,290	6,366	6,483

Notes to Table 2.8: The outcome variables are listed at the top of the columns. All columns present marginal effects obtained from estimation of equation (2.3) for the whole sample of individuals (Law Abiding, Minor and Serious Crime Arrestees) for 2007 wave. The base group is Law Abiding Individuals. Law Abiding Individuals have not committed any crimes as of the last wave of NLSY97. Serious Crime Arrestees have committed at least one of the Index-I crimes of FBI as of the 2007 wave of NLSY97. Minor Crime Arrestees have committed at least one misdemeanor but none of the Index-I crimes of FBI as of the 2007 wave of NLSY97. Columns 4-6 provide OLS estimates and the remaining columns provide marginal effects obtained from probit. Hourly Wage Rate is measured in one hundredths of a dollar. The marginal effects obtained from probit are calculated as the average change in the probability of the outcome when the indicator variables *Minor Crime* and *Serious Crime* are increased from zero to one while other variables are kept at their observed values. The marginal effects obtained from OLS are the coefficient estimates. The marginal effects presented are estimated for the whole sample observed in the last wave of the survey. Robust standard errors are presented in the parentheses. ***, ** and * indicate significance at 1%, 5% and 10%, respectively.

The findings in this section imply that Arrestees are different from Law Abiding individuals in various aspects of legal human capital.[41] These differences are more significant for Serious Crime Arrestees than they are for Minor Crime Arrestees. However, although differences exist, Minor Crime Arrestees resemble to Serious Crime Arrestees at a much greater extent than they resemble to the Law Abiding Individuals. It is more appropriate to group Minor Crime Arrestees with Serious Crime Arrestees rather than with Law Abiding Individuals. In addition, the findings in this section imply that using arrest records to categorize individuals seems to be a good method of classification according to unobservable criminal human capital. If I used the components of legal human capital (education, labor market outcomes, family formation behavior, mental health issues…etc.) instead of the existence of lifetime arrest records to categorize individuals, then samples similar to what I employ in the previous sections of the paper would have been obtained.

[41] Same findings are found when equation (2.3) is estimated over the whole sample of observations consisting of all survey waves.

Table 2.9 Comparison of the Law Abiding Individuals and Arrestees: Marriage and Family Outcomes (2007 wave)

	(1)	(2)	(3)	(4)
	Married	Cohabiting	Separated	Children
Serious Crime Arrestees	-0.052***	0.026	0.016**	0.214***
	(0.015)	(0.016)	(0.007)	(0.036)
Minor Crime Arrestees	-0.055***	0.036***	0.003	0.127***
	(0.012)	(0.013)	(0.005)	(0.026)
Observations	7,348	7,348	7,305	7,359

Notes to Table 2.9:
The dependent variables are listed at the top of the columns. All columns present marginal effects obtained from estimation of equation (2.3) for the whole sample of individuals (Law Abiding, Minor and Serious Crime Arrestees) for 2007 wave. The base group is Law Abiding Individuals. Law Abiding Individuals have not committed any crimes as of the last wave of NLSY97. Serious Crime Arrestees have committed at least one of the Index-I crimes of FBI as of the 2007 wave of NLSY97. Minor Crime Arrestees have committed at least one misdemeanor but none of the Index-I crimes of FBI as of the 2007 wave of NLSY97. Column 4 provides OLS estimates, the remaining columns present marginal effects obtained from probit. The marginal effects obtained from probit are calculated as the average change in the probability of the outcome when the indicator variables *Minor Crime* and *Serious Crime* are increased from zero to one while other variables are kept at their observed values. The marginal effects obtained from OLS are the coefficient estimates. The marginal effects presented are estimated for the whole sample observed in the last wave of the survey. The robust standard errors are presented in the parentheses. ***, ** and * indicate significance at 1%, 5% and 10%, respectively.

2.4.3 Differential Treatment

In this section, I check whether the results presented above are robust to a different model specification. This extension utilizes the variation in the exposure of states to the shall-issue laws. Particularly, some individuals have been living in states that enacted their shall-issue laws several years ago. This differential exposure of states to shall-issue laws may lead to differences in the handgun carrying probability of the individuals. In other words, the handgun carrying probability of an individual who resides in a state which enacted a shall-issue law many years ago may be greater (or smaller) than that of an individual whose state just recently passed a shall-issue law.[42] This hypothesis may be especially important when a longer history of the existence of shall-issue laws implies a culture of gun carrying in a shall-issue state.

To test whether exposure of the states to the shall-issue laws influences the probability of carrying a gun, I estimate the equation outlined below:

$$(2.4)\quad Gun^{*}_{ist} = B_1 Exposure_{st} + B_2 Adult_{ist} + B_3 Ever\ Arrested_{ist} + B_{12} Exposure_{st} Adult_{ist} + B_{13} Exposure_{st} Ever\ Arrested_{ist} + B_{23} Adult_{ist} Ever\ Arrested_{ist} + B_{123} Exposure_{st} Adult_{ist} Ever\ Arrested_{ist} + B_4 X_{ist} + v_{ist}$$

[42] The sign of the average marginal effect can be positive or negative. For example, an individual who have been residing in a state that passed a shall-issue law many years ago may choose not to carry a handgun if he/she observes that other individuals carry handguns enough to provide him/her with protection. Alternatively, the same individual may choose to carry a handgun more frequently as carrying a gun may have become a part of the culture in that state.

where *Exposure* is a trend variable that counts the number of years since the state that the individual resides passed a shall-issue law.[43] Notice that equation (2.4) is exactly same as equation (2.1) except that *Law* is replaced with variable *Exposure*. All of the control variables employed in equation (2.1) are also included in equation (2.4).[44] I estimate equation (2.4) by probit. As an alternative, I also estimate equation (2.4) including the variable *Exposure* and its square, as well as their interactions with *Adult* and *Ever Arrested* as covariates.[45]

The marginal effects obtained from estimating equation (2.4) over the sample of Law Abiding Individuals are presented in the first column of Table 2.11, which corresponds to the first column of Table 2.3. On average, residing in a state with an extra year of exposure to the shall-issue laws does not significantly increase the probability of carrying a handgun for a Law Abiding Individual. However, as presented in the second row and first column of Table 2.11, the same marginal effect calculated for the sample of Law Abiding Individuals who are older than the minimum age requirement is positive. The same result is found when the alternative specification of equation (2.4), which includes both the variable *Exposure* and the square of it as covariates, is employed. The marginal effects obtained from this specification are provided in the second column of Table 2.11.

The marginal effects obtained from estimating equation (2.4) over the samples of Serious and Minor Crime Arrestees are presented in the Table 2.12. The counterpart to this table is Table 2.5. Residing in a state that has greater years of exposure to shall-issue laws does not increase the probability of carrying a handgun for Serious Crime Arrestees (column I). This finding holds when both linear and quadratic *Exposure* are included in equation (2.4) (column II). No influence of residing in a state with greater exposure to shall-issue laws is estimated for Minor Crime Arrestees when only linear *Exposure* is employed in equation (2.4) (column III). However, when both linear and quadratic *Exposure* variables are controlled for, the results change. As presented in the column IV of Table 2.12, a Minor Crime Arrestee who resides in a state which passed a shall-issue law earlier is more likely to carry a handgun than his/her counterpart who resides in a state which has passed a shall-issue law recently. This finding holds for both Eventual and Current Minor Crime Arrestees, except Current Minor Crime Arrestees who have not satisfied the minimum age requirement.[46]

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[43] For those states that passed a shall-issue law earlier than 1970, the enactment year is set at 1970.

[44] The full set of control variables includes both individual and state-level control variables. The individual-level control variables are the *Age* of the individual, indicators for individual's gender (*Female*), race and ethnicity (*Black, Hispanic, Mixed* and *Non-Black* [omitted]), marital status (*Can't Marry*, *Single* [omitted], *Cohabiting, Married* and *Separated*) and *School Enrollment s*tatus. Other control variables are individual's *Household Size*, *Household Income* and *Highest Grade Completed* in addition to the number of days in the last month the individual has drunk 5 or more drinks (*Heavy Drinking*), the number of days in the last month he/she used *Marijuana*, whether the individual was a victim of burglary (*Burglarized*) or bullying (*Bullied*) before the age of 12 and whether the individual witnessed someone getting shot before the age of 12. The state-level control variables are the *Crime Rate*, *Unemployment Rate*, race and gender specific Homicide *Victimization Probability* and the *Hunters' Share in the State's Population*.

[45] When both *Exposure* and the square of it are included in the equation (2.4), there are four main effects, six two-way interactions, four three-way interactions and one four-way interaction in the equation.

[46] Although not reported here, I calculated the marginal effect of satisfying the minimum age requirement at different values of *Exposure*. There was not a clear pattern for any subsamples (Law Abiding Individuals, Eventual or Current Arrestees).

Table 2.10 Comparison of the Law Abiding Individuals and Arrestees: Mental Health Outcomes (2006 wave)

	(1)	(2)	(3)	(4)	(5)
	Nervous	Uncalm	Blue	Unhappy	Depressed
Serious Crime Arrestees	0.053***	0.083***	0.036***	0.084***	0.011
	(0.014)	(0.020)	(0.013)	(0.019)	(0.007)
Minor Crime Arrestees	0.027***	0.029*	0.003	0.025*	0.006
	(0.010)	(0.016)	(0.009)	(0.015)	(0.006)
Observations	7,365	7,418	7,307	7,430	7,315

Notes to Table 2.10: The dependent variables are listed at the top of the columns. All columns present marginal effects obtained from estimation of equation (2.3) using probit for the whole sample of individuals (Law Abiding, Minor and Serious Crime Arretees) for 2006 wave. The base group is Law Abiding Individuals. Law Abiding Individuals have not committed any crimes as of the last wave of NLSY97. Serious Crime Arrestees have committed at least one of the Index-I crimes of FBI as of the 2007 wave of NLSY97. Minor Crime Arrestees have committed at least one misdemeanor but none of the Index-I crimes of FBI as of the 2007 wave of NLSY97. The marginal effects obtained from probit are calculated as the average change in the probability of the outcome when the indicator variables *Minor Crime* and *Serious Crime* are increased from zero to one while other variables are kept at their observed values. The marginal effects presented in Table 2.10 are estimated for the whole sample observed in the 2006 wave of the survey. The robust standard errors are presented in the parentheses. ***, ** and * indicate significance at 1%, 5% and 10%, respectively.

2.4.4 Probability of Carrying a Gun in the Last Month

In this section, I test whether shall-issue laws influence tendency to carry a handgun in the more recent past. For this purpose, I estimate equation (2.1) employing *Gun in Last Month* as the dependent variable instead of *Gun*. The new dependent variable, *Gun in Last Month*, takes the value of one if the individual has indicated that he/she has carried a gun at least one day in the last 30 days.

Tables 2.13 and 2.14 present the marginal effects obtained from estimating equation (2.1), with the dependent variable *Gun in Last Month,* over the samples of Law Abiding Individuals, Serious Crime Arrestees and Minor Crime Arrestees, separately. The marginal effects associated with the enactment of a shall-issue law and satisfying the minimum age requirement are presented in Tables 2.13 and 2.14, respectively. The first columns in Tables 2.13 and 2.14 corresponds to the first columns in Tables 2.3 and 2.4, respectively. Counterparts of the second (third) columns in Tables 2.13 and 2.14 are the first (second) columns in Tables 2.5 and 2.6, respectively.

The marginal effects presented in Tables 2.13 and 2.14 are very similar to those reported previously in Tables 2.3, 2.4, 2.5 and 2.6. Briefly, the probability of carrying a handgun in the last month for the Law Abiding Individuals increases in the presence of a shall-issue law (row 1 column I in Table 2.13). This influence is mostly due to the Law Abiding Individuals who have satisfied the minimum age requirement (row 2, column I in Table 2.13). Serious Crime Arrestees do not change their handgun carrying behavior in the recent past with the presence of a shall-issue law (column II in Table 2.13), whereas Minor Crime Arrestees become more likely to carry a handgun (column III in Table 2.13). The influence of a shall-issue law is greatest for the individuals who do not have an arrest record and who are old enough to satisfy the minimum age requirement. These individuals are 3.5 percentage points more likely to carry a handgun after the enactment of a shall-issue law (row 4, column III in Table 2.13).

Table 2.11 Influence of Exposure to a Shall-Issue Law on Probability of Carrying a Handgun for Law Abiding Individuals

		I	II
		Linear	Linear and Quadratic
	Marginal Effect is calculated for		
1	Whole sample	0.0001	0.0007***
		(0.0001)	(0.0002)
2	Individuals Over Minimum Age[a]	0.0004***	0.0009***
		(0.0001)	(0.0002)
3	Individuals Under Minimum Age[b]	-0.0001	0.0004
		(0.0001)	(0.0003)
	Observations	58,023	58,023

Notes to Table 2.11: This table presents the average marginal effects of the variable *Exposure* based on estimation of equation (2.4) on samples of Law Abiding Individuals. Law Abiding Individuals have not committed any crimes as of the last wave of NLSY97. The marginal effects in the first column are obtained from estimation of equation (2.4) including *Exposure* and the control variables. The marginal effects in the second column are obtained from estimation of equation (2.4) including both linear and quadratic *Exposure* together with the control variables. The first row provides the average marginal effects evaluated for the whole sample. Other rows pertain to marginal effects evaluated for different sub-samples as follows: [a] *Adult*=1, [b] *Adult*=0
The dependent variable, *Gun*, is constructed based on the individuals' answers to the question "*Have you carried a hand gun since the last interview? When we say hand gun, we mean any firearm other than a rifle or shotgun.*" The marginal effects are obtained by calculating the average value of the derivative of the objective function (probit) with respect to the variable *Exposure* evaluated at the observed values of the variables. ***, ** and * indicate significance at 1%, 5% and 10%, respectively.

As presented in Table 2.14, Law Abiding Individuals who become eligible to carry a handgun in terms of satisfying the minimum age requirement are more likely to carry a handgun in the past 30 days (row 1, column I in Table 2.14). This especially holds for those who reside in shall-issue states (row 2, column I in Table 2.14). Satisfying the minimum age requirement does not increase the handgun carrying probability of the Serious or Minor Crime Arrestees (columns II and III in Table 2.14).

2.4.5 Do Shall-Issue Laws Increase Gun Thefts?

Some of the previous researchers, such as Cook, Molliconi and Cole (1995) and Cook and Ludwig (1997), argue that shall-issue laws may increase the availability of guns to potential criminals. For example, following the enactment of a shall-issue law, a greater number of legally obtained guns are vulnerable to being stolen by criminals. If more guns are stolen after the enactment of a shall-issue law, ineligible individuals, such as those who have committed serious crimes, will be more likely to carry guns after the enactment of a shall-issue law. However, results of the previous sections show that shall-issue laws have no influence on individuals who have committed serious crimes in terms of carrying a handgun. Therefore, my findings in the previous sections and the hypothesis that shall-issue laws increase the number of stolen guns are contradicting.

Table 2.12 Influence of Exposure to a Shall-Issue Law on Arrestees' Probability of Carrying Handgun

	Serious Crime Arrestees		Minor Crime Arrestees	
	Only Linear	Linear and Quadratic	Only Linear	Linear and Quadratic
	I	II	III	IV
Marginal Effect is calculated for				
1 Whole Sample	-0.0004	0.0001	0.0001	0.0020***
	(0.0005)	(0.0008)	(0.0003)	(0.0006)
2 Eventual Arrestees, Under Min. Age[b,c]	-0.0010	-0.0025	-0.0002	0.0029**
	(0.0009)	(0.0019)	(0.0005)	(0.0011)
3 Current Arrestees, Under Min. Age[b,d]	-0.0001	0.0011	-0.0001	0.0013
	(0.0009)	(0.0015)	(0.0007)	(0.0013)
4 Eventual Arrestees, Over Min. Age[a,c]	-0.0022*	-0.0029	0.0004	0.0028***
	(0.0013)	(0.0022)	(0.0008)	(0.0008)
5 Current Arrestees, Over Min. Age[a,d]	-0.0003	0.0009	0.0004	0.0016**
	(0.0005)	(0.0007)	(0.0004)	(0.0005)
Observations	10,685	10,685	16,219	16,219

Notes to Table 2.12: This table presents the average marginal effects of the variable *Exposure* based on estimation of equation (2.4) on samples of Serious Crime Arrestees (Columns I and II) and Minor Crime Arrestees (Columns III and IV). Serious Crime Arrestees have committed at least one of the Index-I crimes of FBI as of the 2007 wave of NLSY97. Minor Crime Arrestees have committed at least one misdemeanor but none of the Index-I crimes of FBI as of the 2007 wave of NLSY97. The marginal effects in the columns I and III are obtained from estimation of equation (2.4) including only *Exposure* and the control variables. The marginal effects in the columns II and IV are obtained from estimation of equation (2.4) including both linear and quadratic *Exposure* as well as the control variables. The first row provides the average marginal effects evaluated for the whole sample. Other rows pertain to marginal effects evaluated for different sub-samples as follows: [a] *Adult*=1, [b] *Adult*=0, [c] *Ever Arrested*=0, [d] *Ever Arrested*=1

The dependent variable, *Gun*, is constructed based on the individuals' answers to the question "*Have you carried a hand gun since the last interview? When we say hand gun, we mean any firearm other than a rifle or shotgun.*" The marginal effects are obtained by calculating the average value of the derivative of the objective function (probit) with respect to the variable *Exposure* evaluated at the observed values of the variables. ***, ** and * indicate significance at 1%, 5% and 10%, respectively.

In this section, the hypothesis that shall-issue laws increase the amount of stolen guns is empirically tested. Using state-level data, I investigate whether there is a difference in the amount of gun thefts before and after a shall-issue law is passed in a state. The model to be estimated is the following:

$$(2.5) \quad \textit{Stolen Guns}_{st} = B_1 Law_{st} + B_2 \textit{Post-Passage Trend}_{st} + B_3 X_{st} + z_{st}$$

where $\textit{Stolen Guns}_{st}$ denotes the reported per capita real value of stolen guns in state s in year t. Despite not being the perfect measure of the number of stolen guns, the reported per capita real value of guns stolen is used as a proxy for the actual amount of stolen guns. This measure is calculated through deflating the annual value of reported stolen guns per 100,000 individuals by

the national Consumer Price Index (CPI). Specifically, stolen gun data obtained from the Supplement to Return A Master Files of UCR between 1978 and 2006. Monthly values of the stolen firearms are available at the police agency level, but not all agencies report monthly. To create the variable Stolen Guns Rate, only the data from agencies that reported the full 12 months are employed.47 After calculating the total value of stolen guns in a state (by summing up the monthly figures of all agencies that report full 12 months), this annual total is divided by the total population covered by the agencies (times 100,000) that contributed to the annual total value of guns stolen.[48] Finally, this per capita figure is deflated by the national Consumer Price Index.

The investigating officer provides information about stolen and recovered property. Whenever investigating a reported crime involving theft, the officer in charge includes the value and type of all stolen property in his/her report. This is an obligation of the investigating officer and as described in the Handbook of UCR: "such information is essential to assure the completeness of a law enforcement investigative report on stolen property." These reports are summarized in the Return A Supplement forms are submitted monthly by each agency to the FBI headquarters or to the FBI regional offices. These forms are designed to record the total value of property stolen and recovered in the various classifications of properties, which include Firearms. As defined in the Glossary of Handbook of UCR, firearms are weapons that fire a shot by the force of an explosion. All handguns, rifles, shotguns, and other such devices commonly referred to as firearms are included in this category. The recorded value of the firearms stolen is left to the discretion of the reporting officer and is based upon several objective criteria. However, in most instances the victim's evaluation of the value of the stolen item is accepted. In those cases where value of the stolen item is negotiable, the current market price at the time of the theft is recorded.

An individual is more likely to report a stolen gun case to the police if the gun is obtained legally initially. Otherwise, the reporting individual can be arrested and charged with an offense of illegal gun ownership. The measure of stolen guns employed in the empirical analysis is likely to cover most thefts of legally obtained guns. This is because, a legal gun owner is likely to report the theft of his/her gun to police regardless of the value of the gun. This is a protective measure on the part of the reporting individual against accusations of possible future crimes committed with the stolen gun. Further, this measure is less likely to suffer a bias due to false reports. For example, a falsely reported stolen gun case can be corrected later by the police agency if an individual mistakenly reports that his/her gun is stolen.

Law_{st} in equation (2.5) is an indicator for a shall-issue law and $Post\text{-}Passage\ Trend_{st}$ is a time trend that counts the number of years since the enactment of a shall-issue law in state s in year t. For the states that passed a shall-issue law earlier than 1970 and their counterparts which never passed a shall-issue law, this variable takes the value of zero. The vector X_{st} includes control variables such as the larceny rate, unemployment rate, per capita real personal income, unemployment insurance, income maintenance and retirement payments, lagged incarceration rate, population density and the share of white and black males aged 10-19, 20-29 and 30-39 in the total state population. The summary statistics of these variables are in Table 2.15. Also

[47] Including the data obtained from agencies that reported less than 12 months do not affect the results presented in this paper.

