Did the recent unemployment boom in the Netherlands affect crime rates?

seo economic research

Amsterdam, December 2014

Did the recent unemployment boom in the Netherlands affect crime rates?

Evidence from a 2005-2012 panel data analysis

Paul Bisschop

seo economisch onderzoek

SEO Economisch Onderzoek - Roetersstraat 29 - 1018 WB Amsterdam - T (+31) 20 525 1630 - www.seo.nl - secretariaat@seo.nl
ABN-AMRO IBAN: NL14ABNA0411744356 BIC: ABNANL2A - ING: IBAN: NL96INGB0004641100 BIC: INGBNL2A
KvK Amsterdam 41197444 - BTW NL 003023965 B01

"The science of knowing"

SEO Economic Research carries out independent applied economic research on behalf of the public and private sectors. This research makes a major contribution to the decision-making processes of our clients. SEO Economic Research is affiliated to the University of Amsterdam. This gives us access to the latest scientific methods. Operating on a not-for-profit basis, SEO continually invests in the intellectual capital of its staff by arranging for them to pursue graduate studies, publish scientific works and participate in academic networks and conferences.

Disclaimer: This is a discussion paper, not a completed research report. The content of the paper is not final and may be amended on the basis of discussions and developing insights.

SEO-Discussion paper nr. 78

Abstract

This paper uses municipality-level unemployment rates during 2005-2012 to identify the effect of unemployment on different crime rates. The fixed effects regression finds evidence for a relationship between unemployment and burglary. For every ten percent increase of the unemployment rate, burglary crime shows a three percent increase. Assuming a mean crime cost of $ 46,000 per burglary, the unemployment boom from four percent to seven percent between 2005 and 2013 led to $ 725 million (1999 dollars) additional crime costs. The results indicate that, with respect to burglary, motivational factors of unemployment dominate opportunity factors. The analysis provides no evidence for a significant relationship between unemployment during 2005-2012 and assaults, sexual offences and vandalism.

(JEL-classifications: J6, K4)

Content

1 Introduction

An individual time allocation model provides insight to the unemployment-crime relationship. Unemployment can affect crime through motivational and opportunity factors. Previous empirical work finds evidence for a positive causal relationship between unemployment and property crime. The evidence for a relationship between unemployment and violent crime is less convincing.

The early theoretical framework of Becker (1968) and Ehrlich (1973) triggered many economists to focus on the impact of socio-economic factors on crime rates. The relationship unemployment-crime is one of the most popular topics in crime economics literature. Departing from Becker's assumption of high crime levels as a consequence of low legitimate income possibilities, many researchers empirically have tried to identify the effect of unemployment on crime rates.

Unemployment and crime: a time allocation model

From an economic viewpoint, criminal activity can be seen as a form of employment that requires time and generates income (Witte & Taucher, 1994). The most simplified models predict that work activity and crime activity are substitutes. A rational individual compares returns to legal and illegal activity and makes decisions accordingly. Increasing job-availability and wages in these models makes crime activity relatively less attractive and therefore decreases crime levels. Vice versa, decreasing job-possibility raises the relative returns to criminal activity.

To formalize these assumptions, consider the model derived from Grogger (1998) and Raphael & Winter-Ebmer (2001). Figure 1 shows two consumers which allocate their available non-market time *A* between illegal activity, labor activity and other activity. The extent to which a consumer spends time on a certain activity, depends on the marginal returns of activities and the marginal utility derived from indifference curves (Grogger, 1998). In figure 1A, the negative slopes of the curves *BCE* (criminal activity) and *CD* (potential wage from labor activity) denote the marginal returns. The marginal returns of criminal activity are diminishing, following from the assumption that an individual first chooses crime targets with the highest expected returns. A steeper slope of the curve *CD* at time *t* means a higher marginal return for labor activity at time *t*.

From figure 1A, at time $A - t0$ marginal returns of criminal activity (*BC*) are higher than marginal returns of labor activity (*CD*) since the slope *BC* is steeper than *CD*. To the left of *t0*, marginal returns of labor activity exceed marginal returns of criminal activity. Consumer 1A first locates the point where marginal return of labor equals marginal return of criminal activity. Time allocations to the right of this point *C* ($A - t0$) are devoted to criminal activity, time allocations to the left involves a combination of labor and criminal activity. Consumer 1A's time spent on labor equals $t1 - t0$, for utility is maximized at time point *t1*.

