LUND UNIVERSITY
Department of Economics

Unemployment and Crime
- Exploring the Link in Times of Crises

BSc Thesis in Economics

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1. Introduction

Unemployment has no doubt a number of consequences and costs for society and one of those might be an increase in criminal activity with following costs to society. In the public debate this relationship between unemployment and crime is often taken for granted. But, empirical studies have shown mixed results (Agell & Öster (AÖ), 2007 p. 572). Different determinants of crime have traditionally been studied within other fields of social sciences such as criminology and sociology. In general, labour market conditions play a more dominant role in the field of economics of crime than in previous mentioned disciplines, and both the theoretical and methodological approaches often differ (Tham, 2006). There is no consensus whether the contributions of economics of crime should be seen as a complement or a substitute to other disciplines studying criminality (Eide, Rubin and Shepherd, 2006 p.1-2, 12-14). In this paper I examine the possible relationship between various crimes and different types of unemployment. Exploring this link is important to clarify the public debate and to obtain a better picture of the true social costs of unemployment

Previous papers in economics have been written on this issue using Swedish aggregated data. The last study uses the swings in the unemployment rate during the late 1990s. My main contribution is to add a new time-period, the decade of the 2000s. I use a panel data set of 288 of Sweden's 290 municipalities[1] and annual data from 1997 to 2009 [2]. The crises in the beginning of the decade and the financial crises beginning in 2008 provide data of both ups and downs in the unemployment rate. In addition, the swings in unemployment rates were not uniform across the country. Hence, by using the within-municipality variation in crime rates and unemployment level an opportunity to identify the unemployment effect on crime has evolved. As previous authors of similar papers argue (*e.g.* AÖ 2007, p 753), the fact that the swings are due to macroeconomic events reduces the likelihood of reverse causation.

As a complement to regular total unemployment I look closer into different types of unemployment (youth unemployment and long-term unemployment). It is reasonable that long-term unemployment is closer tied to crimes than overall unemployment. The argument for this follows by logic: Imagine a high unemployment rate but that a person on average is

[1] The municipalities of Nykvarn and Knivsta were created 1999 and 2003 respectively and are therefore excluded.
[2] Unfortunately, data from the year of 2010 were not available yet for some of the control variables when writing this paper.

unemployed only for a couple of days, then there is not even time to plan a crime. It can also be argued that a longer period of unemployment is necessary to put rational choice decision-rules explained below in theory into effect. Further, the long-term unemployment variable probably better corresponds to unemployment-related effects instead of business-cycle effects. None of the latest studies in Sweden have studied long-term unemployment specifically, thus this is another contribution of this paper. In contrast, youth unemployment and its effect on crime has been studied before, here my contribution basically limits to a new time-period.

It should be noted that some previous international studies have used more advanced explanatory variables than unemployment. Ahmed, Doyle and Horn (1999) investigates the effects of changes in overall labour market conditions by constructing a measure that incorporates wage levels, unemployment rates and unemployment benefits. Nevertheless, for the sake of simplicity and for the sake of comparison with previous studies using Swedish data I solely focus on unemployment. Yet, to control for spurious correlation I add control variables that has not been used before in economics papers using Swedish data. These variables are: *Election Participation*, *Migration* and *Proportion of Foreigners*. The latter includes both 1st and 2nd generation immigrants. Although the theory is more applicable to property crimes I also investigate some violent crimes.

This study finds evidence of an association between unemployment and crime. In the Baseline Model, total unemployment seems to have a significant effect on mainly property crimes. Youth unemployment, perhaps in contrast to what one might expect, exhibits a weaker relationship overall but with a significant effect on burglary and narcotic crimes. When looking closer on long-term unemployment I find it to have a significant effect on both violent crimes and property crimes. This reveals a possible discrepancy between reality and basic theory, which suggests a correlation between unemployment and property crimes only.

The structure of this paper is as follows: Section 2 will introduce the basic theory of economics of crime. Section 3 gives an overview of empirics. Section 4 presents the data and the different econometric specifications that are used. Section 5 discusses the results from the Baseline Model. Section 6 shortly presents the results from alternative econometric specifications. Section 7 discusses some unexpected findings. Section 8 gives a short discussion on the costs of crime and Section 9 gives some concluding remarks.

2. The Basic Theory of Economics of Crime

Theories of criminal behaviour mainly based on the assumptions of rational behaviour were first proposed by Bentham (1789). Bentham wrote; "… the profit of the crime is the force which urges man to delinquency: the pain of punishment is the force employed to restrain from it. If the first of these forces be the greater, the crime will be committed; if the second, the crime will not be committed" (Bentham, 1789. p 399).

Becker (1968) employs the usual assumption that the potential criminal acts as if he were maximizing expected utility, and that his utility is a positive function of income:

$$E(U) = p*U(Y-f) + (1-p)*U(Y) \quad (1)$$

where E denotes expected, U is utility, p is the subjective probability of being caught and convicted, Y is the monetary plus psychic income from offence, and f is the monetary equivalent of the punishment. This could be a fine or the opportunity cost of going to jail, i.e. the wage of the individual. The individual will commit the crime if $E(U)>0$, otherwise he will not.

At the aggregated level Becker introduces a "supply of offence function", where p, f and u determines the amount of crime:

$$O(p, f, u) \quad (2)$$

where O is the number of crimes committed and u is a variable accounting for "other influences". The function is assumed to have the following properties;

$$O'_f < 0 \text{ and } O'_p < 0 \quad (3)$$

where O'_f and O'_p are the first derivatives of O with respect to f and p respectively. In addition, with some algebra Becker (1968) shows that the risk preference of the individual determines if an increase in f or p has the greatest effect on the amount of crime committed. An increase in p compensated by an equal percentage reduction in f would not change the expected income from an offence, but it could change the expected utility. It can be shown

that an increase in *p* would reduce the expected utility, and thus the number of offences, more than an equal percentage increase in *f*, if the individual were a risk lover. An increase in *f* would have a greater effect if the individual were risk averse. In general, Becker sought to find the optimal level of *p* and *f* to minimize the social costs. Hence, he tries to find an optimal level of crime given that an increase in *p* or *f* through different public policies costs money. This implies that a zero amount of crime is not necessarily efficient (Becker, 1968). To sum up, early theories mainly focused on the role of the severity- and the probability of punishment.

Inspired by the theories of Becker, Erlich (1973) and Freeman (1999) among others expanded the models and introduced unemployment. The theory described below is a simplified version of the theory outlined by Edmark (2003, 2005)[3], which in turn is drawn upon the theories presented by Erlich (1973) and Freeman (1999). The model describes an individual choice between crime and work as a source of income. As noted by Edmark (2005), the theories of Becker, Erlich and Freeman are mostly applicable on property crimes. Further, work and crime are regarded as substitutes and cannot be combined. The individual chooses crime if the expected returns from crime is higher than the expected returns from work, that is if equation below is fulfilled:

$$E(Wc) > E(W) \tag{4}$$

where *E* denotes expected, *Wc* is income from criminal activity and *W* is income from honest work. Further, the left-hand side (the expected returns from crime) is a probability weighed average of the returns. The probability of being caught is *p*, and not caught (*1-p*). If the individual chooses crime but is caught, the returns, *Wc*, is reduced by the cost of punishment, *S*. This implies that the expected returns from crime can be written as:

$$E(Wc) = (1 - p)*Wc + p*(Wc - S) \tag{5}$$

Similarly, the expected income from honest work can be written as:

[3] Edmark (2005) is a later version of Edmark (2003) using the same data with similar overall findings. However, the outlined theory slightly differs between them and I let both papers contribute to the explained theory in this paper. In the next section and forward I will solely refer to Edmark (2005).

$$E(W) = (1- u)*W + u*A \quad (6)$$

where A is the unemployment benefit and u is the unemployment rate, which is interpreted as the probability of being unemployed. Substituting (5) and (6) into (4) gives the following inequality:

$$(1 - p)*Wc + p*(Wc - S) > (1- u)*W + u*A \quad (7)$$

If you make the assumptions $u < p$ and $S > (W - A)$, then it can be shown to be more risky to commit a crime than to choose an honest living. The returns from crime (Wc) have to be higher than the returns from work, W. This is true because it has to compensate for the increased risk associated with criminal activity. For the individual to choose crime, equation (7) implies that the returns from crime (Wc), has to increase if the risk of getting caught (p) or the cost of punishment (S) rises. Correspondingly, the compensating difference in returns that is demanded for the individual to choose crime instead of work, Wc-W, decreases as the unemployment rate, u, or the cost of being unemployed, W-A, increase.

The conclusion of this theoretical framework is that higher levels of Wc and u make it more favourable for the individual to commit crimes. Higher levels of W, p, S and A raise the probability that the individual chooses an honest work. This gives the supply-function of crime: $CS(Wc, W, p, A, u, S)$, with the following properties;

$CS'_{Wc} > 0$

$CS'_{u} > 0$

$CS'_{A} < 0$

$CS'_{p} < 0$

$CS'_{W} < 0$

$CS'_{S} < 0$

In addition, there is a demand side too. A higher income level and wealth (*i.e.* valuable goods to steal) in a region is technically equal to a higher demand for crime. This effect works in the

opposite direction as compared to the supply side, where we have seen that the income level has a negative effect. This gives the demand-function of crime: *CD(W),* where;

$CD'_W > 0$

This gives an equilibrium. It can be concluded that the theoretical model predicts a positive relationship between unemployment and the supply of crime, but there might also be a potential indirect negative effect on demand, through the effect on the income level. This gives us at least a theoretical possibility that an increased employment level would increase crime rates.

At last, some general comments have to be made. The amount a person can earn in the legal sector may depend on factors such as age, sex, race, education, region and perhaps IQ. Low-earners will have a low opportunity cost of crime. We could therefore expect that young people, minorities and low paid workers in general are more criminal than others (Eide et. al, 2006 p. 11). This way of reasoning makes it possible to justify the adding of other variables, not explicitly mentioned in theory, into empirical models.