[48] Population covered by the agency may not be same as the total state population. However, for most of the cases the agencies that reported a full 12 months cover a quite large share of the population. For example, in 2006, the total population covered by such agencies was over 200 million which makes up about 65% of the US population.

included in the equation (2.5) are state fixed effects, year dummies together with linear state trends.

The main source of the state-level data is Ayres and Donohue (2009).[49] Some of these variables (at the county level) are also used by Lott and Mustard (1997). The authors used this data set to test whether a shall-issue law is associated with an increase in the crime rate of a state. This data set provides, broadly, variables that measure economic conditions, criminal activity and demographic characteristics of states. Table 2.15 provides the summary statistics. The economic condition variables are the *Unemployment Rate*, and four per capita income variables; namely *Personal Income, Unemployment Benefits, Income Maintenance* and *Retirement Payments*. Other control variables include *Larceny Rate* and *Incarceration Rate.* Finally, the variables that proxy the demographic characteristics of a state are the *Population Density* and the share of black and white males aged 10-19, 20-29 and 30-39 in the total state population (*% Black Male Population 10-19*, *% Black Male Population 20-29*, *% Black Male Population 30-39*, *% White Male Population 10-19*, *% White Male Population 20-29*, *% White Male Population 30-39*).

The variables Law_{st} and *Post-Passage* $Trend_{st}$ in equation (2.5) are intended to capture the increase in the availability of guns to potential criminals. However, Lott and Mustard (1997) have demonstrated that when a shall-issue law is enacted, criminals switch to crimes that require less contact with the victims. Specifically, they argue that when a shall-issue law is enacted, the number of thefts increases, while the number of murders, rapes and robberies decreases. Further, guns are one of the most commonly stolen items in thefts. Therefore, there may be a mechanical relationship between shall-issue laws and amount of stolen gun cases through number of thefts. Consequently, if the larceny rate is not controlled for in equation (2.5), the variables that measure the state's status of shall-issue laws (Law_{st} and *Post-Passage* $Trend_{st}$) proxy for both the increase in the availability of guns to potential criminals through theft and (possible) increase in number of larceny cases due to shall-issue laws. In other words, estimating equation (2.5) without the larceny rate provides the total effect of shall-issue laws on stolen gun cases which incorporates both its direct effect (increase in the availability of guns) and indirect effect (due to the (possible) increase in thefts after the passage of shall-issue laws). When the larceny rate is controlled for, the coefficients of *Law* and the *Post-Passage Trend* can be interpreted as the change in the amount of stolen guns per theft when a shall-issue law is enacted in a state.[50]

Specification in equation (2.5) (except the larceny rate) is similar to the ones employed by Ayres and Donohue (2009), Lott and Mustard (1997) and Moody and Marvell (2009). These researchers estimate the impact of shall-issue laws on seven felony crimes employing equation (2.5) in three different ways: (a) including the Law_{st} indicator alone, (b) including the *Post-Passage* $Trend_{st}$ trend variable alone, and (c) including both Law_{st} and *Post-Passage* $Trend_{st}$ together. I follow the convention in estimation and provide the results for all three models. These models are estimated using OLS for the sample period 1978-2006.[51] Except Law_{st}, *Post-Passage* $Trend_{st}$, year dummies, state fixed effects and trends, all variables are in natural logarithms. Standard errors are clustered at the state-level and regressions are weighted by state population covered by the police agencies.

[49] http://works.bepress.com/john_donohue/66/

[50] Similar results are obtained when the burglary rate is included in equation (2.5) instead of the larceny rate.

[51] 1983 is out of the estimation sample. This is because the data set was not available at the source.

Table 2.13 Influence of Enactment of Shall-Issue Law on Probability of Carrying a Handgun in the Last Month

		I	II	III
		Law Abiding Individuals	Serious Crime Arrestees	Minor Crime Arrestees
	Marginal Effect is calculated for			
1	Whole sample	0.006***	-0.004	0.015**
		(0.002)	(0.008)	(0.006)
2	Individuals Over Minimum Age[a]	0.011***		
		(0.002)		
3	Individuals Under Minimum Age[b]	0.001		
		(0.002)		
4	Eventual Arrestees, Over Min. Age[a,c]		-0.012	0.035***
			(0.025)	(0.013)
5	Current Arrestees, Over Min. Age[a,d]		0.001	0.016**
			(0.011)	(0.008)
6	Eventual Arrestees, Under Min. Age[b,c]		-0.023*	0.011
			(0.012)	(0.008)
7	Current Arrestees, Under Min. Age[b,d]		0.006	0.011
			(0.011)	(0.010)
	Observations	58,217	10,762	16,322

Notes to Table 2.13: Columns I, II and III present the average marginal effects of the variable *Law* based on estimation of equation (2.1) with the dependent variable *Gun in Last Month* on samples listed at the top. Law Abiding Individuals have not committed any crimes as of the last wave of NLSY97. Serious Crime Arrestees have committed at least one of the Index-I crimes of FBI as of the 2007 wave of NLSY97. Minor Crime Arrestees have committed at least one misdemeanor but none of the Index-I crimes of FBI as of the 2007 wave of NLSY97. The first row provides the average marginal effects evaluated for the whole sample. Other rows pertain to marginal effects evaluated for different sub-samples as follows: [a] *Adult*=1, [b] *Adult*=0, [c] *Ever Arrested*=0, [d] *Ever Arrested*=1

The dependent variable, *Gun in Last Month*, is an indicator that takes the value of 1 if the individual reported that he/she has carried a handgun at least once in the last 30 days. The marginal effects are obtained by calculating the average of the change in individuals' probabilities of carrying a gun when the variable *Law* is changed from 0 to 1 while other variables are kept at their observed values. ***, ** and * indicate significance at 1%, 5% and 10%, respectively.

The estimates obtained from estimation of equation (2.5) are provided in Table 2.16. In the first three columns, only Law_{st} and *Post-Passage* $Trend_{st}$ are included in the regressions without any controls. None of the coefficients are significantly different from zero. The results in columns 4 to 6 pertain to the model where the measures of shall-issue status of the states and state fixed effects are included. The coefficients of both Law_{st} and *Post-Passage* $Trend_{st}$ are negative and significant, but controlling for year dummies and state trends removes the significance of Law_{st} and *Post-Passage* $Trend_{st}$ (columns 7 to 9). When the whole set of control variables but the larceny rate are included in equation (2.5) as covariates (columns 10 to 12), the sizes of the coefficients of Law_{st} and *Post-Passage* $Trend_{st}$ do not change and they remain insignificant. Controlling additionally for the larceny rate (columns 13 to 15) does not change the statistical significance of the Law_{st} and *Post-Passage* $Trend_{st}$, either. They remain insignificant. These results hold regardless of the employed measure of shall-issue status of states (including

only Law_{st} dummy, only *Post-Passage Trend*$_{st}$, or both). That is, shall-issue laws are unrelated to the per capita real value of guns stolen in a state.[52]

Although more guns may become vulnerable to theft by potential criminals after the enactment of a shall-issue law in a state, the findings in this section provide evidence that there is no difference in the amount of stolen gun cases between shall-issue states versus non-shall-issue states. This supports the findings in the previous sections of this paper. It seems safe to argue that a shall-issue law is unlikely to increase the gun carrying frequency of the individuals with arrest records.[53]

2.5 Summary and Conclusion

Whether the Concealed Weapon Laws, specifically the shall-issue laws, increase or decrease crime is still debated. Employing state-level or county-level data sets, previous studies report conflicting findings. Studies that find a positive impact of shall-issue laws on crime suggest that crime-facilitating effect of these laws dominate the crime-reducing effect. On the other hand, studies that find a reduction in crime following the enactment of shall-issue laws justify their results by arguing that the crime-reducing effect is greater in magnitude than the crime-facilitating effect. The upshot is that the estimated net effect of shall-issue laws on crime reported by existing research is sensitive to model specification, particular data used, and econometric methods.

This paper recognizes that the previous studies on shall-issue laws overlook the fact that neither the crime-facilitating nor the crime-reducing effect of shall-issue laws can emerge if individuals do not respond to shall-issue laws by carrying handguns more frequently (first order effect). To investigate this question, this paper employs an individual-level data set and supplements it with an aggregate-level data set, and tests whether the first order effect of a shall-issue law is actually realized. In other words, this paper investigates the most basic research question in this context: "Do individuals respond to the shall-issue laws by carrying handguns more often?" and "If they do so, what type of individuals respond?" The answers to these questions are critical since the mechanisms through which shall-issue laws can increase or decrease crime cannot be at work if individuals do not respond to these laws by carrying handguns more frequently in the first place.

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[52] The coefficients of the other variables are available upon request. Briefly, those control variables are mostly insignificant except a few. For example, in the models that does not control for larceny rate, the coefficient of the lagged prisoner rate is about -0.30 and the coefficient of the unemployment rate is 0.34. Both are significant at conventional significance levels. However, inclusion of the larceny rate reduces the size of these coefficients (in absolute value) and eliminates their significance. Larceny rate is positively associated with the real value of guns stolen. This relationship is almost one-to-one. A one percent increase in the larceny rate is associated with about a one percent increase in the per capita real value of guns stolen. This is consistent with Cook, Molliconi and Cole (1995) who argued that cash and firearms are the most common types of assets stolen.

[53] The most convenient way to acquire guns for individuals who are likely to commit serious crimes is to obtain them illegally. Such illegal options mainly include stealing a gun or obtaining it through underground channels. Guns traded through informal channels are more likely to be illegally obtained, possibly stolen guns, than legally purchased ones. However, as the results of this section suggest, a shall-issue law does not influence the number of gun thefts. If shall-issue laws do not have an influence on stolen gun cases, availability of guns to criminals through underground markets should not be affected, either.

Table 2.14 Influence of Satisfying Minimum Required Age on Probability of Carrying a Gun in the Last Month

		I	II	III
		Law Abiding Individuals	Serious Crime Arrestees	Minor Crime Arrestees
	Marginal Effect is calculated for			
1	Whole sample	0.006***	-0.001	-0.011*
		(0.002)	(0.008)	(0.006)
2	Individuals In a Shall-Issue State[a]	0.010***		
		(0.003)		
3	Individuals In a Non-Shall-Issue State[b]	-0.001		
		(0.002)		
4	Eventual Arrestees in Shall-Issue State[a,c]		0.001	-0.001
			(0.020)	(0.011)
5	Current Arrestees in Shall-Issue State[a,d]		-0.002	-0.010
			(0.010)	(0.009)
6	Eventual Arrestees in Non-Shall-Issue State[b,c]		-0.005	-0.022**
			(0.025)	(0.010)
7	Current Arrestees in Non-Shall-Issue State[b,d]		0.003	-0.014
			(0.011)	(0.008)
	Observations	58,217	10,762	16,322

Notes to Table 2.14: Columns I, II and III present the average marginal effects of the variable *Adult* based on estimation of equation (2.1) with the dependent variable *Gun in Last Month* on samples listed at the top. Law Abiding Individuals have not committed any crimes as of the last wave of NLSY97. Serious Crime Arrestees have committed at least one of the Index-I crimes of FBI as of the 2007 wave of NLSY97. Minor Crime Arrestees have committed at least one misdemeanor but none of the Index-I crimes of FBI as of the 2007 wave of NLSY97. The first row provides the average marginal effects evaluated for the whole sample. Other rows pertain to marginal effects evaluated for different sub-samples as follows: [a] *Shall*=1, [b] *Shall*=0, [c] *Ever Arrested*=0, [d] *Ever Arrested*=1 The dependent variable, *Gun in Last Month*, is an indicator that takes the value of 1 if the individual reported that he/she has carried a handgun at least once in the last 30 days. The marginal effects are obtained by calculating the average of the change in individuals' probabilities of carrying a gun when the variable *Adult* is changed from 0 to 1 while other variables are kept at their observed values. ***, ** and * indicate significance at 1%, 5% and 10%, respectively.

The findings in this paper indicate that individuals start carrying handguns more often when they become eligible, i.e. when their states pass shall-issue laws or when they satisfy the minimum required age in an already-shall-issue state. This increase in handgun carrying behavior is a result of changes in behavior of *law abiding individuals* and those who are likely to commit *minor crimes*, such as drug possession, public order offenses or traffic offenses. After the enactment of a shall-issue law, no change is observed in the handgun carrying activity of individuals who are likely to commit *serious offenses*, such as assaults, rapes, manslaughters or robberies. Further, the analysis at the state-level suggests that there is no systematic impact of shall-issue laws on the amount of guns stolen, one mechanism through which ineligible individuals can have access to guns. Enactment of a shall-issue law is unlikely to be associated with an increase in the availability of guns to potential criminals. Taken as a whole, these findings cast doubt on the presumed existence of the crime-facilitating effect of shall-issue laws.

Table 2.15 Summary Statistics of Variables used in State-Level Analysis

Variable	Mean	Std. Dev.
Stolen Guns	0.003	0.003
Law	0.391	
Post-Passage Trend	1.983	4.297
Unemployment Rate	5.740	1.891
Per capita Personal Income	$18,627	10,997
Per capita Unemployment Benefits	$76.60	58.55
Per capita Income Maintenance	$247.36	172.19
Per capita Retirement Payments	$2,265	1,509
Larceny Rate	2,838	753
Lagged Incarceration Rate	298	221
Population Density	329	1241
% Black Male Pop. 10-19	0.010	0.010
% Black Male Pop. 20-29	0.009	0.009
% Black Male Pop. 30-39	0.008	0.008
% White Male Pop. 10-19	0.063	0.014
% White Male Pop. 20-29	0.065	0.014
% White Male Pop. 30-39	0.065	0.012

The results in this paper provide no evidence for a positive influence of shall-issue laws on frequency of gun carrying for individuals who are likely to commit serious crimes. This could be a consequence of the criteria to grant a concealed weapon license imposed by the shall-issue laws. Specifically, the criteria only allow carrying handguns for individuals who have maintained a clean arrest record until turning old enough to satisfy the minimum age requirement, which ranges between 18 and 23 among states. The rationale for such a policy can be the high likelihood of individuals who have committed crimes early in their lives to involve in future criminal activity which is highly costly to the society.[54]

On the other hand, individuals who have maintained clean arrest records until satisfying the minimum age requirement are eligible to carry handguns. It is possible for such individuals to commit a crime in the future. However, the results of this paper, similar to the findings of the previous literature, indicate that even if they carry guns, those individuals who have not committed a crime earlier in their lives are less likely to commit violent crimes in the future compared to the individuals who have committed crimes previously. This difference in tendency to commit serious crimes in the future justifies the use of arrest records in determining an individual's eligibility.

[54] Previous research demonstrates that the individuals who have committed crimes (and therefore have a high level of criminal human capital) early in their lives have difficulty in switching back to the legal sector, and thus accumulate even more criminal human capital (Mocan and Bali, forthcoming).

Table 2.16 Impact of Shall-Issue Laws on Stolen Guns

	(1)	(2)	(3)	(4)	(5)	(6)
Law	0.185		0.335	-0.662***		-0.394***
	(0.318)		(0.330)	(0.094)		(0.099)
Post-Passage Trend		0.001	-0.022*		-0.064***	-0.037***
		(0.023)	(0.013)		(0.009)	(0.008)
State FE	No	No	No	Yes	Yes	Yes
Year Dummies	No	No	No	No	No	No
State Trends	No	No	No	No	No	No
Control Variables	No	No	No	No	No	No
Larceny Rate	No	No	No	No	No	No
Observations	1,381	1,381	1,381	1,381	1,381	1,381

	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
Law	-0.044		-0.067	-0.043		-0.051	-0.055		-0.065
	(0.076)		(0.077)	(0.079)		(0.080)	(0.077)		(0.077)
Post-Passage Trend		0.040	0.041		0.022	0.023		0.026	0.027
		(0.025)	(0.025)		(0.029)	(0.029)		(0.023)	(0.023)
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State Trends	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Control Variables	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Larceny Rate	No	No	No	No	No	No	Yes	Yes	Yes
Observations	1,381	1,381	1,381	1,381	1,381	1,381	1,381	1,381	1,381

Notes to Table 2.16: The dependent variable is the natural logarithm of the real value of number of firearms stolen per 100,000 individuals. Control variables are the natural logarithms of the unemployment rate, per capita real personal income, unemployment insurance, income maintenance and retirement payments, lagged incarceration rate, population density and the share of white and black males aged 10-19, 20-29 and 30-39 in the total state population. Standard errors are clustered at the state-level and regressions are weighted using the population. ***, ** and * indicate significance at 1%, 5% and 10%, respectively.

CHAPTER 3. UNEMPLOYMENT AND CRIME

3.1 Introduction

The economics literature has suggested that criminal activity is primarily motivated by net relative benefits to illegal activities. First pointed out by Becker (1968), potential criminals weigh the costs and benefits of committing crime. Crime and labor markets are not mutually exclusive choices but they represent a continuum of legal and illegal income-generating competing activities (Mocan, Billups and Overland 2005, Machin and Meghir 2004, Block and Heineke 1975, Erlich 1973). Individuals with potentially better current and future opportunities in the legal labor market are less likely to commit crime.

One determinant of these opportunities in the labor market is the unemployment rate, which fluctuates over the business cycle. During a recession, when the unemployment rate goes up, employment chances in the legal labor market diminish. As long as the employment prospects of individuals are influenced by the legal labor market conditions, the changes in the unemployment rate will impact the crime rate which is an aggregation of individuals' criminal activities. During times of high unemployment, the relative benefit of working in the legal labor market for an individual decreases on the margin, increasing the crime rate in the country.

Using data from one single country, several studies confirm that unemployment increases crime. For example, Raphael and Winter-Ebmer (2001), Gould, Weinberg and Mustard (2002), Corman and Mocan (2005), and Lin (2008) used data from the U.S. to investigate the impact of unemployment on crime. Other researchers have examined the same question using non-U.S. data, such as Edmark (2005) and Oster and Agell (2007) with Swedish data, and Buonanno (2006) with Italian data.

However, in an international context, the impact of unemployment on crime has not been studied extensively. Only Wolpin (1980) analyzed unemployment's influence on crime by using burglaries in Japan, U.K. and U.S.[55] There is only a handful of studies which investigate other aspects of crime using country-level data sets. For example, Lin (2007) investigated the relationship between democracy and crime. Fajnzylber, Lederman and Loayza (2000, 2002) analyzed the impact of income inequality on crime by analyzing only homicides and robberies. Miron (2001) show that drug prohibition policies are one of the main determinants of crime across countries.

The primary reason for the paucity of research based on international data is the absence of comparable crime statistics across countries. Legal practices, such as definitions and recording methods of crimes differ across countries. Another reason for non-comparability is the fact that some crimes are underreported. Underreporting is a more serious issue for developing countries and especially for low-value property crimes, such as theft and for crimes carrying a social stigma for the victim, such as rape (Soares 2004). Fajnzylber, Lederman and Loayza (2000, 2002) dealt with this measurement problem by assuming a time-invariant form for the measurement error in crimes. In this paper, a similar approach is used to deal with potential underreporting. In addition, differences in legal practices across countries are accounted for. The crime data employed in this paper have the advantage of having consistent measures of crime across countries as explained in more detail below.

[55] In his study U.S. is represented by California.

This paper investigates the impact of unemployment on crime by employing a uniformly collected international data set from European countries. In this international context, using the unemployment rate as an explanatory variable has an additional advantage. Analyses based on city level or state level data may suffer from reverse causality as crime may impact the local unemployment rate (Cullen and Levitt 1999). However, variation in a country's crime rate is not expected to directly affect the unemployment rate of that specific country, reducing the concern of a bias. However, for other reasons such as measurement error and confounding factors, unemployment rate may be endogenous. Therefore, I also estimate IV models where the exchange rate movements, industrial accidents and earthquakes are used as instruments for the unemployment rate. Consistent with Gould, Weinberg and Mustard (2002), I find that 2SLS and OLS estimates are not significantly different from each other.

The overall unemployment rate may not be an appropriate measure to identify the marginal criminal. Raphael and Winter-Ebmer (2001) and Lin (2008) suggest that employment conditions among population subgroups may drive the impact of unemployment on crime. In addition, Engelhardt (2010) suggests that duration of the unemployment is a significant determinant of criminal activity. To test these hypotheses, I decompose the overall unemployment rate into various components according to gender, education and the duration of the unemployment. The results provide evidence that unemployment of males, of the individuals with low education, and of the individuals who have been jobless for more than one year drive the influence of the overall unemployment rate on crime.

3.2 Empirical Framework

Following previous research, I estimate a crime equation that includes controls for deterrence, economic incentives, consumption goods associated with crime and other socio-demographic controls (Raphael and Winter-Ebmer, 2001, and Gould, Weinberg and Mustard, 2002). As described below, the empirical framework aims at isolating the influence of unemployment on crime through mechanism related to individuals' labor market opportunities.

In the empirical analysis, homicide, assault, rape, robbery, theft, burglary and motor vehicle theft are analyzed. Due to the organization of the data at the source, theft includes all activities that involve stealing such as burglaries and motor vehicle thefts. In other words, theft measure in this paper is comparable to the FBI's total property crime measure. As the eighth outcome variable, I construct larceny by taking the difference between the theft rate and sum of the burglary and motor vehicle theft rates.

