



UMEÅ UNIVERSITY

Unemployment and crime in Sweden, 2000 to 2014

A study with a focus on younger
individuals

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Abstract

This thesis studies the relationship between youth unemployment and property crime in Sweden during the period 2000 to 2014. Data on the crime participation of suspected individuals from the NCCP is used to estimate a model that tests the relationship between the unemployment rate and the crime participation of individuals 15 to 17 as well as 18 to 24. The model is estimated using yearly panel data covering the 21 different Swedish counties. Random effects, as well as time dummies, are used. A positive and statistically significant relationship between the unemployment rate among individuals aged 18 to 24 and the crime participation of the same age group is established. No similar statistically significant relationship between the unemployment rate among individuals aged 15 to 17 and the crime participation of the same age group is established. The data on crime participation hasn't previously been used in this way and the results are therefore compared to the results of previous studies. These comparisons result in the conclusion that the data used in this thesis is suitable for these types of analyses.

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1. Introduction

In the spring and summer of 2021 international English-speaking newspapers such as The Economist, The Guardian, and The Spectator all published articles with headlines reading “Sweden’s gun crime epidemic is spiraling under control” and “Sweden is being shot up” (Neuding 2021; Henley 2021; The Economist 2021). These headlines can be viewed as a culmination of the media’s interest in the increase in gun violence that has occurred in Sweden during the latest years. A majority of these shootings are connected to organized crime and they statistically speaking represent a small part of the total amount of crime in society. The NCCP (2021:2) however also state that 80 percent of the population aged 16 to 84 thinks that crime, in general, has increased during the last three years, and around 45 percent of the population aged 16 to 84 are deeply concerned over the level of crime in society. 2022 is an election year in Sweden and around 50 percent of the population aged 18 to 79 thinks that law and order is the most important election issue (Novus 2022). It is therefore important and useful to study crime and what socioeconomic factors that have a relationship with criminal behavior in Sweden.

Beginning with Becker (1968) economists have ventured into the field of criminology using the idea of profit maximization to explain why an individual sometimes chooses a criminal activity in favor of non-criminal activity. The idea proposed by Becker (1968), and later developed by Ehrlich (1973) is that crime can be seen as a type of work that requires time and result in a payoff. This means that criminal activities and non-criminal activities can be viewed as substitutes. The individual makes a choice between the criminal and non-criminal activities based on the expected payoff from the respective activity. This idea is summed up in equation 1.

$$E(w_c) > E(w) \tag{1}$$

Equation 1 shows the condition that needs to hold for an individual to choose a criminal activity in favor of a non-criminal activity. $E(w_c)$ represents the expected payoff from the criminal activity whilst $E(w)$ represents the expected payoff from the non-criminal activity. This means that the likelihood of choosing an illegal activity increase if the left-hand side increases or if the right hand side decrease. On the opposite, the likelihood of choosing a legal activity increases if the left-hand side decreases or if the right-hand side increases.

A term that is oftentimes used to describe the right-hand side of equation 1 is “labor market opportunities”. There is already an existing rich literature on the relationship between labor market opportunities and crime (Mustard 2010). According to Draca and Machin (2015), one area that is especially well studied and well discussed is the relationship between unemployment and crime. Grönqvist (2011) however argues that there are surprisingly few studies that focus on the relationship between youth unemployment and crime. This thesis will therefore study the relationship between youth unemployment and crime. Hirschi & Gottfredson (1983) state that the age pattern for crime is close to universal across the globe. Criminal activity increases with age, peaks in the late teens, and then decreases. Figure 1 shows the number of crimes committed by suspected individuals of a certain age divided by the respective population size. The data are presented as averages for the period 2000 to 2014.

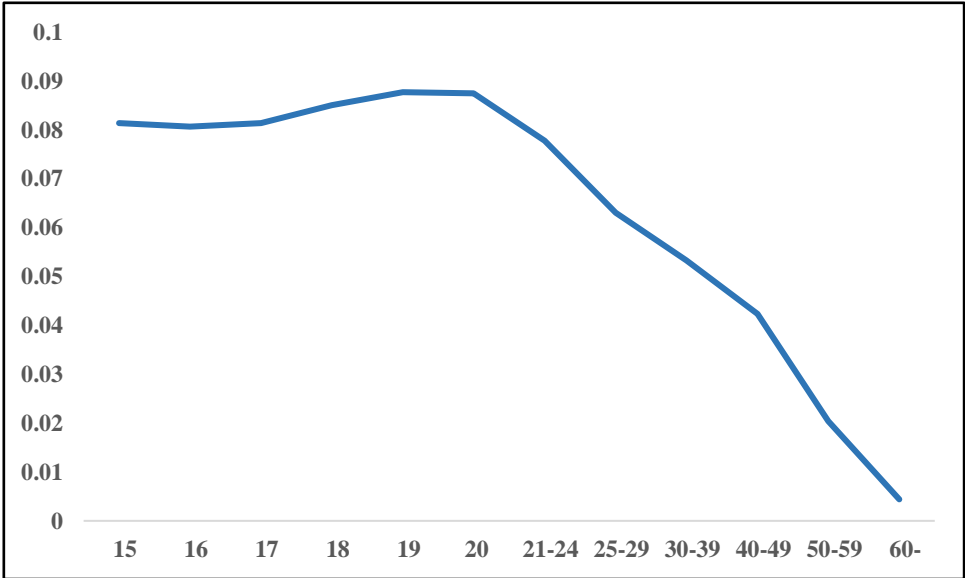


Figure 1. *Crime participation in different age groups*

Figure 1 shows the statement regarding age patterns and crime made by Hirschi & Gottfredson (1983) holds for Sweden as well. The fact that young individuals are overrepresented as perpetrators is one argument for studying the relationship between youth unemployment and crime. Another reason for studying the link between youth unemployment and crime is that the results from previous studies using Swedish data are ambiguous. This means that there are still questions regarding the link between youth unemployment and crime in Sweden. By using data that, at least to my knowledge, hasn’t been used in this context before the hope is to be able to estimate a robust and statistically significant relationship between youth unemployment and crime. Since the model developed by Becker (1968) and Ehrlich (1973) treats crime as a substitute for work it is more applicable to property crime, which oftentimes results in an

economic gain, compared to for example violent crime. The focus of this study will therefore be on the relationship between unemployment and property crime.

Most previous studies on aggregated data use the number of reported crimes per capita as the dependent variable. The change in the number of reported crimes per capita stemming from a change in the unemployment rate is then measured. This implicitly means that when the relationship between youth unemployment and crime is studied the effect that is measured is the change in the total amount of crime stemming from a change in the youth unemployment rate. This thesis will instead use another approach and study the relationship between youth unemployment and the crime specifically committed by younger individuals. A model that estimates the relationship between the unemployment rate among young individuals and the crime participation of the same age group will be estimated. This will hopefully result in a more sensitive and accurate model. The Swedish Police as well as the Swedish National Council for Crime Prevention (NCCP) define young individuals, in the context of crime, as individuals aged 15 to 20 (Swedish Police 2022; NCCP 2022). To match the data on unemployment provided by the Swedish Public Unemployment Service (AF) young individuals will throughout this thesis be defined as individuals aged 15 to 24. A panel of data covering the 21 different Swedish counties over the period 2000 to 2014 is used to estimate the relationship between youth unemployment and crime.

The thesis will be outlined as follows. Section 2 contains a literary review of some of the already existing works on the subject. Section 3 contains a theoretical model that establishes a theoretical foundation for unemployment and crime. Section 4 contains a presentation of the method used to estimate the relationship between youth unemployment and crime. The section also contains the econometric specification that is used and some potential issues regarding the method. Section 5 contains a presentation of the results. Section 6 contains a brief discussion of the results as, a comparison between the results and the previous literature and areas of interest for future research.

2. Literary review

2.1 Unemployment and crime

Draca and Manchini (2015), as well as Mustard (2010), argue that for a time the theory regarding the relationship between unemployment and crime didn't match the empirical results on the subject. According to economic theory, higher levels of unemployment should result in

higher levels of crime since more individuals turn to crime when the opportunities in the legal labor market decrease. However, when Freeman (1999 pp. 3529-3571) reviewed the then existing literature on the subject he stated that the relationship was “*fragile, at best*”. More recent studies have however managed to establish a more robust relationship between unemployment and crime. There is now a consensus that a one percentage point increase in unemployment increases property crime by one to two percent (Lin 2008; Mustard 2010). Nordin and Almén (2017) credit this progress to the introduction of panel data as well as the usage of time and area fixed effects specification. One example is Raphael and Winter-Ebmer (2001) that use panel data covering 50 U.S states from the period 1971 to 1997. The study finds a statistically significant and robust positive relationship between unemployment and property crime. Lin (2008) uses an instrumental variable approach to avoid some of the possible endogeneity issues, which will be further discussed later in the thesis, which might exist between unemployment and crime. The oil price, union memberships, changes in the real exchange rate as well manufacturing GDP are used as instrumental variables for the unemployment rate. Lin (2008) also finds a statistically significant positive relationship between unemployment and property crime.

Two examples of studies on the relationship between crime and unemployment on Swedish data are Edmark (2005) and Nordin and Almén (2017). Edmark (2005) uses panel data covering the 21 different Swedish counties over the period 1988 to 1999 to estimate the relationship. This specific period is chosen since the unemployment rate varied a lot during this period. The study finds a statistically significant positive relationship between the unemployment level and the different property crimes burglary, car theft, and bike theft. Nordin and Almén (2017) conducts a similar study but instead uses panel data covering the 280 different Swedish municipalities over the period 1998 to 2010. The study also finds a positive relationship between unemployment and property crime.

2.2 Unemployment and crime committed by younger individuals

Draca and Machin (2015) argue that there has been a progress in identifying certain groups for which the relationship between unemployment and crime is stronger. One example of this is Gould et al. (2002) that study the relationship between unemployment, wages, and the total crime rates for young unskilled men in the USA. Gould et al. (2002) argue that this is a group that is more likely to turn to crime when legal labor market opportunities are affected negatively. The results are a statistically significant relationship between unemployment rates

and crime as well as between wage levels and crime. Gould et al. (2002) stated that the change in wages has a bigger impact on the crime rate compared to changes in the unemployment rate. Fougère et al. (2009) conduct a similar study on 95 different French metropolitan regions over the period 1990 to 2000. Unlike Gould et al. (2002) the study does not focus on unskilled young men but rather on the whole population of young individuals. The study finds a positive relationship between youth unemployment and property crime.

One study on the relationship between youth unemployment and property crime that uses Swedish data is Nilsson and Agell (2003). The study utilizes the turbulent Swedish labor market during the end of the 1990s to study the relationship between youth unemployment and property crime. This is achieved by using panel data covering the 280 different Swedish municipalities over the period 1996 to 2000. The study however finds no statistically significant relationship between youth unemployment and property crime. All the above-mentioned studies are performed using aggregated data on crime and unemployment. In addition to these studies, there are also a few studies that estimate the relationship between youth unemployment and crime using individual-level data. Grönqvist (2011) uses a sample that contains 723 392 males aged 19 to 25 that during the period 1992 to 2005 had at least one recorded unemployment spell. The study finds a large and statistically significant positive relationship between youth unemployment and certain types of property crimes, especially theft. Grönqvist (2011) however states that the increase in crime is not caused by the income loss, caused by unemployment. The increase in crime instead stems from the fact that an unemployed individual has more time to commit crimes compared to an employed individual.

3. Economic theory

3.1 The individuals choice between work and crime

Edmark (2003) builds on the work of Ehrlich (1973) and Freeman (1999 pp. 3529-3571) and defines a simple model that describes the supply of crime. Since the model treats crime as a type of work, an activity that requires time and results in a payoff, this model is most applicable to property crime. The starting point of the model is an individual's choice between a criminal and a non-criminal activity, as a source of income, during one period. It is assumed that the individuals must have either criminal or non-criminal activity during the period. Lochner (1999), as well as Witte and Tauchen (1994), are examples of more dynamic models that allow for a combination of work and crime. This simpler static model is however sufficient for the

theories that are presented in this paper. Equation 1 shows the condition that needs to hold for the individual to choose the criminal activity in favor of the non-criminal activity.

$$E(w_c) > E(w) \quad (1)$$

$E(w_c)$ represents the expected returns from the criminal activity and $E(w)$ represents the expected returns from the non-criminal activity. Equation 1 implies that the individual will choose a criminal activity in favor of a non-criminal activity if the expected payoff from the criminal activity exceeds the expected payoff from the non-criminal activity. It is assumed that the individual prefers honest work and the non-criminal activity will therefore be chosen if $E(w_c) = E(w)$.

Equation 2 shows the expected payoff from the criminal activity defined as a probability-weighted average.

$$E(w_c) = (1 - p)w_c + p(w_c - S) \quad (2)$$

The term w_c represents the payoff from the criminal activity. For simplicity reasons, it is assumed that all criminal activities succeed but the probability of getting caught after committing the crime is represented by the term p . The probability of not getting caught is therefore defined as $(1 - p)$. If the individual is caught after committing the crime the payoff from the crime is reduced by the punishment, S .

Equation 3 shows the expected payoff from the non-criminal activity this payoff is also defined as a probability-weighted average.

$$E(w) = (1 - u)w + ua \quad (3)$$

The term w represents the payoff (wage) from the non-criminal activity while the term a represents the unemployment benefits the individual receives if being unemployed. The probability of being unemployed is represented by the unemployment rate, u , and the probability of not being unemployed is therefore represented by the term $(1 - u)$. It is possible to use equations 2 and 3 to rewrite equation 1 in the following way:

$$(1 - p)w_c + p(w_c - s) > (1 - u)w + ua \quad (4)$$

Equation 4 shows how the different variables affect the expected payoffs from the criminal activity, $E(w_c)$, and the non-criminal activity, $E(w)$. Edmark (2003) assumes that the chance of getting caught when committing a crime is larger than the chance of becoming unemployed, $p > u$. From 2000 to 2014 the average clear-up rate in Sweden was around 33 percent (NCCP). Since the average unemployment level during the same period was around 5 percent (SCB) this is not an unreasonable assumption. Edmark (2003) further assumes that the cost of being punished when caught committing a crime is larger than the cost of being unemployed, $S > w - a$. This assumption implies that there is more risk involved in choosing the criminal activity in favor of the non-criminal activity. The payoff from the criminal activity, w_c , must thus fore exceed the wage from the non-criminal activity, w , to compensate for this increase in risk. Equation 5 shows that higher levels of w_c and u increases the chance of the individual choosing the criminal activity. On the contrary higher levels of w , p and a increase the chance of the individual choosing non-criminal activity.

3.2 The aggregate supply of crime

With the usage of equation 4, it is possible to derive equation 6, a function for the aggregated supply of property crime in society, Q_c .

$$Q_c = f(p, W_c, W, S, A, u, \pi) \quad (5)$$

The terms W_c , W and A represent the aggregated payoff from criminal activities, the aggregated wages the non-criminal activities, and the aggregated unemployment benefits respectively. Similar to equation 5 the term, p represents the probability of getting caught after choosing the criminal activity, the term S represents the received punishment when getting caught and the term u represents the unemployment rate. Following Ehrlich (1973) the term π is added to the model. It represents a vector of additional variables that affect the aggregated supply of crime. With equation 5 as a starting point, it is possible to create hypotheses regarding the effects of the different variables on the aggregated supply of crime. An increase in the aggregated payoffs from criminal activities, W_c , are assumed to have a positive effect on the aggregated supply of crime. An increase in the aggregated unemployment benefits, A , the probability of getting caught, p , and the punishment, S , are instead assumed to decrease the aggregated supply of crime. The above-mentioned assumed effects are similar to the assumed effects of the corresponding variables in equation 4. Edmark (2003) however argues the effects of the unemployment rate, u , and the aggregated wages, W , are not entirely similar to the effects of the corresponding variables in equation 5. An increase in the unemployment rate, u , can be

expected to affect the aggregated levels of crime in two different ways. Firstly a higher unemployment rate increases the probability of being unemployed and this decreases the expected payoff from the non-criminal activity. Secondly, a higher unemployment rate might also put downward pressure on the wages for the individuals that do have work. This means that the aggregated supply of crime is affected positively in two different ways. The effect of an increase in the aggregated wages, W , can be expected to be ambiguous. An increase in the aggregated wages means a higher expected payoff from the non-criminal activity and this will decrease the aggregated supply of crime. An increase in the aggregated wages on the other hand also might increase the aggregated payoffs from criminal activity, W_c , since there now are more valuable objects to steal, and this might affect the aggregated supply of crime positively. The net effect of an increase in, W , therefore depends on which of these two effects is the strongest.

4. Method

Three different multiple OLS models with time dummies as well as random effects are estimated to study the relationship between youth unemployment and property crime. Most other similar studies use fixed effects in favor of random effects with Pappas and Winkelmann (2002) being one exception. A Hausman test was performed for each of the estimates and the results uniformly ruled in favor of the random effects method. The results from the Hausman tests can be found in appendix B. By using time dummies as well as random effects it is possible to control for all factors that are constant over time but vary across regions. It also controls for the factors that are varying over time but are constant across all areas. (Raphael & Winter-Ebmer 2001). Model 1 is estimated using the crime participation of all individuals aged 15 to 64, the whole population, as the dependent variable. The main reason for estimating this model is to compare the results with the results from previous studies. Model 2 is estimated using the crime participation of individuals aged 15 to 17 as the dependent variable and model 3 is estimated using the crime participation of individuals aged 18 to 24 as the dependent variable. Multiple versions of Model 2 and 3 are estimated. One version is estimated using the income level and educational level of the whole population as independent variables while another version is estimated using the income level and educational level of the specific age groups. According to Edmark (2003), most other similar studies either use a log-linear or a log-log specification. Following Ehrlich's (1973) equation 6 is estimated using a log-log specification. This means that the coefficients will be estimated as elasticities.

4.1 Econometric specification

The theoretical model on the aggregated supply of crime (equation 5) is used as a foundation for the econometric model that is shown in equation 6.

$$\ln(C_{it}) = \beta_2 \ln(u_{it}) + \beta_3 \ln(W_{it}) + \beta_4 \ln(p_{it}) + \beta_K \ln(\pi_{it}) + \delta_t + \alpha_i + \varepsilon_{it} \quad (6)$$

The dependent variable C_{it} represents the crime participation in region i at time t for a certain age group. The number of crimes committed by that certain age group is divided by the population size of the same age group. The independent variable u_{it} represents the unemployment rate for a certain age group in region i at time t . The independent variable W_{it} represents the deflated average income for a certain age group in region i at time t . Unemployment benefits are included in this definition of income. No separate variable representing the average unemployment benefits is therefore included in the model. The variable δ_t represents time-varying but region invariant factors that affect the dependent variable. These factors will be controlled by adding yearly time dummies. The variable α_i represents the time constant but region-specific factors that the dependent variable. These factors will be controlled for by estimating the model with random effects. An idiosyncratic error term, ε_{it} , is also added to the model. In Equations 5 and 6 the variable p represents the probability of getting caught by law enforcement while committing a property crime. In equation 7 the variable p_{it} instead represents the overall clear-up rate for all types of crimes in region i at time t . The variable p_{it} should therefore be interpreted as a measure of the resources and the effectiveness of the law enforcing authorities instead of the probability of getting caught committing a property crime (Edmark 2005). The reason for not including the clear-up rate for only property crimes, which could be interpreted as the probability of getting caught, is to avoid the endogeneity problems proposed by Levitt (1998). Due to data limitations the variables representing the aggregated payoff from criminal activities (W_c) is not present in equation 7.

The term π_{it} represents a vector of additional sociodemographic variables that are also included in the model. Grönqvist (2011) as well as the NCCP (2008) states that male individuals and individuals with a foreign background are over-represented as perpetrators and variables that represent the distribution of gender, as well as ethnicity, is therefore added to the model. Lochner & Moretti (2004) and Machin et al. (2011) state that there is a negative relationship between education and crime. A variable that represents the educational level is therefore added to the model. A variable representing the population density is added to the model since cities

or metropolitan areas oftentimes experience a higher level of crime compared to rural areas (Glaeser & Sacerdote 1999). A variable representing the share of the population that is divorced is also included in the model. Edmark (2005), Grönqvist (2011), and Nordin and Almén (2017) all include this variable in their models. A complete list of the variables that are included in the econometric model can be found in appendix A.

4.2 Potential issues

There are a few well-discussed potential issues when estimating the relationship between unemployment and crime. Mustard (2010) states that omitted variable bias is one potential issue. If some unobserved regional differences and characteristics are correlated with the crime participation it could mean that the estimated results are biased. Mustard (2010) further argues that the modern standard approach to dealing with this potential issue is to include a wide variety of control variables in addition to using time and fixed effects. Time dummies and fixed effects however don't control for any factors that are varying across regions as well as varying over time. This potential issue will have to be kept in mind when discussing the results that are presented in this thesis.

Ehrlich (1973) discusses the possible issue of reverse causality where the crime rate in a region affects the unemployment level in the same region. If this is the case then the OLS estimates will be biased. Raphael and Winter-Ebmer (2001) consider the possibility that high levels of crime might negatively affect the local labor market. A potential new business might choose not to establish in areas with high levels of crime and an already established business might choose to move away. Edmark (2005) states that individuals with a criminal record may have a harder time finding work and that could affect the unemployment level in the area. One common approach to dealing with this issue is the instrumental variable approach used by Lin (2008). Due to the time limitations, the idea of using an instrumental variable for the unemployment level was abandoned. Edmark (2005) however argues that studying geographically larger areas should decrease the risk of reverse causality. Since this study is performed at a county level this hopefully means that the risk of achieving biased results due to endogeneity problems is low. There are two potential issues regarding the data on unemployment and the data on crime participation but these two issues will be discussed in the data section.

5. Data

A yearly panel of data covering the 21 different Swedish counties from the year 2000 to 2014 is used to estimate equation 6. The county-level was chosen since the data used in this thesis was not available at the municipality level. Edmark (2005) however argues that one advantage of county-level data is that the “mobility of criminals” could affect the results. Individuals could choose to commit crimes in areas other than their area of residence and this could result in biased results. Since the counties are geographically larger the chance of receiving biased results from “the mobility of criminals” is smaller when using county-level data compared to for example municipality-level data.

4.1 Property crime/independent variables

Data on the crime participation of suspected individuals from the NCCP is used as the data on crime participation. Most other studies, Swedish as well as international, on aggregated data use the number of reported crimes as a measure of the number of crimes. This thesis instead uses data on the total number of crimes committed by individuals that are considered reasonable suspects by either the police, persecutor, or another law enforcing authority in a closed case (NCCP 2007). The advantage of this data is that it that is organized by age. By using this data is, therefore, possible to construct a variable that represents the crime participation of a certain age group.

Property crime is in this thesis defined as robbery, burglary, theft/pilfering, fraud/embezzlement, and handling of stolen property. Auto theft is excluded from the definition since technological advances in vehicle security during the early 2000s have decreased the total number of auto thefts (NCCP 2007). Nordin and Almén (2017) argue that this could result in biased results and therefore also exclude auto theft from their definition of property crimes. The NCCP defines vandalism as a property crime but following Edmark (2005) it is excluded from the definition since vandalism normally isn't associated with any economic gain. During the period 2000 to 2014 property crime, as defined in this thesis, on average represented around 30 percent of the total number of crimes committed by suspected individuals. Around 35 percent of the property crimes during the same period were committed by individuals aged 15 to 24. Figure 2 shows the distribution of property crimes and how this distribution differs between the three different age groups.

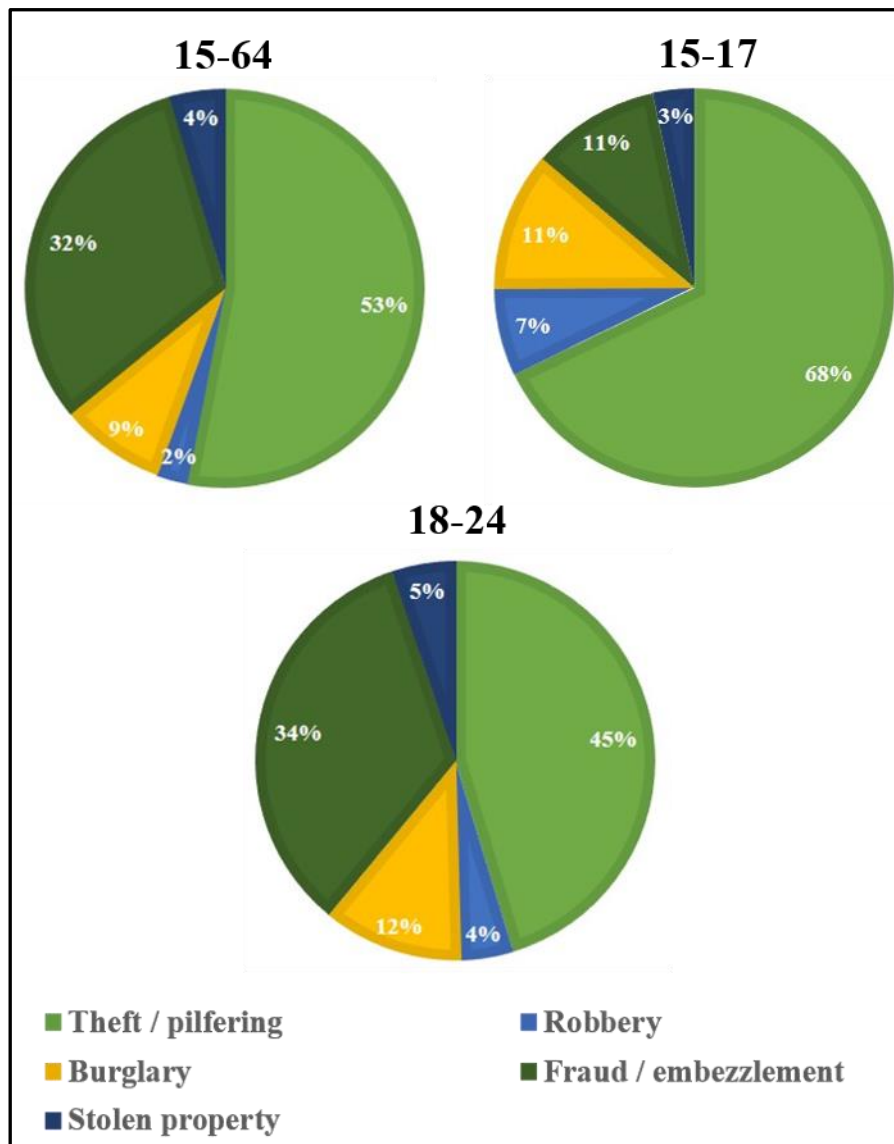


Figure 2. *Distribution of property crimes*

Since the data on the crime participation of suspected individuals haven't been used in this context before it is useful to discuss if the data can be used as a measure for the number of crimes in society. The NCCP (2007; 2017) states that their data on reported property crimes represents the number of committed property crimes in a correct way. This is partly explained by the fact that it is oftentimes obligatory to report a crime to receive insurance compensation (Edmark 2005; NCCP 2017). It is therefore useful to compare the data on property crime used in this thesis with the data on reported property crimes. Figure 3 shows the total number of property crimes reported as well as the total number of property crimes committed by suspected individuals during the period 2000 to 2014. Both values are normalized by the population size.

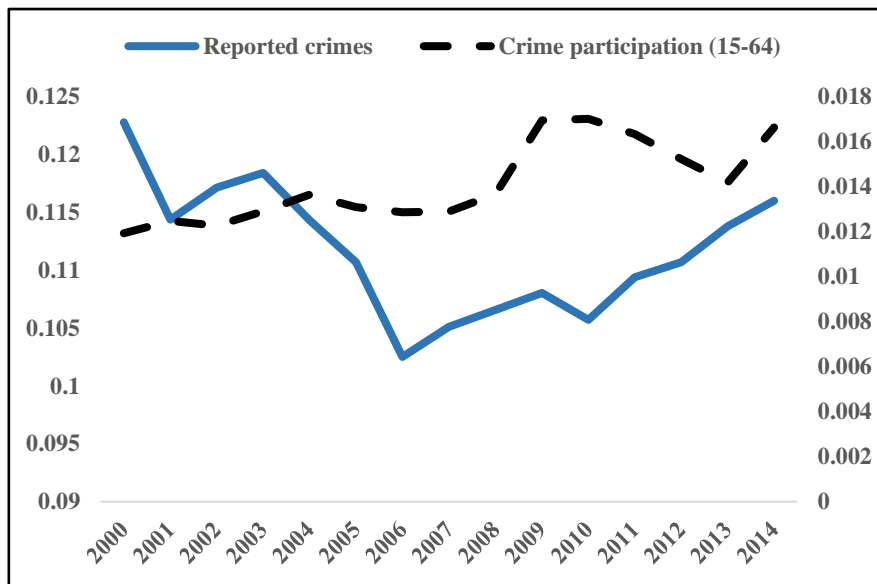


Figure 3. *Reported crimes and crime participation*

Figure 3 shows that the overall trends for the two lines differ. Since the data on the number of reported property crimes can be viewed as a correct measure for the total amount of crime this is a case for concern. It is, therefore, possible that the data on crime participation is not suitable for this type of analysis.

4.2 Independent variables

Data on unemployment is taken from the Swedish Public Employment Service (AF). The number of unemployed individuals is defined as the average number of individuals in a certain age group that is registered as job seekers on a certain date each month. Individuals participating in labor market programs are also included in the definition. According to Nordin and Almén (2017), this is the definition that is most frequently used in similar studies. One potential issue with using data from AF is that not all unemployed individuals register as job seekers. There is a large incentive to register as a job seeker since it is required to receive unemployment benefits but it is still useful to discuss this issue. Statistics Sweden (SCB) also collects data on the unemployment rate and this data is based on statistical surveys (SCB 2016). Comparing the data from the Swedish Public Employment Service to the data from SCB is one way to evaluate if the data from AF represents the unemployment level accurately. Figure 4 shows the percentage of the population aged 15 to 64 that is registered as job seekers at AF as well as the unemployment rate for the population aged 15 to 64 from SCB.

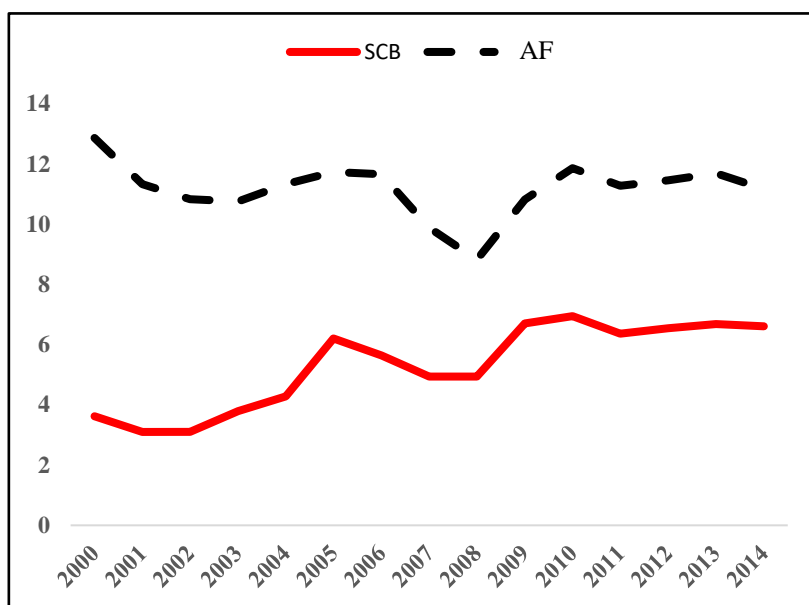


Figure 4. *The unemployment rate (%), SCB, and AF*

Figure 4 shows that the two lines differ because SCB and AF define unemployment in different ways (SCB 2016). The overall trends for the two lines are however similar and this supports the idea that the data from the AF can be used as a measurement for the unemployment rate.

Data from the NCCP is used for the clear-up rate. The clear-up rate is defined as the total number of criminal injunctions divided by the total number of crimes committed by suspected individuals. Data on the average population income is taken from the STATIV database which is provided by SCB. The average population income is defined as the average deflated net income for all individuals aged 19 to 64. Most individuals in Sweden attend upper secondary education and since students normally complete upper secondary education at the age of 19 individuals aged below 19 are not included in the definition (SNAE 2022).

The same data from SCB is used when calculating the average income for the two specific age groups, 15 to 17 and 18 to 24. Since the data on income is only available for individuals aged 16 and above this means that the average income for individuals 16 to 17 will be used as a measurement for the income level of individuals aged 15 to 17. It would perhaps have been preferable to use the hourly or monthly wage as a measure of income. Gould et. al (2002) use an estimate for the average weekly wage and this may be a better measure of the income. The reason for using the average total income instead of the average wage is due to data availability.

Data on the educational level of the population is also collected from SCB. The educational level is defined as the share of the population aged 20 to 64 that has completed upper secondary education. Individuals aged below 19 are excluded since students normally complete upper secondary education at the age of 19 (SNAE 2022). This unfortunately means that the share of all individuals aged 19 to 24 that has completed upper secondary education is used as the measurement for the educational level for individuals aged 18 to 24. When calculating the age group-specific educational level for the individuals aged 15 to 17 data on the proportion of all students that are qualified for upper secondary education after graduating from lower secondary education is used as a measurement. This data is collected from the Swedish National Agency for Education (SNAE). The data on the distribution of gender, distribution of ethnicity, population density as well as the proportion of divorced individuals are also collected from the STATIV database at SCB.

6. Results

The estimated results for model 1 are shown in table 1. Version 1a includes the unemployment rate among individuals aged 15 to 17 as a dependent variable. Version 1b includes the unemployment level of individuals aged 18 to 24 as a dependent variable. Version 1c includes the unemployment level of individuals aged 25 to 64 as a dependent variable. All the three different versions of model 1 are estimated using the income level and the educational level of the whole population.

Table 1. *Unemployment and property crimes committed by individuals aged 15 to 64*

	1a	1b	1c
	Property crimes	Property crimes	Property crimes
	(15-64)	(15-64)	(15-64)
Unemployment (15-17)	-0.004 (0.020)		
Unemployment (18-24)		0.182* (0.106)	
Unemployment (25-64)			0.307** (0.156)
Income (population)	-1.147** (0.461)	-0.701 (0.513)	-0.611 (0.503)
Education (population)	-0.345 (1.166)	0.016 (1.113)	0.341 (0.897)
R ²	0.496	0.509	0.545
Control variables	X	X	X
Random effects	X	X	X
Time dummies	X	X	X

Robust clustered standard errors in brackets

*** p < 0.01; ** p < 0.05; * p < 0.1

Table 1 shows that there is a positive and statistically significant relationship between the unemployment rate among individuals aged 18 to 24 and the crime participation of the whole population. There is also a statistically significant relationship between the unemployment rate among individuals aged 25 to 65 and crime participation of the whole population. The estimated coefficients show that an increase in the unemployment rate among individuals aged 25 to 64 has a larger positive effect on crime participation compared to a similar increase in the unemployment rate among individuals aged 18 to 24. One thing to note is that there is a statistically significant negative relationship between the population's average income and the crime participation when the model is estimated with the unemployment rate among individuals aged 15 to 17 as an independent variable.

The estimated results for model 2 are shown in table 2. Model 2 is estimated using the crime participation among individuals aged 15 to 17 as the dependent variable. Version 2a and 2b are estimated using the unemployment rate among individuals aged 15 to 17 as a dependent variable. Version 2c is instead estimated using the unemployment rate among individuals aged 25 to 64 as a dependent variable. The difference between version 2a and 2b is that version 2a is estimated using the population income level and the population educational level while version 2b is estimated using the specific age group income level and educational level.

Table 2. *Unemployment and property crimes committed by individuals aged 15 to 17*

	2a	2b	2c
	Property crimes (15-17)	Property crimes (15-17)	Property crimes (15-17)
Unemployment (15-17)	-0.012 (0.032)	-0.016 (0.031)	
Unemployment (25-64)			0.158 (0.253)
Income (population)	-0.859 (1.091)		-0.635 (1.110)
Income (16-17)		-0.125 (0.432)	
Education (population)	2.393 (1.558)		2.837** (1.219)
Education (15-17)		0.997 (0.960)	
R ²	0.395	0.318	0.434
Control variables	X	X	X
Random effects	X	X	X
Time dummies	X	X	X

Robust clustered standard errors in brackets
 *** p < 0.01; ** p < 0.05; * p < 0.1

Table 2 shows that the only statistically significant estimate is the estimated coefficient for the educational level of the population in version 2c. The coefficient is positive and this means that an increase in the proportion of the population that has completed upper secondary education will increase property crime committed by individuals aged 15 to 17.

The estimated results for model 3 are shown in table 3. Model 3 is estimated using the crime participation among individuals aged 18 to 24 as the dependent variable. Version 3a and 3b are estimated using the unemployment rate among individuals aged 18 to 24 as a dependent variable. Version 3c is instead estimated using the unemployment rate among individuals aged 25 to 64 as a dependent variable. The difference between version 3a and 3b is that version 3a is estimated using the population income level and the population educational level while version 3b is estimated using the specific age group income level and education level.

Table 3. *Unemployment and property crimes committed by individuals aged 18 to 24*

	3a	3b	3c
	Property crimes (18-24)	Property crimes (18-24)	Property crimes (18-24)
Unemployment (18-24)	0.260** (0.132)	0.151 (0.123)	
Unemployment (25-64)			0.622*** (0.169)
Income (population)	0.136 (0.627)		0.569 (0.603)
Income (18-24)		-1.030* (0.559)	
Education (population)	1.027 (1.344)		1.051 (1.144)
Education (19-24)		-0.015 (1.158)	
R ²	0.242	0.232	0.628
Control variables	X	X	X

Random effects	X	X	X
Time dummies	X	X	X

Robust clustered standard errors in brackets
*** p < 0.01; ** p < 0.05; * p < 0.1

Table 3 shows that there is a statistically significant and positive relationship between the unemployment rate and the crime participation of individuals aged 18 to 24. Version 3a shows a statistically significant and positive relationship between the unemployment rate among individuals aged 18 to 24. One thing to note is that when the model is estimated with the income level and education level of the specific age group it is instead the estimated coefficient for the income variable that is statistically significant. The estimated coefficient is negative which means that a decrease in the income level for the individuals aged 18 to 24 will increase the crime participation of the same age group. When comparing the results from versions 3a and 3b it is possible to see that the absolute value of the estimated coefficient for the income level in version 2b, -1.030, is larger than the estimated coefficient for the unemployment variable in version 3a, 0.260. This means that a percentage change in the income level of the individuals aged 18 to 24 will have a larger effect on the crime participation of the same group compared to a similar percentage change in the unemployment rate of the same age group. Version 3c is estimated using the unemployment rate of individuals aged 25 to 64 as the dependent variable. The estimated coefficient for this variable is positive and statistically significant. This indicates that there is a positive and statistically significant relationship between the unemployment rate of the individuals aged 25 to 64 and the crime participation of the individuals aged 18 to 24.

7. Discussion

One of the main issues regarding this thesis is whether or not the data on the crime participation of suspected individuals can be used as a measurement for the amount of crime in society. Figure 3 in the data section showed that the overall trends for the number of reported property crimes and the number of property crimes committed by suspected individuals differ. Since the reported number of reported property crimes is assessed to match the number of committed property crimes in a correct way this raised some questions. The main purpose of estimating model 1 was to compare the results with the results from previous studies. These comparisons would then hopefully give more insight into the usefulness of the data on crime participation that is used in this thesis. Model 1 was estimated using the crime participation of the whole

population. Since most of the previous studies on aggregated data use the total number of reported property crimes as the dependent variable this makes comparisons easier. The results from model 1 showed a statistically significant positive relationship between property crime and the unemployment rate among individuals aged 18 to 24 as well as the unemployment rate among individuals aged 25 to 64. These results are in line with the consensus regarding the positive relationship between unemployment and crime presented by Lin (2008) as well as Mustard (2010). The results from model 1 are also for the most part in line with the results from previous Swedish studies. Edmark (2005), as well as Nordin and Almén (2017), find a positive relationship between the overall unemployment rate and crime. The most important thing about the results from model 1 is that the results can be interpreted as proof that the data on crime participation used in this thesis can be used as a measure of the amount of crime in society.

This study finds no statistically significant relationship between the labor market opportunities for the individuals aged 15 to 17 and the crime participation of the same age group. The results are similar when the crime participation of the individuals 15 to 17 is studied and when the crime participation of the whole population is studied. These results are perhaps not that surprising since the vast majority of all individuals aged 15 to 17 are still in school. During the period 2000 to 2014 only around 3 percent of all individuals aged 15 to 17 are not in school. It is therefore not that surprising that the crime participation of this specific age group doesn't react to shifting labor market opportunities. One surprising result from model 2 is that the estimated coefficient for the educational level of the population is statistically significant and positive. It is not surprising the estimated coefficient is statistically significant. It is however surprising that the estimated coefficient is positive since this means that an increase in the proportion of the population that has completed upper secondary education will increase the crime participation of the individuals aged 15 to 17.

The study finds a statistically significant positive relationship between the labor market opportunities for the individuals aged 18 to 24 and the crime participation of the same age group. Around 47 percent of all individuals aged 18 to 24 are not in school (SCB) so it is not surprising that the crime participation of this age group reacts more to changes in the labor market opportunities compared to the group of individuals aged 15 to 17. The results for the group of individuals aged 18 to 24 are not in line with the results from Nilsson and Agell (2003) since they don't find a statistically significant relationship between youth unemployment and crime in Sweden. The results are however in line with Grönqvist (2011), Gould et al. (2002),

and Fougère et al. (2009) who all find a positive and statistically significant relationship between youth unemployment and crime. Similar to Gould et al. (2002) this study finds that the income level of the individuals aged 18 to 24 has a larger impact on the crime participation of the individuals aged 18 to 24 compared to the unemployment rate of the same age group. One thing to note is that Gould et al. (2002) use the average wage level and this study uses the average income level. This must be kept in mind when comparing these two results. Version 3c is that estimated using the unemployment rate of individuals aged 25 to 64 as a dependent variable and it shows the highest r-squared value of the three different versions of model 3. Comparing versions 3a and 3c it is possible to see that a change in the unemployment rate among the individuals aged 25 to 64 has a larger impact on the crime participation of the individuals aged 18 to 24 compared to a change in the unemployment rate of the same age group.

6.1 Future research

This study shows that it is possible to use the data on the crime participation of suspected individuals, provided by the NCCP, to study the crime participation of different age groups in Sweden. This opens up new possibilities for studying how different socioeconomic factors affect crime participation in society. It is, as previously discussed, possible that there is no relationship between the crime participation of the youngest individuals and the labor market opportunities of the same age group. It would therefore be useful to use the data on crime participation to identify which socioeconomic factors that have a relationship with the crime participation of the individuals aged 15 to 17. Another area of future research is the relationship between the crime participation of individuals aged 18 to 24 and the unemployment rate among individuals aged 25 to 64. A change in the unemployment rate among individuals aged 25 to 64 has a larger effect on the crime participation of the individuals aged 18 to 24 compared to a similar change in the unemployment rate among individuals aged 18 to 24. Why this is the case is something that could be studied more deeply in the future.

6.2 Summary and conclusion

This thesis establishes a positive and statistically significant relationship between the labor market opportunities for individuals aged 18 to 24 and crime participation in the same group. This relationship is found when studying the crime participation of the individuals aged 18 to 24 as well as the crime participation of the entire population. The thesis also finds a statistically significant and negative relationship between the income level of the individuals aged 18 to 24

and the crime participation of the same age group. The thesis is not able to establish a similar relationship between the unemployment rate and the crime participation of individuals aged 15 to 17. This thesis also shows that it is possible to use data on the crime participation of suspected individuals for these types of analyses. Hopefully, this will lead to the creation of more sensitive and precise models that can predict the criminal behavior of different age groups in society.

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Appendix A

Table A1. Definitions of variables

Variables	Definition
Property crime (15-64) (15-17) (18-24)	The number of property crimes committed by suspected individuals in a specific age group is divided by the population size of the same age group.
Income (population) (16-17) (18-24)	Average deflated net income of a specific age group. The population is defined as all individuals aged 19 to 64.
Education (population) (19-24)	The proportion of a specific age group that has completed upper secondary education. The population is defined as all individuals aged 19 to 64.
Education (15-17)	The proportion of all students that are qualified for upper secondary education after graduating from lower secondary education.
Clear-up rate	The total number of criminal injunctions is divided by the total number of crimes committed by suspected individuals.
Proportion foreign	The number of foreign-born individuals is divided by the size of the whole population.
Proportion divorced	The number of divorced individuals is divided by the size of the whole population.
Population density	The number of individuals is divided by the number of k^2 in the respective county.
Proportion male (15-64) (15-17) (18-24)	The number of male individuals in a specific age group is divided by the population size of the same age group.

Table A2. *Descriptive statistics*

<i>Dependent variables</i>	Min	Max	Mean	Std. dev.	Obs.	Source
Property crime (15-64)	0	0.033	0.013	0.004	314	NCCP
Property crime (15-17)	0	0.077	0.026	0.009	314	NCCP
Property crime (18-24)	0	0.077	0.023	0.008	314	NCCP
<i>Independent variables</i>						
Unemployment (15-17)	0	0.020	0.001	0.001	315	AF
Unemployment (18-24)	0.047	0.263	0.166	0.047	315	AF
Unemployment (25-64)	0.057	0.198	0.125	0.025	315	AF
Income (16-17)	7.802	12.814	9.741	0.871	315	SCB
Income (18-24)	81.542	131.190	96.829	8.463	315	SCB
Income (19-64)	158.536	297.398	205.436	24.177	315	SCB
Education (15-17)	80.091	96.227	88.956	2.511	315	SNAE
Education (19-24)	0.647	0.763	0.702	0.026	315	SCB
Education (19-64)	0.728	0.879	0.807	0.030	315	SCB
Clear-up rate	0.176	0.814	0.415	0.079	315	SCB
Proportion foreign born	0.0383	0.230	0.105	0.040	315	SCB
Proportion divorced	0.065	0.105	0.090	0.009	315	SCB
Population density (km ²)	6.960	336.917	56.622	69.960	315	SCB
Proportion men (15-64)	0.477	0.556	0.511	0.005	315	SCB
Proportion men (15-17)	0.489	0.535	0.515	0.006	315	SCB
Proportion men (18-24)	0.477	0.556	0.518	0.014	315	SCB

Appendix B

Table B1. *Hausman tests*

Model	Chi-Sq. statistic	p-value
1a	21.28	0.622
1b	14.82	0.926
1c	12.00	0.980
2a	25.89	0.359
2b	22.46	0.552
2c	18.08	0.799
3a	16.51	0.869
3b	12.47	0.974
3c	9.77	0.995

Appendix C

Table C1. *Unemployment and property crimes committed by individuals aged 15 to 64*

	1a	1b	1c
	Property crimes	Property crimes	Property crimes
	(15-64)	(15-64)	(15-64)
Unemployment	-0.004		
(15-17)	(0.020)		
Unemployment		0.182*	
(18-24)		(0.106)	
Unemployment			0.307
(25-64)			(0.156)**
Income	-1.147**	-0.701	-0.611
(population)	(0.461)	(0.513)	(0.503)
Education	-0.345	0.016	0.341
(population)	(1.166)	(1.113)	(0.897)
Clear-up rate	-0.655***	-0.627***	-0.624***
	(0.144)	(0.141)	(0.137)
Proportion foreign	0.152	0.168*	0.210**
(population)	(0.082)	(0.073)	(0.065)
Proportion divorced	0.118	0.009	0.004
(population)	(0.340)	(0.343)	(0.338)
Population density	0.114**	0.119**	0.095**
	(0.044)	(0.043)	(0.036)
Proportion male	-2.580***	-2.234***	-2.455***
(15-17)	(1.087)	(0.920)	(1.040)
Proportion male	-0.215	-0.543	-0.580
(18-24)	(1.194)	(0.977)	(0.893)
Proportion male	0.044	-1.778	-1.802
(25-64)	(2.809)	(2.501)	(2.473)
R ²	0.496	0.509	0.545
Control variables	X	X	X
Random effects	X	X	X
Time dummies	X	X	X

Robust clustered standard errors in brackets

*** p < 0.01; ** p < 0.05; * p < 0.1

Table C2. *Unemployment and property crimes committed by individuals aged 15 to17*

	2a	2b	2c
	Property crimes	Property crimes	Property crimes
	(15-17)	(15-17)	(15-17)
Unemployment	-0.012	-0.016	
(15-17)	(0.032)	(0.031)	
Unemployment			0.158
(25-64)			(0.253)
Income	-0.859		-0.635
(population)	(1.091)		(1.110)
Income		-0.125	
(16-17)		(0.432)	
Education	2.393*		2.837**
(population)	(1.558)		(1.219)
Education		0.997	
(15-17)		(0.960)	
Clear-up rate	-0.255***	-0.239**	-0.260***
	(0.149)	(0.149)	(0.142)
Proportion foreign	-0.015	-0.044	0.033
(population)	(0.152)	(0.173)	(0.124)
Proportion	-0.046	0.169	-0.123
divorced	(0.562)	(0.716)	(0.553)
(population)			
Population density	0.063	0.035	0.044
	(0.0787)	(0.067)	(0.063)
Proportion male	-0.597	-0.658	-0.736
(15-17)	(1.872)	(1.172)	(1.705)
Proportion male	2.113*	2.016	1.650
(18-24)	(1.765)	(1.924)	(1.346)
Proportion male	-10.637**	-7.867*	-12.121***
(25-64)	(6.615)	(6.647)	(5.451)
R ²	0.395	0.318	0.434
Time and are fixed	X	X	X
effects			
Control variables	X	X	X

Robust clustered standard errors in brackets

*** p < 0.01; ** p < 0.05; * p < 0.1

Table C3. *Unemployment and property crimes committed by individuals aged 18 to 24*

	3a	3b	3c
	Property crimes	Property crimes	Property crimes
	(18-24)	(18-24)	(18-24)
Unemployment	0.260**	0.151	
(18-24)	(0.132)	(0.123)	
Unemployment			0.622***
(25-64)			(0.169)
Income	0.136		0.569
(population)	(0.627)		(0.603)
Income		-1.030	
(18-24)		(0.559)*	
Education	1.027		1.051
(population)	(1.344)		(1.144)
Education		-0.015	
(19-24)		(1.158)	
Clear-up rate	-0.269**	-0.234**	-0.268**
	(0.099)	(0.102)	(0.093)
Proportion foreign	0.108	0.103	0.165*
(population)	(0.093)	(0.099)	(0.083)
Proportion	0.576*	0.398	0.346
divorced	(0.297)	(0.521)	(0.316)
(population)			
Population density	0.043	0.047	0.022
	(0.065)	(0.062)	(0.056)
Proportion male	-0.868	-0.509	-1.120
(15-17)	(1.668)	(1.641)	(1.148)
Proportion male	0.251	0.351	-0.063
(18-24)	(1.167)	(1.270)	(1.173)
Proportion male	-1.563	0.199	-2.452
(25-64)	(4.575)	(4.288)	(4.638)
R ²	0.242	0.232	0.628
Time and are fixed	X	X	X
effects			
Control variables	X	X	X

Robust clustered standard errors in brackets

*** p < 0.01; ** p < 0.05; * p < 0.1