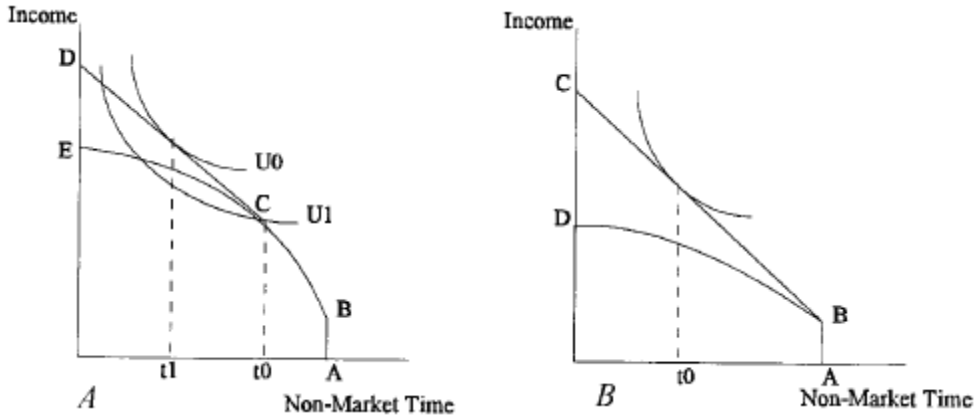
Individual 1B's marginal return of criminal activity (*BD*) never exceeds the marginal return of labor (*BC*). Therefore, this individual will never involve in criminal activity as long as this person is able to compete in the labor market. Consumer 1B also spends time $A - t0$ to labor activity, to maximize utility.

The effect of unemployment depends on an individual's preferences (or indifference curves) (Raphael & Winter-Ebmer, 2001). For consumer 1A, whose initial return of criminal activity exceeds potential wages, the budget constraint shifts from *ABCD* to *ABCE* as a response to unemployment (potential wage is cancelled). The optimal time allocation decision in absence of unemployment for person 1A is located to the left of point *C*. In other words, in point *C* the marginal rate of substitution (marginal return of indifference curve U1) is lower than the marginal rate of the new budget constraint *ABCE*. The new optimal point where marginal utility equals the slope of the budget constraint is therefore located to the left of *t0*. Accordingly, consumer 1A allocates more time to criminal activity in this new situation.

Thus consumer 1A, formerly engaged in criminal activity (*A* – *t0*) and labor activity (*t1* – *t0*), will now spend more time than before on criminal activity as a response to the shift of the budget constraint. However, for a consumer with the same budget constraints as consumer 1A, but previously only engaged in criminal activity (other indifference curves), unemployment will not affect his optimal allocation.

Consumer 1B's budget constraint changes from *ABC* to *ABD* in case of unemployment. Whether this consumer starts offending depends on the consumer's reservation wage. Consumers with a high reservation wage (e.g. because of high non-labor income) are not likely to involve in crime to compensate for unemployment. On the other hand, people with low reservation wages are more likely to commit crimes to cover for their income loss due to unemployment (Raphael & Winter-Ebmer, 2001).

Figure 1 Time allocation model



Source: Raphael & Winter-Ebmer (2001)

The model above shows that the extent to which unemployment leads to higher crime rates depends on the preferences of unemployed individuals. A society with relatively many consumer 1A-type individuals, who experience relatively high expected return to crime, will suffer higher crime rates due to rising unemployment rates. The question how individuals allocate their time in response to unemployment is an empirical one. Many previous studies attempted to analyze the relationship between unemployment empirically.

Motivational and opportunity factors

Canton & Land (1985) mention two factors through which unemployment may affect crime rates. Following the *routine activity theory* (Cohen & Felson, 1979), they argue that unemployed people find themselves in places where the risk of being victimized to crime is low and that they are more likely to be at home to guard their belongings. In addition to this *guardianship effect*, Canton & Land (1985) mention a *system activity effect*. This effect accounts for the downward shift of production and consumption activity in economic downturns. That affects the availability of lucrative targets as well as the consumption of crime-related commodities, like alcohol. Hence, unemployment will reduce crime opportunities, as a consequence of a *guardianship effect* and a *system activity effect*.

On the other hand, motivational factors could explain an increase in crime through an upward shift of unemployment. Unemployed people are more motivated to involve in crime because of financial needs. In addition, employed people are more likely to commit crimes in recessions because they find themselves underemployed or forced to stay in jobs they dislike (Cantor & Land, 1985). According to this theory, unemployment will increase crime, especially crimes that involve financial motivation.