The variable of interest is the unemployment rate. As explained in the introduction, in an individual level framework, participation in criminal activity is associated with the employment status of the individual. As long as the current and future employment prospects of individuals are influenced by the legal labor market opportunities in the country, the changes in the unemployment rate will affect the crime rate which is an aggregation of individuals' criminal activities. The relationship between unemployment and crime is expected to be stronger for thefts, burglaries, larcenies and motor vehicle thefts which involve pecuniary benefits.[56]

[56] However, as noted by Corman and Mocan (2000), there may be some impact of unemployment on violent crimes as well. This is because violent crimes and property crimes can take place together in one incident. For example, a murder can follow a burglary.

There are mechanisms through which unemployment can influence crime other than labor market opportunities. One of these channels is the consumption of crime-related goods. For example, Ruhm (1995) has shown that alcohol consumption increases during expansions and decreases during recessions. Raphael and Winter-Ebmer (2001) argue that gun availability and drug use may also move pro-cyclically. In addition, the link between unemployment and crime may be driven by the availability of theft-worthy goods. Specifically, during a recession individuals' incomes decline and this possibly reduces the consumption of high-value-storing goods such as jewelry or consumer durables. The decrease in consumption of such wealth-storing goods may decrease the expected returns to criminal activity and therefore, leads to reduction in crime rate. A third mechanism may work through income inequality. Mocan (1999) and the papers he cites find that increases in unemployment worsen the relative position of low-income groups in the income distribution. Kelly (2000) and Fajnzylber, Lederman and Loayza (2002) suggest that a higher degree of income inequality induces greater criminal activity.

The first two of the mechanisms mentioned above are directly controlled for in this analysis. The influence of unemployment on crime is isolated from the impact of consumption of crime-related goods by controlling for alcohol consumption per capita and drug crime rate. In addition, control variables include GDP per capita as a proxy for pecuniary returns to criminal activity. A similar approach is taken by Witte (1980).

Income inequality is not explicitly controlled for in my main analysis because the sample size would have been reduced to almost half if a measure of inequality such as the Gini coefficient was added as a control variable. However, for a smaller sample, I run regressions that additionally employ Gini as a covariate.[57] The results are almost identical to those that do not employ Gini.[58] In order to conduct the empirical analysis with a larger sample, I do not employ the Gini coefficient in my empirical analysis.

In addition to alcohol consumption per capita, drug crime rate and GDP per capita, control variables include lagged police rate, urbanization rate and the ratio of young to old people.[59] I also control for country indicators and year dummies in the regressions. Police rate is lagged by one year to avoid a potential reverse causality problem (Corman and Mocan 2000, 2005).

The unit of observation in this paper is a country-year. Consequently, the estimation strategy, as described above, may suffer from omitted variables that are not conventionally considered by previous studies that use data from one country. For example, Lin (2007) shows that the level of democracy in a country can be a significant determinant of crime. If the regime type in a country also influences the employment opportunities in a country, then my estimation will be biased. Similarly, immigration may influence both crime and unemployment (Bianchi, Buonanno and Pinotti 2011). Although I do not control for such influences in my main regressions, in the Results section, I show that my estimation is robust to controlling for such possibly-confounding factors.

[57] For example, inclusion of the Gini coefficient reduces the sample size in my largest sample (theft rate) from 187 to 95. The source of the Gini coefficient is World Bank's World Development Indicators.

[58] To do this analysis, I run the models that include and exclude Gini coefficient in the same samples to eliminate the influence of the reduction in sample size. Gini was always insignificant. Generally, the signs, magnitudes and significance of the coefficients of unemployment rate are unaffected by the inclusion of Gini. The only exception is theft. The coefficient of the unemployment rate turns significant when Gini is additionally controlled for in theft regressions.

[59] Ratio of young to old population is computed by dividing the number of people who are aged between 15 and 39 to the number of people older than 39.

Exogeneity of unemployment in a crime regression could be questionable. Previous literature provided mixed evidence on the exogeneity of the unemployment rate in this context. For example, with a state panel data set, Gould, Weinberg and Mustard (2002) have shown that there is not much difference between OLS and IV estimates of the unemployment rate in a crime equation, suggesting reverse causality is not a major issue with state level data. Lin (2008) and Raphael and Winter-Ember (2001) have found that IV estimates of the unemployment rate are consistently larger than the OLS estimates.

In this paper, reverse causality is not alarming since a panel of countries (more aggregated units of observation) is employed in the empirical analysis. This is because variations in the crime rate of a country in a given year are not expected to influence the unemployment rate of the country in that same year. Moreover, in the empirical analysis, I control for several country characteristics as well as country fixed effects to account for time-invariant unobservable variables. However, for other reasons such as measurement error and confounding factors, unemployment rate may be endogenous. Therefore, I also estimate instrumental variable models in which the unemployment rate is instrumented by the exchange rate, industrial accidents and earthquakes. Instrumental Variables section below provides a more detailed discussion of the instruments and the estimation.

Lin (2008) and Raphael and Winter-Ember (2001) suggested that unemployment of population sub-groups may be the driving force behind the impact of the overall unemployment rate on crime. To gauge the potentially differential impact on crime of the unemployment prevailing in different population groups in a country, several unemployment rate measures are constructed. Specifically, I decompose the overall unemployment rate into measures of female and male unemployment; unemployment of the low educated and high educated individuals. These measures are constructed by computing the ratios of the unemployed people in the specified sub-groups of the population to the total labor force. For example, labor force share of unemployed females (males) is calculated by dividing the number of unemployed females (males) by the total labor force. Similarly, labor force share of the unemployed with primary education (with high education) is the ratio of the number of unemployed individuals who have completed at most primary school (at least secondary school) to the total labor force.

Notice that the sum of the labor force shares of the unemployed from population sub-groups equals to the overall unemployment rate. Therefore, employing the overall unemployment rate in the specification restricts the coefficients of the labor force share variables to be equal to each other. For example, the unrestricted form depicted by equation (3.1) below would reduce to equation (3.2) under the restriction that the coefficients β_m and β_f are equal to β_u.

(3.1) $Crime = (\beta_m \, Unemployed\ Males + \beta_f \, Unemployed\ Females) \,/\, Labor\ Force + X\gamma + \varepsilon$

(3.2) $Crime = \beta_u \, Unemployment\ Rate + X\gamma + \varepsilon$

Similarly, labor force shares of the unemployed individuals with primary education and high education are used in the empirical analysis.

The influence of unemployment on crime may also depend on its duration. An individual who has been unemployed for a longer time period is more likely to commit a crime. This is because, individuals who have been jobless for a longer time periods face a lower opportunity cost of committing crime. Along the lines of this idea, Engelhardt (2010) reports that reduction in unemployment spell leads to decreases in criminal activity. To test this finding with an

international data set, I decompose the overall unemployment rate according to the duration of the unemployment and gender, similar to education and gender decomposition of the unemployment rate described above. Specifically, the constructed variables measure the labor force shares of males and females who are long and short-term unemployed.[60]

3.3 Data

The crime and police officers data are obtained from two waves of European Sourcebook of Crime and Criminal Justice, covering the period between 1995 and 2003.[61] The first wave of the European Sourcebook, which covers the period between 1990 and 1994, is not included in this analysis because police officers data are not available. Prosecutions and convictions are available in all three waves and they can be considered as measures of deterrence. However, they are not consistently measured between and within the countries over time, making the comparison difficult.[62]

The data set used in this paper includes information from 33 countries. The list of the countries and the years covered for each country is presented in Table 3.1. Some of the European countries are excluded from the analysis due to missing data. However, the included countries can be claimed to represent an overall picture of Europe. As of 2009, three quarters of the Europeans lived in the 33 countries that are included in this study. Further, these countries account for production of about 74 percent of the total European GDP.[63]

Crime statistics obtained from the European Sourcebook are similar to those provided by the Uniform Crime Reports in US. Both sources present information about crime as measured by reported complaints to the police. Another similarity between the European Sourcebook and Uniform Crime Reports is the uniformity in what is counted as a crime. That is, crime definitions in both sources are consistent over time. This quality of European Sourcebook is unique among cross-country crime data sets.[64]

For all crimes included in the European Sourcebook, a standard definition is used and the statistics follow this standard definition where possible. These definitions are provided in Table 3.2. If a country's crime statistics deviate from the standard definition, the European Sourcebook provides information about what aspect of the standard definition is not met. For example, the standard definition of homicide is "intentionally killing of a person." According to this definition, euthanasia should be included as homicide, since euthanasia involves killing a fetus intentionally. However, euthanasia is not considered a homicide by some countries and it is impossible for these countries to provide homicide data that include euthanasia cases. The European Sourcebook lists the countries that follow the standard definition and also those that do

[60] The long-term (short-term) unemployed individuals are those who are unemployed for at least one year (less than one year).
[61] Since I use lagged police rate in estimation, the effective sample period becomes 1996-2003.
[62] In most of the European countries the police use discretion to decide whether to prosecute or not. For example, the criminal can get away with a warning for small scale thefts or burglaries. Most importantly, the crime definitions used by the judicial system and the police are not identical. Although offence definitions adopted by the various police systems present uniformity among countries, rules for recording punishments can vary substantially.
[63] Source: World Bank, World Development Indicators.
[64] For example, the United Nations Surveys of Crime Trends and Operations of Criminal Justice Systems provide data reported by law enforcement agencies in each country. The crime statistics in the U.N. dataset are not standard across countries, unlike the European Sourcebook data.

not follow. The countries that deviate from the standard crime definitions and the way they deviate from the standard definitions are listed in Table 3.3. In the empirical analysis, any non-conformity to definitions is controlled for by a set of dummy variables.

The source of labor market variables, GDP per capita and urban population is the World Development Indicators.[65] The ratio of young population to the old population is the ratio of population aged 15-39 to the population aged 40 or more. It is constructed using the data from the U.S. Census Bureau's International database.[66] Alcohol consumption per capita variable is obtained from the World Health Organization's Global Alcohol Database.[67] Drug crime rate and the police rate are crimes related to drugs and police officers per 100,000 individuals, respectively. They are obtained from the European Sourcebook. Table 3.4 presents the definitions and the descriptive statistics of all the variables as well as their sources.

Among the instrumental variables, exchange rate is obtained from the Penn World Tables version 6.3. Exchange rate is measured as the amount of domestic currency that one US dollar can buy. Share of manufacturing sector's value added in GDP is obtained from World Development Indicators. Finally, the data on industrial accidents and earthquakes are obtained from EM-DAT data base (the international disaster data base).[68]. More details about the instruments are provided in the Instrumental Variables Regressions Section below.

3.4 Results

3.4.1 Overall Unemployment Rate

Figure 1 provides a visual analysis of the influence of the unemployment rate on crime. In Figure 1, a measure of theft rate and the unemployment rate for the set of the countries with non-missing data are depicted. Theft rate is chosen because as defined in this paper, thefts include all property crimes, such as burglaries, larcenies and motor vehicle thefts. As a result, thefts in this paper correspond to FBI's total property crimes. The graphs of individual crime types are similar to that of theft. The solid line represents the variation in the theft rate that is unexplained by the control variables. Specifically, the measure of the theft rate depicted in Figure 1 is obtained by calculating the residuals from the regression of theft rate on control variables.[69] The dashed line is the unemployment rate.

Among the graphs of the 16 countries presented in Figure 1, most graphs show that the unemployment rate and the theft rate have very similar trends. Graphs of seven countries (UK, Switzerland, Sweden, Poland, Italy, Hungary and Finland) display an obvious positive correlation between the unemployment rate and the theft rate for the whole sample period.[70] Another 6 graphs (Slovenia, Portugal, Ireland, Denmark, Czech Republic and Croatia) reveal positive correlation for some years in the sample.

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[65] http://data.worldbank.org/indicator
[66] http://www.census.gov/ipc/www/idb/
[67] http://www.who.int/globalatlas/default.asp
[68] http://www.emdat.be/
[69] The control variables are Lagged Police Rate, GDP per capita, % Urban Population, Drug Rate, Young per Old population and Alcohol consumption per capita as well as country fixed effects, year dummies and indicators that account for the differences in crime definitions.
[70] In this study UK refers to England and Wales.

Table 3.1 Countries Covered in the Study

Country	Years covered
Albania	2001
Austria	1996 - 2003
Belgium	2000, 2003
Croatia	1996 - 2003
Cyprus	1999 - 2003
Czech Republic	1996 - 2003
Denmark	1996 - 2003
Estonia	1996 - 2001, 2003
Finland	1996 - 2003
France	1997, 2001, 2003
Georgia	1998 - 2003
Greece	1996 - 2003
Hungary	1996 - 2003
Iceland	2003
Ireland	1996 - 2003
Italy	1996 - 2003
Latvia	1996 - 1999
Lithuania	1996 - 2003
Luxembourg	2003
Malta	2000, 2001
Moldova	1999, 2000
Netherlands	1998 - 2003
Norway	1996 - 1999
Poland	1996 - 2003
Portugal	1996 - 2003
Romania	1996 - 1999, 2001 - 2003
Russia	2001
Slovakia	2001 - 2003
Slovenia	1996 - 2003
Sweden	1996 - 2003
Switzerland	1996 - 2003
Turkey	1996 - 1999
UK: England & Wales	1996 - 2003

To quantify the relationship between unemployment and crime observed in Figure 1, I regress the crime rates on the unemployment rate and the control variables using OLS. The crimes considered are homicide, assault, rape, robbery, total theft, burglary, larceny and motor vehicle theft.[71] The variable of interest in this section is the unemployment rate. Control variables include lagged police rate, GDP per capita, % urban population, drug rate, young per old population and alcohol consumption per capita. The regressions also control for country

[71] The definitions of these variables are presented in Table 3.2 and the Data section.

fixed effects and year dummies as well as indicators that account for the differences in crime definitions. Standard errors that are clustered at the country level are reported in parentheses. Regressions are weighted by the country population.[72] The results are provided in Table 3.5.

Being unemployed can induce motivation to earn income illegally, but it does not necessarily increase violent behavior. The estimates in Table 3.5 support this hypothesis. The sign of the unemployment rate's coefficients are positive for all crimes that involve pecuniary benefits except robbery. Further, this influence is statistically significant for total thefts, larcenies and motor vehicle thefts. A one percentage point increase in the unemployment rate is associated with 2%, 1% and 4% increase in total thefts, larcenies and motor vehicle thefts, respectively.[73] These results are consistent with previous studies that employ US data, such as Lin (2008), Gould, Weinberg and Mustard (2002) and Levitt (2004). The unemployment rate is not significantly associated violent crimes. The negative sign of the unemployment rate in violent crime regressions is not uncommon in the literature. For example, OLS estimates in Lin (2008) show the same exact pattern.

GDP per capita is positively associated with property crimes but not with violent crimes. This may be because GDP per capita is a proxy for the benefits associated with crimes. The greater is the average income in a country, the greater returns to committing property crimes are on average. Along the similar lines, the coefficient of Young per Old for crimes that involve monetary benefits is negative. This variable may be indicative of wealth in a country. Generally wealth is accumulated over the life cycle and the elderly have more valuable assets compared to the young. If in a country there are more young individuals for each elderly individual, then there is less to steal.[74]

The coefficient of Drug Crime Rate is consistently positive for violent crimes and negative for property crimes.[75] This pattern may arise because drug crimes can be substitutes for theft, burglary and motor vehicle theft, but complements for violent crimes. Individuals who choose to work in illegal sector allocate their time between several illegal income-generating activities. The criminals whose net returns to drug crimes are greater than net returns to theft, burglary or vehicle theft are less likely to commit theft, burglary or motor vehicle theft. They rather earn income through drugs.

[72] The country population that is used for weighting is the average for the sample period.

[73] Similar elasticities are estimated when natural log of the crimes are used instead of the level of the crime. When standard errors are corrected for first-order serial correlation, the coefficients of the unemployment rate in theft, larceny and motor vehicle theft regressions are significant at conventional levels and the estimated elasticities are similar to those reported in Table 3.5.

[74] On the other hand, it is well-known that the young are more likely to commit crimes compared to the old. In fact, this is reflected in the positive coefficient of Young per Old in the Assault regression. The greater the ratio of young individuals to old individuals is, the greater the number of assaults which has no monetary rewards to the offender.

[75] The Drug Crime Rate is not only a proxy for the prevalence of drug use and possession, but also a measure of the extent of illegal income-generating activities related to drugs.

Table 3.2 Standard Definitions of Crimes in the European Sourcebook

Crime	Definition
Homicide	Intentional killing of a person. It includes assault leading to death, euthanasia and infanticide, excludes assistance with suicide.
Assault	Inflicting bodily injury on another person with intent. It excludes assault leading to death, threats, acts just causing pain, slapping/punching, sexual assault.
Rape	Sexual intercourse with a person against her/his will (per vaginam or other). Where possible, the figures include other than vaginal penetration (e.g. buggery), violent intra-marital intercourse, sexual intercourse without force, with a helpless person, sexual intercourse with force with a minor, incestual sexual intercourse, with or without force with a minor. But it excludes sexual intercourse with a minor without force and other forms of sexual assault.
Robbery	Stealing from a person with force or threat of force. Where possible, the figures include muggings (bag-snatching), theft with violence. But they exclude pick-pocketing, extortion and blackmail.
Theft	Depriving a person/organization of property without force with the intent to keep it. Where possible, the figures include burglary, theft of motor vehicles, theft of other items, theft of small value. But they exclude embezzlement, receiving/handling of stolen goods.
Burglary	Gaining access to a closed part of a building or other premises by use of force with the intent to steal goods. Figures on burglary should, where possible, include theft from a factory, shop or office, from a military establishment, or by using false keys; they should exclude, however, theft from a car, from a container, from a vending machine, from a parking meter and from a fenced meadow/compound.
Motor Vehicle Theft	According to the standard definition, figures on theft of a motor vehicle should, where possible, include joyriding, but exclude theft of motorboats and handling/receiving stolen vehicles.

Table 3.3 Countries that Deviate from the Standard Crime Definitions

Offense	Deviation from the definition	Countries – 2nd wave	Countries – 3rd wave
Homicide	Assault leading to death excluded	Belgium, Czech Republic, Denmark, Estonia, Greece, Hungary, Latvia, Malta, Moldova, Netherlands, Norway, Romania, Russia, Slovenia.	Albania, Belgium, Czech Republic, Denmark, Estonia, Greece, Hungary, Moldova, The Netherlands, Russia, Slovenia.
Homicide	Euthanasia excluded	Estonia, Georgia, Greece, Ireland, Italy, Latvia, Malta, Russia, Slovenia.	Belgium, Estonia, Greece, Malta, Slovenia.
Homicide	Infanticide excluded	Czech Republic, Greece, Norway, Romania.	Czech Republic, Greece, Romania.
Homicide	Assistance with suicide included	Austria, Latvia, Norway, Slovakia, Switzerland.	Belgium, Cyprus, France, Ireland, Italy, Malta, Switzerland.
Assault	Assault leading to death included	Belgium, Czech Republic, Denmark, Estonia, Georgia, Greece, Hungary, Latvia, Malta, Moldova, Norway, Romania, Russia, Slovenia.	Albania, Belgium, Czech Republic, Denmark, Estonia, Georgia, Greece, Hungary, Malta, Moldova, Netherlands, Russia, Slovenia.
Assault	Threats included	Finland, Georgia, Latvia, Malta, Netherlands, UK.	Georgia, Ireland, Malta.
Assault	Acts causing pain included	Cyprus, Denmark, Estonia, Finland, Georgia, Ireland, Latvia, Malta, Netherlands, Portugal, Sweden, Turkey, UK.	Czech Republic, Denmark, Finland, Ireland, Malta, Netherlands, Portugal, Sweden, UK.