At last, some faults of the model have to be mentioned. In the field of economics of crime, theories about culture conflict, anomie, cultural deviance, and environmental impact on the preferences of the individual are often neglected. Some theories from other disciplines suggest that preferences are inherited or dependent on age, gender, race intelligence and other personal characteristics (Eide et al 2006 p. 12-15). Freeman (1999) also highlights a couple of drawbacks of the theory. Among others, the theory clearly fails to explain why women are much less active in criminal activity even though they have a lower average income (*W*) and legal work does not necessarily rule out the possibility of holding illegal work. Far more advanced theories have been developed as an answer to some of the critique. Nevertheless, I believe that the basic model explained above is enough for the argumentation in this paper. To sum up, the basic rational choice framework gives a sound motivation for some variables

3. Previous Empirical Work, An Overview

Early empirical work on the relationship between unemployment and crime shows disappointing results and a great discrepancy empirics and theory. Erlich tested his theories with the use of repeated cross-section data on state-level from the 1940s,- 50s and 60s in the U.S. He found that crime is positively related to both the median state income and the percentage of families that are below one-half of the median income. Variations in these variables explain more of the variation in property crime than in violent crime, especially murder. He also found a strong positive relationship between income inequality and property crime. This was in line with his theory. However, he did not find a statistical significant relationship between unemployment and crime. Further, many scientists have concluded that the relationship between crime and any labour market variable in general is very questionable. This is because of very mixed results throughout the years and therefore showing weak evidence. This gap between empirical work and theory has characterized the literature up until the 1990:s (Mustard, 2010, p. 2-5).

Chiricos (1987) has made a comprehensive survey over the early literature. He reviewed 63 aggregated studies on the relationship between unemployment and crime published in major journals of economics, sociology and criminology. He found that about one third of the estimates showed a significant positive relationship, 2% of the estimates were negative and significant and most of the non-significant estimates were positive.

However, recent studies show a much stronger relationship. Mustard (2010) has done an extensive overview over empirical work and argues that this is mostly due to new methods. I will provide some of his arguments. First, he argues that panel-data regression models are more commonly used in recent studies and they almost always show a statistical significant relationship between labour market variables and crime. The studies that use cross section and repeated cross section data can control for fewer alternative explanations and show more ambiguous results. Second, the use of data at local levels like cities, counties, and census tracts, is now standard when using aggregated data. This is in line with what was proposed by Levitt (2001) in the paper “Alternative Strategies for Identifying the Link Between

Unemployment and Crime". These studies are much more likely to document relationships between labour markets and crime than research that uses larger areas of aggregation. Because crime varies in important ways across even relatively small geographic areas, national or state-level data might disguise a large part the important variation that is needed to identify causation. Third, Mustard finds it surprising that the empirical work for so long time have almost solely focused only on unemployment rates and omitted variables such as income and education. Those who have included both income and unemployment in their study generally find that the relationship between income and crime is stronger than unemployment and crime. However, unemployment does in general still have an effect. To sum up, Mustard finds that the once very large gap between theory and empirical work has narrowed substantially in recent years.

An overview over 11 EU-member countries is a good example of what is discussed above. Baharum & Habibullah (2008) have selected 11 EU-member countries and uses panel-data from 1993 to 2001. They found that unemployment had a positive statistical significant effect on four different crimes. The crime categories were; total crime, motor vehicle crime (theft), domestic burglary and drug trafficking. The analysis also showed a significant negative relationship between unemployment and violent crimes. The basic theory predicts no relationship, but the negative relationship might be explained by that unemployment increases the relative attractiveness of large and less violent gangs engaging more in property crime. Hence, criminals substitute violent crime for property crime (Poutvaara and Priks, 2007).

In Sweden, four previous studies have been made using Swedish data. Le Grand (1986) uses time series data and finds a negative correlation between burglary and the vacancy rate. Schuller (1986) uses cross-sectional data for the years 1975 and 1976 between Swedish municipalities and finds no significant correlation between crime and unemployment. However, his time series analysis for the period 1966-1982 showed a positive relationship. The two latest studies are made by Edmark (2005) and AÖ (2007)[4]. AÖ (2007) uses panel-data for Swedish municipalities for the period 1996-2000 to explore how unemployment in general and among youth, impacts on crime. The unemployment rate decreased from 11,9 to

[4] The paper of Agell & Öster (2007) are based on a previous paper Agell & Nilsson (2003) which had similar findings overall (Öster, formerly Nilsson).

6,8 percent between 1996 and 2000 and the difference between municipalities were large, hence a pleasant opportunity turned up. AÖ (2007) found a strong link between unemployment and property crimes. A *one-percentage point* drop in unemployment causes significant reductions of 2,8 percent in the burglary rate, and 3,8 percent in the auto theft rate. AÖ (2007) also sought to answer the question if labour market programs reduce crime. To their knowledge, no such study was done before them. They mention three possible reasons why labour market programs could reduce crime. First, participation implies less time for other activities such as crime. Second, social interactions might prevent the participant from adopting the wrong kind of social norms. Third, a greater ability to earn legal income in the labour market might also make crime less attractive. However, they found no evidence that labour market programs reduce crime. In addition AÖ (2007) also investigated youth unemployment and its effect on crime rates and found no clear evidence of a relationship.

Edmark (2005) uses the fact that during the first five years of the period studied (1988-1999), unemployment rates more than quadrupled. The unemployment increased from 2 percent in 1988 to 10.4 percent in 1993, after which they gradually declined to 6.4 percent in 1999. Based on panel-data of 21 (crime-statistics at municipality level is not available before 1996) Swedish counties during the period 1988–1999, she finds strong evidence of a positive link between unemployment and property crime. Specifically in the form of burglary and car theft. Edmark finds somewhat weaker evidence regarding aggregate property crime and bike theft. In her baseline model a 1 *percent* (notice the different model specification than the one made by AÖ (2007)) increase in the unemployment rate leads to an increase in aggregate crime by 0.11 percent, in burglary by 0.15 percent, in car theft by 0.16 percent, in bike theft by 0.07 percent, and in fraud by 0.22 percent. However, only burglary and car theft have significant coefficients at the 5 and 10 percent levels in all different model specifications made in the paper.

Edmark (2005) concludes: ”The results from studies on unemployment and crime place the cost of unemployment in a broader perspective. According to the results of this study, it seems that higher unemployment does not solely lead to expenses directly related to unemployment, but may also have indirect effects in the form of increased property crime” (p. 370). AÖ (2007) and Edmark (2005) comment that their findings generally are in line with previous work that finds a positive relationship. That is, property crimes such as burglary and car thefts and not violent crimes show dependence on unemployment, just as theory predicts.

4. Data and Econometric Specifications[5]

4.1. Data and Descriptive Statistics

The panel data set consists of 288[6] municipalities and annual data from the period of 1997-2009[7]. Unemployment statistics have at the municipality level been, for the period of 1997 to 2009, collected from The National Labour Market Board in Sweden[8]. The statistics are collected for youth unemployment (age 18-24) and total unemployment (age 16-64) and these variables are in the text below referred to as *YU* and *TU*. Long-term unemployment (referred to as *LTU*) rates for the age group 20-64 are collected from Statistics Sweden[9]. The data on unemployment have total population in the relevant age group in the denominator and hence not the labour force[10]. As argued by Fougère, Kramarz and Pouget (2009, p. 921-922), this might be a more effective measurement for the purpose of this paper. If the labour force is in the denominator an increase of the amount of students for example (which will reduce crime both in the short- and long run) will reduce the labour force, which pushes up the unemployment rate. With the total population in the denominator this possible bias is avoided.

As shown below in Figure 1 the national unemployment rates vary a lot during the period 1997 to 2009. Further, as can be seen in Table 1 there is much variation in total unemployment in comparison with most of the control variables shown in Table 3. This helps to isolate the unemployment effect when running the panel data regression.

[5] For definitions of all the variables, see appendix.
[6] The municipalities of Nykvarn and Knivsta were created 1999 and 2003 respectively and are therefore excluded. Nykvarn was previously a part of the municipality of Södertälje and Knivsta was previously a part of the municipality of Uppsala. The sizes of the new municipalities are small in comparison with Södertälje and Uppsala, therefore I believe that the consequences of the bias due to the break in the time series are of minor significance.
[7] As previously mentioned, data from the year of 2010 were not available yet for some of the control variables when this paper was written. And, even though data on municipality-level crime rates is available from the year of 1996, statistics for some of the control variables were not. Therefore, the time-series is limited to 1997-2009.
[8] All statistics are downloadable at www.ams.se
[9] All statistics are downloadable at www.scb.se
[10] Also used by both Edmark (2005) and AÖ (2007). However, AÖ uses total unemployment ("openly" unemployed + people in labour market programs) whereas Edmark includes only "openly" unemployed. I follow AÖ:s definition of unemployment, see appendix for all definitions of variables.

Figure 1. Graph of Unemployment Rates 1997-2009

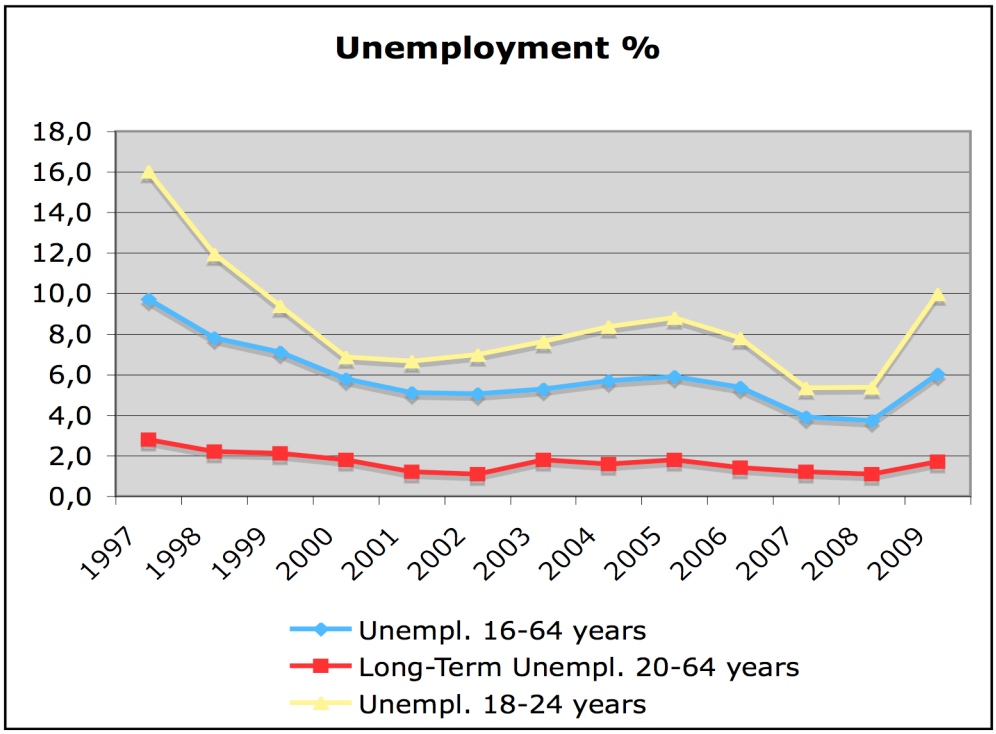


Table 1. Descriptive Statistics of Unemployment Variables

Unempl.-Category	Min	Max	Mean	Standard Deviation
Prop. Unempl. Age 16-64	0,0063	0,3812	0,1002	0,0511
Prop. Unempl Age 18-24	0,0095	0,2096	0,0599	0,0269
Prop. Long-Term Unempl. Age 20-64	0,0010	0,0590	0,0141	0,0073