At a macro-level, Canton & Land (1985) argue, many empirical studies do not find clear relationships between unemployment and crime, because opportunity factors and motivational factors simultaneously take place and cancel out.

Cook & Zarkin (1985) mention two possible ways through which a poor business condition can increase crime. First, legitimate opportunities are scarce in economic downturns. High unemployment rates can promote crime by lowering opportunity cost of time spent in criminal activity. Second, lower tax collections during economic bad times can cause governments to reduce police budgets. In addition, Cook & Zarkin (1985) list two factors that can work procyclical on crime: criminal opportunities and the consumption of crimogenic commodities. Economic booms bring attractive opportunities for criminals, especially for those with financial motives. Potential victims earn more and spend less time to defend their belongings. Assuming that the consumption of crimogenic commodities like alcohol is higher when an economy is booming, alcohol related crime (mostly violent crime or vandalism) also is likely to increase.

Previous empirical work

As criminologists identify both negative and positive effects of unemployment on crime (Cantor & Land, 1985; Paternoster & Bushway, 2001), the question which effect dominates is an empirical matter. During the 1990's, most crime economists were fascinated by a drastic fall of crime rates in most Western countries, combined with increasing social problems like youth unemployment. It led to many empirical investigations on factors that potentially explain crime levels.

Chiricos (1987) provides a review of studies from 1960-1987 that examined the unemployment-crime relationship with aggregate data. He distinguishes property crime estimates from violent crime estimates and finds that property crime is positively affected by unemployment in most studies (85 percent of the estimates). Only 40 percent of the estimates on property crime shows a significant positive relationship. Among property crime, most significant relationships are found for burglary (52 percent) and larceny (47 percent). 21 percent of the car theft estimates resulted in

a significant positive relationship. Of all 138 estimates on violent crime, only 22 percent found a significant positive relationship with unemployment. Within the broad category violent crime, rape and general violent crime are most frequently positively affected by unemployment.

The review also addresses methodological differences in previous empirical studies. As most economists would agree, the effect of unemployment on crime would be best examined by individual micro-level data analysis. A lack of availability of this microeconomic data forces most students of crime to work with aggregate data. Chiricos (1987) finds that studies that use data of lower aggregation levels more frequently find positive relationships. He argues that those studies capture higher variation in unemployment and crime levels and therefore are more likely to find strong effects.

In a later review, Freeman (1999) classifies the effect of unemployment on crime as quite small. A one percentage point drop of unemployment decreases crime rates by approximately two percent (Bushway & Reuter, 2001). Freeman (1999) argues that unemployment is not the overwhelming determinant of crime, because crime and legitimate work are not exclusive activities. Not every crime is committed by a jobless person. More recent studies with sophisticated methodologies confirm that unemployment significantly affects property crime (Gould et al., 2002; Lin, 2008; Altindag, 2012; Buonanno et al., 2014)

This paper analyses to which extent crime rates in the Netherlands were affected by the recent economic crisis. It therefore uses municipality level data from 2005-2012. As most studies on the unemployment-crime relationship are conducted on US data, the Dutch context offers another research environment. A recent empirical study in the Netherlands, based on a high risk sample of juveniles, showed that employment was associated with decreased levels of recidivism for both men and women (Verbruggen et al, 2012). Some studies suggest that the magnitude of the relationship depends on the level of social benefits in a country (Aaltonen et al, 2013). Given that the financial shock to those who turn unemployed in the Netherlands is smaller than in the US, one might expect smaller positive effects in this study. However, Oster & Agell (2007) also find significant effects of unemployment on property crime in Sweden, a country known for its relatively high social insurance level.

2 Empirical framework

The analysis uses panel data of Dutch municipalities to estimate the effect of unemployment on several types of crime. Municipality fixed effects and time fixed effects control for municipality characteristics and general crime trends that influence crime rates. To control for other factors, a set of additional regressors is included.

The empirical strategy in this paper is to use a municipality-level panel dataset with annual data for the period 2005-2012. The dataset covers information for 406 Dutch municipalities. Using the panel structure of the data set, this paper tests for the relationship between unemployment and four types of crime: burglary, assault, sexual offences and vandalism. The empirical tests in this paper rely on an aggregated relationship between unemployment rate and crime rates, implying that the analysis needs to control for other factors that systematically vary with regional business cycles and affect crimes.