Table 3.3 continued

Offense	Deviation from the definition	Countries – 2nd wave	Countries – 3rd wave
Assault	Sexual assault included	Georgia, Ireland, Malta, Norway.	Croatia.
Rape	Acts other than vaginal penetration excluded	Latvia, Romania, Russia.	Denmark, Georgia, Greece, Russia, UK.
Rape	Violent intra-marital intercourse excluded	Greece, Romania, Russia.	Greece, Moldova, Russia.
Rape	Sexual intercourse without force with a helpless person excluded	Denmark, Greece, Netherlands, Norway, Sweden.	Denmark, Georgia, Greece, Netherlands, Slovenia, Sweden.
Rape	Sexual intercourse with force with a minor excluded	--	Georgia, Greece, Slovenia.
Rape	Incestual sexual intercourse with or without force with a minor excluded	Denmark, Finland, Hungary, the Netherlands, Poland, Russia, Slovakia, UK.	Austria, Czech Republic, Denmark, Finland, Georgia, Greece, Hungary, Poland, Russia, Slovakia, Slovenia, UK.
Rape	Sexual intercourse with a minor without force included	Albania, Belgium, Cyprus, Georgia, Italy, Lithuania, Malta, Moldova, Portugal, Romania, Slovenia	Albania, Belgium, Cyprus, Czech Republic, Malta, Moldova, Portugal.
Rape	Other forms of sexual assault included	Czech Republic, Georgia, Ireland, Italy, Lithuania, Malta, Portugal, Romania.	Romania.
Robbery	Extortion and blackmail included	Cyprus.	--

Table 3.3 continued

Offense	Deviation from the definition	Countries – 2nd wave	Countries – 3rd wave
Robbery	Pick-pocketing included	Turkey.	Moldova, Netherlands.
Robbery	Muggings excluded	Czech Republic, Denmark, Italy, Lithuania, Norway, Poland, Slovakia, Sweden.	Czech Republic, Denmark, Greece, Poland, Slovakia, Sweden.
Robbery	Theft with violence excluded	Czech Republic, Denmark, Hungary, Italy, Norway.	Denmark, Greece, Hungary, ,
Theft	Burglary excluded	Cyprus, Norway.	--
Theft	Theft of motor vehicles excluded	Denmark.	Denmark, Moldova.
Theft	Theft of small values excluded	Czech Republic, Hungary, Lithuania, Poland, Slovakia, , Switzerland.	Czech Republic, Hungary, Lithuania, Poland, Russia, Slovakia.
Theft	Receiving/handling stolen property included	UK.	--
Theft	Embezzlement included	--	Albania, Cyprus, Greece, Moldova.
Burglary	Burglary from a factory, shop, or office excluded	Italy, Luxembourg, Norway.	Italy.
Burglary	Burglary from a military establishment excluded	Georgia, Italy, Luxembourg and Norway.	Albania, , Georgia, Greece, Italy, Slovenia

Table 3.3 continued

Offense	Deviation from the definition	Countries – 2nd wave	Countries – 3rd wave
Burglary	Theft (burglary) by gaining entrance with false keys excluded	Georgia, Norway, Switzerland.	Greece, Switzerland
Burglary	Theft from a car included	Albania, Austria, Czech Republic, Estonia, Greece, Latvia, Malta, Moldova, Netherlands, Poland, Romania, Russia, Slovenia, Turkey.	Austria, Czech Republic, Estonia, Iceland, Malta, Moldova, Netherlands, Poland, Romania, Russia, Slovenia.
Burglary	Theft from a container included	Albania, Austria, Croatia, the Czech Republic, Estonia, Finland, Georgia, Greece, Latvia, Malta, Moldova, the Netherlands, Poland, Romania, Russia, Slovenia, Sweden, Switzerland, Turkey.	Austria, Czech Republic, Estonia, Finland, Iceland, Moldova, Netherlands, Poland, Romania, Russia, Slovenia, Sweden, Switzerland.
Burglary	Stealing from vending machine included	Albania, Austria, Czech Republic, Estonia, Finland, Greece, Latvia, Malta, Netherlands, Poland, Romania, Russia, Slovenia, Sweden, Switzerland.	Austria, Czech Republic, Estonia, Finland, Iceland, Malta, Moldova, Netherlands, Poland, Romania, Russia, Slovenia, Sweden, Switzerland.
Burglary	Theft from a parking meter included	Albania, Austria, Czech Republic, Estonia, Finland, Greece, Latvia, Netherlands, Poland, Romania, Russia, Slovenia, Sweden, Switzerland.	Austria, Czech Republic, Estonia, Finland, Netherlands, Poland, Romania, Russia, Slovenia, Sweden, Switzerland.

Table 3.3 continued

Offense	Deviation from the definition	Countries – 2nd wave	Countries – 3rd wave
Burglary	Theft from a fenced meadow or compound included	Albania, Austria, Czech Republic, Estonia, Finland, Greece, Malta, Moldova, Netherlands, Poland, Romania, Russia.	Austria, Czech Republic, Estonia, Finland, Iceland, Moldova, Netherlands, Poland, Romania, Russia.
Motor Vehicle Theft	Joyriding excluded	Cyprus, Czech Republic, Estonia, Netherlands, Poland, Russia, Slovakia.	Czech Republic, Georgia, Greece, Moldova, Netherlands, Poland, Russia, Slovenia.
Motor Vehicle Theft	Theft of motorboats included	Cyprus, Finland, France, Georgia, Italy, Lithuania, Norway, Sweden, UK.	Cyprus, Finland, Lithuania, Sweden.
Motor Vehicle Theft	Receiving/handling stolen motor vehicles included	Cyprus, Georgia.	Lithuania.

Table 3.4 Summary Statistics and Descriptions

Variable	Definition	Source	N	Mean	Std. Dev.
Homicide Rate*	Homicides per 100,000 individuals.	A	169	5.28	3.94
Assault Rate*	Assaults per 100,000 individuals.	A	187	185.83	239.54
Rape Rate*	Rapes per 100,000 individuals.	A	187	8.01	6.41
Robbery Rate*	Robberies per 100,000 individuals.	A	187	73.74	67.75
Theft Rate*	Thefts per 100,000 individuals.	A	187	2618.52	1991.86
Burglary Rate*	Burglaries per 100,000 individuals.	A	160	938.69	681.00
Larceny Rate	Difference between the Theft Rate and the sum of Burglary Rate and Motor Vehicle Theft Rate.	A	153	1668.26	1339.17
Motor Vehicle Theft*	Thefts of motor vehicles per 100,000 individuals.	A	179	275.10	238.89
Unemployment Rate	Ratio of unemployed population to labor force times 100.	B	187	8.52	4.25
Share of Unemployed Males in Labor Force	Ratio of unemployed male population to total labor force times 100.	B	187	4.48	2.27
Share of Unemployed Females in Labor Force	Ratio of unemployed female population total labor force times 100.	B	187	4.04	2.11
Share of the Poorly-Educated and Unemployed in Labor Force	Ratio of unemployed population with at most primary schooling to total labor force times 100.	B	172	2.67	1.58
Share of the Well-Educated and Unemployed in Labor Force	Ratio of unemployed population with more than primary schooling to total labor force times 100.	B	171	5.71	3.67
Share of the Poorly-Educated and Unemployed Males in Labor Force	Ratio of unemployed male population with at most primary schooling to total labor force times 100.	B	172	1.47	0.93

Table 3.4 continued

Variable	Definition	Source	N	Mean	Std. Dev.
Share of the Poorly-Educated and Unemployed Females in Labor Force	Ratio of unemployed female population with at most primary schooling to total labor force times 100.	B	172	1.19	0.74
Share of the Well-Educated and Unemployed Males in Labor Force	Ratio of unemployed male population with more than primary schooling to total labor force times 100.	B	171	2.91	1.97
Share of the Well-Educated and Unemployed Females in Labor Force	Ratio of unemployed female population with more than primary schooling to total labor force times 100.	B	171	2.80	1.78
Share of Short-term Unemployed Males in Labor Force	Ratio of males who are unemployed for less than one year to total labor force times 100.	B	154	2.38	1.02
Share of Short-term Unemployed Females in Labor Force	Ratio of females who are unemployed for less than one year to total labor force times 100.	B	154	2.16	0.94
Share of Short-term Unemployed Males in Labor Force	Ratio of males who are unemployed for more than one year to total labor force times 100.	B	154	1.89	1.35
Share of Short-term Unemployed Females in Labor Force	Ratio of females who are unemployed for more than one year to total labor force times 100.	B	154	1.74	1.34
Lagged Police Rate	Total number of police officers per 100,000 people	A	187	349.21	168.69
GDP per capita	Real GDP per capita in 2000 dollars. Scaled by 0.01.	B	187	207.47	105.81
% Urban Population	Ratio of the population living in urban areas to the total population times 100.	B	187	67.25	12.81
Drug Rate	Crimes related to drugs per 100,000 individuals.	A	187	145.55	180.67
Alcohol	Alcohol consumption per capita per annum, in liters.	C	187	9.69	3.09
Young/Old	Ratio of population aged 15-39 to the population aged more than 40 times 100.	D	187	83.09	9.80

Table 3.4 continued

Variable	Definition	Source	N	Mean	Std. Dev.
Exchange Rate × Manuf. GDP_{t-1}	Exchange rate weighted with the share of manufacturing sector's value added to GDP	F, B	175	372.83	1155.74
Industrial Accidents × Manuf. GDP_{t-1}	Dummy for industrial accidents weighted with the share of manufacturing sector's value added to GDP	E,B	175	1.60	5.65
Earthquake	Dummy for earthquakes	E	187	0.09	0.29

Notes to Table 3.4:

* See Table 3.2 for the standard definitions of crimes and the Table 3.3 for the deviations of the countries from the standard definition

A – European Sourcebook of Crime and Criminal Justice, B – World Development Indicators, C – World Health Organization, Global Alcohol Database, D – U.S. Census Bureau, International Database, E – EM-DAT, the international disaster data base.

A similar pattern is observed for the coefficient of the Alcohol consumption. Alcohol consumption per capita is correlated positively with violent crimes and negatively with property crimes. A possible explanation of this pattern involves the impact of alcohol on individual behavior. First, excessive alcohol consumption is associated with more aggressive and violent behavior (Markowitz 2005). Secondly, individuals who consume large amounts of alcohol may suffer from judgment impairment and diminished physical performance. These and other mechanisms that relate alcohol consumption and criminal activity are discussed in Carpenter and Dobkin (2010). The side effects of alcohol consumption are reflected in the estimated coefficients of alcohol. Potential criminals under the influence of alcohol are less likely to effectively carry out activities related to property crimes. In fact, several property crimes require some skills such as opening a locked door (in case of a burglary) or starting a car without keys (in case of motor vehicle theft).

Although most of variables' coefficients exhibit the expected signs, police rate and urbanization rate do not. Nevertheless, those variables are not the variables of interest. Notice that these control variables are included in the regressions to isolate the influence of the unemployment rate on crime through mechanisms other than legal labor market opportunities. The reason for the unexpected coefficient signs may be due to imprecise estimation as these control variables may be a noisy measure. Therefore, I do not put much stake on these coefficients.[76]

The sample I employ contains countries with both stable and unstable democracies. Using a country-level data set, Lin (2007) shows the level of democracy in a country is a significant determinant of crime. If the regime type in a country also influences the unemployment rate, then my estimation will be biased. Further, the influence of unemployment rate on crime may be different in democratic versus less democratic countries.77 To investigate these possibilities, I obtained the Democracy index of the countries in my sample from Polity IV.78 The Democracy index ranges between -10 (strongly autocratic) and 10 (strongly democratic). European countries in my sample were mostly strongly democratic countries with median Democracy level of 10. I construct an indicator variable that takes the value of one if a country's average democracy level during the years covered is equal to 10. 18 countries' average democracy levels are 10 the sample.79 In addition to all of the control variables mentioned above, I included the democratic country indicator and its interaction with the unemployment rate in the regressions. The coefficients of the unemployment rate variable remain unaffected, while the interaction term is insignificant. The sum of the interaction term and the unemployment rate is also positive and significant at conventional levels. These results indicate that there is no systematic difference between the strongly democratic and less democratic countries in terms of the influence of the unemployment rate on crime. In other words, findings reported in this section are not driven by the countries with stable democracies.

[76] Similarly, some previous studies had positive coefficients for police in crime regressions. Examples include Cornwell and Trumbull (1994).
[77] I thank an anonymous referee for pointing this out.
[78] http://www.systemicpeace.org/polity/polity4.htm
[79] These countries are Austria, Belgium, Cyprus, Czech Republic, Denmark, Finland, Greece, Hungary, Ireland, Italy, Lithuania, Netherlands, Norway, Portugal, Slovenia, Sweden, Switzerland and UK.

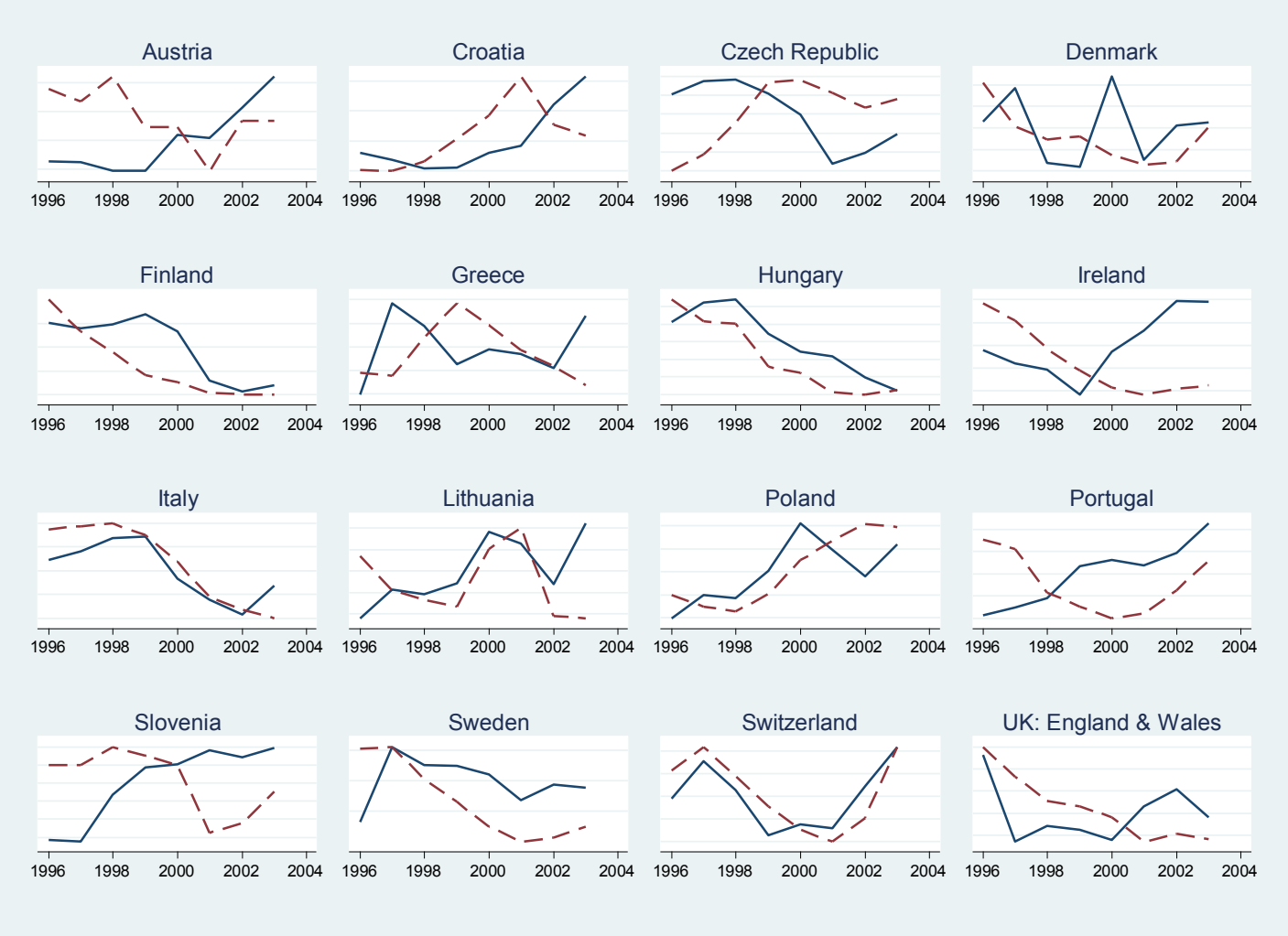

Figure 3.1 Thefts and the Unemployment Rate

Solid line represents the residuals from the regression where the theft rate is regressed on all control variables except the unemployment rate (police rate, GDP per capita, alcohol consumption, drug rate, % urban population, young per old population country fixed effects, year dummies and indicators that account for differences in crime definitions). Theft is defined as the sum of Burglaries, Larcenies and Vehicle Thefts. Dashed line is the unemployment rate. Only graphs for the countries that have data for the whole sample period (1996-2003) are presented.

Table 3.5 Crime and Overall Unemployment Rate

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Homicide	Assault	Rape	Robbery	Theft	Burglary	Larceny	Vehicle Theft
Unemployment Rate	-0.02	-4.86	-0.25*	-0.85	43.10***	6.01	21.07**	11.17***
	(0.03)	(4.05)	(0.14)	(1.68)	(14.26)	(7.75)	(8.60)	(2.90)
Police Rate (t-1)	0.00***	0.20	0.00	0.02	0.73	0.50	2.57	0.18
	(0.00)	(0.21)	(0.01)	(0.04)	(0.61)	(1.21)	(1.80)	(0.11)
GDP per cap.	-0.01	1.77	-0.04	-0.31	7.44**	0.23	4.28**	1.75
	(0.01)	(1.91)	(0.08)	(0.81)	(2.98)	(2.35)	(1.95)	(1.03)
% Urban Pop.	0.15**	-10.25	-0.84*	6.88*	15.63	-5.95	5.21	-7.74
	(0.06)	(25.61)	(0.48)	(3.57)	(30.84)	(14.52)	(19.80)	(10.57)
Drug Rate	0.00	1.01***	0.00	0.03	-1.30*	-1.00***	-0.00	-0.57***
	(0.00)	(0.31)	(0.01)	(0.06)	(0.73)	(0.33)	(0.38)	(0.15)
Young/Old	-0.06	23.16*	0.04	-3.02	-42.90**	-17.52	-35.91***	-1.86
	(0.04)	(12.55)	(0.26)	(3.24)	(20.08)	(10.49)	(12.62)	(6.02)
Alcohol	0.12	35.11	0.68	2.28	-14.93	-25.90	-0.65	-9.25
	(0.08)	(24.29)	(0.52)	(3.36)	(44.62)	(16.47)	(27.18)	(14.86)
N	169	187	187	187	187	160	153	179
F test for fixed effects	10,344	2,152	12,218	676	861	88	843	265
P value for fixed effects	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Notes to Table 3.5: Outcome variables are listed on top of each column. Theft is defined as the sum of Burglaries, Larcenies and Vehicle Thefts. All models include country fixed effects, year dummies and indicators that account for the differences in crime definitions. Standard errors that are clustered at the country level are presented in parentheses. The regressions are weighted by the country population. *, ** and *** denotes significance at 10%, 5% and 1% respectively. F test for fixed effects and P value for fixed effects rows provide the F statistic and p value for the joint significance of country fixed effects and year dummies, respectively. See Table 3.1 for the countries and years included in the sample. Tables 3.2 and 3.3 provide the descriptions of the outcome variables and the crime definitions differences across countries, respectively.

Many mechanisms can motivate a positive influence of migration on crime. For example, migrants are more likely to be poorly-educated and to be discriminated against. Customers may reveal distaste against migrants. Alternatively, migrants may be less productive in some industries. All of these mechanisms may cause migrants to have less lucrative labor market opportunities and consequently lead them to involve in criminal activity. As a result, exclusion of a measure of migration may result in biased estimates if migration influences both unemployment and crime.[80] To prevent against this possibility, I include the share of migrants in country population in the regressions. The results are virtually unchanged. Despite a slight decrease, the magnitude and significance of the unemployment rate remain almost identical to Table 3.5 for property crimes. The share of migrants does not significantly influence any crime except motor vehicle theft. The coefficient of the share of migrants is negative and significant for motor vehicle thefts.[81]

3.4.2 Unemployment of Population Sub-Groups

As discussed in the introduction and empirical framework sections and by Gould, Weinberg and Mustard (2002), Raphael and Winter-Ebmer (2001) and Lin (2008), overall unemployment rate may not be able to identify the marginal criminal. Individuals who belong to two different population sub-groups (such as the highly-educated versus poorly-educated or males versus females) and who are financially at the margin of committing a crime may respond differently when they become unemployed. For example, Freeman (1995), Grogger (1998), and LaGrange, Teresa and Silverman (1999) argued that males are more likely to commit a crime than do females. Similarly, Becker and Mulligan (1997), Lochner (2004), and Lochner and Moretti (2004) have suggested that greater schooling decreases criminal activity. Furthermore, Grogger (1998) and Gould, Weinberg and Mustard (2002) report that unskilled and uneducated males respond to changes in their employment statuses most significantly by committing crimes.

3.4.2.1 Gender-Specific Unemployment

In this section, I investigate whether the influence of male unemployment on crime is different from that of female unemployment. The overall unemployment rate is decomposed into measures of gender-specific unemployment as described in the empirical framework section. Specifically, instead of the overall unemployment rate, labor force shares of the unemployed males and females are included in regressions.[82] Notice that these labor force shares add up to the overall unemployment rate. In the upper panel of Table 3.6, results for total theft, burglary, larceny and motor vehicle theft are summarized.[83] Although only the coefficients of the measures of gender-specific unemployment are provided, the control variables included in the models are

[80] I thank another anonymous referee for pointing this out.
[81] The coefficient of migrants share is negative but insignificant for other property crimes. This result may be due to migrants' poverty. Migrants are associated with low levels of income and wealth. After all, poverty may be one reason why they migrate to another country. Therefore, an increase in the share of migrants in a country implies fewer pecuniary benefits of committing a crime on average.
[82] Labor force share of unemployed males (females) is calculated as the ratio of unemployed males (females) to the total labor force.
[83] For violent crimes, the coefficients of gender-specific unemployment measures are statistically insignificant.

same as those in Table 3.5. The signs and significance of these control variables are similar to those in the model with the overall unemployment rate (Table 3.5). The regressions are weighted by the country population and standard errors are clustered at the country-level. For comparison purposes, the lower panel includes the estimates from the specification where the overall unemployment rate is included instead of labor force shares of unemployed males and females.

As shown in Table 3.6, when labor force shares of unemployed both males and females are included jointly instead of the overall unemployment rate, their coefficients turn insignificant or become significant at a lower level. This result is not surprising, as male and female unemployment rates are highly correlated with each other (0.85). However, the comparison of the magnitudes of the coefficients reveals that male unemployment is more dominant for property crimes compared to female unemployment. The coefficients of male unemployment are significantly greater than coefficients of the female unemployment with p-values less than 0.05.

The results obtained from burglaries are interesting. Conditional on female unemployment, an increase in the male unemployment is associated with an increase in the burglary rate. On the other hand, keeping the male unemployment rate constant, the female unemployment rate is negatively correlated with burglary rate. This systematic difference may be due to difference in the behavior of unemployed males and females. If an unemployed female is more likely to stay at home than an unemployed male, then increase in female unemployment will constitute deterrence for burglaries.[84]

3.4.2.2 Education-Specific Unemployment

The overall unemployment rate is decomposed into education-specific unemployment measures. This allows me to gauge the differential impacts on crime of the unemployment of individuals with higher and lower levels of education. Specifically, instead of the overall unemployment rate, the shares of the unemployed people with primary education and higher education in the labor force are included in regressions.[85] Since individuals with primary education have worse labor market prospects than high educated individuals, the relationship between crime and the unemployment of individuals with primary education is expected to be stronger.

Table 3.7 displays the results. In the upper panel, results for total theft, burglary, larceny and motor vehicle theft are summarized. For comparison purposes, the lower panel presents the estimates from the specification where the overall unemployment rate is included instead of the labor force share variables. The sample sizes in these regressions are smaller due to missing education-specific unemployment data. Consequently, in Table 3.7, the coefficients estimates of the overall unemployment rate are different from those reported in Tables 3.5 and 3.6.

[84] This is because burglarizing a house when the residents are inside is costlier for a potential criminal.

[85] Labor force share of the unemployed with primary education (high education) is the ratio of the unemployed individuals who has completed primary school (who has completed secondary or tertiary school) to the total labor force.

Table 3.6 Crime and Gender-Specific Unemployment

	Theft	Burglary	Larceny	Vehicle Theft
Unemployed Males in Labor Force	121.63	83.40**	68.82	30.12*
	(80.30)	(38.26)	(67.50)	(14.96)
Unemployed Females in Labor Force	-52.44	-85.37**	-34.03	-11.95
	(83.70)	(37.89)	(71.84)	(18.69)
Overall Unemployment Rate	43.10***	6.01	21.07**	11.17***
	(14.26)	(7.75)	(8.60)	(2.90)
Observations	187	160	153	179

Notes to Table 3.6: Outcome variables are listed on top of each column. Theft is defined as the sum of Burglaries, Larcenies and Vehicle Thefts. All regressions include the whole set of control variables as well as country fixed effects, year dummies and indicators that account for the differences in crime definitions. The upper panel presents the results from the regressions that include the labor force shares of unemployed males and females. For comparison purposes, the lower panel provides the estimates of the overall unemployment rate instead of the labor force shares in the same sample. Standard errors that are clustered at the country level are presented in parentheses. The regressions are weighted by the country population. *, ** and *** denotes significance at 10%, 5% and 1% respectively. See Table 3.1 for the countries and years included in the sample. Tables 3.2 and 3.3 provide the descriptions of the outcome variables and the crime definitions differences across countries, respectively.

Results presented in Table 3.7 provide evidence that unemployed individuals with primary education are the driving force behind the influence of the unemployment rate on crime. A one percentage point increase in the labor force share of the unemployed with low education leads to about 7% and 16% increase in total thefts and motor vehicle thefts, conditional on the unemployment of the high educated individuals.[86] The influence of the labor force share of the unemployed with low education is greater than that of the unemployed with high education in magnitude for all property crimes. The difference is statistically significant for total thefts and motor vehicle thefts.[87]

3.4.2.3 Gender-and-Education-Specific Unemployment

In this section, the estimated specification is modified to include unemployment measures of males and females with primary and higher education instead of the overall unemployment rate. That is, four unemployment variables are included in the regressions instead of the overall

[86] These elasticity estimates are consistent with the estimates of the overall unemployment rate. For example, a one percentage point increase in the overall unemployment rate is associated with two percent increase in the total theft rate. In this sample, on average, one third of the all unemployed individuals have at most primary education. If individuals with low education and high education are equally likely to be laid off for example due to a recession, a one percentage point increase in the unemployment rate leads to a one third percentage point increase in the unemployment of individuals with primary education. According to the estimates in Table 3.7, such a change will lead to a two percent increase in the total theft rate (six percent multiplied by one third).

[87] However, the impact of education specific unemployment on violent crimes is statistically not different than zero with very high p-values. The results are not presented.

unemployment rate: labor force shares of the unemployed males and females with low and high education.[88]

Table 3.8 presents the results. In the upper panel, results for total theft, burglary, larceny and motor vehicle theft are summarized. For comparison purposes, in the lower panel, the estimates from the specification where the overall unemployment rate is included are presented. The sample sizes in these regressions are smaller due to missing education-specific unemployment data. Consequently, in Table 3.8, the coefficients estimates of the overall unemployment rate are different from those reported in Tables 3.6 and 3.7.

The results in Table 3.8 are very similar to the findings in the previous sections. The coefficients of unemployment of males with primary education are significant and positive for total thefts and motor vehicle thefts, but not for burglaries and larcenies. This may be due to either smaller sample sizes or the high correlation of the unemployment of males and females in the same education group.[89] The unemployment of males with primary education is positively associated with other property crimes as well. Within the education categories, the coefficients of the labor force share of the unemployed males are greater than that of females. In addition, within gender categories, the coefficients of the labor force share of the unemployed individuals with primary education are greater than that of individuals with high education.

3.4.3 Duration of the Unemployment

This section investigates whether the length of the unemployment spell is a significant determinant of the influence of unemployment on crime. Specifically, I investigate whether the individuals who are long-term unemployed (more than one year) or short-term unemployed drives the relationship between crime and the overall unemployment rate. Individuals who are unemployed for longer periods are expected to be more likely to commit crimes.

To test this hypothesis, the overall unemployment rate is decomposed into labor force shares according to the duration of the unemployment. Specifically, I construct variables that measure the labor force shares of the long-term and short-term unemployed males and females. These labor force share variables are then included into the regressions instead of the overall unemployment rate.[90]

The results are presented in Table 3.9. In the upper panel, results for total theft, burglary, larceny and motor vehicle theft are summarized. For comparison purposes, in the lower panel, the estimates from the specification where the overall unemployment rate is included are presented. The sample sizes in these regressions are smaller due to missing unemployment duration data. Consequently, in Table 3.9, the coefficients estimates of the overall unemployment rate are different from those reported in previous tables.

[88] Labor force share of the unemployed males (females) with low education [high education] is the ratio of the number of unemployed males (females) with low education [high education] to the total labor force.

[89] Correlations between males and females' unemployment are 0.71 for individuals with primary education and 0.92 for individuals with high education.

[90] There are four such components. The labor force share of the long term (short term) unemployed males [females] is calculated by the ratio of the number of males [females] who are unemployed for more than one year (less than one year) to the total labor force. Notice these four components add up to the overall unemployment rate.

Table 3.7 Crime and Education-Specific Unemployment

	Theft	Burglary	Larceny	Vehicle Theft
Unemployed with Primary Educ. in LF	214.67*	69.59	96.36	46.09**
	(107.50)	(54.13)	(92.57)	(18.47)
Unemployed with High Educ. in LF	3.02	-4.29	4.78	-1.33
	(31.55)	(15.72)	(25.60)	(4.91)
Overall Unemployment Rate	48.25**	8.64	20.81	9.15*
	(20.02)	(10.39)	(14.13)	(4.59)
Observations	171	150	145	166

Notes to Table 3.7: Outcome variables are listed on top of each column. Theft is defined as the sum of Burglaries, Larcenies and Vehicle Thefts. All regressions include the whole set of control variables as well as country fixed effects, year dummies and indicators that account for the differences in crime definitions. The upper panel presents the results from the regressions that include the labor force shares of the unemployed with primary and higher (secondary or tertiary) education. For comparison purposes, the lower panel provides the estimates of the overall unemployment rate instead of the labor force shares in the same sample. Standard errors that are clustered at the country level are presented in parentheses. The regressions are weighted by the country population. *, ** and *** denotes significance at 10%, 5% and 1% respectively. See Table 3.1 for the countries and years included in the sample. Tables 3.2 and 3.3 provide the descriptions of the outcome variables and the crime definitions differences across countries, respectively.

The labor force share of the long-term unemployed males is positively associated with all property crimes. Conditional on the unemployment of other groups, a one percentage point increase in the labor force share of the males with long-term unemployment is associated with about 9%, 11%, 7% and 21% increase in the total thefts, burglaries, larcenies and motor vehicle thefts. These elasticities may seem to be too high, but notice that the mean of the labor force share of the long-term unemployed males is about two percent. A one percentage point increase from the base line of two percent corresponds to a 50% increase.

3.5 Instrumental Variables

As discussed in the empirical framework section, unemployment can be endogenous in a crime regression. Although using a country-level panel data set minimizes this concern, there may be other reasons that motivate IV estimation such as measurement errors and unobserved confounding factors. Therefore, I estimate IV models where the unemployment rate is instrumented by several instrumental variables.

First instrument is the exchange rate weighted by the manufacturing sector's value added to the country's GDP in previous year. This instrument is similar to the one used by Lin (2008) for his analysis of crime and unemployment in US, and by Oster and Agell (2007) for their analyses of crime and unemployment in Sweden. The impact of the exchange rate on the unemployment rate is theoretically well-founded.[91] When the exchange rate appreciates, goods

[91] See the studies cited by Lin (2008) for a review.

and services in the country become more expensive compared to the rest of the world. This leads to a decrease in foreign demand for domestic goods and an increase in domestic demand for foreign goods. As a result, exports and eventually production in the domestic country declines which increases the unemployment rate. That is, if the exchange is calculated as the amount of domestic currency per U.S. dollar, then theoretically there should be an inverse relationship between the exchange rate and the unemployment rate. Following the previous literature, I weighted the exchange rate movements with the manufacturing sector's value added in previous year.

The second and third instruments are constructed using disasters experienced by countries. Data on occurrence of such disasters are obtained from EM-DAT (the international disaster data base).[92] For an event to be included in the EM-DAT database as a disaster, it has to satisfy certain criteria. First, the event must be unforeseen and sudden. Because of this criterion, the events included in the EM-DAT database are unquestionably random. Secondly, the event must fit at least one of the following categories: A) 10 or more people got killed; B) 100 or more people got affected[93]; C) the affected country declared a state of emergency; D) the affected country called for international assistance. Consequently, the events listed in the EM-DAT database can be considered to have caused great damage, destruction and human suffering.

One of the instruments that are created based on disasters is the occurrence of industrial accidents in a country. EM-DAT defines an industrial accident as a technological accident of an industrial nature or involving industrial buildings such as factories. Examples of industrial accidents include collapse or explosion of mines, destruction of industrial buildings or infrastructure and spill of hazardous/chemical materials. The list of industrial accidents in the sample used is presented in Table 3.10.

Industrial accidents can be related to employment through two mechanisms. First, industrial accidents lead to shut-down of a plant/factory and therefore cause termination of employment of the workers. Secondly, because of the spill-over effects, employment in other plants/factories may be affected as well. Specifically, the production of the businesses that use the output of the closed plant/factory as an input in their production is expected to reduce. Similarly, the production of the businesses that supply inputs to the closed factory/plant is expected to decrease. Consequently, the employment in such businesses is likely to decrease as well as the employment in the firm affected by the accident.

The mechanism can be explained better using an example of, say, a coal mine and a transportation company that delivers the coal from the mine to other locations. When the coal mine collapses, the production of the coal mine stops or gets reduced. This reduces the employment in the coal mine. Further, the services of the transportation company will not be needed which may lead to a reduction of employment in the transportation company. The collapse of the coal mine will also reduce the employment in other businesses which use coal as an intermediate good.

As a result, an increase in the unemployment rate is expected due to the industrial accidents. The influence of industrial accidents on unemployment must be greater for the

[92] http://www.emdat.be/

[93] According to the EM-DAT, a person is considered affected if he/she has required immediate assistance during a period of emergency, i.e. requirement of basic survival needs such as food, water, shelter, sanitation and immediate medical assistance.

countries with greater employment in manufacturing sector. Other things equal, manufacturing employment is greater in the countries whose contribution of the manufacturing sector to the GDP. As a result, I use the interaction of the indicator variable for the occurrence of industrial accidents in a country with the share of manufacturing sector's value-added to GDP in previous year as an instrument.

The third instrument is the occurrence of earthquakes. An earthquake is defined as the shaking and displacement of ground due to seismic waves by EM-DAT. As mentioned above, these earthquakes were large enough to influence the lives of many individuals. The list of earthquakes (observed by EM-DAT) in the sample used is provided in Table 3.11.

Generally speaking, in the area where an earthquake is observed, buildings and the infrastructure are destroyed or damaged and people are killed or injured and so on. Therefore, the initial influence of an earthquake *in the local area where it is observed* is a reduction in employment. There are multiple papers which show that the area struck by an earthquake suffers extensive economic losses For example, Cavallo, Powell and Becerra (2010) show that the Haiti earthquake of 2010 has cost at least eight billion dollars to Haitians. Holden, Bahls, and Real (2007) forecast that an earthquake with a magnitude of 6.9 in the Bay Area in Northern California could result in a loss of employment in the Bay area by about 420,000.

Although the initial effect of disasters such as earthquakes can be devastating in the local area affected, in the longer run both the local and the aggregate labor market improve. That is, despite its initial damage on the local areas, an earthquake can improve the economic conditions in the *country as a whole in the longer run*. The mechanism involves the reconstruction efforts in the shaken locality. Specifically, in the local area hit by an earthquake, the demand for goods and services such as demand for health care and especially construction services go up. In such a case, employment opportunities for those individuals who are not affected by the earthquake can get improved. This is demonstrated by Pereira (2009) who studies the economic impact of 1755 Lisbon Earthquake which is the largest natural catastrophe ever recorded in Europe. Pereira (2009) argues that the earthquake lead to a rise in the wage premium of construction workers due to the reconstruction efforts. Using evidence from hurricanes (which are similar to earthquakes), Ewing and Kruse (2005) suggest that "hurricanes may have a short run adverse impact on a community; however, these storms may also be associated with a long run positive impact on economic activity." Similarly, Ewing, Kruse and Thompson (2009) argue that 1999 Oklahoma City tornado led to improvements in the labor market at the aggregate level. In the light of the evidence provided above, an earthquake is expected to reduce the annual unemployment rate in a country.[94]

The 2SLS estimates of the impact of the unemployment rate on thefts, burglaries, larcenies and motor vehicle thefts are presented in Panels 1 to 4 of Table 3.12. Panels for each crime also provide the first stage results and test statistics pertaining to validity and strength of the instruments (F statistic for the strength and J statistic for the validity). Notice that there are differences between the samples used in each panel. Due to the unavailability of the outcome

[94] Using earthquakes as an instrument, I assume that earthquakes do not directly influence crime, but only through the changes through the unemployment rate. This is indeed in line with the previous research. For example, using the Hurricane Katrina which was very destructive for New Orleans, Varano et.al. (2010) argue that there was not significantly large increases in the crime rates of Houston, San Antonio, and Phoenix which received largest numbers of displaced New Orleans residents due to Hurricane Katrina. Moreover, since the number of instruments is greater than the number of endogenous variables, I conduct test for over-identifying restrictions. In this test, the null hypothesis is that the instruments are valid instruments, and that the excluded instruments are correctly excluded from the estimated equation. The instruments used in the paper pass this test.

variable, the sample sizes of burglary and larceny rate are much smaller than sample sizes of theft rate and meter vehicle theft.[95] In the first column of each panel, the OLS estimate of the unemployment rate is given for comparison purposes. In each panel, columns 2 to 5 provide the 2SLS estimates where a different combination of the instruments is used in the first stage. Specifically, second columns present the estimates of 2SLS model where exchange rate, industrial accidents and earthquakes are included as instruments jointly. In columns 3, 4 and 5, exchange rate and industrial accidents; exchange rate and earthquakes; and industrial accidents and earthquakes are used as instruments, respectively.

For all samples the interaction of the exchange rate with the lagged manufacturing share of GDP is a strong instrument. The other instruments, industrial accidents and earthquakes are not always strong instruments. Especially for the Burglary rate (Panel 2) and Larceny rate (Panel 3) samples, earthquakes and industrial accidents are not significant determinants of the unemployment rate. This is due to the reduced variation in industrial accidents and earthquakes in burglary rate and larceny rate samples.96 Nonetheless, the F-statistic for the instruments in the first stage is around 10 which is the rule of thumb threshold for a weak instrument suggested by Stock and Watson (2003).97 Admittedly, in some cases, the instruments barely pass this threshold. However, the lowest F-statistic is about 9 (excluding the specification in the 5th columns of Panels 2 and 3 with smaller samples and weaker instruments of industrial accidents and earthquakes).

In addition, Table 3.12 presents the J-statistic. This is a test of over-identifying restrictions.98 With the exception of the larceny rate in Panel 3, all of the crime categories pass the over-identification test. Moreover, most of the J-statistics are smaller than two. This indicates that the 2SLS method is insensitive to the choice of instrumental variables.

According to the OLS estimates in columns 1 of each panel, a one percentage point increase in the unemployment rate is associated with 1.7%, 0.8%, 1.3%, 3% increase in thefts, burglaries, larcenies and motor vehicle thefts. 2SLS estimation (columns 2-5) produces larger point estimates. For example, the 2SLS estimations of unemployment elasticity for theft rate using different sets of instrumental variables range from 2.4 to 3.8 percent. These estimates are larger than the OLS estimates. However, in 3 out of 4 cases, OLS point estimate for the unemployment rate is within one standard error distance from the 2SLS point estimate (columns 2, 3 and 5 of Panel 1). In one case, OLS estimate is much smaller than the 2SLS estimate (column 4 of Panel 1), but still, it is within two standard errors distance.

[95] Depending on the availability of the outcome variable, the sample sizes differ for each panel. Also sample size in Table 3.12 is smaller than the size of the sample used in Table 3.5 (OLS results). This is due to the missing data on instruments for some years and countries.

[96] For example, the sign of the industrial accident is always positive in all samples but insignificant in burglary and larceny samples. This is just due to the smaller sample size. Table 3.12 presents change of sign for earthquake. This is due to fact that Greece and Italy are not in the burglary and larceny samples. Greece and Italy account for about half of the earthquakes in the estimation sample. See Table 3.11 for details.

[97] The null hypothesis is that all coefficient estimates of the instrumental variables in the first-stage regression are not jointly different from zero.

[98] The null hypothesis is that the instruments are valid instruments, and that the excluded instruments are correctly excluded from the estimated equation.

Table 3.8 Crime and Education & Gender-Specific Unemployment

	Theft	Burglary	Larceny	Vehicle Theft
Unemployed Males with Primary education in LF	393.39*	167.93	131.1	91.73**
	(235.66)	(148.59)	(179.67)	(40.37)
Unemployed Females with Primary education in LF	14.4	-32.42	75.3	-6.53
	(237.52)	(152.85)	(221.60)	(41.67)
Unemployed Males with High education in LF	68.34	65.89	77.64	12.22
	(102.25)	(64.17)	(105.02)	(20.47)
Unemployed Females with High education in LF	-80.17	-90.17	-85.68	-18.09
	(126.57)	(74.44)	(148.16)	(25.83)
Overall Unemployment Rate	48.25**	8.64	20.81	9.15*
	(20.02)	(10.39)	(14.13)	(4.59)
Observations	171	150	145	166

Notes to Table 3.8: Outcome variables are listed on top of each column. Theft is defined as the sum of Burglaries, Larcenies and Vehicle Thefts. All regressions include the whole set of control variables as well as country fixed effects, year dummies and indicators that account for the differences in crime definitions. The upper panel presents the results from the regressions that include the labor force shares of the unemployed males and females with primary and higher (secondary or tertiary) education. For comparison purposes, the lower panel provides the estimates of the overall unemployment rate instead of the labor force shares in the same sample. Standard errors that are clustered at the country level are presented in parentheses. The regressions are weighted by the country population. *, ** and *** denotes significance at 10%, 5% and 1% respectively. See Table 3.1 for the countries and years included in the sample. Tables 3.2 and 3.3 provide the descriptions of the outcome variables and the crime definitions differences across countries, respectively.

This similarity between the OLS and 2SLS estimates can be observed for other crime categories as well. For example, the 2SLS estimates of unemployment elasticity for burglary rate range between 2.8 and 4.2 percent and for motor vehicle theft between 5.7 and 7 percent. Similar to the theft rate, for burglaries and motor vehicle thefts OLS point estimates are smaller than the 2SLS estimates, but they are generally within two standard errors distance from the 2SLS point estimates.

The results in this section indicate a positive impact of the unemployment rate on property crimes after accounting for endogeneity of unemployment. The 2SLS point estimates are larger than the OLS estimates. However, the difference between the 2SLS and OLS estimates are not significant. In the context of the similarity between 2SLS and OLS estimates, these results are in line with Gould, Weinberg and Mustard (2002).

3.6 Economic Impact of Crime Due to Recessions

In this section, I simulate the economic impact of one percentage point increase in the unemployment rate on crime. The back-of-the-envelope calculations rely on the cost of crime estimates of Anderson (1999) who decomposes the aggregate burden of crime into several components.

Table 3.9 Crime and Unemployment Duration

	Theft	Burglary	Larceny	Vehicle Theft
Long-term Unemployed Males in LF	225.75***	105.81**	114.38*	57.24**
	(81.12)	(45.61)	(60.35)	(24.40)
Short-term Unemployed Males in LF	150.52	107.85***	129.78	22.1
	(119.04)	(36.51)	(87.00)	(19.83)
Long-term Unemployed Females in LF	-331.98**	-211.88***	-188.69**	-49.6
	(137.26)	(47.15)	(80.92)	(36.23)
Short-term Unemployed Females in LF	121.71	16.13	44.88	10.94
	(108.07)	(36.81)	(107.53)	(30.25)
Overall Unemployment Rate	35.90***	4.73	23.99***	11.25***
	(11.03)	(7.57)	(8.28)	(2.87)
Observations	154	138	132	148

Notes to Table 3.9: Outcome variables are listed on top of each column. Theft is defined as the sum of Burglaries, Larcenies and Vehicle Thefts. All regressions include the whole set of control variables as well as country fixed effects, year dummies and indicators that account for the differences in crime definitions. The upper panel presents the results from the regressions that include the labor force shares of the long and short-term unemployed males and females. For comparison purposes, the lower panel provides the estimates of the overall unemployment rate instead of the labor force shares in the same sample. Standard errors that are clustered at the country level are presented in parentheses. The regressions are weighted by the country population. *, ** and *** denotes significance at 10%, 5% and 1% respectively. See Table 3.1 for the countries and years included in the sample. Tables 3.2 and 3.3 provide the descriptions of the outcome variables and the crime definitions differences across countries, respectively.

Based on Anderson (1999)'s estimates, I calculate each property crime costs about $46,000 in US in 1999 dollars. The calculations are summarized in Table 3.13. Thefts in the European Sourcebook include thefts of all kinds such as burglaries, larcenies and motor vehicle thefts. That is, aggregate property crime rate in the Uniform Crime Reports of FBI corresponds to the theft rate in this paper. Therefore, I use $46,000 as the cost of one theft in this analysis.

The OLS estimates in this paper as well as those in previous studies suggest that a one percentage point increase in the unemployment rate is associated with about one to two percent increase in thefts. Consequently, a one percentage point rise in the overall unemployment rate translates into about 25,000-30,000 extra thefts for a country with population similar to France, Italy or UK (50-60 million). Therefore, for each percentage point increase in the unemployment rate, the French, Italians and Britons incur about $1.2 – $1.4 billion additional cost due to crime.

The 2SLS estimates in this paper draw a more pessimistic picture. According to the 2SLS estimates, a one percentage point increase in the unemployment rate increases theft rate by about 2.4 – 3.8 percent. These elasticities translate into about $1.6 – $2.5 billion additional cost of crime for Italy, France or UK due to the increase in the unemployment rate by one percentage point.

Table 3.10 Industrial Accidents

Year	Country	Location	Sub Type	Detail
1998	Austria	Lassing	Collapse	Mine
2001	Denmark	Baltic sea	Other	Fuel
2001	France	Toulouse	Explosion	Petro-chemical factory AZF
2003	France	Saint-Nazaire	Collapse	Ocean liner Queen Mary 2
2000	Hungary		Chemical Spill	Cyanide
1999	Ireland	Belmullet	Fire	
1997	Italy	Turin	Poisoning	Food
1997	Norway	Barentsburg	Explosion	Coal mine
2002	Poland	Jastrzebie Zdroj	Explosion	Mine Jast-Mos
2001	Romania	Vulcan	Explosion	Coal mine
2001	Romania	Iasi	Poisoning	Cyanure
1995	Slovenia	Mezica	Fire	Waste dumping
1998	Turkey	Istanbul	Explosion	Bazar Egyptian
1999	Turkey	Istanbul	Chemical Spill	
1998	Ukraine	Donetsk	Explosion	Mine
1996	UK	Wales	Chemical Spill	Petrol
1996	UK	Aiskew	Explosion	Gas storage depot
1997	UK	Cadoxton	Chemical Spill	Vinyl Chloride Monomer

3.7 Summary and Conclusion

This paper investigates the impact of unemployment on crime using a panel data set of 33 European countries, and it is one of the few papers which studies crime in an international context. The primary advantage of the data set is that it contains consistently measured crime variables across countries and over time.

The findings presented in this paper are consistent with the previous literature. I find that a one percentage point increase in the unemployment rate increases thefts by about 2 percent using OLS. Although unemployment can be endogenous in a crime regression, using a country-level panel data set minimizes this concern. My 2SLS estimation using the exchange rate, industrial accidents and earthquakes as instruments for the unemployment rate supports this hypothesis. 2SLS estimates are larger than the OLS estimates, but the difference between OLS and 2SLS estimates is not significant. This finding is similar to the conclusion of Gould, Weinberg and Mustard (2002).

Because the overall unemployment rate may not be able to identify people on the margin of committing a crime (Lin 2008 and Raphael Winter-Ebmer 2001), the influences of gender-specific, education-specific and duration-specific unemployment on crime are investigated. The overall unemployment rate is decomposed into labor force shares of unemployed males and females, unemployed individuals with poor and well education and unemployed individuals with a short and long unemployment spell. The results show that the unemployment of males, individuals with poor education, and individuals with longer unemployment spells are significant determinants of the impact of the unemployment rate on crime. Most of the influence of the overall unemployment rate on crime can be attributable to the unemployment of males who are unemployed for more than one year.

Table 3.11 Earthquakes

Year	Country	Location
1998	Austria	Arnoldstein
1996	Croatia	Ston, Slano area
2002	Georgia	Tbilisi area
1996	Greece	Konitsa
1999	Greece	Athens Suburbs of Menidi
2000	Greece	Mihalitsi, Mitikas, Flabo
2001	Greece	Aegean sea
2002	Greece	Bartholomio
2003	Greece	Lefkada
1997	Italy	Umbria, Marche regions
1998	Italy	Gualdo Tadino-Nocera
2002	Italy	Sicily, Palermo
2002	Italy	San Guliano di Puglia
2002	Italy	Zafferana Etnea, Giarre
2003	Italy	Alessandria (Piemont)
1998	Slovenia	Bovec, Trenta, Kobarid
1996	Turkey	Corum-Amasya
1998	Turkey	Kayseri
1998	Turkey	Ceyhan, Adana area
1998	Turkey	Adana, Ceyhan, Hatay
1999	Turkey	Duzce, Bolu, Kaynasli
1999	Turkey	Sakarya Province
1999	Turkey	Izmit
1999	Turkey	Marmaris
1999	Turkey	Kocaeli, Bursa, Istanbul
1999	Turkey	Izmit, Kocaeli, Yalova

The magnitude of the unemployment's impact on crime is economically significant. For example, France, Italy or UK suffer about 25,000-30,000 additional larcenies, burglaries and motor vehicle thefts per year for one percentage point increase in the unemployment. The cost of each property crime can be roughly approximated to be $46,000 in 1999 dollars. Due to one percentage point increase in the unemployment rate, the French, Italian and British incur an extra crime cost of about $1.2-$1.4 billion according to the OLS estimates or $1.6 – $2.4 billion according to the 2SLS estimates.99

[99] See Table 3.13 and section 6 for the details of this calculation.

Table 3.12 2SLS Estimates of Unemployment on Crime

Panel 1: Theft Rate	(1)	(2)	(3)	(4)	(5)
	OLS	2SLS	2SLS	2SLS	2SLS
Unemployment Rate	48.390***	77.810**	70.747**	110.376***	72.049
	(13.662)	(36.784)	(32.188)	(31.958)	(47.157)
Number of Observations	172	172	172	172	172
J statistic		0.992	0.426	0.200	0.777
P-value of the J statistic		0.609	0.514	0.655	0.378
First Stage Results					
Exchange Rate × Manuf. GDP_{t-1}		-0.002***	-0.002***	-0.001***	
		(0.000)	(0.000)	(0.000)	
Ind. Accidents × Manuf. GDP_{t-1}		0.090**	0.075*		0.084**
		(0.037)	(0.037)		(0.038)
Earthquake		-1.175***		-0.450**	-1.158***
		(0.279)		(0.174)	(0.279)
F statistic for weak IV		8.924	9.697	10.634	10.776
P-value for weak IV		0.000	0.001	0.000	0.000

Panel 2: Burglary Rate	(1)	(2)	(3)	(4)	(5)
	OLS	2SLS	2SLS	2SLS	2SLS
Unemployment Rate	7.266	39.908*	34.948**	26.511***	51.645
	(10.615)	(20.729)	(17.453)	(9.676)	(54.813)
Number of Observations	145	145	145	145	145
J statistic		2.391	0.050	2.158	2.369
P-value of the J statistic		0.303	0.823	0.142	0.124
First Stage Results					
Exchange Rate × Manuf. GDP_{t-1}		-0.002***	-0.002***	-0.001***	
		(0.000)	(0.000)	(0.000)	
Ind. Accidents × Manuf. GDP_{t-1}		0.051	0.044		0.043
		(0.031)	(0.028)		(0.033)
Earthquake		-0.437		0.200	-0.338
		(0.575)		(0.467)	(0.577)
F statistic for weak IV		9.395	14.458	11.156	1.135
P-value for weak IV		0.000	0.000	0.000	0.340

Table 3.12 continued

Panel 3: Larceny Rate	(1)	(2)	(3)	(4)	(5)
	OLS	2SLS	2SLS	2SLS	2SLS
Unemployment Rate	22.977*	18.125	14.989	54.719***	-43.401
	(12.790)	(23.731)	(25.381)	(9.832)	(35.224)
Number of Observations	141	141	141	141	141
J statistic		3.856	3.539	2.055	1.201
P-value of the J statistic		0.145	0.060	0.152	0.273
First Stage Results					
Exchange Rate × Manuf. GDP_{t-1}		-0.002***	-0.002***	-0.001***	
		(0.000)	(0.000)	(0.000)	
Ind. Accidents × Manuf. GDP_{t-1}		0.050	0.044		0.043
		(0.032)	(0.028)		(0.033)
Earthquake		-0.439		0.197	-0.337
		(0.579)		(0.469)	(0.579)
F statistic for weak IV		9.150	14.044	11.087	1.115
P-value for weak IV		0.000	0.000	0.001	0.347

Panel 4: Vehicle Theft Rate	(1)	(2)	(3)	(4)	(5)
	OLS	2SLS	2SLS	2SLS	2SLS
Unemployment Rate	11.176***	20.467**	21.331**	3.791	25.074**
	(3.133)	(8.050)	(9.242)	(10.307)	(11.174)
Number of Observations	166	166	166	166	166
J statistic		1.074	1.017	0.003	0.333
P-value of the J statistic		0.584	0.313	0.958	0.564
First Stage Results					
Exchange Rate × Manuf. GDP_{t-1}		-0.002***	-0.002***	-0.001***	
		(0.000)	(0.000)	(0.000)	
Ind. Accidents × Manuf. GDP_{t-1}		0.090**	0.075*		0.084**
		(0.037)	(0.037)		(0.038)
Earthquake		-1.169***		-0.444**	-1.153***
		(0.277)		(0.175)	(0.275)
F statistic for weak IV		9.075	9.544	10.400	10.919
P-value for weak IV		0.000	0.001	0.001	0.000

Notes to Table 3.12: The method of estimation is indicated at the top of each column. Theft is defined as the sum of Burglaries, Larcenies and Vehicle Thefts. All regressions include the whole set of control variables. The upper panels present the results from the 2nd stage. The bottom panels provide estimates of the 1st stage where the unemployment rate is regressed on the instruments. Standard errors that are clustered at the country level are presented in parentheses. The regressions are weighted by the country population. *, ** and *** denotes significance at 10%, 5% and 1% respectively. See Table 3.1 for the countries and years included in the sample. Tables 3.2 and 3.3 provide the descriptions of the outcome variables and the crime definitions differences across countries, respectively.

Table 3.13 Cost per Property Crime

Anderson (1999)'s estimate of cost of crime	Crime-induced production ($397 billion) + Opportunity costs ($130 billion) + Risks to life and health ($574 billion) – Transfers from victims to offenders ($603 billion) = $1,102 billion. [From Table 7 in Anderson (1999)]
Number of Property Crimes in 1999	1,380,000
Number of Violent Crimes in 1999	10,120,000
Total Cost of Violent Crimes	Risks to life and health ($574 billion) + 12% * Remaining Costs ($531 billion) = $638 billion
Total Cost of Property Crimes	88% * $531 billion = $467 billion
Cost per Property crime	$467 billion / 10,120,000 = $46,000

Notes to Table 3.13: Since the Index-I crimes of FBI are the costliest to the society, I assume that all of these costs are incurred due to Index-I crimes (murder, rape, robbery, assault, burglary, larceny, motor vehicle theft). All of the costs associated with Risks to life and health are assigned to violent crimes. The remaining costs are allocated to property and violent crimes according to their shares in total crimes (violent crimes + property crimes).

CHAPTER 4. CRIME AND INTERNATIONAL TOURISM

4.1 Introduction

Tourism is typically regarded as a major industry in many countries, and particularly desirable one, since it is relatively low in energy consumption and pollution. Tourism generates about 7.3% of the total worldwide exports[100]. For some countries, tourism is the main source of income and foreign currency, and many local economies heavily depend on tourism.

This paper investigates the possibility that crime creates an externality in the form of reduction in international tourism activity. Although the impact of economic activity on crime has been investigated extensively (Corman and Mocan 2000, Levitt 1998, Block and Heineke 1975), there are a few studies that analyzed the influence of crime on economic activity. For example, Cullen and Levitt (1999) report that individuals move away from areas with high crime rates. Peri (2004) argues that organized crime is associated with low economic development. Further, despite its economic importance, tourism received very little attention in this context. There are only a handful of studies that investigated whether tourism activity (as a part of overall economic activity) is influenced by crime using data obtained from small geographic regions. For example, Levantis and Gani (2000) find that increased crime is associated with less tourism activity using time-series data from South Pacific and the Caribbeans. McPheters and Stronge (1974) report that property crime is positively correlated with the number of tourists in Miami. Howsen and Jarrell (1987 and 1990) argue that an increase in the number of tourists is associated with an increase in the property crimes. However, these cross-sectional or time-series analyzes have limitations, such as the inability to control for unobservable area characteristics. Furthermore, the results from the studies that focus on one specific location may not be generalizable. Using a panel data set of European countries covering years 1995 to 2003, this paper investigates the influence of crime on international tourism activity and the differential responsiveness of tourism by region. The findings suggest that violent crimes (homicide, rape, robbery and assault) are negatively associated with incoming international tourists and with tourism revenue for an average country in Europe.

The negative influence of crime on tourism activity is not surprising theoretically. Crime is a demand shifter for tourism. When individuals decide about whether to take a holiday and where to spend that holiday, they would take the risk of victimization into account. Other things being equal, potential tourists are more likely to visit countries with smaller risk of victimization.

However, individuals do not have a true measure of victimization risk in the destination country; they can only have a perception about it. This ex-ante expectation about being victimized in the destination country can be formed by obtaining information through various channels, such as print or electronic media or word-of-mouth[101]. Regardless of the source of the information, the actual crime rate in the destination country can be a proxy for the perceived risk of being victimized. In this paper, this proxy (the crime rate) is used in the empirical analysis.

The rest of the paper is organized as follows: Section II has a discussion of the empirical framework and the data employed in the analysis. Section III summarizes the results and Section IV concludes.

[100] World Tourism Organisation (http://www.world-tourism.org/facts/tmt.html).
[101] Regarding the impact of word-of-mouth information on behavior, see Rincke and Traxler (Forthcoming).

4.2 Empirical Framework and Data

Weather conditions and touristic attractions are the main determinants of tourism activity for a country (Richardson and Loomis 2004, Lyssiotou 2000). Other influential factors may include quality of the health services, prevalence of diseases, economic development and various socio-economic characteristics of the country. This paper hypothesizes that the perception of victimization risk is a determinant of the demand for tourism by the international visitors.

Following the guidelines described above, the estimated equation is depicted below:

$$(4.1) \quad T_{c,t} = \alpha + \beta Crime_{c,t-1} + \gamma S_{c,t} + \mu_c + \tau_t + \varepsilon_{c,t}$$

where $T_{c,t}$ stands for international tourists visiting country c in year t per 10 residents, or real international tourism revenue per 10 residents[102]. Both variables are obtained from World Development Indicators.

I assume that the potential tourists' perceptions of victimization can be proxied by the actual crime rate in the destination country. $Crime_{c,t-1}$ denotes the number of crimes per 100,000 residents in country c in year t. Following Corman and Mocan (2000) and Levitt (1998), crime rate is lagged by one year to avoid potential reverse causality. Both violent crimes (homicides, assaults, rapes, robberies) and property crimes (thefts and burglaries) are analyzed. Crime data are obtained from European Sourcebook of Crime and Criminal Justice.

The vector $S_{c,t}$ controls for the unemployment rate, GDP growth rate, exchange rate, urbanization rate, number of hospital beds per 1,000 people, prevalence of tuberculosis, teenage pregnancy rate and the ratio of old people to young people in the country[103]. Time invariant factors that may influence the international tourism activity such as a country's historical sites, its coastline's length and average temperature and other unobservable country characteristics are captured by country fixed effects (μ_c). Regressions also include time dummies represented by τ_t.

4.2.1 Potential Endogeneity

It can be argued that the crime rate in the estimated equation may be endogenous. Specifically, as the number of tourists visiting a country goes up, crime in that country may rise. This is because, the incoming tourists are presumably wealthy and they may increase the expected return for criminals. In fact, McPheters and Stronge (1974) and Howsen and Jarrell (1987 and 1990) argue that an increase in the number of tourists increases property crimes.[104]

However, these papers do not have strong empirical designs as they employ cross-sectional or time series data sets. Time series data from one geographical location do not include

[102] The mean of tourists per 10 residents is 7.2 and that of the tourism revenue per 10 residents is $4942.56

[103] The source of labor market variables and income, teen pregnancy and urban population controls is the World Development Indicators. The ratio of old population to the young population is constructed using the data from the U.S. Census Bureau's International database. Alcohol consumption per capita variable is obtained from the World Health Organization's Global Alcohol Database.

[104] These authors do not find a relationship between tourism activity and violent crime. This may be because, when tourists (who are presumably wealthy) visit a country, the expected return to criminal activities such as theft and burglary goes up, since incoming tourists may increase the number of targets from whom valuable assets can be stolen by the potential criminals. However, there are no direct incentives for committing a violent crime, such as murder or rape. Therefore, the link from tourism to violent crime is expected to be much weaker.

any kind of comparison group. With cross sectional data, unobserved heterogeneity that can impact both the crime rate and the tourism activity cannot be controlled for. Therefore, using cross sectional or time series data sets may lead to biased estimates. This paper, on the other hand, uses a panel data set which allows for inclusion of country fixed effects and year dummies to capture the time-invariant unobservable country characteristics.

Further, in the estimated equation, the crime rate is lagged by one year to overcome a potential reverse causality. The rationale behind this approach is that tourists that visit a country in a specific year cannot influence the crime rate of that country in the previous year. Same method has been employed by Corman and Mocan (2000) and Levitt (1998) even in the context of crimes and arrests which are very much likely to be dependent on each other[105].

4.3 Results

Table 4.1 presents the results from the specification where the number of international tourism revenue per 10 residents is the dependent variable. Total violent crime rate (which consists of homicide, rape, robbery and assault) have a significant negative impact on receipts from international tourists. All of the components of violent crime are also associated negatively with tourism revenue separately[106]. On the other hand, aggregate property crime or its components (theft and burglary) do not have a significant influence. Elasticity estimates of international tourism revenue per 10 residents in the host country with respect to aggregate violent crime, homicide, rape and assault rates are -0.08, -0.14, -0.13 and -0.07, respectively. Similar results, which are displayed in Table 4.2, are obtained from the specification where the number of international tourists per 10 residents in the host country is the dependent variable. Elasticities of international tourists per 10 residents with respect to aggregate violent crime, homicide and assault rates are -0.07, -0.28 and -0.07, respectively.

Crime's impact on international tourism may differ between countries. Similar to the trade-off between risk and return (Fama and MacBeth 1973), if international tourists are highly attracted to a country's touristic prospects, the crime rate in that country may not be a significant deterrent for international tourists. In other words, the attractiveness of a country may partly compensate for the probability of victimization. According to the World Tourism Organization[107], 50% of all international tourists visit a foreign country for leisure and recreation. According to this criterion, Southern Europe is a more attractive tourist destination compared to Northern Europe, since Southern European countries have longer coastlines available for sea tourism, more historical artifacts and mountainous terrain that offer opportunities for skiing.