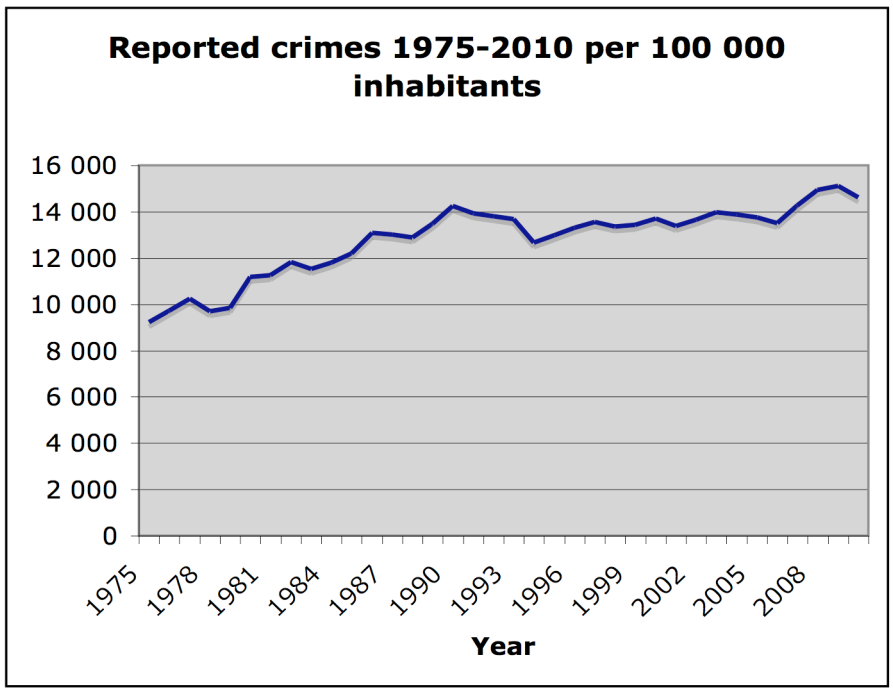
Note: 3744 observations, covering 288 municipalities during the period of 1997-2009. Long-Term Unemployment (*LTU*) has 3727 observations.

Data on overall crime rates as well as for specific crimes are collected from The National Council for Crime Prevention[11]. Although theory is better applicable on property crimes I have, for the sake of comparison, collected data for some violent crimes as well. Previous studies have guided me in choosing what crimes to include. The data are reported as crimes per 100 000 inhabitants. Working with crime statistics is a puzzle though it is hard to get data on actual crime rates. One must keep in mind that the crime-statistics are reported number of crimes and not actual number of committed crimes. The overall reported crime rate has steadily increased during the last decades, as shown in Figure 2. However, for the period of 1997 to 2009, the curve is less steep. It is probably true that the overall crime rate follows the

[11] All statistics are downloadable at www.bra.se

curve of the reported crimes in the long run. But, the propensity to report a crime has probably increased and decreased during different periods of time. This makes it hard to evaluate how well the curve represents actual committed crimes (NCCP, report 2006:1, p. 94-96).

Figure 2. Graph of Reported Crimes



Source: The National Council for Crime Prevention.

The propensity to report a crime varies quite much among different crimes. The property crimes that are included in this study do in general have a relatively high reporting rate. car theft and theft from car (not identical to the variable *Theft From Motor Vehicle* that I am using) have reporting rates of 90 % and 75 % respectively ((NCCP(a)). This is because in order to benefit from your insurance you have to report the crime to the police. In general, the actual theft-crimes are about three times as high as the reported number. An exception is theft of lower values, i.e. pilfering from shops, where the under-coverage is huge (NCCP(a)). Burglary probably has, because of insurances reasons, a low under-coverage (NCCP, report 2006:1, p. 111). Actual violent crimes (such as assault and robbery[12]) are estimated to be between 4 to 10 times more than reported depending on how severe the crime is (NCCP(a)). Rape is probably highly under-covered and it is hard to estimate the size of it because the definition is less clear-cut than for example in the case of theft. The numbers of reported rapes

[12] Robbery is in Swedish law considered as a violent crime. However, because the motive is monetary it is also reasonable to consider it as a property crime. Therefore, it can be applicable to economic theory.

have increased during late years. One of the causes is that the definition of rape has been changed and expanded a couple of times during the last 20 years (NCCP, report 2006:1, p. 104-106). Vandalism has a high under-coverage, and large variations in reported crimes are probably mainly due to changed propensity to report the crime (NCCP, report 2006:1, p. 115).

If we assume that the propensity to report a particular crime changes over time in the same way across all municipalities or varies across municipalities but remain constant over time, then the fixed effect estimate will not be biased due to measurement errors. As Eide et al (2006 p. 32-33) points out, this seems to be an implicit assumption in most studies. The propensity to report a crime is indeed different between different areas of the country but as mentioned this will not cause any bias. However, there might be some evidence that this gap between different areas vary over time (NCCP, report 2008:23, p. 35-36). If the latter is true, then our assumption is too strong and our fixed effect estimator may be biased. Further, reported crimes specifically related to narcotics are in general more likely to show much variation and it might vary a lot across time and space. This is due to that the police often conducts targeted operations for this type of crimes (NCCP, report 2008:23, p. 15,42 and NCCP(a), p. 36-37). Reported crimes in this category are in general hard do draw any conclusions from due to huge under-coverage and large fluctuation (NCCP, report 2006:1, p. 117-118). The size and ambition of such operations may vary across time and area. This has to be kept in mind when doing the analysis on this particular category of crime. There have been developed advanced methods in order to deal with measurement errors due to variation in propensity to report crime across areas and time (Eide et al. 2006 p. 32-33). Still, I believe that the fixed effects estimator is the best option available for the purpose of this paper.

The number of reported crimes per 100 000 inhabitants varies a lot between different crimes and different municipalities. The descriptive statistics are shown in Table 2. Small municipalities are sometimes reported to have 0 crimes per 100 000 inhabitants, in those cases the actual number of crimes does not necessarily have to be 0. In most cases it is probably not.

Table 2. Descriptive Statistics of Crime Variables

Crime-Category	Min	Max	Mean	Standard Deviation
Robbery	0	360	35,977	43,227
Narcotics	0	4166	387,336	361,509
Vandalism	37	6670	1185,705	539,706
Theft From Motorveh.	75	4546	1030,526	547,659
Car Theft	0	1762	374,600	265,172
Receivng	0	1435	33,632	38,031
Theft and Pilfering	112	6494	1584,277	723,913
Burglary	196	4075	1204,438	481,276
Rape	0	450	24,154	27,214
Assault	25	1685	566,546	242,927
Total Violent Crimes	25	2024	677,688	307,937
Total Crimes	1275	23210	9752,812	3094,122

Note: 3744 observations, covering 288 municipalities during the period 1997-2009. I have dropped out three outlier observations; *Total Violent-Crimes*, *Car Theft* and *Assault* for the year of 2001 in the municipality of Bjurholm.

4.2. Choosing Control Variables

In order to avoid an omitted variable bias a number of variables are added as explanatory variables. I choose variables with motivation from economics-, sociologies and previous empirical work.

From economic theory income is predicted to influence the behaviour of the individual. Therefore average per capita income[13] ought to belong in the model and is collected from Statistics Sweden and deflated with the KPI-index (Consumer Price Index) also collected from Statistics Sweden. The risk of getting caught unfortunately has to be left out of the model due to lack of data at municipality- and county-level[14] thus an omitted variable bias is possible. However, if changes in the risk of getting caught are uniform across the country the fixed effect specification will handle this potential problem. Unemployment benefits are incorporated in the average deflated income. The return from crime is excluded due to lack of data. The cost of punishment is also excluded due to lack of data. However, one can argue that the cost of punishment is incorporated in average deflated per capita income. First, the income can be said to be the opportunity cost of being in jail. Second, some fines are based on the criminal's income. In addition, if we assume that the cost of punishment is the same all

[13] Some previous papers include alcohol consumption as a control variable because it has been shown to induce violent crimes. I follow AÖ (2007) and argue that including *Income* as a control variable is a way to control for unobservable alcohol consumption because the income elasticity of alcohol consumption can be assumed to be positive. Raphael and Winter-Ebmer (2001) and Gould, Weinberg and Mustard (2002) provide a further discussion.

[14] See Levitt (1997) for a further discussion on possible omitted variable bias.

over the country, my fixed effect specification eliminates the potential omitted variable problem. The *Proportion of People with Higher Education* is also included. This variable is often included in previous empirical work. Various reports from The National Council for Crime Prevention supports that low educated people tend to be over represented among criminals. This can also be supported by economic theory though these people have a lower expected income both now and in the future.

Foreigners (including both 1st and 2nd generation immigrants) have approximately twice as high propensity to commit crime than non-foreigners (The actual definition used in the study (NCCP, report 2005:17) is paraphrased as "excess risk of being *suspected* for a crime"). A part of it can be explained by that foreigners more often belong to demographic and socio-economic groups that generally are over represented among criminals. Standardizing for some of these factors makes the propensity to commit crime drop, but the gap between foreigners and non-foreigner does not disappear. The excess risk drops to 2,1 for 1st generation- and 1,5 for 2nd generation immigrants (NCCP, report 2005:17). This suggests that socio-economic factors alone cannot explain foreigners' over representation among criminals. In some literature that studies criminal activity (see for example Dahlbäck, 1998), foreigners are a measure of "cultural estrangement"[15] and perhaps this is an appropriate explanation for the previous mentioned difference in propensity to commit a crime. There are also large variations between the different geographical areas that the foreigners come from (NCCP, report 2005:17). Some previous empirical papers have separated foreigners into different groups (see for example Fougère et. al, 2009), but due to lack of data this is not possible in this paper. For the reasons stated above, *Proportion of Foreigners* is included in the model. Age and gender are probably the strongest determinants of criminal activity. Men and young people are highly over represented among criminals. Different age groups are also potential victims for different crimes (NCCP, report 2008:23, p. 42-49), hence the age groups represents both the demand- and supply-side of criminal activity. For above reasons, variables of proportions of different age groups and *Proportion of Men* are included in the model.