The log-log specification is common in empirical studies of crime (Ehrlich, 1973; Entorf & Spengler, 1998; Papps & Winkelmann, 2000). Hence, parameter β can be interpreted as an elasticity. For instance, if β is 0.8, then a ten percent increase in the regressor variable leads to a eight percent increase in the outcome variable. A log-log specification is preferable, since data plots indicate that the relationship between the log unemployment rate and the log crime rates best fit a linear relationship. The analysis starts from a reduced regression form following the log-log specification (1):

$$(1) \qquad \ln crime_{it} = \alpha + \gamma_i + \lambda_t + \beta \ln u_{it} + \varepsilon_{it}$$

Subscript *i* denotes the municipality and *t* the year of observation. ε_{it} is the error term and is assumed to have mean zero. Parameter α is a constant, u contains the unemployment rate of municipality *i* in year *t*. The parameter of interest is β, the effect of unemployment on a certain crime rate. The γ and λ-terms are the municipality fixed effects and the time specific effects. Including time-effects accounts for factors that vary over time but are the same for all municipalities. Hence, time-effects control for the general crime trend in the Netherlands. Municipality fixed-effects control for factors that are different between municipalities but are constant over time.

The crime-unemployment elasticity from equation (1) is identified by within-municipality differences in unemployment relative to the national unemployment rate. Time-effects and entity-effects included, the model still can suffer from omitted variable bias with respect to the estimated unemployment effect β. This is the case if variables are omitted that neither are constant over time nor constant over municipalities. To control for these factors, specification (1) is further expanded:

$$(2) \qquad \ln crime_{it} = \alpha + \gamma_i + \lambda_t + \beta \ln u_{it} + \theta X_{it} + \varepsilon_{it}$$

X denotes a vector of demographic and socio-economic controls that potentially explain variation in crime. One of these regressors is the mean standardized income per household. Previous studies

showed that mean income and crime rates are related (Lin, 2008; Öster & Agell, 2007). Other studies identify income inequality as a determinant of crime rates (Raphael & Winter-Ebmer, 2001; Levitt, 1999). The evidence for the effects of income inequality on crime rates is rich (see for instance Rufrancos et al. 2013). However, due to a lack of complete income inequality data, I use mean standardized household income to control for income effects.

To control for urban areas, that usually deal with higher crime levels, I use population density and the share of foreign population as control variables. Crime numbers potentially are influenced by the effort and success of local police forces in apprehending criminals. I include clearance rates of property crime, violent crime and vandalism as control factors. I use one-year-lagged values of clearance rates, since criminals most likely are deterred by the police's success in the recent past.

The possible effect of education level on crime can work two ways. First, the mean education level of offenders is low, so municipalities with a large share of low educated people have higher chances of possible offenders among their population. Vice versa, municipalities with a large share of high educated people have lower chances of possible offenders among their population. At the same time, education level is correlated to mean income. A municipality with many high-income residents creates attractive targets for criminals who seek high expected payoff crimes. Simultaneously, rich people make more effort to protect their property.

Last, I include mean unemployment of neighboring municipalities as control variable. Although offenders in most cases commit crimes close to their homes (see Oude Alink, 2010; Bernasco & Nieuwbeerta, 2005), it is always possible that they cross municipality borders to do their criminal job.

3 Data

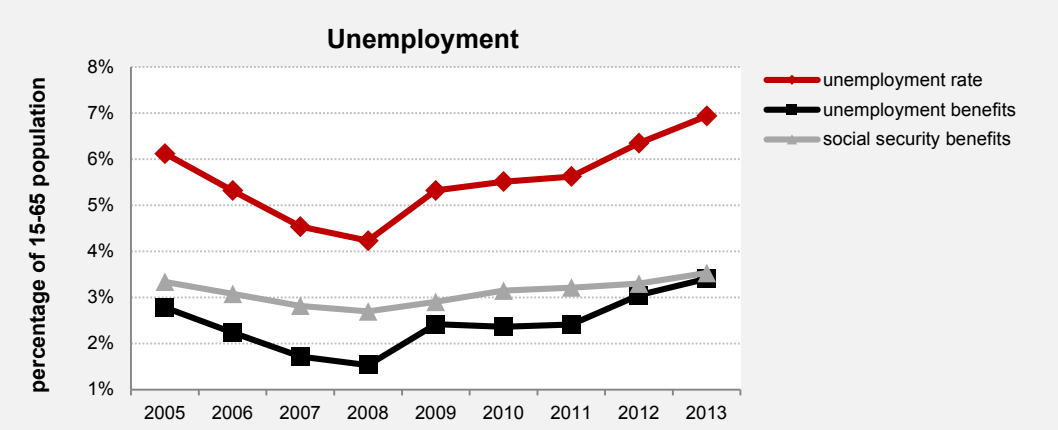
All data in this analysis are obtained from CBS Statline. Crime rates are derived from police data and are presented as number of offences per 1,000 population. Unemployment rates are obtained by adding the number of social security benefits and the number of unemployment benefits. Unemployment rates are expressed as a percentage of the population aged 15-65.