[105] Specifically, these authors use one period lagged arrest rates to explain the variation in crime.
[106] Although the coefficient of robbery rate is insignificant, its sign is still negative.
[107] http://www.unwto.org/facts/menu.html

Table 4.1 Impact of Crime on International Tourism Revenue

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Violent Crime	Homicide	Rape	Robbery	Assault	Property Crime	Theft	Burglary
Crime Listed	-1.750***	-260.780**	-80.812*	-1.561	-2.236***	0.251	0.440	0.365
	(0.570)	(104.465)	(41.445)	(2.886)	(0.631)	(0.241)	(0.286)	(0.721)
Unemployment Rate	-23.391	-76.474*	-38.060	-39.758	-42.364	-68.461	-44.982	-68.297
	(48.014)	(38.677)	(46.972)	(46.383)	(47.443)	(60.332)	(45.248)	(61.021)
GDP Growth Rate	-12.595	-12.848	6.175	0.740	-3.785	0.401	6.576	-4.987
	(30.746)	(31.206)	(28.254)	(29.046)	(30.079)	(37.601)	(29.519)	(38.223)
% Urban Population	-0.203	22.470	-4.127	-8.884	-2.430	-131.037	-12.247	-137.459
	(129.571)	(96.464)	(126.984)	(121.600)	(126.175)	(143.042)	(125.285)	(140.487)
Teen Pregnancy Rate	9.957**	13.702***	8.838**	7.951*	10.230**	13.351*	9.609**	12.744
	(4.117)	(4.731)	(4.012)	(4.384)	(4.441)	(7.593)	(4.115)	(8.047)
Tuberculosis Rate	-26.405	-16.754	-26.489	-30.171	-26.494	-38.577	-29.824	-38.157
	(21.298)	(32.426)	(21.364)	(21.795)	(21.813)	(30.290)	(20.810)	(30.352)
Hospital Beds	-33.967	-8.806	-26.475	-43.386	-7.476	-142.702	-16.643	-173.263
	(231.457)	(239.036)	(209.681)	(206.042)	(217.060)	(264.878)	(212.364)	(267.365)
Old / Young	-3.519	37.393	23.396	-0.934	-7.620	-39.616	-13.737	-35.268
	(62.294)	(62.339)	(60.755)	(62.255)	(64.198)	(61.857)	(60.049)	(62.935)
Exchange Rate	-3.695	241.521	-2.830	-3.256	-3.477	-2.769	-2.741	-3.064
	(2.263)	(217.064)	(1.831)	(2.167)	(2.255)	(2.999)	(2.094)	(3.114)
Observations	181	162	192	193	190	156	192	156

Notes to Table 4.1: The dependent variable is *international tourism revenue per 10 residents*. In each column the first row represents the coefficient of the crime rate listed on the top. ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively. Standard errors are clustered at country level. Each regression includes country fixed effects and time dummies.

Table 4.2 Impact of Crime on International Tourists

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Violent Crime	Homicide	Rape	Robbery	Assault	Property Crime	Theft	Burglary
Crime Listed	-0.002***	-0.691***	-0.059	-0.000	-0.003***	0.001	0.001*	0.002
	(0.001)	(0.146)	(0.050)	(0.007)	(0.001)	(0.000)	(0.000)	(0.001)
Unemployment Rate	-0.035	-0.130**	-0.044	-0.047	-0.042	-0.078	-0.041	-0.071
	(0.069)	(0.063)	(0.065)	(0.060)	(0.066)	(0.082)	(0.064)	(0.082)
GDP Growth Rate	0.057	0.052	0.074*	0.071*	0.065	0.081	0.081*	0.070
	(0.040)	(0.034)	(0.042)	(0.040)	(0.042)	(0.052)	(0.041)	(0.051)
% Urban Population	0.051	0.033	0.051	0.040	0.070	-0.053	0.045	-0.071
	(0.162)	(0.111)	(0.158)	(0.136)	(0.163)	(0.165)	(0.144)	(0.166)
Teen Pregnancy Rate	-0.008	-0.005	-0.010	-0.010	-0.009	-0.016	-0.007	-0.016
	(0.007)	(0.007)	(0.006)	(0.006)	(0.006)	(0.012)	(0.005)	(0.013)
Tuberculosis Rate	-0.085**	-0.111*	-0.085**	-0.086**	-0.081**	-0.103**	-0.082**	-0.096*
	(0.038)	(0.057)	(0.038)	(0.039)	(0.037)	(0.050)	(0.037)	(0.048)
Hospital Beds	0.224	0.280	0.297	0.298	0.360	0.206	0.328	0.096
	(0.232)	(0.220)	(0.232)	(0.234)	(0.230)	(0.281)	(0.244)	(0.267)
Old / Young	0.048	0.088	0.058	0.036	0.031	-0.005	0.018	0.007
	(0.073)	(0.075)	(0.079)	(0.085)	(0.075)	(0.061)	(0.070)	(0.062)
Exchange Rate	-0.004	0.065	-0.004	-0.004	-0.005	-0.005	-0.004	-0.005
	(0.003)	(0.109)	(0.003)	(0.003)	(0.003)	(0.005)	(0.002)	(0.005)
Observations	182	156	193	194	191	152	193	152

Notes to Table 4.2: The dependent variable is *international tourists per 10 residents*. In each column the first row represents the coefficient of the crime rate listed on the top. ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively. Standard errors are clustered at country level. Each regression includes country fixed effects and time dummies.

Table 4.3 Impact of Violent Crimes on International Tourism in North versus South Europe

Panel A: Dependent Variable: International Tourism Revenue per 10 Residents

	Violent Crime		Homicide		Rape		Robbery		Assault	
	North	South	North	South	North	South	North	South	North	South
Crime Listed	-1.572*	-1.384	-93.582	-221.780	-87.875***	21.866	0.421	-2.876	-2.064**	-1.523
	(0.749)	(4.987)	(119.766)	(237.409)	(22.968)	(169.031)	(3.683)	(8.004)	(0.948)	(5.308)
Observations	79	102	79	83	87	105	87	106	87	103

Panel B: Dependent Variable: International Tourists per 10 Residents

	Violent Crime		Homicide		Rape		Robbery		Assault	
	North	South	North	South	North	North	South	North	South	North
Crime Listed	-0.002**	-0.006	-0.493**	-0.573	-0.024	0.035	0.001	-0.013	-0.003**	-0.007
	(0.001)	(0.004)	(0.193)	(0.377)	(0.055)	(0.088)	(0.006)	(0.008)	(0.001)	(0.006)
Observations	77	105	77	79	85	108	85	109	85	106

Notes to Table 4.3: North and South samples are separated by the latitude 50 North. Full set of control variables (as in Tables 4.1 and 4.2) are included in the regressions. The coefficients presented are those of the crime rates listed on the top of each column. ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively. Standard errors are clustered at country level.

To investigate whether crime impacts tourism differently in Southern versus Northern Europe, I estimate the model described in section II using two sub-samples. Countries whose average latitude is above (below) 50 North are included in the Northern (Southern) sample[108]. In the interest of space, only the coefficients of the violent crimes are reported in Table 4.3. As presented in Panel A of Table 4.3, more rapes, assaults and aggregate violent crimes are associated with less tourism revenue in Northern sample, but not in the Southern sample [109]. Similar findings are displayed in Panel B of Table 4.3 which presents the estimates of violent crimes' separate components' (homicide, rape, robbery and assault) impacts on incoming international tourists. Tourists respond to aggregate violent crime, homicide and assault in Northern sample significantly whereas in Southern sample the impact is statistically insignificant.

The results presented in Table 4.3 suggest that international tourism activity is not influenced by the crime rate in the Southern European Countries which are more attractive tourism destinations than Northern European countries. To investigate this differential response further, I divided the whole sample according to the sea tourism attractiveness of the countries and run the analysis in these samples separately. That is, the countries that have favorable conditions for sea tourism are included in "Attractive" sample and those countries that are not suitable for sea tourism are included in the "Unattractive" sample. Specifically, the countries that have a coastline and are located close to Equator[110] are considered as "Attractive". The remainder of the countries is included in the "Unattractive" sample[111].

In Panel A and B of Table 4.4, I present the results of the models where the whole sample is divided according to sea tourism attractiveness. Violent crimes significantly reduce both tourism revenue (Panel A) and international tourists (Panel B) only in the countries which are *not* suitable for sea tourism, or which are less attractive in terms of sea tourism.

I further estimate models where the interaction of a country's average latitude with its crime rate is included as an independent variable. The main effect of the latitude cannot be included jointly with the interaction term as the models contain country fixed effects. The results presented in Table 4.5 indicate that the closer to the North Pole a country is, the larger the impact of violent crimes on tourism activity becomes (in absolute value). A 1% increase in the aggregate violent crime rate decreases the international tourism revenue per 10 residents by (0.00156×Latitude) percent. According to this estimate, for Iceland (which is located at the latitude 65 North), the elasticity of tourism revenue per 10 residents with respect to the aggregate violent crime rate is -0.101. The same elasticity for Cyprus (at 35 North) is -0.055. As shown in the Panel B of Table 4.5, similar results are obtained for international tourists.

[108] South sample consists of the following countries: Albania, Armenia, Austria, Bulgaria, Croatia, Czech Republic, France, Georgia, Greece, Hungary, Italy, Luxembourg, Republic of Moldova, Romania, Slovak Republic, Slovenia, Spain, Switzerland, Turkey and Ukraine.. The countries in the North sample are Belgium, Denmark, Estonia, Finland, Germany, Ireland, Latvia, Lithuania, Netherlands, Norway, Poland, Russian Federation, United Kingdom and Iceland.

[109] Similar results are obtained when 47.2 North (the median latitude) or 45 North is used to separate Northern European countries from Southern European countries.

[110] Latitude is mechanically correlated with average temperature. If some place is closer to the Equator than, it receives rays of the Sun more directly throughout the year and have warmer temperatures over the year on average.

[111] Albania, Bulgaria, Croatia, Cyprus, France, Georgia, Greece, Italy, Romania, Slovenia, Spain, Turkey and Ukraine are in the Attractive sample.

Table 4.4 Impact of Violent Crimes on International Tourism in Attractive versus Unattractive Countries

Panel A: Dependent Variable: International Tourism Revenue per 10 Residents

	Violent Crime		Homicide		Rape		Robbery		Assault	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Crime Listed	-1.67***	6.45	-130.64	-224.23	-61.34*	-15.25	0.53	3.40	-2.41***	16.59
	(0.53)	(9.89)	(140.17)	(264.67)	(33.33)	(250.39)	(3.95)	(10.09)	(0.61)	(16.48)
Attractive:	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Observations	114	67	106	56	122	70	122	71	122	68

Panel B: Dependent Variable: International Tourism Revenue per 10 Residents

	Violent Crime		Homicide		Rape		Robbery		Assault	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Crime Listed	-0.002***	-0.008	-0.482**	-0.315	-0.032	0.000	-0.000	-0.014	-0.003***	-0.019
	(0.000)	(0.008)	(0.170)	(0.441)	(0.056)	(0.165)	(0.007)	(0.010)	(0.001)	(0.015)
Attractive:	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Observations	111	71	99	57	119	74	119	75	119	72

Notes to Table 4.4: Countries in the "Attractive" sample are located below the latitude 50 North and have a coastline. Countries in the "Unattractive" sample are located above the Latitude 50 North or do not have a coastline. In each panel, the odd (even) numbered columns present the results from the unattractive (attractive) sample. Full set of control variables (as in Tables 4.1 and 4.2) are included in the regressions. The coefficients presented are those of the crime rates listed on the top of the columns. ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively. Standard errors are clustered at country level.

Table 4.5 Changing Impact of Violent Crimes on International Tourism According to Latitude

Panel A: Dependent Variable: International Tourism Revenue per 10 Residents

	(1)	(2)	(3)	(4)	(5)
	Violent Crimes	Homicide	Rape	Robbery	Assault
Crime Listed x Latitude	-3.242***	-436.008**	-158.448**	-2.487	-4.169***
	(1.048)	(174.465)	(74.314)	(5.287)	(1.165)
Observations	181	162	192	193	190

Panel B: Dependent Variable: International Tourism Revenue per 10 Residents

	(1)	(2)	(3)	(4)	(5)
	Violent Crimes	Homicide	Rape	Robbery	Assault
Crime Listed x Latitude	-0.004***	-1.226***	-0.123	0.001	-0.006***
	(0.001)	(0.224)	(0.099)	(0.014)	(0.002)
Observations	182	156	193	194	191

Notes to Table 4.5: The coefficients presented are those of the crime rates listed on the top of each column interacted with the latitude of the country. Full set of control variables (as in Tables 4.1 and 4.2) are included in the regressions. ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively. Standard errors are clustered at country level.

4.4 Conclusion

Using a panel data set of European countries, this paper investigates the impact of crime on international tourism activity. Violent crimes are negatively associated with incoming international tourists and international tourism revenue. The results suggest that tourists evaluate the risk of victimization when choosing a destination. Further, the analyzes show that the impact of violent crimes on international tourism activity in Northern Europe is stronger than it is in Southern Europe which has more touristic attractions. Especially, a country's sea tourism attractiveness may be a factor offsetting the effect of the risk of being victimized for potential tourists. This finding may be evidence for the hypothesis that the risk of victimization borne by the tourists is (partly) compensated by the touristic attractiveness of the country.

The impact of crime on tourism is also economically significant. For example, for an average country with a population of 25 million, a 10% increase in aggregate violent crime rate leads to about $100 million (in 2000 dollars) decline in international tourism revenue. Using Siegfried and Zimbalist (2000)'s locally-owned entertainment venue multiplier of 1.5 as a lower bound, the economic impact of such an increase in violent crime rate is at least $150 million.

CHAPTER 5. SUMMARY AND CONCLUSION

The three pieces of my research presented in second, third and fourth chapters of this dissertation contribute to the economics of crime literature. Second chapter investigates the impact of shall-issue laws on crime. Third chapter analyzes the impact of unemployment on crime. Chapter four pointed out that cost of crime includes losses from tourism revenue.

As explained in the second chapter, a shall-issue law allows law-abiding individuals to obtain a license to carry concealed handguns provided that they satisfy some requirements indicated by the law. Employing state-level or county-level data sets, previous studies report conflicting findings. Studies that find a positive (negative) impact of shall-issue laws on crime suggest that crime-facilitating (reducing) effect of shall-issue laws dominate the crime-reducing (facilitating) effect. There is no consensus on the net effect of shall-issue laws on crime.

The previous studies on shall-issue laws overlook the fact that neither the crime-facilitating nor the crime-reducing effect of shall-issue laws can emerge if individuals do not respond to shall-issue laws by carrying handguns more frequently (first order effect). To investigate this question, second chapter tests whether the first order effect of a shall-issue law is actually realized using an individual-level data set. The mechanisms through which shall-issue laws increase or decrease crime cannot be at work if individuals do not respond to these laws by carrying handguns more frequently in the first place.

The findings in this paper indicate that individuals start carrying handguns more often when they become eligible, i.e. when their states pass shall-issue laws or when they satisfy the minimum required age in an already-shall-issue state. This increase in handgun carrying behavior is a result of changes in behavior of *law abiding individuals* and those who are likely to commit *minor crimes*, such as drug possession, public order offenses or traffic offenses. After the enactment of a shall-issue law, no change is observed in the handgun carrying activity of individuals who are likely to commit *serious offenses*, such as assaults, rapes, manslaughters or robberies. These findings cast doubt on the presumed existence of the crime-facilitating effect of shall-issue laws.

The third chapter investigates the impact of unemployment on crime using a panel data set of 33 European countries, and it is one of the few papers which studies crime in an international context. The primary advantage of the data set is that it contains consistently measured crime variables across countries and over time.

The findings presented show that a one percentage point increase in the unemployment rate increases property crimes by about two percent. Although unemployment can be endogenous in a crime regression, using a country-level panel data set minimizes this concern. My 2SLS estimation using the exchange rate, industrial accidents and earthquakes as instruments for the unemployment rate supports this hypothesis. 2SLS estimates are larger than the OLS estimates, but the difference between OLS and 2SLS estimates is not statistically significant. This finding is similar to the conclusion of Gould, Weinberg and Mustard (2002).

The magnitude of the unemployment's impact on crime is economically significant. For example, France, Italy or UK suffer about 25,000-30,000 additional larcenies, burglaries and motor vehicle thefts per year for one percentage point increase in the unemployment. The cost of each property crime can be roughly approximated to be $46,000 in 1999 dollars. Due to one percentage point increase in the unemployment rate, the French, Italian and British incur an extra crime cost of about $1.5 billion. Further, the results show that the impact of unemployment on

crime is mainly driven by the unemployment of males, individuals with poor education, and individuals with longer unemployment spells.

The fourth chapter investigates the impact of crime on international tourism activity, using the panel data set of European countries which is introduced in the third chapter. Violent crimes are negatively associated with incoming international tourists and international tourism revenue. The results suggest that tourists evaluate the risk of victimization when choosing a destination. Further, the analyzes show that the impact of violent crimes on international tourism activity in Northern Europe is stronger than it is in Southern Europe which has more touristic attractions. Especially, a country's sea tourism attractiveness may be a factor offsetting the effect of the risk of being victimized for potential tourists. This finding may be evidence for the hypothesis that the risk of victimization borne by the tourists is (partly) compensated by the touristic attractiveness of the country.

The impact of crime on tourism is also economically significant. For example, for an average country with a population of 25 million, a 10% increase in aggregate violent crime rate leads to about $100 million (in 2000 dollars) decline in international tourism revenue. Using Siegfried and Zimbalist (2000)'s locally-owned entertainment venue multiplier of 1.5 as a lower bound, the economic impact of such an increase in violent crime rate is at least $150 million.

REFERENCES

Anderson, David A. "The Aggregate Burden of Crime." *Journal of Law and Economics* 42 (1999): 611-42.

Ayres, Ian and John J. Donohue III. "More Guns, Less Crime Fails Again: The Latest Evidence from 1977 – 2006." *Econ Journal Watch* 6 (2009): 218-38.

Ayres, Ian and John J. Donohue III. "Shooting Down the `More Guns, Less Crime` Hypothesis." *Stanford Law Review* 55 (2003): 1193-312.

Becker, Gary S. "Crime and Punishment: An Economic Approach." *The Journal of Political Economy* 76 (1968): 169-217.

Becker, Gary S., and Casey B. Mulligan. "The Endogenous Determination of Time Preference." *Quarterly Journal of Economics* 112 (1997): 729-58.

Black, Dan A., and Daniel S. Nagin. "Do Right-to-Carry Laws Deter Violent Crime?" *The Journal of Legal Studies* 27 (1998): 209-19.

Block, M. K., and J. M. Heineke. "A Labor Theoretic Analysis of the Criminal Choice." *American Economic Review* 65 (1975): 314-25.

Buonanno, Paolo. "Crime and Labor Market Opportunities in Italy (1993-2002)." *Labour* 20 (2006): 601-24.

Buonanno, Paolo, Milo Bianchi, and Paolo Pinotti. "Do Immigrants Cause Crime?" *Journal of European Economic Association* (2011). Forthcoming.

Carpenter, Christoper, and Carlos Dobkin. "Alcohol Regulation and Crime." National Bureau of Economic Research Working Paper No. 15828. (2010).

Cavallo, Eduardo, Andrew Powel, and Oscar Becerra. "Estimating the Direct Economic Damages of the Earthquake in Haiti." *Economic Journal* 120 (2010): F298-312.

Cook, Philip. "The Technology of Personal Violence." *Crime and Justice: An Annual Review of Research* 14 (1991): 1-71.

Cook, Philip J. and Jens Ludwig.*Guns in America: Results of a Comprehensive National Survey on Firearms Ownership and Uses*. Washington, D.C.: Police Foundation,1997.

Cook, Philip J., Jens Ludwig, Sudhir A. Venkatesh, and Anthony A. Braga. "Underground Gun Markets." *The Economic Journal* 117 (2007): F558–F588.

Cook, Philip J., Stephanie Molliconi, and Thomas B. Cole. “Regulating Gun Markets." *Journal of Criminal Law and Criminology* 86 (1995): 59–92.

Corman, Hope, and Naci Mocan. “Carrots, Sticks and Broken Windows.” *Journal of Law and Economics* 48 (2005): 235-66.

Corman, Hope, and Naci Mocan. “A Time-Series Analysis of Crime, Deterrence, and Drug Abuse in New York City.” *The American Economic Review* 90 (2000): 584-604.

Cornwell, Christopher, and William N. Trumbull. “Estimating the Economic Model of Crime with Panel Data.” *The Review of Economics and Statistics* 76 (1994): 360-366.

Cullen, Julie B., and Steven D. Levitt. “Crime, Urban Flight, and the Consequences for Cities.” *The Review of Economics and Statistics* 81 (1999): 159-169.

Donohue III, John J., and Steven D. Levitt. “Guns, Violence, and the Efficiency of Illegal Markets.” *The American Economic Review* 88 (1998): 463-467.

Edmark, Karin. “Unemployment and Crime: Is There a Connection?” *Scandinavian Journal of Economics* 107 (2005): 353-373.

Ehrlich, Isaac. “Participation in Illegitimate Activities: A Theoretical and Empirical Investigation.” *Journal of Political Economy* 81 (1973): 521-565.

Engelhardt, Bryan Eldon. “The Effect of Employment Frictions on Crime.” *Journal of Labor Economics* 28 (2010): 677-718.

Ewing, Bradley T. and Jamie B. Kruse. “Hurricanes and Unemployment.” East Carolina University Center for Natural Hazards Research Working Paper 0105-002, (2005).

Ewing, Bradley T., Jamie B. Kruse and Mark A. Thompson. “Twister! Employment Responses to the 3 May 1999 Oklahoma City Tornado.” *Applied Economics* 41 (2009): 691-702.

Fajnzylber, Pablo, Daniel Lederman, Norman Loayza. “What Causes Violent Crime?” *European Economic Review* 46 (2000): 1323-1357.

Fajnzylber, Pablo, Daniel Lederman, Norman Loayza. “Inequality and Violent Crime.” *Journal of Law and Economics* 45 (2002): 1-40.

Fama, Eugene and James MacBeth. “Risk, Return, and Equilibrium: Empirical Tests.” *The Journal of Political Economy* 81 (1973): 607-636.

Freeman, Richard. B. “Why Do So Many Young American Men Commit Crimes and What Might We Do About It?” *The Journal of Economic Perspectives* 10 (1995): 25-42.

Glaeser, Edward and Spencer Glendon. "Who Owns Guns? Criminals, Victims, and the Culture of Violence." *The American Economic Review* 88 (1998): 458-462.

Gould, Eric D., Bruce A. Weinberg, and David B. Mustard. "Crime Rates and Local Labor Market Opportunities in the United States: 1979-1997." *The Review of Economics and Statistics* 84 (2002): 45-61.

Grogger, Jeffrey. "Market Wages and Youth Crime." *Journal of Labor Economics* 16 (1998): 756-791.

Grogger, Jeffrey. "The Effect of Arrests on the Employment and Earnings of Young Men." *The Quarterly Journal of Economics* 110 (1995): 51-71.

Holden, Richard J., Donna Bahls, and Charles Real. "Estimating Economic Losses in the Bay Area from a Magnitude-6.9 Earthquake." *Monthly Labor Review* 130 (2007): 16-22.

Howsen Roy M., and Stephen Jarrell. "Transient Crowding and Crime: The More 'Strangers' in an Area, the More Crime Except for Murder, Assault and Rape." *American Journal of Economics and Sociology* 49 (1990): 483-494.

Howsen Roy M., and Stephen Jarrell. "Some Determinants of Property Crime: Economic Factors Influence Criminal Behavior But Cannot Completely Explain the Syndrome." *American Journal of Economics and Sociology* 46 (1987): 445-457.

Kelly, Morgan. "Inequality and Crime." *The Review of Economics and Statistics* 82 (2000): 530–539.

LaGrange, Teresa C., and Robert A. Silverman. "Low Self-Control and Opportunity: Testing the General Theory of Crime as an Explanation for Gender Differences in Delinquency." *Criminology* 37 (1999): 41-72.

Levantis, Theodore and Azmat Gani. "Tourism Demand and the Nuisance of Crime." *International Journal of Social Economics* 27 (2000): 959-967.

Levitt, Steven D. "Understanding Why Crime Fell in the 1990s: Four Factors that Explain the Decline and Six That Do Not." *Journal of Economic Perspectives* 18 (2004): 163-190.

Levitt, Steven D. "Juvenile Crime and Punishment." *Journal of Political Economy* 106 (1998): 1156-1185.

Levitt, Steven D. "Using Electoral Cycles in Police Hiring to Estimate the Effect of Police on Crime." *The American Economic Review* 87(1997): 270-290.

Lin, Ming-Jen. **"**Does Democracy Increase Crime? The Evidence From International Data." *Journal of Comparative Economics* 35 (2007): 467-483.

Lin, Ming-Jen. “Does Unemployment Increase Crime? Evidence From U.S. data 1974–2000.” *Journal of Human Resources* 43 (2008): 413–436.

Lochner, Lance. “Education, Work, and Crime: A Human Capital Approach.” *International Economic Review* 45 (2004): 811-843.

Lochner, Lance, and Enrico Moretti. “The Effect of Education on Crime: Evidence From Prison Inmates, Arrests, and Self-Reports.” *The American Economic Review* 94 (2004): 155-189.

Lott Jr., John R. “The Concealed-Handgun Debate.” *Journal of Legal Studies* 37 (1998a): 221-243.

Lott Jr., John R. *More Guns, Less Crime*. Chicago: University of Chicago Press, 1998b.

Lott Jr., John R., and David B. Mustard. “Crime, Deterrence, and Right-To-Carry Concealed Handguns.” *The Journal of Legal Studies* 26 (1997): 1-68.

Ludwig, Jens. “Concealed-Gun-Carrying Laws and Violent Crime: Evidence from State Panel Data.” *International Review of Law and Economics* 18 (1998): 239-254.

Lyssiotou, Panayiota. “Dynamic Analysis of British Demand for Tourism Abroad,” *Empirical Economics* 15 (2000): 421-436.

Machin, Stephen.,and Costas Meghir. “Crime and Economic Incentives.” *The Journal of Human Resources* 39 (2004): 958-979.

McPheters, Lee and William Stronge. “Crime as an Environmental Externality of Tourism: Miami, Florida.” *Land Economics* 50 (1974): 288-292.

Marcotte, Dave E., and Sarah Markowitz. “A Cure for Crime? Psycho-Pharmaceuticals and Crime Trends.” National Bureau of Economic Research Working Paper No.15354, (2009).

Markowitz, Sarah. “Alcohol, Drugs and Violent Crime.” *International Review of Law and Economics* 25 (2005): 20-44.

Miron, Jeffrey. “Violence, Guns, and Drugs: A Cross-country Analysis.” *Journal of Law and Economics* 44 (2001), pp.615-633.

Mocan, Naci. “Structural Unemployment, Cyclical Unemployment and Income Inequality.” *The Review of Economics and Statistics* 81 (1999): 122-134.

Mocan, Naci and Daniel Rees. “Economic Conditions, Deterrence and Juvenile Crime: Evidence from Micro Data.” *American Law and Economics Review* 7 (2005): 319-349.

Mocan, Naci, Stephen C. Billups, and Jody Overland. “A Dynamic Model of Differential Human Capital and Criminal Activity.” *Economica* 72 (2005): 655-681.

Mocan, Naci and Turan G. Bali. “Asymmetric Crime Cycles.” *The Review of Economics and Statistics.* 92 (2010): 899-911.

Moody, Carlisle. “Testing for the Effects of Concealed Weapons Laws: Specification Errors and Robustness.” *Journal of Law and Economics* 44 (2001): 799-813.

Moody, Carlisle and Thomas Marvell. “The Debate on Shall Issue Laws, Continued.” *Econ Journal Watch* 6 (2009): 203-217.

Olson, David and Michael Malt. “Right-To-Carry Concealed Weapon Laws and Homicide in Large U.S. Counties: The Effect on Weapon Types, Victim Characteristics, and Victim-Offender Relationships.” *Journal of Law and Economics* 44 (2001): 747-70.

Oster, Anna. and Jonas Agell. “Crime and Unemployment in Turbulent Times.” *Journal of the European Economic Association* 5 (2007): 752-775.

Pereira, Alvaro S. “The Opportunity of a Disaster: The Economic Impact of the 1755 Lisbon Earthquake.” *Journal of Economic History* 69 (2009): 466-499.

Peri, Giovanni. “Socio-Cultural Variables and Economic Success: Evidence from Italian Provinces.” *B.E. Journals in Macroeconomics: Topics* 4 (2004): article 12.

Polsby, Daniel D. “Firearms Costs, Firearms Benefits and the Limits of Knowledge” *The Journal of Criminal Law and Criminology (1973-)* 86 (1995): 207-220.

Raphael, Steven, and Raphael Winter-Ebmer. “Identifying the Effect of Unemployment on Crime.” *Journal of Law and Economics* 44 (2001): 259-283.

Richardson, Robert B., and John B. Loomis. “Adaptive Recreation Planning and Climate Change: A Contingent Visitation Approach.” *Ecological Economics* 50 (2004): 83-99.

Rincke Johannes, and Christian Traxler. “Enforcement Spillovers,” *The Review of Economics and Statistics* (Forthcoming). doi:10.1162/REST_a_00128.

Rubin, Paul and Hashem Dezhbakhsh. “The Effect of Concealed Handgun Laws on Crime: Beyond the Dummy Variables.” *International Review of Law and Economics* 23 (2003): 199–216.

Ruhm, Christopher J. “Economic Conditions and Alcohol Problems.” *Journal of Health Economics* 14 (1995): 583-603.

Siegfried, John and Andrew Zimbalist. “The Economics of Sports Facilities and Their Communities." *The Journal of Economic Perspectives* 14 (2000): 95-114.

Soares, Rodrigo R. “Development, Crime and Punishment: Accounting for the International Differences in Crime Rates.” *Journal of Development Economics* 73 (2004): pp.155-184.

Varano, Sean, Joseph Schafer, Jeffrey Cancino, Scott Decker, and Jack Greene. “A Tale of Three Cities: Crime and Displacement After Hurricane Katrina.” *Journal of Criminal Justice* 38 (2010): 42-50.

Williams, Jenny and Robin Sickles. “An Analysis of the Crime as Work Model: Evidence from the 1958 Philadelphia Birth Cohort Study.” *Journal of Human Resources* 37 (2002): 479-509.

Witte, Ann D. “Estimating the Economic Model of Crime with Individual Data.” *Quarterly Journal of Economics* 94 (1980): 57-84.

Wolpin, Kenneth I. “A Time Series-Cross Section Analysis of International Variation in Crime and Punishment.” *The Review of Economics and Statistics* 62 (1980): 417-423.

APPENDIX
STATES' CONCEALED WEAPON LAWS

State	Shall-Issue State?	Minimum Age Requirement	Source	Reference
Alabama[A]	Yes	18	Alabama Code 13A-11-76	http://www.atf.gov/publications/download/p/atf-p-5300-5/atf-p-5300-5-alabama.pdf
Alaska[B]	Yes	21	Alaska Statues 11.61.190-11.61.220	http://www.atf.gov/publications/download/p/atf-p-5300-5/atf-p-5300-5-alaska.pdf
Arizona	Since 1995	21	Arizona Department of Public Safety	http://www.azdps.gov/Services/Concealed_Weapons/Permits/Obtain/
Arkansas	Since 1996	21	Arkansas Statue 5-73-309	http://www.asp.arkansas.gov/divisions/rs/pdf/CHCL%20statutes_effective%20073107_010109.pdf
California[C]	No	21	See the note C below	http://ag.ca.gov/firearms/dwcl/index.php
Colorado	Since 2004	21	Colorado Statue 18-12-203	http://www.atf.gov/publications/download/p/atf-p-5300-5/atf-p-5300-5-colorado.pdf
Connecticut	Since prior to 1970	21	General Status of Connecticut 29-36f	http://www.atf.gov/publications/download/p/atf-p-5300-5/atf-p-5300-5-connecticut.pdf
Delaware	No	21	Delaware Code, law 1441 in Chapter 5 of Title 11	http://delcode.delaware.gov/title11/c005/sc07/index.shtml
District of Columbia[D]	No	21	Code of DC numbered 7-2502.03	http://www.atf.gov/publications/download/p/atf-p-5300-5/atf-p-5300-5-district_of_columbia.pdf
Florida	Since 1988	21	Florida Statue 790.06	http://www.flsenate.gov/statutes/index.cfm?App_mode=Display_Statute&URL=Ch0790/ch0790.htm
Georgia	Since 1990	21	Georgia Code 16-11-129	http://www.atf.gov/publications/download/p/atf-p-5300-5/atf-p-5300-5-georgia.pdf

Appendix continued

State	Shall-Issue State?	Minimum Age Requirement	Source	Reference
Idaho	Since 1991	21	Idaho Statue 18-3302	http://www.legislature.idaho.gov/idstat/Title18/T18CH33SECT18-3302.htm
Illinois[E]	No	21	See note E below	http://www.ilga.gov/legislation/ilcs/ilcs3.asp?ActID=1657&ChapAct=430%26nbsp;ILCS%26nbsp;65/&ChapterID=39&ChapterName=PUBLIC%2BSAFETY&ActName=Firearm%2BOwners%2BIdentification%2BCard%2BAct
Indiana	Since 1981	18	Indiana Code 35-47-2-3	http://www.in.gov/legislative/ic/code/title35/ar47/ch2.html
Iowa	No	21	Iowa Code 724.15	http://www.atf.gov/publications/download/p/atf-p-5300-5/atf-p-5300-5-iowa.pdf
Kansas	Since 2007	21	Kansas Code 75-7c04	http://www.ksag.org/files/2010_Summary_SB306_-_Website2.pdf
Kentucky	Since 1997	21	Kentucky Statue 237.11	http://www.lrc.ky.gov/KRS/237-00/110.PDF
Louisiana	Since 1997	21	Louisiana State Police Public Safety Services	http://www.lsp.org/handguns.html
Maine	Since 1986	18	Maine Revised Statues Annotated 25-2003	http://www.maine.gov/dps/msp/licenses/documents/Weapons/CFP%20Booklet.pdf
Maryland[F]	No	21	Maryland State Statue 5–133	http://mlis.state.md.us/asp/web_statutes_2011.asp?gps&5-133
Massachusetts	No	21	Massachusetts Gun Control Act of 1998	http://www.mass.gov/dfwele/dfw/education/hed/hed_gun_laws.htm
Michigan	Since 2002	21	Michigan Compiled Law 28.422	http://www.atf.gov/publications/download/p/atf-p-5300-5/atf-p-5300-5-michigan.pdf
Minnesota	Since 2004	21	Minnesota Statue 624.714	https://www.revisor.mn.gov/bin/getpub.php?pubtype=STAT_CHAP_SEC&year=current&section=624.714

Appendix continued

State	Shall-Issue State?	Minimum Age Requirement	Source	Reference
Mississippi	Since 1991	21	Mississippi Code 45-9-101	http://www.mscode.com/free/statutes/45/009/0101.htm
Missouri	Since 2004	23	Missouri Statue 571.101.1	http://www.moga.mo.gov/statutes/c500-599/5710000101.htm
Montana	Since 1992	18	Montana Statue 45-8-321	http://www.mtssa.org/mtlaws.phtml?code=45-8-315+M.C.A.
Nebraska	Since 2007	21	Revised Statue 69-2433	http://nebraskalegislature.gov/laws/statutes.php?statute=69-2433
Nevada	Since 1996	21	Nevada Statue 202.3657	http://www.atf.gov/publications/download/p/atf-p-5300-5/atf-p-5300-5-nevada.pdf
New Hampshire[G]	Since prior to 1970	18	See note G below	http://www.atf.gov/publications/download/p/atf-p-5300-5/atf-p-5300-5-new_hampshire.pdf
New Jersey	No	18	Administrative Code 13:54-2.3 of New Jersey	www.njsp.org/info/pdf/firearms/njac-title13-ch54.pdf
New Mexico	Since 2004	21	New Mexico Department of Public Safety	http://www.dps.nm.org/lawEnforcement/ccw/index.php
New York	No	21	New York Consolidated Law 400.00	http://www.atf.gov/publications/download/p/atf-p-5300-5/atf-p-5300-5-new_york.pdf
North Carolina	Since 1996	21	North Carolina General Statue 14-415.12	http://www.ncleg.net/EnactedLegislation/Statutes/HTML/ByChapter/Chapter_14.html
North Dakota	Since prior to 1970	18	North Dakota Attorney General	http://www.ag.state.nd.us/BCI/CW/ObtainPermit.htm
Ohio	Since 2005	21	Ohio Code 2923.125	http://codes.ohio.gov/orc/2923.125
Oklahoma	Since 1996	21	Oklahoma Statue 21.1290.9	http://www.oscn.net/applications/OCISWeb/DeliverDocument.asp?CiteID=69792

Appendix continued

State	Shall-Issue State?	Minimum Age Requirement	Source	Reference
Oregon	Since 1991	21	Oregon Statue 166.291	http://www.leg.state.or.us/ors/166.html
Pennsylvania	Since 1990	21	Pennsylvania State Police	http://www.portal.state.pa.us/portal/server.pt?open=512&objID=4451&&PageID=462424&level=2&css=L2&mode=2
Rhode Island	No	21	Rhode Island statue 11-47-48	http://www.rilin.state.ri.us/Statutes/Title11/11-47/11-47-18.HTM
South Carolina	Since prior to 1970	21	South Carolina Code of Laws 23-31-215	http://www.scstatehouse.gov/code/t23c031.htm
South Dakota	Since prior to 1970	18	South Dakota Codified Law 23-7-7.1	http://legis.state.sd.us/statutes/DisplayStatute.aspx?Statute=23-7-7.1&Type=Statute
Tennessee	Since 1995	21	Tennessee Statue 39-17-1351	http://www.michie.com/tennessee/lpext.dll/tncode/1191f/1234d/126a5/1274a?f=templates&fn=document-frame.htm&2.0#JD_39-17-1351
Texas	Since 1996	21	Government Code of Texas 411.172	http://www.statutes.legis.state.tx.us/Docs/GV/htm/GV.411.htm#411.172
Utah	Since 1996	21	Utah Code 53-5-704	http://le.utah.gov/~code/TITLE53/htm/53_05_070400.htm
Vermont[H]	Since prior to 1970	18	See Note H below	http://www.leg.state.vt.us/statutes/fullsection.cfm?Title=13&Chapter=085&Section=04008
Virginia	Since 1989	21	Code of Virginia 18.2-308	http://leg1.state.va.us/cgi-bin/legp504.exe?000+cod+18.2-308
Washington	Since prior to 1970	21	Washington's Revised Code 9.41.070	http://apps.leg.wa.gov/RCW/default.aspx?cite=9.41.070
West Virginia	Since 1990	18	West Virginia Code 61-7-4	http://www.legis.state.wv.us/WVCODE/Code.cfm?chap=61&art=7#07

Appendix continued

State	Shall-Issue State?	Minimum Age Requirement	Source	Reference
Wisconsin[I]	No	18	See note I below	http://www.atf.gov/publications/download/p/atf-p-5300-5/atf-p-5300-5-wisconsin.pdf
Wyoming	Since 1995	21	Wyoming Statue 6-8-104	http://attorneygeneral.state.wy.us/dci/pdf/6-8-104With2010Aammendment.pdf

Notes to Appendix:

[A] Alabama is considered a shall-issue state by Ayres and Donohue (2009) although it is a may-issue state by its law (Alabama Code 13A-11-75).

[B] Alaska is originally an unrestricted state. However, since 1995, it also issues licenses to individuals who demand one.

[C] California is a may-issue state and some argue that it is a de facto no-issue state. The Concealed Weapon Law of California does not state a minimum required age for the eligibility to obtain a license. The law and the standardized application documents (http://www.lasd.org/contact_us/inquiry/gen_pub_ccw_app.pdf) for a concealed weapon actually discourage individuals from applying. For example, it is explicitly stated that carrying a concealed gun is not a right, but a privilege. Therefore, to be consistent with the de facto conditions, age 21 is used as the minimum age requirement in the empirical analysis.

[D] Because there is no concealed carry law in DC, the minimum age to register a gun is used in the empirical analysis for minimum age requirement. According to the Code of DC numbered 7-2502.03, no individual who is younger than 21years of age can register a gun.

[E] Since Illinois is a no- issue state, the minimum age requirement for owning a gun is used in the empirical analysis. All individuals who own a firearm must have a Firearm Owner's Identification Card. According to Illinois Compiled Statue 65/4 all applicants to Firearm Owner's Identification Card must be 21 years old or older.

[F] The Maryland state Statue 5–133 does not allow individuals below 21 years of age to possess a handgun.

[G] In the state's Statues there is no age restriction listed. Therefore, the Federal minimum age requirement of 18 years is used in the empirical analysis.

[H] Vermont is an unrestricted state. Therefore, it is considered to be a shall-issue state in the empirical analysis. Since the state does not have a concealed weapon law, the minimum age requirement for possession is used in the empirical analysis. According to the Vermont Statue Ch. 85 13-4008, only children under the age of 16 are considered to be delinquent if they possess a gun or have a gun in their control (http://www.leg.state.vt.us/statutes/fullsection.cfm?Title=13&Chapter=085&Section=04008). This implies that the minimum age required to possess a gun is 16. However, the US Code Section 922 (http://www.law.cornell.edu/uscode/uscode18/usc_sec_18_00000922----000-.html) indicates that possession of firearm by an individual younger than 18 is unlawful. For this reason, age 18 is used in the empirical analysis as the minimum required age in Vermont.

[I] Wisconsin is a no-issue state. Because of the lack of a concealed weapon law in Wisconsin the minimum age requirement regarding the possession of a firearm is used in the empirical analysis. According to the Wisconsin Statue 948.60 any individual younger than 18 years old cannot possess a firearm.

VITA

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