[15] There does not seem to be a clear definition of "cultural estrangement" available in the literature. However, many philosophers, psychologists and sociologists seem to agree on that "cultural estrangement" occurs when people feel that their values are not shared by the society that they are a part of. In other words, a sense of alienation due to discrepancies in values between an individual and society (see Maio et. al. (2003, p. 300-301) for a discussion and further references).

It is a well-known fact that crime rates are higher in larger cities (NCCP, report 2008:23, p. 35-38). To catch this phenomenon the *Population Density* variable is added; inhabitants per km^2. Theoretical support can be drawn from the "routine activity theory" in rational choice sociology (see Cohen & Felson, 1979). The rational is simply that more crimes will be committed if the supply of victims and things to steal is larger and the number of temptations and opportunities offered during a day are more. This captures a different side of the supply side than the basic economic model outlined in Section 2. Unfortunately, inhabitants per km^2 is not a good measure of urbanization. It will certainly underestimate the true population density in the area where people actually live in a municipality like Kiruna, which is huge by area, and have large uninhabited areas. A better measure would be the proportion of the inhabitants in the municipality that live in an urbanized area. Nevertheless, due to lack of data for the whole period the general population density measure has to be used in this paper.

A statistical report on crimes in the municipalities of Sweden (NCCP, report 2002:5) from The National Council for Crime Prevention finds it important to include *Migration*, *Proportion Divorced* and *Election Participation* as explanatory variables. I include these variables as well. In a sociologic paper, Dahlbäck (1998) discusses and uses the first two variables as representatives of "social contact" and "bonds to the conventional society" in order to fully explain criminal activity. Martens (1992) suggests that the propensity to commit crime might be higher among those growing up with divorced parents, hence giving another reasonable motivation to include *Proportion Divorced* as a control variable. The report from The National Council for Crime Prevention (NCCP, report 2002:5) uses election participation to represent "participation in the public life of society". Many similar variables could be potential measures of "participation in the public life of society". For simplicity reasons I will, as stated above, let *Election Participation* represent this aspect. The election considered is the election to Sveriges Riksdag (Swedish National Parliament). For the time period studied, elections have been held three times, 1998, 2002 and 2006. Hence, only 5 different values are collected per municipality thus not offering much variation. A complete list of control variables is shown in Table 3 below.

Table 3. Descriptive Statistics of Control Variables

Variable	Min	Max	Mean	Standard Deviation	Expected Sign
Income	126,822	387,631	182,242	26,567	+ / –
Prop. With Higher Education	0,0227	0,2676	0,0710	0,0356	–
Prop. Foreigners	0,0200	0,0523	0,1114	0,0688	+
Prop. 0-14 years	0,1131	0,2458	0,1781	0,0215	..
Prop. 15-19 years	0,0360	0,0960	0,0663	0,0077	..
Prop. 20-24 years	0,0303	0,1220	0,0503	0,0107	..
Prop. 25-34 years	0,0561	0,2274	0,1088	0,0218	..
Prop. 35-44 years	0,0903	0,1809	0,1331	0,0127	..
Prop. Men	0,4757	0,5291	0,5012	0,0077	+
Migration	0,0433	0,2637	0,0952	0,0249	+
Prop. Divorced	0,0908	0,3298	0,1869	0,0330	+
Pop. Density	0,2000	4410,40	127,25	426,60	+
Election Participation	0,6720	0,9260	0,8133	0,0331	–

Note: 3744 observations, covering 288 municipalities during the period 1997-2009.

4.3. Baseline Econometric Specification

The regression model used in this paper is in line with previous papers with this topic. A log-linear model is chosen instead of a log-log model (as used by Edmark (2005)) though I find it more appealing when having mostly proportions as explanatory variables (The results should in this case not be affected by the choice of model (Wooldridge, 2003, p. 189). I use a fixed effect model with a full set of time- and area-dummies. The fixed effect specification eliminates the influence of measurement errors that (i) varies across municipalities but remain constant over time, and (ii) changes in a uniform way over time across all municipalities. Hence, the regression model will identify the unemployment effect on crime using the within-municipality deviations from aggregated national trends. The regression model is shown below.

$$Log(Crime_{it}) = \alpha_i + \beta_t + \theta Unempl_{it} + \xi X_{it} + \psi Y_{it} + \eta Z_{it} + \varepsilon_{it} \quad (8)$$

In this model, i and t are indices for municipality and time respectively. $Crime_{it}$[16] is the number of crimes per 100 000 inhabitants for the particular crime regressed on. α_i is the

[16] As shown in Table 2, some municipalities have 0 reported crimes for at least 1 observation. In these cases, the problem with the undefined logarithm of 0 is solved by adding 1 to every observation.

municipality fixed effect dummy and β_t is the time fixed effect dummy. $Unempl_{it}$ is a variable representing the particular type of unemployment. *TU*, *YU* and *LTU* are used as the unemployment measures in this paper. However, they are never used as regressors simultaneously. X_{it} is a vector with *Income*, *Proportion with High Education* and *Proportion of Foreigners* as elements. The *Income* variable is the only regressor that is in logarithms. It is also transformed to a first difference variable, dealing with its non-stationary nature[17]. Y_{it} is a vector with all the demographic- and gender variables as elements. At last, Z_{it} is a vector with the variables; *Proportion Divorced*, *Migration*, *Election Participation* and *Population Density* as elements. ε_{it} is the residual term. Unfortunately, the regression on equation (8) suffers from tendencies of auto-correlation, heteroskedasticity and non-normal distributed residuals. Different specifications are tried but these attempts to avoid the problems were unsuccessful. Therefore, to correct for the heteroskedasticity bias, the White´s cross-section coefficient covariance method are used on all regressions on equation (8). A specification that fully corrects for the auto-correlation is presented in the next section. The non-normal distributed residuals implies that inference has to be done with caution (for an overview of the consequences of above mentioned problems see for example Wooldridge (2003))

4.4. Alternative Econometric Specifications

In this section, seven alternative regression models are specified. First, the term $(Log(Crime_{it}(-1))$ is added to correct for the auto-correlation tendencies in the baseline model. Thus, one new specification is:

$$Log(Crime_{it}) = \alpha_i + \beta_t + \theta Unempl_{it} + \xi X_{it} + \psi Y_{it} + \eta Z_{it} + \gamma(Log(Crime_{it}(-1)) + \varepsilon_{it} \qquad (9)$$

Equation (9) is regressed with all three unemployment-categories. The following alternative equations are all variations of equation (9) and will only be regressed with *TU* as unemployment regressor. Moving on to the next alternative specification, what happens if we run a regression model with; no vector, only vector X_{it} and vectors X_{it} and Y_{it} respectively? Hence leaving out vector Z_{it}. To clarify, the equations are shown below:

[17] *Income* is the only variable considered non-stationary. Although some other explanatory variables might exhibit non-stationary characteristics I choose not to consider them as non-stationary variables with the argument that proportion variables can impossibly be non-stationary in the long run. Also, it seems unreasonable that crime rates are non-stationary in the long run. However, a possible non-stationary nature of crime rates is discussed by Blomquist & Westerlund (2007). A paper written by Holoviak & Lee (2006) is an example of a study with a cointegration method approach. Obviously, the case is not clear-cut.

$$Log(Crime_{it}) = \alpha_i + \beta_t + \theta Unempl_{it} + \gamma(Log(Crime_{it}(-1)) + \varepsilon_{it} \quad (10)$$

$$Log(Crime_{it}) = \alpha_i + \beta_t + \theta Unempl_{it} + \xi X_{it} + \gamma(Log(Crime_{it}(-1)) + \varepsilon_{it} \quad (11)$$

$$Log(Crime_{it}) = \alpha_i + \beta_t + \theta Unempl_{it} + \xi X_{it} + \psi Y_{it} + \gamma(Log(Crime_{it}(-1)) + \varepsilon_{it} \quad (12)$$

Moreover, what happens if we run the regression in equation (9) but split the period into two periods, 1997-2003 and 2003-2009? These are another two alternative regression models. At last, one can argue that it will take some time for the consequences of unemployment to put into effect and that it sometimes will take some time before a crime is reported. Therefore it might be appropriate to lag the unemployment variable one year. Hence:

$$Log(Crime_{it}) = \alpha_i + \beta_t + \theta Unempl(-1)_{it} + \xi X_{it} + \psi Y_{it} + \eta Z_{it} + \gamma(Log(Crime_{it}(-1)) + \varepsilon_{it} \quad (13)$$

is the seventh and last alternative specification. It has to be clarified that the results from above alternative specifications are not comparable with previous studies not using the $Log(Crime_{it}(-1))$-term. The regression results from these equations are an underestimate of the total unemployment effect. The total effect also includes a long-term dynamic effect of unemployment and crime. As in the Baseline Model, White´s cross-section coefficient covariance method is used to correct for the heteroskedasticity bias. The residuals still suffer from non normal-distributed residuals. The results of these alternative regression models are shortly discussed at the end of next section.

5. Results from the Baseline Econometric Specification

5.1. Effects of Total Unemployment

As can be seen in Table 4 and 5 (table 5 gives some help in summarizing and interpreting 4). *TU* has a positive sign for every crime except for *Car Theft* in the Baseline Model. This gives an indication of a positive relationship between unemployment and various crimes in general. *TU* has a significant effect on five crime-categories and the effect is positive for all. The crime-categories are; *Total Crimes*, *Burglary*, *Receiving*, *Robbery* and *Narcotics*. The Log-Linear econometric specification tells us that a one *percentage-point* increase in *TU* generates

an increase in; *Total Crimes* with 0,5%, *Burglary* with 1,3%, *Reveiving* with 4,5%, *Robbery* with 3,6% and *Narcotics* with 3,2% respectively. Property crimes are the largest single part of *Total Crimes* (in 2007 property crimes corresponded to 44% of all reported crimes in Sweden (NCCP, report 2008:23, p. 30)) and the other crime-categories except for *Narcotics* are property crimes. Hence, the result is in line with economic theory stating that property crimes and unemployment are correlated. Also, the fact that *TU* does not show a significant effect on any of the "pure" violent crimes supports the theory and strengthens previous empirical findings; that property crimes are more correlated with unemployment than violent crimes. As previous mentioned, a reverse direction of causality is rather unlikely because the municipality unemployment rates during the period are consequences of macroeconomic events at the national (and perhaps world?) level, completely out of control of the municipalities. On the other hand one could argue that industries and small businesses ought to be reluctant towards establishing themselves in areas where criminal activity is high, hence less jobs might become available in the area. Nevertheless, I believe that these reverse causality effects are small and investigating the direction of causality is beyond of scope of this paper.[18]

The results are generally in line with the results of both Edmark´s (2005) and AÖ´s (2007) studies. *Receiving* has never been studied using Swedish data before. There is one discrepancy between the above mentioned results and the results of previous studies. Unemployment does in previous studies generally have a significant positive effect on *Car Theft* while showing an insignificant negative sign in this study. Possible explanations for this will be discussed in Section 7.

Even though this paper focuses on the effect of unemployment, some of the control variables deserve some comments. One must not forget that unemployment is only a part of the explanation of fluctuation in crime rates. Looking at Table 4 and 5 gives at hand that other factors indeed are important when understanding criminal behaviour. The three variables; *Proportion Divorced*, *Migration* and *Election Participation* seem to all play an important role in understanding criminal activity. All of them have the right sign on all the significant coefficients and the coefficients for *Migration* and *Election Participation* almost always show

[18] Some literatures discuss this issue. Cullen & Levitt (1996) argue that high-income individuals or employers leave areas with higher or increasing crime rates. Gould, Weinberg and Mustard (2002) discuss the fact that crime might make businesses to relocate to areas with lower crime rates. Willis (1997) found that low-wage employers in the service sector are more likely to relocate due to increasing crime rates.

the expected sign. Of course, the direction of causation can be debated but there is indeed some evidence of correlation. The *Proportion of People with Higher Education* also seems to be an important determinant of criminal activity. The coefficient always shows the expected sign and is significant for more than half of the crime-categories. It can also be seen that a high *Proportion of Foreigners* tend to increase the number of crimes. This is perhaps evidence of the effect of "cultural estrangement". However, some of the effect can of course be explained by their socioeconomic disadvantages because the age-variables included, *Proportion with Higher Education* and *Income* are to few variables to catch up for all of it. The income coefficient does in general have a positive sign. Hence, positive changes (remember the first difference specification) in income do in general seem to increase the crime rates. Quite surprising, the coefficient for *Population Density* only shows the expected sign half of the times and only 1 of 5 had the expected sign among the significant coefficients. A discussion on this issue will be held in Section 7.

Table 4. Total Unemployment in the Baseline Model. All control variables are shown

Vector	Variable	Total Crimes	Burglary	Cartheft	Theft and Pilfering	Theft From Motor Vehicle	Receiving	Tot. Violent Crimes	Robbery	Assault	Rape	Vandalism	Narcotics
..	Total Unempl.	**0,539	**1,329	-1,012	0.566	0,890	*4,448	0,524	**3,644	0,485	0,762	0,791	*3,170
		0,225	0,563	0,930	0,357	0,636	2,483	0,431	1,523	0,464	2,549	0,638	1,732
X	Income (First-Diff)	0,596	*1,571	0,317	*0,696	0,324	-0,399	0,240	-1,839	0,165	***6,095	0,743	0,533
		0,377	0,940	0,938	0,357	0,950	2,707	0,659	2,457	0,650	1,811	0,495	1,897
X	Prop. With Higher Education	***-3,248	-2,089	***-4,517	***-2,324	***-8,028	-4,215	**-2,224	-8,307	**-2,099	-5,001	-0,574	***-12,243
		1,098	1,772	1,719	0,531	2,326	4,264	0,865	6,035	0,816	4,805	0,522	2,430
X	Prop. Foreigners	***1,042	***4,941	*2,034	***2,389	0,659	*-4,700	0,329	4,977	0,130	1,601	0,749	-1,001
		0,384	1,012	1,05	0,388	0,718	2,791	0,631	3,048	0,674	2,345	0,655	1,911
Y	Prop. 0	-0,529	**-4,289	***-9,881	-0,041	***-5356	-3,185	1,024	-3,656	1,308	0,758	***1,956	**-7,287
		0,641	1,86	1,741	0,802	1,460	7,651	1,039	3,826	1,331	3,829	0,723	3,675
Y	Prop. 15	*1,435	**-4,841	**-9419	2,000	***-8,31	13,825	***5,848	1,896	***6,294	-4,497	***7,408	-4,345
		0,830	2,141	3,715	1,294	2,884	10,265	1,779	7,704	1,641	9,492	1,411	4,835
Y	Prop. 20	-1,202	-3,126	-1,678	***-5,555	1,004	*13,824	1,190	7,147	-0,077	7,519	0,875	6,872
		0,977	2,163	4,099	1,744	2,095	7,889	1,882	6,423	1,960	11,615	1,765	6,116
Y	Prop. 25	*1,387	1,681	-1,901	0,126	***3,244	**12,484	-0,292	3,295	-0,065	**-13,383	0,044	-1,388
		0,821	1,424	2,299	0,617	0,930	5,803	0,786	8,52	0,812	5,329	1,085	4,272
Y	Prop. 35	1,185	1,202	*-3,214	1,512	3,616	***13,419	***-1,926	**7,343	**-2,196	-3,218	1,223	0,354
		1,353	1,974	1,905	0,930	2,416	4,340	0,660	3,604	0,869	3,726	0,997	5,705
Y	Prop. Men	**3,292	-0,842	**12,562	1,134	2,088	16,859	1,460	-5,303	1,778	12,754	**-5,033	-1,384
		1,562	1,802	4,931	2,296	2,640	21,478	2,968	9,168	3,027	14,703	2,187	7,079
Z	Prop. Divorced	***2,146	***3,930	-1,743	-0,164	0,564	-5,436	***2,657	-4,338	***1,907	***14,356	-0,428	-0,656
		0,532	1,061	2,178	0,828	1,435	5,539	0,583	3,802	0,679	4,197	1,351	1,969
Z	Migration	***1,551	1,141	1,200	***2,091	***2,775	4,194	***3,262	**5,636	***3,416	4,531	***1,530	2,693
		0,377	0,759	1,122	0,558	0,815	3,130	0,427	2,857	0,417	3,780	0,557	2,474
Z	Election Participation	**-0,752	-0,493	**-2,85	**-0,609	-0,136	-0,133	**-1,283	-1,295	-0,846	-1,218	0,272	-3,556
		0,319	0,730	1,400	0,314	0,993	4,371	0,621	2,719	0,757	3,207	0,635	2,577
Z	Pop. Density	2,09E-05	*-0,001	-0,001	-0,000	0,000	0,000	***-0,000	***-0,001	***-0,001	8,43E-05	*0,001	5,81E-05
		0,000	0,000	0,000	0,000	0,000	0,001	0,000	0,001	0,000	0,000	0,000	0,000
	R2	0,858	0,664	0,743	0,863	0,746	0,388	0,816	0,579	0,784	0,423	0,753	0,700

Note: Standard errors are shown below the coefficients. *** < P-value = 0,01, ** < P-value = 0,05, * < P-Value = 0,1

Table 5. Summary of Statistics in Table 4

Vector	Variable	Regr. with expected sign	in %	Regr. with significant coef.	in %	Number of coef. with expected sign among the significant coef.	in %
..	Total Unempl.	11 of 12	92%	5 of 12	42%	5 of 5	100%
X	Income (First-Diff)	10(+) and 2(-)		3 of 12	25%	All signif. coef. were (+)	
X	Prop. With Higher Education	12 of 12	100%	7 of 12	58%	7 of 7	100%
X	Prop. Foreigners	10 of 12	83%	5 of 12	42%	4 of 5	80%
Y	Prop. 0	4(+) and 8(-)		5 of 12	42%	1(+) and 4(-)	
Y	Prop. 15	7(+) and 5(-)		7 of 12	58%	4(+) and 3(-)	
Y	Prop. 20	7(+) and 5(-)		2 of 12	17%	1(+) and 1(-)	
Y	Prop. 25	7(+) and 5(-)		4 of 12	33%	3(+) and 1(-)	
Y	Prop. 35	8(+) and 4(-)		5 of 12	42%	2(+) and 3(-)	
Y	Prop. Men	8 of 12	67%	3 of 12	25%	2 of 3	67%
Z	Prop. Divorced	6 of 12	50%	5 of 12	42%	5 of 5	100%
Z	Migration	12 of 12	100%	7 of 12	58%	7 of 7	100%
Z	Elec. Participation	11 of 12	92%	4 of 12	33%	4 of 4	100%
Z	Pop. Density	6 of 12	50%	5 of 12	42%	1 of 5	20%
			Aver: 79%		Aver: 38%		Aver: 83%

5.2. Effects of Youth Unemployment

Table 6 shows the results from running regression (8) with *YU* instead of *TU* as one of the explanatory variables. The coefficients for *YU* are positive and significant for two of the crime-categories regressed on, *Burglary* and *Narcotics*. 8 out of 12 crime-categories have a positive sign on the coefficient for *YU* while 4 out of 12 shows a negative sign. Quite surprisingly, 3 out of 4 crime-categories that show a negative relationship are property crimes and thus contradicting theory. Nevertheless, none of the coefficients were significant. The results from Table 6 give some indication that *YU* exhibits a weaker relationship to various crimes than what *TU* does. Previous Swedish empirical studies (Agell & Nilsson, 2003 and Agell & Öster, 2007) that have studied this relationship did not find any clear correlation at all. In contrast, a recent French study did (Fougère et. al, 2009).

Table 6. Youth Unemployment in the Baseline Model

Crime-Category	Youth Unempl.	Std Error	R2
Total Crimes	0,129	0,134	0,858
Burglary	*0,488	0,276	0,664
Cartheft	-0,182	0,429	0,743
Theft and Pilfering	-0,005	0,198	0,862
Theft From Motor Vehicle	-0,033	0,275	0,746
Receiving	0,909	1,37	0,387
Total Violent Crimes	0,064	0,217	0,816
Robbery	1,501	1,048	0,579
Assault	-0,047	0,247	0,784
Rape	0,726	1,4	0,423
Vandalism	0,372	0,274	0,753
Narcotics	**1,616	0,782	0,7

Note: *** < P-value = 0,01, ** < P-value = 0,05, * < P-Value = 0,1.

5.3. Effects of Long-Term Unemployment

Table 7 shows the results from running equation (8) as a regression with *LTU* as regressor. 10 coefficients out of 12 have an expected positive sign on the coefficient for *LTU*. *Cart Theft* has a negative sign on the coefficient for *LTU* as in the case of *TU* and *YU*. Surprisingly, *Robbery* also shows a negative sign on the coefficient for *LTU*. Nevertheless, none of the two are significant. On the other hand, five crime-categories have a significant coefficient for *LTU*, all with a positive sign. The crime-categories are: *Total Crimes*, *Theft From Motor Vehicle*, *Total Violent Crimes*, *Assault* and *Narcotics*.

LTU has not specifically been studied in previous economics papers using Swedish data, thus giving no opportunity for comparison. The fact that property crimes do not seem to dominate the relationship to *LTU* is a very interesting result. Although property crimes are by far the largest component of *Total Crimes*, *Total Violent Crimes* and *Assault* clearly show a connection with *LTU* as well. This cannot be explained by the basic economic theory that is outlined in this paper. Perhaps does long-term unemployment create a feeling of alienation that fosters violent behaviour and other non-rational behaviours, which make the assumption of maximizing expected monetary value less applicable? Perhaps, under these circumstances, the utility functions of the individuals become severely changed in a way where the relative importance of monetary value is downplayed by other factors in an irrational way? Regarding *Narcotics* the result shows a significant link and the coefficient is large, almost three times larger than in the case of *TU*.

Table 7. Long-Term Unemployment in the Baseline Model

Crime-Category	Long-Term Unempl.	Std. Error	R2
Total Crimes	**1,396	0,651	0,86
Burglary	0,995	1,361	0,668
Cartheft	-0,708	1,965	0,752
Theft and Pilfering	0,528	0,901	0,865
Theft From Motor Vehicle	***3,624	0,889	0,75
Receiving	1,885	5,008	0,382
Total Violent Crimes	***2,359	0,856	0,82
Robbery	-1,554	3,082	0,576
Assault	**2,298	0,995	0,788
Rape	1,946	4,243	0,424
Vandalism	0,661	0,924	0,757
Narcotics	***8,652	2,594	0,703

Note: *** < P-value = 0,01, ** < P-value = 0,05, * < P-Value = 0,1. Due to some NAs in the *LTU*-variable the regressions are run with 3727 observations instead of 3744.

6. Results from Alternative Econometric Specifications

6.1 Effects of Total Unemployment

As can be seen in Table 8 and 9, *TU* has a positive sign for every crime except for *Car Theft* as in the Baseline Model. As expected when adding the term $Log(Crime_{it}(-1))$ the relationship between various crimes and the unemployment variable seems to be weaker. *TU* now has a significant positive relationship to two crime-categories, *Receiving* and *Robbery* and thus looses significance on three crime-categories. Although the link seems to be weaker there is still a relationship at hand. The control variables are generally not much affected.

Table 8. Regression on equation (9) with Total Unemployment as regressor. All control variables are shown

Vector	Variable	Total Crimes	Burglary	Car Theft	Theft and Pilfering	Theft From Motor Vehicle	Receiving	Tot. Violent Crimes	Robbery	Assault	Rape	Vandalism	Narcotics
..	Total Unempl.	0,341	0,812	-0,923	0,402	0,408	*4,509	0,562	**3,654	0,550	0,998	0,484	2,419
		0,236	0,594	0,889	0,289	0,701	2,458	0,452	1,538	0,490	2,516	0,600	1,912
X	Income (First-Diff)	*0,644	1,252	0,272	***0,839	0,414	-0,433	0,291	-1,852	0,166	***5,982	*0,825	-0,051
		0,367	0,868	1,055	0,304	0,940	2,672	0,654	2,447	0,643	1,897	0,448	1,788
X	Prop. With Higher Education	**-2,232	-1,083	*-3,059	***-1,503	***-5,131	-4,238	**-1,775	-8,342	**-1,667	-5,560	-0,713	***-10,036
		1,007	1,413	1,721	0,453	1,982	4,294	0,776	6,064	0,756	4,782	0,474	2,509
X	Prop. Foreigners	*0,711	***3,305	1,518	***1,631	0,698	*-4,686	0,278	*5,003	0,098	1,543	0,676	-1,102
		0,421	0,972	1,021	0,387	0,673	2,812	0,623	3,022	0,684	2,268	0,671	1,646
Y	Prop. 0	0,016	-2,401	***-7,637	-0,033	**-3,618	-3,332	1,146	-3,662	1,333	0,799	***1,848	-4,862
		0,727	1,854	1,736	0,751	1,624	7,624	0,977	3,837	1,292	3,707	0,690	3,484
Y	Prop. 15	1,377	-2,931	**-7,367	1,516	**-5,907	13,760	***5,482	1,835	***5,970	-4,862	***5,821	-2,358
		0,923	2,136	3,534	1,353	2,966	10,182	1,887	7,714	1,695	9,066	1,410	5,244
Y	Prop. 20	-0,976	-2,163	-1,361	**-4,535	0,692	*14,218	0,781	7,211	-0,408	7,672	0,762	6,296
		0,996	2,019	4,199	1,792	2,326	7,925	1,732	6,385	1,894	11,406	1,863	5,967
Y	Prop. 25	1,089	0,943	-2,033	0,498	*2,203	**12,462	-0,553	3,275	-0,292	***-13,669	0,177	-0,352
		0,800	1,546	2,373	0,627	1,134	5,766	0,830	8,500	0,829	5,225	1,059	3,977
Y	Prop. 35	1,076	1,139	-2,493	1,288	2,682	***13,485	***-1,987	**7,373	***-2,241	-2,522	0,820	1,107
		1,397	1,729	1,982	0,918	2,450	4,409	0,642	3,623	0,858	3,667	1,150	5,153
Y	Prop. Men	*2,669	0,039	**10,686	0,660	0,758	16,865	1,687	-5,284	2,012	14,369	**-4,795	-1,325
		1,366	1,477	5,156	2,267	2,429	21,280	3,149	9,128	3,074	14,553	2,296	7,526
Z	Prop. Divorced	***1,730	**2,395	-1,540	-0,031	0,406	-5,482	***2,308	-4,376	**1,600	***14,847	-0,335	-0,273
		0,538	1,092	2,115	0,821	1,309	5,545	0,624	3,773	0,734	4,122	1,307	2,116
Z	Migration	***1,088	0,713	1,521	***1,612	***2,00	4,258	***2,893	**5,664	***2,988	4,446	**1,092285	1,095
		0,373	0,643	1,135	0,536	0,754	3,129	0,453	2,887	0,447	3,766	0,557	2,451
Z	Elec. Participation	-0,455	-4,313	-2,385	-0,430	-0,011	-0,098	*-1,212	-1,289	-0,897	-1,704	0,612	*-3,682
		0,298	0,549	1,469	0,316	1,017	4,402	0,681	2,718	0,817	3,219	0,629	2,221
Z	Pop. Density	7.84E-06	-0,000	-0,000	-0,000	-0,000	0,000	***-0,001	***-0,001	***-0,001	0,000	*0,000	0,000
		0,000	0,000	0,000	0,000	0,000	0,001	0,000	0,001	0,000	0,000	0,000	0,000
	R2	0,871	0,707	0,755	0,876	0,766	0,388	0,820	0,590	0,788	0,426	0,770	0,709

Note: Standard Errors are shown below the coefficients. *** < P-value = 0,01, ** < P-value = 0,05, * < P-Value = 0,1.

Table 9. Summary of Statistics in Table 8

Vector	Variable	Regr. with expected sign	in %	Regr. with significant coef.	in %	Number of coef. with expected sign among the significant coef.	in %
..	Total Unempl.	11 of 12	92%	2 of 12	17%	2 of 2	100%
X	Income (First-Diff)	9(+) and 3(-)		4 of 12	33%	All signif. coef. were (+)	
X	Prop. With Higher Education	12 of 12	100%	7 of 12	58%	7 of 7	100%
X	Prop. Foreigners	10 of 12	83%	5 of 12	42%	4 of 5	80%
Y	Prop. 0	5(+) and 7(-)		3 of 12	25%	1(+) and 2(-)	
Y	Prop. 15	7(+) and 5(-)		5 of 12	42%	3(+) and 2(-)	
Y	Prop. 20	7(+) and 5(-)		2 of 12	17%	1(+) and 1(-)	
Y	Prop. 25	7(+) and 5(-)		3 of 12	25%	2(+) and 1(-)	
Y	Prop. 35	8(+) and 4(-)		4 of 12	33%	2(+) and 2(-)	
Y	Prop. Men	9 of 12	75%	3 of 12	25%	2 of 3	67%
Z	Prop. Divorced	6 of 12	50%	5 of 12	42%	5 of 5	100%
Z	Migration	12 of 12	100%	7 of 12	58%	7 of 7	100%
Z	Elec. Participation	11 of 12	92%	2 of 12	17%	2 of 2	100%
Z	Pop. Density	5 of 12	42%	4 of 12	33%	1 of 4	25%
			Aver: 79%		Aver: 33%		Aver: 84%

6.2. Effects of Youth Unemployment

Table 10 shows the results from running regression (9) with *YU* instead of *TU* as one of the explanatory variables. Here as well, the relationship seems to be weaker. The coefficients for *YU* are not significant for any of the crimes regressed on. 9 out of 12 crimes have a positive sign on the coefficient of *YU* while 3 of 12 shows a negative sign.

Table 10. Regr. on eq. (9) with Youth Unempl. as regressor

Crime-Category	Youth Unempl. Coef.	Std. Error	R2
Total Crimes	0.069	0.152	0,871
Burglary	0.307	0.275	0,706
Cartheft	-0.256	0.502	0,754
Theft and Pilfering	-0.046	0.167	0,876
Theft From Motor Vehicle	-0.152	0.244	0,766
Receiving	0.932	1.354	0,388
Total Violent Crimes	0.090	0.217	0,820
Robbery	1.505	1.048	0,579
Assault	0.002	0.246	0,788
Rape	0.804	1.378	0,426
Vandalism	0.259	0.272	0,770
Narcotics	1.288	0.847	0,709

Note: *** < P-value = 0,01, ** < P-value = 0,05, * < P-Value = 0,1

6.3. Effects of Long-Term Unemployment

Results from running equation (9) with *LTU* as regressor are shown in Table 11. The results still show a strong relationship with this alternative specification. All the coefficients show the same signs and the same coefficients are significant. However, the sizes of the coefficients are, as expected, overall smaller.

Tabell 11. Regr. on eq. (9) with Long-Term Unempl. as regressor

Crime-Category	Long-Term Unempl. Coef.	Std.Error	R2
Total Crimes	**1.113	0.567	0,873
Burglary	0.751	1.179	0,711
Cartheft	-0.953	1.846	0,767
Theft and Pilfering	0.507	0.915	0,880
Theft From Motor Veh.	***2.528	0.958	0,769
Receiving	1.950	5.045	0,382
Total Violent Crimes	**2.196	0.910	0,825
Robbery	-1.555	3.089	0,576
Assault	**2.192	1.044	0,793
Rape	2.503	4.286	0,427
Vandalism	0.096	0.846	0,777
Narcotics	***6.765	2.487	0,713

Note: *** < P-value = 0,01, ** < P-value = 0,05, * < P-Value = 0,1. Due to some NAs in the *LTU*-variable the regressions are run with 3727 observations instead of 3744.

6.4. Investigating What Happens When Excluding Vectors, Splitting the Time Period in Two and Lagging the Unemployment Variable

All the following regressions are only regressed with *TU* as regressor. The results of the regressions on equations (10), (11) and (12) are shown in Table 12. In these regressions I add one vector at the time in order to see how the results changes.

When running a regression on equation (10) (no vector added) the signs on the coefficients are mixed. The unemployment coefficient is among others negative for *Total Crimes*. The regression on equation (11) (vector X_{it} added) gives a significant coefficient for *TU* for four crime-categories. *Robbery* and *Receiving* as when regressing on equation (9) with all vectors included, but also for *Car Theft* and *Theft and Pilfering*. And, the *TU*-coefficient turns positive for *Total Crimes* and *Theft from Motor Vehicle*. The violent crimes still show an insignificant negative relationship. The greatest change occurs when vector Y_{it} is added with the age- and gender structure. This is reasonable because, as mentioned in section 4.1, these factors probably are the strongest determinants of criminal activity. All signs turn positive

except the *TU*-coefficient for *Car Theft*. The results are now similar to the results shown in Table 8.

Table 12. Regressions on equations (10), (11) and (12). Adding one vector at the time

	No Vector. Eq. (10)			Vector X. Eq. (11)			Vector X and Y. Eq. (12)		
Crime-Category	**Total Unempl.**	**Std Error**	**R2**	**Total Unempl.**	**Std. Error**	**R2**	**Total Unempl.**	**Std. Error**	**R2**
Total Crimes	-0,142	0,236	0,866	0.141	0.215	0,869	0,209	0.234	0,870
Burglary	0,250	0,452	0,700	0.561	0.506	0,704	0,677	0.573	0,706
Cartheft	**-2,569	1,041	0,750	**-2.024	0.998	0,751	-1,134	0,926	0,754
Theft and Pilfering	0,417	0,327	0,873	**0.601	0.286	0,874	0,331	0.303	0,875
Theft From Motor Vehicle	-0,304	0,830	0,761	0.126	0.744	0,764	0.352	0.735	0,765
Receiving	*4,617	2,528	0,384	*4.303	2.527	0,384	*4.587	2.499	0,387
Total Violent Crimes	-0,570	0,416	0,812	-0.100	0.453	0,815	0.334	0.463	0,817
Robbery	**3,828	1,780	0,575	**3.820	1.516	0,578	**3.609	1.522	0,578
Assault	-0,423	0,457	0,780	-0.008	0.486	0,784	0.383	0.514	0,785
Rape	-3,361	2,310	0,415	-0.682	2.428	0,421	0.227	2.515	0,423
Vandalism	0,783	0,575	0,766	0.823	0.605	0,767	0.522	0.575	0,769
Narcotics	0,206	1,762	0,705	1.456	1.856	0,708	2.013	2.023	0,709

Note: *** < P-value = 0,01, ** < P-value = 0,05, * < P-Value = 0,1.

Table 13 shows the results from running a regression on equation (9) but with different time periods. Table 13 reveals that the results are sensitive to the chosen period. *TU* has not a significant effect on *Receiving* in any period and shows different signs in the different periods. For *Theft and Pilfering*, *TU* has a significant effect in both periods but with different signs. The unemployment variable only shows the same sign in both periods for five crime-categories but the coefficient is never significant in both periods. As can be seen in Figure 1, the total unemployment rate mostly goes down in the first period. And, in the second period the rate exhibits both ups and downs but mostly ups. One can conclude that longer time-series, and more important great variation, is essential for getting good and reasonable results that are in line with economic theory.

Table 13. Regressions on equation (9). Two different time periods

	Period of 1997-2003. Eq. (9)			Period of 2003-2009. Eq. (9)		
Crime-Category	Total Unempl. Coef.	Std. Error	R2	Total Unempl. Coef.	Std. Error	R2
Total Crimes	-0,267	0.758	0,872	0.748	0.538	0,901
Burglary	*0.960	0.554	0,720	2.058	1.883	0,742
Cartheft	1.452	1.163	0,800	*-3.19	1.670	0,752
Theft and Pilfering	*-0.611	0.360	0,886	**1.16	0.585	0,904
Theft From Motor Veh.	0.216	0.828	0,778	1.181	1.674	0,796
Receiving	4.077	4.045	0,455	-1.021	4.196	0,433
Total Violent Crimes	**1.763	0.842	0,813	-0.114	0.640	0,833
Robbery	**6.582	3.081	0,618	2.459	4.115	0,621
Assault	**1.872	0.915	0,780	-0.027	0.719	0,803
Rape	-1.142	5.378	0,382	-3.982	3.125	0,430
Vandalism	**-2.061	0.840	0,773	***1.286	0.345	0,806
Narcotics	3.830	2.561	0,695	1.547	3.900	0,731

Note: *** < P-value = 0,01, ** < P-value = 0,05, * < P-Value = 0,1.

Does lagging the unemployment variable improve the model? The results of the regressions on equation (13) are shown in Table 14 and 15 below. Overall, the control variables are not much affected. However, results of the coefficients for the unemployment variable do change. The coefficient is now negative for four crime-categories instead of one. In addition to *Car Theft*; *Total Violent Crimes*, *Theft From Motor Vehicle* and *Assault* all have a negative sign on the coefficient for *TU*. Further, the *TU*-coefficient turns insignificant for *Robbery* while the *TU*-coefficient turns significant for *Burglary* instead. The unemployment effect is still significant for *Receiving* and the size of the coefficient has become somewhat larger. It is hard to say if this model is closer to reality than a model without a lag as in equation (9). On the one hand, theory predicts no relationship between unemployment and violent crimes. Even

though the sign in the regression on *Theft from Motor Vehicles* also turns negative, the two other crime-categories that turned negative are violent ones. And, *Burglary* takes *Robbery´*s place and might be considered as a more "pure" property crime. Hence, the results of this model are perhaps more in line with the expected results of the theory. On the other hand, a negative sign on the coefficient of the unemployment variable might seem unrealistic for any crime, making the results of the Baseline Model more reasonable. But again, negative signs could be explained by that criminals substitute violent crimes for more profitable property crimes as proposed by Poutvaara and Priks (2007).

Table 14. Regressions on eq. (13). Lagged Total Unemployment as regressor. All control variables are shown

Vector	Variable	Total Crime	Burglary	Car Theft	Theft and Pilfering	Theft From Motor Vehicle	Receiving	Tot. Violent Crimes	Robbery	Assault	Rape	Vandalism	Narcotics
..	Tot.Unempl. Lag(-1)	0,272	***0,931	-0,718	0,341	-0,346	**6,319	-0,086	2,320	-0,083	1,920	0,637	0,430
		0,227	0,358	0,962	0,318	0,746	2,628	0,433	1,720	0,487	1,936	0,598	2,112
X	Income (First-Diff)	*0,589	1,139	0,422	***0,778	0,306	-0,983	0,166	-2,479	0,044	***5,894	*0,764	-0,542
		0,357	0,833	1,069	0,298	0,944	2,572	0,624	2,507	0,606	1,927	0,432	1,771
X	Prop. With Higher Education	**-2,250	-1,183	*-3,009	***-1,529	**-5,021	-5,000	**-1,709	-8,441	**-1,604	-5,826	*-0,787	***-10,789
		0,991	1,390	1,741	0,446	1,987	4,293	0,760	6,157	0,741	4,830	0,443	2,521
X	Prop. Foreigners	*0,727	***3,319	1,469	***1,649	0,789	*-4,743	0,363	*5,252	0,181	1,476	0,675	-0,822
		0,417	0,971	1,026	0,385	0,665	2,858	0,637	3,118	0,685	2,214	0,658	1,757
Y	Prop. 0	-0,007	-2,450	***-7,571	-0,060	**-3,665	-3,545	1,086	-3,939	1,275	0,770	***1,823	-5,070
		0,720	1,860	1,755	0,750	1,649	7,596	0,973	3,896	1,277	3,693	0,675	3,500
Y	Prop. 15	1,370	-2,928	**-7,345	1,508	**-5,966	13,891	***5,423	1,700	***5,914	-4,790	***5,832	-2,529
		0,927	2,127	3,555	1,350	2,931	10,220	1,886	7,845	1,689	9,084	1,409	5,264
Y	Prop. 20	-0,957	-2,018	-1,402	**-4,506	0,465	*15,449	0,613	7,181	-0,572	8,138	0,880	5,866
		0,990	2,055	4,151	1,798	2,327	8,060	1,751	6,490	1,889	11,483	1,868	6,282
Y	Prop. 25	1,115	1,074	-2,090	0,534	*2,069	**13,463	-0,638	3,411	-0,375	**-13,322	0,274	-0,522
		0,792	1,519	2,343	0,595	1,157	5,842	0,798	8,783	0,792	5,287	1,029	4,008
Y	Prop. 35	1,112	1,149	-2,597	1,325	2,905	***13,223	***-1,781	**7,925	**-2,041	-3,723	0,804	1,777
		1,367	1,720	1,896	0,907	2,464	4,355	0,610	3,717	0,835	3,808	1,162	4,911
Y	Prop. Men	*2,650	0,089	**10,738	0,646	0,517	17,523	1,487	-5,657	1,815	14,685	**-4,738	1,928
		1,363	1,465	5,105	2,321	2,418	21,093	3,163	8,857	3,088	14,586	2,257	7,418
Z	Prop. Divorced	***1,736	**2,458	-1,556	-0,020	0,309	-4,962	***2,235	-4,395	**1,529	***15,044	-0,286	-0,457
		0,538	1,079	2,150	0,819	1,302	5,647	0,649	3,864	0,752	4,088	1,304	2,122
Z	Migration	***1,091	0,731	1,512	***1,617	***1,978	4,393	***2,882	**5,684	***2,977	4,493	**1,106	1,063
		0,372	0,635	1,139	0,531	0,745	3,112	0,455	2,889	0,446	3,770	0,553	2,496
Z	Elec. Participation	-0,446	-0,453	*-2,410	-0,423	0,099	-0,390	*-1,120	-1,111	-0,806	-1,847	0,587	-3,401
		0,291	0,580	1,455	0,327	1,006	4,472	0,683	2,578	0,822	3,191	0,614	2,304
Z	Pop. Density	0,000	0,000	0,000	0,000	0,000	0,000	***-0,0007	***-0,0042	***-0,0009	0,000	*0,0004	0,000
		0,000	0,000	0,000	0,000	0,000	0,001	0,000	0,016	0,000	0,000	0,000	0,000
	R2	0,871	0,707	0,754	0,876	0,766	0,389	0,820	0,579	0,788	0,426	0,770	0,709

Note: Standard Errors are shown below the coefficients. *** < P-value = 0,01, ** < P-value = 0,05, * < P-Value = 0,1.

Table 15. Summary of Statistics in Table 14

Vector	Variable	Regr. with expected sign	in %	Regr. with significant coef.	in %	Number of coef. with expected sign among the significant coef.	in %
..	Total Unempl. Lag(-1)	8 of 12	67%	2 of 12	17%	2 of 2	100%
X	Income (First-Diff)	9(+) and 3(-)		4 of 12	33%	All significant coef. were (+)	
X	Prop. With Higher Education	12 of 12	100%	8 of 12	67%	8 of 8	100%
X	Prop. Foreigners	10 of 12	83%	5 of 12	42%	4 of 5	80%
Y	Prop. 0	4(+) and 8(-)		3 of 12	25%	1(+) and 2(-)	
Y	Prop. 15	7(+) and 5(-)		5 of 12	42%	3(+) and 3(-)	
Y	Prop. 20	7(+) and 5(-)		2 of 12	17%	1(+) and 1(-)	
Y	Prop. 25	7(+) and 5(-)		3 of 12	25%	2(+) and 1(-)	
Y	Prop. 35	8(+) and 4(-)		4 of 12	33%	2(+) and 2(-)	
Y	Prop. Men	10 of 12	83%	3 of 12	25%	2 of 3	67%
Z	Prop. Divorced	6 of 12	50%	5 of 12	42%	5 of 5	100%
Z	Migration	12 of 12	100%	7 of 12	58%	7 of 7	100%
Z	Elec. Participation	10 of 12	83%	2 of 12	17%	2 of 2	100%
Z	Pop. Density	5 of 12	42%	4 of 12	33%	1 of 4	25%
			Aver: 76%		Aver: 34%		Aver: 84%

7. Why Does Not the Coefficient Have the Expected Sign?

In every regression except for one (regression on Eq. (9) for the period of 1997-2003 shown in table 11), the coefficient for the unemployment-variable has the wrong sign when regressed on *Car Theft*. And, the coefficient for *Population Density* only shows the expected sign in 6 out of 12 regressions and only 1 out of 5 significant coefficients had the expected sign in the Baseline Model with *TU* as regressor. In previous papers, the coefficient for the unemployment variable is in general positive and significant for *Car Theft*. In this case, the results of this paper contradict both theory and empirics. A part of the answer to this puzzle might lie in the difficulties of separating the effects of supply and demand. It is possible that, during the period studied in this paper, unemployed people find it too expensive to have a car and perhaps also unnecessary because the car was primary a transportation vehicle to work and back. Hence, it is possible that unemployed people sell their car and therefore might areas with high unemployment contain fewer cars to steal which in the theoretical framework equals a downward shift in demand for crime. This can make car thefts less common in these areas. However, the added income variable should control for indirect effects on demand (Edmark, 2005 p. 357). Thus, the argument that some unemployed people consider a car an

unnecessary transport vehicle (thus substitute it to another product) seems to be the most plausible explanation. But, one question arises. Why has not this been the case before? Regarding the wrong sign of the coefficient for *Population Density* Edmark (2005) discovered similar properties of this variable. Edmark (2005) argues that, due to the fixed effect model specification, the coefficient for *Population Density* actually measures changes in the population density. This implies that there is a connection between a negative trend in population density and crime rates. It might be the case that the negative sign actually reflects omitted municipality-specific factors that correlates with changes in population density. Edmark (2005) tests her hypothesis by including county specific time trends, which should capture such effects of omitted variables. In this model, most of the signs turn to positive thus implying that the hypothesis was correct.

8. Economic Consequences on Society

With the above results in mind it is clear that the costs of unemployment not only are direct costs in the form of unemployment benefits etc, but also indirect costs in the form of costs of crime. Exploring the relationship between unemployment and crime is important to obtain a better picture of the true costs of unemployment, which might have an impact on future policy decisions. Previous research on the social costs of crime generally concludes that even property crimes have great costs to society although violent crimes generally are many times more costly to society. The above showed results on especially the link between *LTU* and different violent crimes can therefore be of substantial economic importance at the aggregated level. For a discussion on the social costs of crime and different methods of estimation see, Cohen et. al. (2004), Cohen (1998), Miller et. al. (1996) and Boardman et. al. (2011, Ch. 16).

9. Conclusions

Studies on the link between unemployment and crime have shown mixed results. Scientists have, at the aggregated level, failed to find strong evidence of the positive link proposed by Erlich (1973) among others. However, more and more studies have recently found statistically significant relationships between unemployment and crime. For Sweden, the two latest studies using aggregated data (Edmark 2005 and Agell & Öster (2007)) found a strong link between unemployment and some property crimes.

In this paper I use a fixed effect panel-data model and adds some further evidence on the proposed link between unemployment and crime. The results from the Baseline Model suggest an association between total unemployment (age 16-64) and mainly property crimes, just as theory predicts. Total unemployment seems to have a significant effect on five crime-categories; *Total Crimes*, *Burglary*, *Receiving*, *Robbery* and *Narcotics*. Youth unemployment (age 18-24) seems to have a weaker relationship with crime rates. A significant effect is only found for two crime-categories, *Narcotics* and *Burglary*, and the coefficients are overall much smaller. Long-term unemployment (age 20-64) is also studied in this paper. In contrast to the previous unemployment categories, long-term unemployment exhibits a strong association with violent crimes in addition to property crimes. The result is some evidence of a link between long-term unemployment and alienation, which in turn might induce violent behaviour. This finding cannot be explained by basic economic theory, hence this study reveals a clear discrepancy between empirics and basic theory of economics of crime. Several alternative specifications are also made in this paper. Since the Baseline Model suffers from tendencies of auto-correlation this model is slightly modified and regressed again. With this alternative specification total unemployment only has a significant effect on *Receiving* and *Robbery* and youth unemployment shows no significant effect on any crime-category. Long-term unemployment still shows a strong association thus unaffected by the alternative specification except for slightly smaller sizes of the coefficients. However, due to the chosen specification the results from these alternative regressions are an underestimate of the total unemployment effect. The total effect also includes a long-term dynamic effect of unemployment and crime.

One might be surprised that youth unemployment shows a weaker correlation with various crimes than the other two unemployment-categories. The result might falsely give the impression that the results of this paper contradict common wisdom of that young people are more likely to commit crime than the overall population. I believe that, regarding this matter, the correct interpretation of the results give at hand that younger people indeed are more likely to commit crime than others. But, even more so if their parents are or have been unemployed, and especially if long-term unemployed.

When alternating control variables, testing with different time periods and lagging the unemployment variable three crime-categories stand out as robust to different specifications; *Receiving, Robbery* and *Burglary* show a strong relationship with total unemployment.

Alternative specifications give at hand that these kinds of studies can be sensitive to the chosen period of time. This highlights the importance of choosing periods that clearly exhibits great variation in the unemployment rate. At last, research on the costs of crime tells us that evidence of a link between unemployment and various crimes can be of major importance if you have the ambition to reveal the true costs of unemployment.

References

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Appendix

YU (Youth Unemployment): Defined as the number of unemployed people in the age group 18-24 registered at The National Labour Market Board as "jobseekers" (people in labour market programs are included) divided by the total number of persons in the age group.

TU (Total Unemployment): Defined as the number of unemployed people in the age group 16-64 registered at The National Labour Market Board as "jobseekers" (people in labour market programs are included) divided by the total number of persons in the age group.

LTU (Long-Term Unemployment): The nominator is defined as the number of people in the age group 20-25 who have been registered at The National Labour Market Board as "jobseekers" for at least 100 days, plus the number of people in age group 26-64 that have been registered for at least 6 months (people in labour market programs are included). The denominator is defined as the number of people in age group 20-64.

Income: Defined as the annual mean total earned gross-income for the individuals of age 20+ deflated with the KPI-index (Consumer Price Index). The figures are in 1000 kr. When regressed the variable is the logarithm of the first-difference transformation.

Proportion With Higher Education: Defined as the number of people in the age group 16-74 with post high school education for 3 years or more divided by total population.

Proportion Foreigners: Defined as the number of people not born in Sweden (1^{st} generation immigrants) plus the number of people with both parents not born in Sweden (2^{nd} generation immigrants) divided by total population.

Proportion Men: Defined as the number of men divided by total population.

Proportion 0: Defined as the number of individuals in the age group 0-14 divided by total population.

Proportion 15: Defined as the number of individuals in the age group 15-19 divided by total population.

Proportion 20: Defined as the number of individuals in the age group 20-24 divided by total population.

Proportion 25: Defined as the number of individuals in the age group 25-34 divided by total population.

Proportion 35: Defined as the number of individuals in the age group 35-44 divided by total population.

Migration: Defined as the number of people that move across the boundary into- and out from the municipality during a year divided by the total population of the municipality.

Proportion Divorced: Defined as the number of divorced divided by the sum of divorced and married people.

Population Density: Defined as the total population divided by the area of the municipality in km^2.

Election Participation: Defined as number of voters divided by the total number of people entitled to vote.

Crime Categories: Number of crimes are reported as per 100 000 inhabitants. *Narcotics* refers to violation of Swedish drug laws. *Receiving* refers to both buying and selling stolen goods. Other crime-categories are explained by their titles. All crime statistics are collected from The National Council for Crime Prevention, which uses the definitions of the Swedish Law. "Attempt" is included in the crime category if there is such concept stated in law for the particular crime.