Unemployment rates

The analysis uses municipality-level annual unemployment rates derived from registration data. The official Dutch CBS unemployment measure is derived from the national labor force survey. It is not possible to obtain reliable numbers of this measure at the municipality level. Hence, I use a proxy for unemployment. This paper determines unemployment rates by dividing the total of social security benefits and unemployment benefits at the beginning of the third quarter of each year by the total population aged 15-65.

Figure 2 points out the increasing unemployment rates since the beginning of the economic crisis in 2009. Both unemployment benefits and social security benefits were at a minimum in 2008 (1.5 percent and 2.7 percent respectively). Strong increases in 2009, 2012 and 2013 brought the national unemployment rate to almost 7 percent in 2013.

Figure 2 Unemployment rate is increasing since 2009



Source: CBS Statline

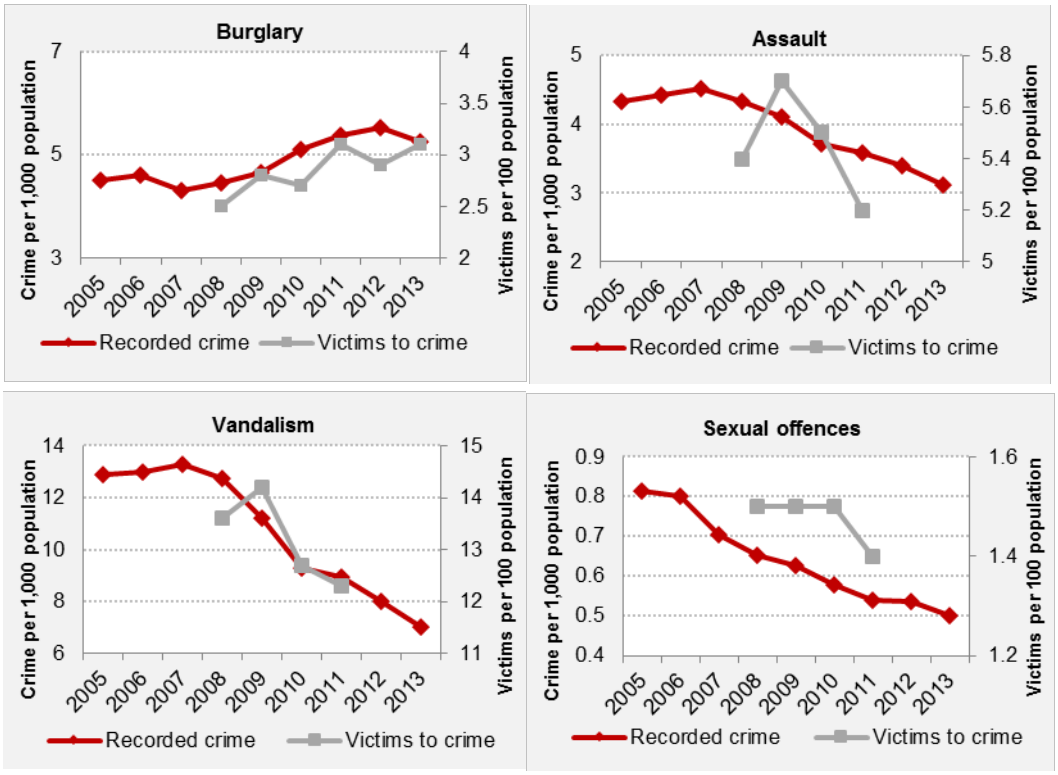
Crime rates

Crime measures often underestimate true numbers of committed crimes. Not every crime committed ends up in a police report. A Dutch victimization survey shows that little more than 66 percent of victims reports burglary. The report rates for assaults, sexual offences and vandalism are much lower: 52 percent, 12 percent and 22 percent respectively. The reasons for not reporting crimes are various. Violent offences often are not reported because the crime was not important enough in the victim's perception (30%) or the problem already was solved (20%). Taking this into account, police registrations only account for the more serious incidents. A significant part of the

victims to property crime (45%) and vandalism (36%) did not report because they thought reporting was useless (Huys, 2010). The fixed effects specification in this paper controls for national changes in report rates over time and for differences in report rates among municipalities that are stable over time.

The used dataset contains administrative records of crime reports of the Dutch police[1]. For each year from 2005-2013 the dataset contains the number of offences for all 408 Dutch municipalities, for different crime categories. This paper distinguishes into four different crime categories: (1) burglary, (2) assault, (3) sexual offences and (4) vandalism. The sexual offences category is a total of sexual assault and rape[2]. Figure 3 shows the recent trends of the four crime categories. In addition, it compares crime rates to victim numbers in the same period[3].

Figure 3 Increasing burglary rates, decreasing violent crime and vandalism 2005-2013.



Source: CBS Statline.

The number of burglary offences per 1,000 population follows an increasing trend for the period 2007-2012. The other three crime categories show a different pattern. Both assault rates and vandalism rates increase until 2007 and drop afterwards. The number of sexual offences per 1,000 population decreases during the complete observation period 2005-2013. The victimization trends largely run parallel to the corresponding crime registration trends.

1 The administrative records are made available for open access by CBS (Statistics Netherlands) via CBS Statline.
2 Appendix A presents spatial distributions of crime and unemployment rates across municipalities.
3 Victimization numbers are from the Politie Monitor Bevolking (PMB), a large victimization survey. Results from this survey are also available via CBS Statline.

Other regressors

The analysis in this paper controls for various factors that potentially explain crime rates. The regressors include a list of economic, socioeconomic factors as well as police clearance rates. Table 1 summarizes these statistics.

Crime registrations are rounded to the nearest fifth digit. Crime rates are expressed in registrations per 1,000 individuals. The clearance rate is the ratio of the number of crimes cleared to the total numbers of crime in a category, municipality and year. A crime is classified as 'cleared' if at least one suspect of that crime is known to the police, leaving out whether that suspect is a fugitive or is denying the crime. Clearance rates are provisional, since clearances of crimes that occurred many years ago can drive the clearance rate of that particular year up.

Income denotes the mean standardized annual income per household. This measure controls for the composition and size of households and therefore is comparable between municipalities. Income data for 2005 is missing. The education level variable represents the percentage of people aged 15-65 that owns a degree in level 5, 6 or 7 in accordance with the ISCED.[4] In the Netherlands that is, the ratio of people owning a degree in hbo, wo or a comparable vocational degree.

The unemployment rate of adjacent municipalities is conducted via an adjacency matrix. In this 406 x 406 matrix Φ, the *i j* element takes value 1 if municipalities *i* and *j* share a common border, and 0 otherwise. The matrix Φ then is multiplied by a vector *U,* containing unemployment rates of municipalities in a certain year. The product Φ x *U* now is a vector with average unemployment rates of neighboring municipalities. The average unemployment rates have not been weighted for municipality size.

[4] International Standard Classification of Education.

Table 1 Summary statistics

Variable	Description	Obs.	Mean	Weighted Mean	St.dev.
Burglary rate	Burglary per 1,000 population	3176	3.73	4.75	2.01
Assault rate	Assaults per 1,000 population	3176	2.94	3.97	1.51
Sexual crime rate	Sexual offences per 1,000 population	3176	0.53	0.64	0.34
Vandalism rate	Vandalism offences per 1,000 population	3176	9.84	10.86	4.26
Unemployment rate	Ratio of social security + unemployment benefits to population aged 15-65	3176	0.04	0.05	0.02
Population density	Population per 1 km^2	3176	814.00	1612.73	967.28
Foreign population	Foreign people per 1,000 population	3176	130.23	202.45	76.05
Young men	Men aged 15-30 per 1,000 population	3176	179.67	183.22	17.36
Income	Mean standardized income per household (x 1,000 euro)	2776	23.64	23.12	2.74
Education level	Ratio of people aged 15-65 with a degree in higher education to population aged 15-65	2746	0.24	0.27	0.08
Clearance rate theft & burglary	Clearance rate theft & burglary offences	3255	0.11	0.12	0.04
Clearance rate violent crime	Clearance rate violent crime	3254	0.66	0.65	0.10
Clearance rate vandalism	Clearance rate vandalism	3251	0.16	0.18	0.06
Unemployment neighboring municipalities	Mean (unweighted) unemployment in neighboring municipalities	3256	0.04	0.04	0.01

Source: CBS Statline

4 Results and analysis

Only the burglary rate was significantly affected by the unemployment rate between 2005-2012. For every ten percent increase in the unemployment rate, the burglary rate increases three percent. The total costs of burglary crime due to an increased unemployment rate between 2008 and 2013 are calculated at more than $ 725 million.

Table 2 presents the results of the main regression analysis. The dependent variables are log-values of burglary, assault, sexual offences and vandalism rates. Moreover, the covariates are log-values too, to create an intuitively interpretable model. Hence, a coefficient of 0.5 means that a ten percent increase of that variable causes a five percent increase of the outcome variable.

Burglary is the only type of crime that is significantly affected by unemployment rates. The coefficient of 0.297 implies that a ten percent increase in unemployment leads to a three percent increase in burglary rates. The effect is robust against other log-log specifications. The three percent elasticity is high in comparison with property crime effects found in studies from other countries (Lin, 2008). The effect of unemployment on assault and sexual offences is positive, but not significant. There is no evidence for effects of unemployment on vandalism.

Assuming that the effect of unemployment on crime mainly runs through those newly unemployed, a lagged value of unemployment might lead to stronger results. An unemployed individual might first spend his savings before turning to crime to earn income. If that is the case, long term unemployed are likelier to commit crimes than new unemployed and a lagged value of unemployment would better explain variation in crime rates. Running the regression, lagged unemployment shows significant positive coefficients on assault and sexual offences. The effects are small: 1.9 percent for assault and 2.4 percent for sexual offences. The only crime type that includes financial motives, burglary, is not affected by the lagged value of unemployment.

Unemployment in adjacent municipalities does not seem to influence crime rates. Sexual offences seem to be an exception, where higher levels of neighboring municipalities are associated with lower crime levels. This finding is significant at the 5 percent level. The results indicate that population density is an important estimator for crime rates. A large share of the variation in burglary, assault and vandalism rates is explained by variation in population density. An increase of ten percent of population density increases crime rates by 6.9 to 7.6 percent. The share of immigrants also has a significant positive impact on burglary and sexual offences.

In contrary to many previous studies, this study does not find evidence for effects of the share of young men in the population. The share of high educated residents has a small positive significant effect on vandalism and a small negative significant effect on burglary.

The most interesting results from a policy perspective are the negative effects of lagged clearance rates. Although the coefficients are small, potential criminals seem to get deterred by apprehension success of the police. A ten percent increase of the clearance rate leads to a 0.9 percent decrease of burglaries, a 1.3 percent decrease of assault and a 0.5 percent decrease in vandalism. Raising assault

clearance rates ultimately leads to the best results in terms of lower crime rates. The crime rate of sexual offences is not affected by the police's clearance rate.

Table 2 Only burglary rates are affected by unemployment rates

	burglary	**assault**	**sexual offences**	**vandalism**
constant	-1.129	**-8.844****	**-14.210***	**-6.097***
	(4.747)	**(4.086)**	**(7.273)**	**(3.371)**
unemployment	**0.308*****	0.049	0.164	-0.000
	(0.093)	(0.070)	(0.137)	(0.064)
unemployment adjacent	-0.022	0.077	**-0.289****	0.047
municipalities	(0.116)	(0.068)	**(0.124)**	(0.054)
clearance rate t-1	**-0.090*****	**-0.132*****	-0.111	**-0.045*****
	(0.031)	**(0.042)**	(0.076)	**(0.015)**
income	-0.305	0.181	1.084	**0.854****
	(0.581)	(0.506)	(0.794)	**(0.407)**
population density	**0.735*****	**0.762*****	0.693	**0.689****
	(0.202)	**(0.200)**	(0.478)	**(0.310)**
immigrants	**0.440***	0.325	**0.879****	0.166
	(0.231)	(0.224)	**(0.343)**	(0.163)
men aged 15-30	-0.450	0.603	-0.188	-0.193
	(0.696)	(0.562)	(1.047)	(0.543)
high educated	**-0.164****	0.088	0.086	**0.097***
	(0.082)	(0.061)	(0.111)	**0.052**
year effects?	yes	yes	yes	yes
municipality effects?	yes	yes	yes	yes
N	2,323	2,323	2,250	2,323
r^2 (within)	0.30	0.32	0.14	0.61
r^2 (between)	0.35	0.28	0.10	0.29

* = significant at the 10% level, ** = significant at the 5% level, *** = significant at the 1% level. Standard errors in parentheses.

Following Altindag (2012), it is possible to calculate the economic impact of the crime increase due to unemployment growth in the recent economic recession[5]. The back-of-the-envelope-calculation presented here is based upon the work of Anderson (1999), who estimated the costs of several crime components. Altindag (2012) pointed the average costs of a property crime at $ 46,000 (1999 US dollars).

The recent economic crisis drove the unemployment rate up from four to seven percent (see Figure 2), a change of 75 percent. The 0.297 burglary coefficient implies a 22.3 percent change in burglaries due to the increase of unemployment during the recession. In the Dutch context, that means an extra 15,770 burglaries as a consequence of the unemployment rate increase between 2008-2013.

5 Appendix B shows the calculations in more detail.

The total crime costs of extra burglaries in the Netherlands between 2008 and 2013 are calculated at more than $ 725 million (1999 US dollars)[6].

[6] Taking into account the average costs per crime of 46,000 USD (Altindag, 2012).

5 Conclusions

Only the burglary rate is significantly affected by the unemployment rate. For burglary, motivational factors dominate opportunity factors. This study provides no evidence for the relationship between unemployment and assault, sexual offences and vandalism.

This paper studied the impact of unemployment rates on crime rates in the Netherlands between 2005-2012. It uses a panel data regression on 406 municipalities. The regression results show that only for the burglary rate the relationship unemployment-crime is significantly positive. The effect is high in comparison to previous findings: an elasticity of 0.297. The effect of unemployment on other types of crime is positive, but not significant. The results in this paper confirm what previous studies in crime literature suggested: the link between property crime and unemployment is stronger than the link between violent crime and unemployment.

A back-of-the-envelope-calculation estimates the total of additional burglaries in the Netherlands as a result of the 2008-2013 unemployment rate increase at 15,770. Taking a mean cost value of $ 46,000 (1999 US dollars) (Anderson, 1999), this counts for over $ 725 million burglary crime costs due to unemployment growth between 2008-2013.

Drawing back to the theoretical framework, the results indicate that motivational factors dominate opportunity factors for burglary crime. Economic downturns restrict the possibilities to legitimate income for some groups of people. Criminal payoffs become relatively financially attractive for these groups. The results show that at least some groups of people increased their burglary activity as a consequence of unemployment growth.

With respect to assault, sexual offences and vandalism, this paper provides no evidence for the relationship unemployment-crime. Hence, for these crimes it is not clear whether opportunity factors dominate motivational factors or vice versa. A potential explanation is that the *system activity effect* neutralizes the motivational factors. Consumption is lower during economic downturns, and so is the consumption of crimogenic goods. Violent offences, sexual offences and vandalism are more likely than burglary to be influenced by consumption of alcoholic- (or drug-) commodities. The analysis does not control for alcohol consumption, so it is possible that unemployment includes the system activity effect, which is larger for assault, sexual offences and vandalism.

An interesting result from a policy perspective is the relationship between police clearance rates and crime. Criminals, especially those involved in burglary, assault and vandalism, seem to get deterred by the police's success to clear cases. At first this might sound obvious. A higher clearance rate means a higher apprehension rate, so apprehended criminals are forced to stop or at least reduce their criminal activity. However, with low mean clearance rates for burglary (10.5%) and vandalism (15.8%) and high frequency of burglary and vandalism offences, apprehended criminals only represent a fraction of total offenders in a population. Although the coefficients of clearance rate are small, the significant effect suggests that investments in police success rates pay off. An interesting feature for further research is to dig deeper into the effectivity of these clearance rates.

At what cost is it cost-effective to raise clearance rates in order to lower crime rates and save costs of crime?

Furthermore, more insight is needed into the rationale of offenders. Little is known about the role of motivational and opportunity factors in different crime decisions. In addition, there is little broad-scale information about offender characteristics, like occupation and income position. Ultimately, the extent to which business cycle-motives play a role in criminal behavior can best be estimated at a micro-level. So far, data availability restricts economic researchers to work with aggregate supply-of-offence functions. More detailed micro-data is needed to better understand criminal's motives in order to prevent crime.

References

Aaltonen, M. & