Unemployment and crime

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Abstract
This study investigates the relationship between unemployment and crime by examining the large variation in unemployment in Sweden between 2007 and 2017. In this paper, I use a panel data set that consist of 3190 observations over 290 municipalities. The variation in unemployment serves as a proxy for macroeconomic events. The results suggest at best a weak effect from unemployment on violent crime and no effect from unemployment on property crime which goes against the established crime theory.
1. Introduction

The unemployment rate in Sweden varied during the boom and bust in the Swedish economy in the 2000s. In 2007, when the Swedish economy was in a boom phase just before the start of the financial crisis, the unemployment rate was 6.2%. The unemployment rate quickly increased and peaked at 8.6% in 2010; it then started to decrease as the economy recovered. In 2017, the unemployment rate was down to 6.7%. A high unemployment rate is expensive for the government since the cost of unemployment benefits increases, but according to various crime theories, this is not the only cost; an increase in unemployment may also lead to an increase in crime. Crime rates during 2007-2017 reflected a decrease in property crimes but an increase in other types of crimes.

The purpose of this paper is to reinvestigate the effect of unemployment on crime in Sweden. I do so by examining the variation in unemployment in Swedish municipalities between 2007 and 2017 using a fixed effect model based on panel data. I choose to examine this years since it is a period that covers both a time of economic prosperity and a financial crisis. This paper contributes to the literature by using data previously not available to researches. The remainder of my paper is structured as follows. Section 2 presents the previous literature about the relationship between unemployment and crime. In Section 3, I review the theory of crime. Section 4 describes the data and the model used. In Section 5, I present my results and findings to answer the question:

*What is the effect of unemployment on crime*

Section 6 presents a conclusion.

2. Literature review

The connection between unemployment and crime has been examined in various empirical studies before, and the results have been mixed. Chiricos (1987) reviews 63 studies and finds that less than a majority of the studies reveals a statistically significant relationship between unemployment and crime. He finds that earlier research, which use mostly aggregate data from larger areas, do not support the theory that unemployment affects crime.

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1 Descriptive statistics are collected from Statistics Sweden, National Council for Crime Prevention and Swedish Public Employment Service.
Later research has produced different results. More recent studies in this subject instead use data at local levels because crime varies across regions. Using aggregate data from larger areas may hide the variation needed to identify causation (Mustard 2010). These recent studies have been more in line with various crime theories and reveals that unemployment may lead to an increase in the crime rate. These recent studies also use more comprehensive control variables and includes time and region fixed effects in their regressions, thereby reducing the problem of omitted-variable bias.

Edmark (2002) use Swedish panel data from 1988 to 1999 at the county level. She finds that an increase in unemployment leads to more property crimes, but she does not find any effect on violent crimes.

Nilsson and Agell (2003) use panel data at the municipality level and investigate the effect of various labor market programs on crime. They find that a decrease in the unemployment rate reduces the crime rate, but they also argue that labor market programs has at best a very weak effect in reducing crime.

Fougère et al. (2009) studies panel data from France and finds a significant effect of youth unemployment on property crimes but no significant effect from general unemployment. They also do not find any effect from long-term unemployment on crime. In contrast, Nordin and Almén (2011) uses panel data from 1997 to 2009 in Sweden. They examine the effect of long-term unemployment on crime and finds that long-term unemployment has a larger effect on crime compared to regular unemployment. Their results differ from previous research since they identify a much larger effect on violent crimes that has not been recognized before.

Öster and Agell (2007) examine the variation in unemployment in Swedish municipalities with data from the late 1990s. They find a positive effect of unemployment on overall crime, burglary, auto theft, and drug possession. Their findings suggest that the decrease in unemployment in the 1990s may have reduced burglary by 15% and auto theft by 20%. They also examine whether youth unemployment has an effect on crime, but this inquiry yields no significant results.

Grönqvist (2011) investigates the link between youth unemployment and crime in Sweden, and his findings contrasts with those of Öster and Agell (2007). His results indicate that unemployment is largely responsible for the overrepresentation of young males in crime statistics. He also investigates whether there is any difference between crimes committed during weekdays and crimes committed during weekends. He finds evidence that unemployment
increases free time for individuals, which in turn increases the opportunity for individuals to engage in crime.

To conclude, the result from earlier research which mostly used aggregate data from larger areas varied, but more recent studies using data from local regions are more in line with the crime theory.

3. Theory

Various crime theories connect crime with unemployment. Becker (1968) develops a model of crime in which an individual who is unemployed will be more likely to engage in crime than an individual who is employed. This is because an unemployed individual has a lower income. Ehrlich (1973) continues this subject and develops a model which states that individuals are expected to maximize their utility when they have different market activities to choose from.

In the Ehrlich model, individuals decide to allocate their time between two options. The first option is an illegal working activity (i.e. committing a crime), and the second option is a legal working activity. A violation of the law can be viewed as something that might increase the monetary wealth, the physical well-being of the perpetrator, or both. However, the perpetrator also risks a reduction in monetary wealth or physical well-being from punishments: for instance, paying a fine, losing income due to serving time in prison, or having a criminal record. The alternative is to choose activities that do not violate laws, but this choice is also to some degree subject to risks.

A person could both commit crimes and have a job; it is also possible to change between the two options. Ehrlich considers this and expands his model to include time. Since time is limited, the individual’s choice between working and committing crimes is about finding the optimal allocation of time.

In the Ehrlich model, the individuals must make a choice regarding their optimal participation at the beginning of a given period. The model assumes no entry costs and no costs when moving between the activities. Thus, it is not a choice exclusively between two options; rather, the individual is choosing his or her optimal combination of the two options. The returns of both activities are monotonically increasing function of working time. The net returns from the legitimate activity, \( l \), are given with certainty by the function \( W_l(t_l) \), where \( t \) is the time input. The net return from the illegitimate activity, \( i \), is conditional upon two different states of the
world: $a$, where the perpetrator is detected and punished with probability $p_i$, and $b$, where the perpetrator is getting away with the crime with probability $1 - p_i$. If the perpetrator gets away with the crime, the gain is the entire value of the output of the illegitimate activity, net of the cost of the purchased inputs, $W_i(t_i)$. If the perpetrator is detected and punished, the returns will be reduced with the amount of $F_i(t_i)$, which is the value of the penalty for the illegitimate activity and other losses. We assume that the goal of the individual is to be maximizing his or her total utility. The utility in any given state of the world $s$, is given by the function

$$U_s = U(X_s, t_c)$$

where $X_s$ is defined as the stock of a composite market good which is contingent on the occurrence of state $s$. $t_c$ is the time spent on consumption or nonmarket activity, and $U$ is an indirect utility function that converts $X_s$ and $t_c$ into consumption flows. During these assumptions it exist only two states in the world with respect to $X$:

$$X_b = W' + W_i(t_i) + W_l(t_l)$$

which is obtained with probability $1 - p_i$, or

$$X_a = W' + W_i(t_i) - F_i(t_i) + W_l(t_l)$$

which is obtained with probability $p_i$, where $W'$ is the market value of the individual’s asset. The expected utility is given by

$$EU(X_s, t_c) = \sum_{s=a}^{n} \pi_s U(X_s, t_c)$$

where $\pi_s$ is the probability of state $s$, reduces in our case to

$$EU(X_s, t_c) = (1 - p_i) U(X_b, t_c) + p_i U(X_a, t_c)$$

Next step is to maximize equation (4a) with respect to the variables $t_i, t_l, t_c$ subject to the wealth constraints given by equation (2) and (3), a time constraint,

$$t_0 = t_i + t_l + t_c,$$

and nonnegativity requirements,

$$t_i \geq 0; t_l \geq 0; t_c \geq 0.$$
Substitute equations (2) and (3) in equation (4a), the Kuhn-Tucker first-order optimality conditions can be stated as follows:

\[
\frac{\partial EU}{\partial t} - \lambda \leq 0,
\]

\[
\left(\frac{\partial EU}{\partial t} - \lambda\right) t = 0,
\]

\[t \geq 0,
\]

where \(t\) is the optimal values of each \(t_i, t_l, t_c\) and \(\lambda\) is the marginal utility of time spent in consumption. Equation (7) can be used for analyzing the range of possible combinations of illegitimate and legitimate activities. The optimal allocation of time spent between \(i\) and \(l\), given the amount of time spent on consumption \(t_c\), and in case of an interior solution, must satisfy the following first order condition:

\[
-w_i - f_i - w_l = pU'(X_a) \left(1 - p\right)U'(X_b),
\]

(8)

where \(w_i = \left(\frac{dW_i}{dt_i}\right), f_i = \left(\frac{dF_i}{dt_i}\right)\) and \(w_l = \left(\frac{dW_l}{dt_l}\right)\). The left-hand side of equation (8) is the slope of an opportunity boundary and the right-hand side is the slope of an indifference curve. The model developed is using two different states of the world, but it also applies to \(n\) states of the world. Ehrlich gives an example where the returns in \(i\) and \(l\) are each subject to a binomial probability distribution due to if the individual would get away with the crime in \(i\) and unemployment or employment in \(l\) for a given period. The condition for an interior solution with respect to the allocation of working time between \(i\) and \(l\) which maximize equation (4) is then

\[
(1 - p_i)(1 - u_l)U_a(w_i - w_l) + (1 - p_i)u_lU_b w_i + p_i(1 - u_i)U_c (w_i - f_i) + p_i u_l U_d (w_i - f_i) - p_i u_i U_d (w_i - f_i) = 0,
\]

(9)

where \(u_l\) is the probability of unemployment in \(l\), and \(a, b, c,\) and \(d\) are the states of the world. Equations (7), (8) and (9) can be used for identifying the factors that determine the optimal participation in legitimate and illegitimate activities. Holding everything else constant, an increase in either the probability of getting caught when committing a crime or in the value of the punishment, will reduce the incentive to participate in illegitimate activities since the expected marginal cost of punishment will increase. Similarly, an increase in the marginal return from illegal activity will increase the incentive for committing crimes.
Looking at unemployment, the partial effect of an increase of the probability of unemployment on entry into illegitimate activities are positive. Thus, an increase in the probability of being unemployed will increase the incentive to commit crimes.

This theory is mostly suited for property crimes since it has more economic incentives compared to violent crimes which are rarely committed due to economic reasons (Levitt, 2004). However, the model may still explain crime that has no economic incentive. If the possibility to earn money legitimately from working increases, then the time that is spent on work will increase, holding everything else constant. This will decrease the available time for committing crime, which in turn may lead to a decrease in the overall crime rate (Ehrlich, 1973). Being unemployed may also make individuals frustrated, which in turn may lead to violent crime (Agnew, 1992). Nilsson and Agell (2003) argue that criminality is an outcome of social interactions. Thus, if the unemployment rate increases, it may create a criminal culture within some groups of society.

There might be some selection bias in this theory. One could suspect that individuals, consciously or not, select where to live. For instance, companies or high-income individuals might avoid regions with a high crime rate. There is a risk of reverse causation, as a high crime rate in a region might affect economic growth, which could lead to a bias in the effect of unemployment on crime. Another factor that might lead to reverse causation is that individuals who commit crimes and have a criminal record might be less attractive on the labor market (Fougère et al., 2009). However, since the variation in unemployment during this period is mainly due to macroeconomic events such as the financial crisis, the variation is exogenous to the municipalities and thus the problem of reverse causation is likely to be reduced (Nilsson & Agell, 2003).

To conclude, if the unemployment rate increases, then the individuals is assumed to be more likely to commit a crime. Thus, an increase in unemployment rate should have a positive effect on crime according to the model.

4. Data and empirical model

The variation in unemployment during the last financial crisis provides an opportunity to isolate the effect of unemployment on crime. The shift in the unemployment rate during those years
reveals an overall increase followed by a decrease. However, the shift in the unemployment rate was not the same across all regions in Sweden; therefore, I use data from the municipality level to isolate the relationship between unemployment and crime. The panel data consists of 3,190 annual observations from all 290 municipalities in Sweden from 2007 to 2017.

The unemployment data is collected from the Swedish Public Employment Service\(^2\). The unemployment variables are the total open unemployment rate and the open long-term unemployment rate for individuals between 16 and 64 years of age. Individuals are considered to be long-term unemployed if their open unemployment spell has lasted for six months or more. A longer period of unemployment increases the time available to individuals and thus the number of opportunities for individuals to engage in crime. It is therefore important to consider the prevalence of long-term unemployment in addition to the overall unemployment rate (Bindler, 2016). Similar to previous Swedish studies, my study uses the open unemployment rate relative to the total population rather than to the labor force. Nordin and Almén (2011) and Fougère et al. (2009) argues that using the total population is more effective since variations in the labor force may affect the unemployment rate.

Figure 1 shows the change in the unemployment rate from 2007 to 2017. The time trend illustrates a steep increase in the unemployment rate during the financial crisis, followed by a decrease when the Swedish economy started to recover.

**Figure 1.** Unemployment rate

\(^2\) Arbetsförmedlingen
Table 1 presents sample summary statistics of my variables. The rates of unemployment vary across the municipalities and years. The highest values are found in 2010 in municipalities in the northern part of Sweden; for instance, Haparanda has a total unemployment rate of 16.9% that year. The lowest unemployment rate is found in relatively wealthier municipalities near Stockholm. In 2008, Vaxholm, Vallentuna, Lidingö, Täby, Danderyd, and Ekerö all have a total unemployment rate between 1.1 and 1.5%. The mean value for all years is 6.4%.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean</th>
<th>Min</th>
<th>Max</th>
<th>Std. Dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Violent crime</td>
<td>876.65</td>
<td>108.94</td>
<td>3647.85</td>
<td>322.27</td>
</tr>
<tr>
<td>Property crime</td>
<td>3172.60</td>
<td>771.147</td>
<td>12503.85</td>
<td>1144.54</td>
</tr>
<tr>
<td>Unemployment</td>
<td>6.35</td>
<td>1.07</td>
<td>16.90</td>
<td>2.46</td>
</tr>
<tr>
<td>Long-term unemployment</td>
<td>3.00</td>
<td>0.27</td>
<td>8.47</td>
<td>1.50</td>
</tr>
<tr>
<td>Share of men 15-24</td>
<td>52.89</td>
<td>47.53</td>
<td>61.77</td>
<td>1.92</td>
</tr>
<tr>
<td>Share of men 25-34</td>
<td>51.87</td>
<td>45.13</td>
<td>61.35</td>
<td>2.06</td>
</tr>
<tr>
<td>Mean income</td>
<td>236.91</td>
<td>177.58</td>
<td>739.50</td>
<td>39.26</td>
</tr>
<tr>
<td>Population density</td>
<td>140.55</td>
<td>0.20</td>
<td>5689.10</td>
<td>493.47</td>
</tr>
<tr>
<td>Share with higher education</td>
<td>16.58</td>
<td>7.00</td>
<td>52.84</td>
<td>6.71</td>
</tr>
<tr>
<td>Share with foreign background</td>
<td>16.50</td>
<td>3.78</td>
<td>65.01</td>
<td>8.70</td>
</tr>
<tr>
<td>Share of divorced</td>
<td>32.00</td>
<td>0</td>
<td>61.97</td>
<td>6.11</td>
</tr>
</tbody>
</table>

Similar trends are generally observed for the long-term unemployed relative to the total population aged 16 to 64, where the wealthier municipalities near Stockholm have the lowest rate at well below 1%. The highest long-term unemployment rate is found in 2016 in the municipality Södertälje, which has a long-term unemployment rate of 8.5%. This differs from Täby, for example, which in the same year has a rate of 0.9%. The mean for all years is 3.0%.

The crime data is collected from the National Council for Crime Prevention and is calculated as number of reported crimes per 100,000 inhabitants. The crime data follows the categorization from the National Council for Crime Prevention with one exception. Similar to Nordin and Almén (2011), I exclude vehicle theft from the data due to technological progress that has made vehicles much harder to steal (BRÅ, 2007). This decrease in vehicle theft might have affected the property crime variable since it could lead to a large negative relationship between vehicle theft and unemployment.

Property crimes include theft from vehicle, burglary, theft and pilfering, robbery, and handling stolen goods. Violent crimes include attempted murder or manslaughter, assault, rape, violation of a woman’s integrity, violence to public servant, and stalking.

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3 Brottsförebyggande rådet
Figure 2 and 3 illustrate the change in the number of reported property crimes and violent crimes during the years studied. The time trend for property crimes suggests a negative trend, with a decrease of about 13% during the years examined. A total of 460,000 crimes were reported in 2007, which decreased to 400,000 in 2017. In contrast, violent crimes increased by about 5.8%. In 2007, 104,000 violent crimes were reported; the number increased to a peak of 117,000 during 2011 before falling to 110,000 in 2017. Property crimes were thus far more common than violent crimes.

There is also a large variation in crimes across the municipalities. For instance, the lowest number of crimes reported per 100,000 inhabitants is generally found in municipalities with a lower population. For instance, Ydre, a small municipality with fewer than 4,000 inhabitants, has the lowest number of reported violent crimes: in 2009, it has 109 crimes reported per 100,000 inhabitants. The mean across all years and municipalities is 877, and the highest number is consistently found in Stockholm, which has between 1,500 and 2,000 reported violent crimes per 100,000 inhabitants during the examined years.

**Figure 2.** Amount of property crime

The general trend of property crime is that the three largest cities in Sweden—Stockholm, Gothenburg, and Malmö—are the municipalities with the most reported property crimes. In 2007, there were 8,196 in Malmö, 8,174 in Stockholm, and 8,060 in Gothenburg. In 2017, the property crimes reported had decreased to 5,658 in Malmö, 6,581 in Stockholm, and 6,062 in Gothenburg. The mean across all municipalities is 3,200, and the lowest number of reported property crimes is generally found in municipalities with lower populations, such as Pajala, Robertsfors, and Berg, each of which has about 1,000 reported crimes per year.
It is important to note that the propensity to report crimes may vary over time. For some crimes, such as property crimes, the propensity to report crimes will likely not vary over time since insurance companies normally require the crime to be reported to police before paying economic compensation. Violent crimes might differ from property crimes in this aspect. BRÅ (2015a) found that a crime is more likely to be reported if the perpetrator is unknown to the victim; however, a crime is less likely to be reported when the perpetrator belongs to the victim’s family. The more severe the crime is, the more likely it is to be reported.

However, the fixed effect in my regression eliminates the effect of changes over time in the propensity to report crime which are caused by 1) factors that vary across municipalities but are constant over time and 2) factors that vary over time but are constant over municipalities. Thus, there are no bias from changes in the propensity to report crimes if the change is the same in all municipalities. If the propensity to report crimes varies across municipalities, there might be a bias; however, Nilsson and Agell (2003) argue that this happens only if the trend in propensity to report crimes is correlated with trends in unemployment at the municipality level.

To answer the research question, I use the following regression models:

1. $Crime_{it} = \alpha + \beta_1 unemployment_{it} + \beta_2 highereducation_{it} + \beta_3 foreignbackground_{it} + \beta_4 men1524_{it} + \beta_5 men2534_{it} + \beta_6 divorced_{it} + \beta_7 income_{it} + \beta_8 populationdensity_{it} + \nu_{it}$

2. $Crime_{it} = \beta_1 unemployment_{it} + \beta_2 highereducation_{it} + \beta_3 foreignbackground_{it} + \beta_4 men1524_{it} + \beta_5 men2534_{it} + \beta_6 divorced_{it} + \beta_7 income_{it} + \beta_8 populationdensity_{it} + \alpha_i + \alpha_t + \varepsilon_{it}$
In both models, \( i \) and \( t \) are indices for municipality and time. The dependent and independent variables are in log form. *Crime* is the number of crimes per 100,000 inhabitants. *Unemployment* represents the specific type of unemployment investigated. In the first model, \( \nu_{it} \) is the combined error term \((\epsilon_{it}+\mu_{it})\). This model has random effects included which allows for generalization beyond the data that is used in the model. The random effect model treats the intercept as a random variable.

In the second model, \( \alpha_i \) is a municipality fixed effect and \( \alpha_t \) is a year fixed effect. I assume that municipalities differ from each other, not only due to their size and geographic location, but also due to socioeconomic and demographic factors. I also assume that there are elements that change over time and affect all municipalities. Therefore, fixed effects are included in this model. The purpose of using fixed effects in the model is to eliminate the variation in crime that are caused by factors that vary across municipalities but are constant over time (e.g. cultural differences) or by factors that vary over time but are constant over municipalities (e.g. if the police force gets more effective or if various macroeconomic events occur).

According to crime theory, there are other elements that might affect crime. I therefore include a broad set of control variables to reduce the effect from omitted-variable bias in both models. These data are collected from Statistics Sweden\(^4\).

Both men and youth are highly overrepresented in crime statistics (BRÅ, 2008). The highest share of men is generally found in rural municipalities, and the lowest ratio of men is found in large cities. Youths are also less educated and have less working experience, which means that they have a disadvantage in the labor market. The variables *men1524* and *men2534* are therefore included in the specification and defined as the share of men in the age groups of 15-24 and 25-34 respectively. The average share of men aged 15-24 in my study is 52.9\%, and the average share of men aged 25-34 is 51.9\%.

Higher education will increase a person’s legal working opportunities in addition to the alternative cost for crime, which might lead to a decrease in crime (Lochner, 2004). *Higher education* is therefore included in the specification and defined as the share of individuals aged 25-64 who have been studying for three years or more at the undergraduate level. The share of individuals with higher education varies greatly across municipalities. The

\(^4\) Statistiska Centralbyrån
highest share with higher education is found every year in Danderyd, which has a maximum share of 52.8%. The lowest share with higher education is found in Eda with 7.0%.

The unemployment rate is higher for individuals who have lower education and lower income (BRÅ, 2015a). One could also expect that in municipalities with a high income, there will be a relatively large supply of goods with a higher risk of being stolen, which might increase the crime rate. However, in regions with high incomes, the resources for protecting property against crime are also more extensive, which might lead to a decrease in property crimes. Also, with a higher income, people will have fewer economic incentives to commit crimes, which might also reduce the likelihood of property crime (Nilsson & Agell, 2003). The effect of a high income is thus uncertain, which is why I add income as a control variable. The variable is defined as the mean income per capita in SEK, which I deflated with the Consumer Price Index for the population in Sweden in the age cohort of 20-64. The mean income per capita for the examined years is 236,910 SEK.

Individuals with foreign backgrounds are overrepresented in crime statistics (BRÅ, 2005). Therefore, the share of individuals aged 15-64 with a foreign background is also added to the specification. I use the definition from Statistics Sweden, which defines an individual with a foreign background as a person who was either born abroad or was born in Sweden but has two parents who were born abroad. The average share of individuals with a foreign background is 16.5%.

Large cities have a higher crime rate. However, BRÅ (2015b) finds that the discrepancy in the crime rate between large cities and rural areas has decreased over the last 10 years. This is mainly because crime rates in large cities have been decreasing. However, there is still a significant difference. Population density is therefore added and defined as the number of inhabitants per km². The average share of population density is 140.55 inhabitants per km².

Martens (1992) finds that individuals who grow up with divorced parents have a higher risk of committing crimes. To catch this effect, the variable divorced is added in the specification and defined as the number of divorced individuals divided by the total number of married and divorced individuals. The mean share of divorced individuals is 32.0%.

Table 2 illustrates a correlation matrix for my control variables. Hair et al. (2013) argues that if the correlation between variables were over 0.9, then a problem with multicollinearity might

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5 The Consumer Price Index is collected from Statistics Sweden
result. As expected, the only strong correlation found is between the mean income and the share with higher education, which is 0.73. Regardless, I include both the mean income and the share with higher education in the regression since they are both possible determinants of crime. The rest of the variables have weak correlations between each other.

I do not include any variables that cover detection risk or punishments in my regression. This might have induced omitted-variable bias, but as argued by Nilsson & Agell (2003), this effect is most likely small for two reasons. First, it is likely that criminals change their behavior only gradually over time, and the fixed effects should thus account for a large part of that change. Second, Swedish police resources are allocated at the county level, which consists of a range of municipalities (Nilsson & Agell, 2003). In Sweden, there are 290 municipalities divided into 20 counties; most differences likely follow county borders rather than municipality borders. Another possible bias in my study is if an individual living in a given municipality commits crimes in a neighboring municipality. In conclusion, no model will exactly estimate the causal effect of unemployment on crime, but since I consider various biases and attempt to reduce the effects thereof, the models I use provide an overall picture of the relationship between unemployment and crime.

5. Result

The results from the random effect regression (Model 1) corresponding to equation (4) are presented in table 3, and the results from the fixed effect regression with municipality-specific time trends (Model 2) corresponding to equation (5) are presented in table 4. Since I use a log-log model, the coefficients are interpreted as elasticities. In the first column in Model 1, where the dependent variable is violent crime, the results indicate that the coefficient of the total unemployment of individuals aged 16-64 is small but significant.
Table 3. Random effect model (Model 1). The effect of unemployment and long-term unemployment on crime.6

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>Violent crime</th>
<th>Property crime</th>
<th>Violent crime</th>
<th>Property crime</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unemployment</td>
<td>0.106***</td>
<td>-0.009</td>
<td>0.065***</td>
<td>-0.009</td>
</tr>
<tr>
<td></td>
<td>(0.032)</td>
<td>(0.020)</td>
<td>(0.022)</td>
<td>(0.020)</td>
</tr>
<tr>
<td>Long-term unemployment</td>
<td></td>
<td></td>
<td>0.065***</td>
<td>-0.009</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(0.022)</td>
<td>(0.020)</td>
</tr>
<tr>
<td>Share of men 15-24</td>
<td>0.222</td>
<td>-0.213</td>
<td>0.220</td>
<td>-0.213</td>
</tr>
<tr>
<td></td>
<td>(0.365)</td>
<td>(0.241)</td>
<td>(0.372)</td>
<td>(0.241)</td>
</tr>
<tr>
<td>Share of men 25-34</td>
<td>-0.399</td>
<td>-0.095</td>
<td>-0.403</td>
<td>-0.095</td>
</tr>
<tr>
<td></td>
<td>(0.283)</td>
<td>(0.213)</td>
<td>(0.283)</td>
<td>(0.213)</td>
</tr>
<tr>
<td>Mean income</td>
<td>-0.759***</td>
<td>-0.539***</td>
<td>-0.826***</td>
<td>-0.539***</td>
</tr>
<tr>
<td></td>
<td>(0.158)</td>
<td>(0.157)</td>
<td>(0.154)</td>
<td>(0.157)</td>
</tr>
<tr>
<td>Population density</td>
<td>-0.005</td>
<td>0.092***</td>
<td>-0.007</td>
<td>0.092***</td>
</tr>
<tr>
<td></td>
<td>(0.016)</td>
<td>(0.019)</td>
<td>(0.016)</td>
<td>(0.019)</td>
</tr>
<tr>
<td>Share with higher education</td>
<td>0.170**</td>
<td>0.011</td>
<td>0.166**</td>
<td>0.011</td>
</tr>
<tr>
<td></td>
<td>(0.066)</td>
<td>(0.062)</td>
<td>(0.066)</td>
<td>(0.062)</td>
</tr>
<tr>
<td>Share with foreign background</td>
<td>0.442***</td>
<td>0.125***</td>
<td>0.434***</td>
<td>0.125***</td>
</tr>
<tr>
<td></td>
<td>(0.049)</td>
<td>(0.047)</td>
<td>(0.049)</td>
<td>(0.047)</td>
</tr>
<tr>
<td>Share of divorced</td>
<td>0.019</td>
<td>0.021</td>
<td>0.019</td>
<td>0.021</td>
</tr>
<tr>
<td></td>
<td>(0.027)</td>
<td>(0.021)</td>
<td>(0.027)</td>
<td>(0.021)</td>
</tr>
<tr>
<td>R²</td>
<td>0.11</td>
<td>0.21</td>
<td>0.11</td>
<td>0.21</td>
</tr>
</tbody>
</table>

Clustered standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

In Model 2, I follow the more recent studies of the relationship between unemployment and crime where fixed effects are added to the regression. I also run a Hausman test7 to examine which model is most appropriate. Two hypotheses are formulated in the test:

H0: Random effect model is appropriate.

H1: Fixed effect model is appropriate.

The result from the test reveals a p-value of 0.00 which means rejection of the null hypothesis in favor of the alternative hypothesis which states that the fixed effect model is appropriate. Therefore, my primary focus is on the result from Model 2. Adding fixed effects to the model decreases the coefficient of the total unemployment on violent crime even further, but the result is still significant. Assuming the point estimate is correct, a 1% increase in total unemployment will increase violent crime by 0.07% (all else held constant).

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6 R² values in the fitted models are low which means that the models explain less of the variability than desired. However, this do not change the interpretations of the coefficients. There is still a significant relationship but the estimations are likely to be less precise.

7 Hausman test is a test used to determine if a model is corresponding to the data.
To be clear, since the average annual number of violent crimes during the examined years is 110,169, a 1% increase in total unemployment will lead to an increase of 77 crimes per year. For instance, if the total unemployment rate increases by 38.7% from 6.2% to 8.6%, which happen between 2008 and 2010 during the financial crisis, it would lead to an increase of 2,980 more violent crimes per year (ceteris paribus). Turning to property crimes, the coefficients in both models are very small and not significant. Hence, the results show no effect on property crimes and, at best, weak evidence that total unemployment affects violent crimes.

Table 4. Fixed effect model (Model 2). The effect of unemployment and long-term unemployment on crime.

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>Violent crime</th>
<th>Property crime</th>
<th>Violent crime</th>
<th>Property crime</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unemployment</td>
<td>0.067*</td>
<td>-0.008</td>
<td>0.041</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>(0.037)</td>
<td>(0.030)</td>
<td>(0.025)</td>
<td>(0.021)</td>
</tr>
<tr>
<td>Long-term unemployment</td>
<td>0.435</td>
<td>0.064</td>
<td>0.441</td>
<td>0.061</td>
</tr>
<tr>
<td></td>
<td>(0.418)</td>
<td>(0.247)</td>
<td>(0.419)</td>
<td>(0.246)</td>
</tr>
<tr>
<td>Share of men 15-24</td>
<td>-0.575*</td>
<td>-0.178</td>
<td>-0.580*</td>
<td>-0.179</td>
</tr>
<tr>
<td></td>
<td>(0.297)</td>
<td>(0.217)</td>
<td>(0.297)</td>
<td>(0.217)</td>
</tr>
<tr>
<td>Share of men 25-34</td>
<td>-0.007</td>
<td>-0.271</td>
<td>-0.053</td>
<td>-0.250</td>
</tr>
<tr>
<td></td>
<td>(0.250)</td>
<td>(0.167)</td>
<td>(0.247)</td>
<td>(0.167)</td>
</tr>
<tr>
<td>Mean income</td>
<td>-0.464**</td>
<td>-0.147</td>
<td>-0.430**</td>
<td>-0.155</td>
</tr>
<tr>
<td></td>
<td>(0.190)</td>
<td>(0.157)</td>
<td>(0.189)</td>
<td>(0.158)</td>
</tr>
<tr>
<td>Population density</td>
<td>0.468**</td>
<td>-0.062</td>
<td>0.460**</td>
<td>-0.065</td>
</tr>
<tr>
<td></td>
<td>(0.229)</td>
<td>(0.156)</td>
<td>(0.231)</td>
<td>(0.156)</td>
</tr>
<tr>
<td>Share with higher education</td>
<td>-0.452***</td>
<td>-0.140*</td>
<td>-0.444***</td>
<td>-0.141*</td>
</tr>
<tr>
<td></td>
<td>(0.085)</td>
<td>(0.080)</td>
<td>(0.085)</td>
<td>(0.080)</td>
</tr>
<tr>
<td>Share with foreign background</td>
<td>0.006</td>
<td>0.006</td>
<td>0.006</td>
<td>0.006</td>
</tr>
<tr>
<td></td>
<td>(0.027)</td>
<td>(0.021)</td>
<td>(0.027)</td>
<td>(0.021)</td>
</tr>
<tr>
<td>R²</td>
<td>0.12</td>
<td>0.22</td>
<td>0.12</td>
<td>0.22</td>
</tr>
</tbody>
</table>

Clustered standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Looking at the control variables, the results demonstrate no significant relationship between the share of men aged 15-24 and the number of crimes. The share of men aged 25-34 is not significant in the random effect model for any type of crime, but when adding fixed effects, there is a significant result. A 1% increase in the number of men aged 25-34 is predicted to decrease violent crimes by 0.58%. This result is somewhat surprising since young men are overrepresented in crime, both as perpetrators and victims. Nordin and Almén (2011) finds a similarly surprising result in a marginal negative significant relationship between the share of men aged 26-35 and violent crimes. Furthermore, the coefficient of the mean income in Model 1 is, as expected, negative where the result on both crimes are significant. However, when
adding fixed effects, the coefficients lose their significance. The results seem to be sensitive to
the model’s specification since they differ in some variables according to the model used.
However, as expected and as found by Nordin and Almén (2011), some variables lose their
significance when adding fixed effects.

The coefficient of population density is positive and significant for property crimes in Model
1, but when adding fixed effects, the coefficient loses its significance. Adding fixed effects also
leads to a surprising result in Model 2, where the coefficient of violent crimes is now negative
and significant. A 1% increase in population density will reduce violent crime by 0.46%. Since
cities with a large population density are overrepresented in crime statistics, one could have
expected a positive sign. However, Edmark (2002) finds a similar result and argued that in
regions with a low population density, the risk of being caught might be lower for some types
of crime, which might increase the incentive to commit these types of crimes.

There is no significant relationship between higher education and property crime. However,
there is a positive relationship between higher education and violent crime in both models. An
increase in individuals with higher education will thus increase violent crime. An explanation
could be that individuals with higher education more often live in large cities where the crime
rate is higher. Alternatively, individuals with higher education may have a higher propensity to
report crimes. Nordin and Almén (2011) reached a similar result. They argued that there are
always plausible explanations for unexpected results, so one should be careful when
speculating.

The share of individuals with a foreign background has a significant positive relationship with
both violent crime and property crime in Model 1. When adding fixed effects, the results
indicate that a 1% increase in the share of individuals with a foreign background will increase
violent crimes by 0.45%. Turning to property crimes, the sign turns negative when adding fixed
effects, and an increase in the share of individuals with a foreign background will thus decrease
the property crime rate. The coefficient is smaller compared to violent crimes but still
significant. The share of divorced individuals has no significant relationship in either of the
models.

Thus far, I have used the total unemployment rate as the dependent variable. I will now analyze
whether there is any significant relationship between long-term unemployment and crime. The
results are presented in the right columns in table 3 and 4. Nordin and Almén (2011) argues that
the potential marginal group that commits crimes may not be properly represented by the total
unemployment variable, as most individuals included by the total unemployment variable have a strong connection to the labor market and are expected to return to a job soon. In contrast, long-term unemployment identifies another group of individuals who have a weaker connection to the labor market. They also argue that crime rates respond slowly to new circumstances (i.e. a short unemployment spell might not affect crime in the same way as a long-term unemployment spell does).

The coefficient of long-time unemployed is similar to the results found in total unemployment. In Model 1, there is a significant positive relationship between long-term unemployment and violent crime, but when adding fixed effects, the coefficient becomes borderline significant. The p-value is 0.1, which is just above the desired level, and the coefficient is even smaller compared to total unemployment. Similar to the result from total unemployment, there is no significant relationship between long-term unemployment and property crime in either of the models. Thus, it seems that unemployment, both total and long-term, has at best a small effect.

The coefficients of the control variables are, as expected, similar compared to using total unemployment as the dependent variable and thus do not require further discussion. The overall effects of total unemployment and long-term unemployment on crimes do not differ significantly. This contrasts with the results from Nordin and Almén (2011), who found a larger effect from long-term unemployment relative to total unemployment on violent crimes. However, they note that even if the effect of long-term unemployment seemed to be plausible and causal in their study, the choice of which years to include in the regression might affect the results.

6. Conclusion

This study has the advantage of having an extensive data set acquired from a period of time with a large variation in the unemployment rate due to macroeconomic events. The variation in unemployment was much larger compared to any other factors that might have affected crime during the investigated years. According to the crime theory earlier discussed, an increase in unemployment was expected to have a positive effect on crime. This paper empirically investigated this theory and found, at best, weak evidence that total unemployment and long-

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8 to be significant on a 10% level, the p-value should be less than 0.1
term unemployment affect violent crimes and no evidence that total unemployment and long-term unemployment affect property crimes.

Why does unemployment have an effect, however small, on violent crimes, but no effect on property crimes? This result goes against the established crime theory and most of the recent empirical research. However, Nordin and Almén (2011) who also finds an effect of unemployment on violent crime argues, as one explanation, that long-term unemployment might create violent and non-rational behavior due to alienation. This has economic significance since violent crimes are costlier to society in comparison to property crimes (Webber, 2010). Further research in this subject is therefore needed.

References:


Brottsförebyggandet Rådet, (2015b), ”Brottslighet och otrygghet i stad och på landsbygd”, http://www.bra.se/download/18.4a33c027159a89523b1b1346/1488273418442/13_Brottslighe_t_och.otrygghet_i_stad.och_pa_landsbygd.pdf [2018-05-24]


Martens, P L, (1992), ”Familj, uppväxt och brott,” Brottsförebyggande rådet, Stockholm


## Appendix

### Table 2. Correlation matrix

<table>
<thead>
<tr>
<th></th>
<th>Unemployed</th>
<th>Men 15-24</th>
<th>Men 25-34</th>
<th>Income</th>
<th>Popdensity</th>
<th>Higheredu</th>
<th>Foreign</th>
<th>Divorced</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unemployed</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Men 15-24</td>
<td>0.198</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Men 25-34</td>
<td>0.417</td>
<td>0.308</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Income</td>
<td>-0.402</td>
<td>-0.106</td>
<td>-0.355</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Popdensity</td>
<td>-0.167</td>
<td>-0.275</td>
<td>-0.193</td>
<td>0.341</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Higheredu</td>
<td>-0.330</td>
<td>-0.358</td>
<td>-0.377</td>
<td>0.729</td>
<td>0.491</td>
<td>1.000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Foreign</td>
<td>0.104</td>
<td>-0.200</td>
<td>-0.050</td>
<td>0.190</td>
<td>0.417</td>
<td>0.246</td>
<td>1.000</td>
<td></td>
</tr>
<tr>
<td>Divorced</td>
<td>0.198</td>
<td>0.177</td>
<td>0.012</td>
<td>0.041</td>
<td>-0.003</td>
<td>-0.044</td>
<td>0.203</td>
<td>1.000</td>
</tr>
</tbody>
</table>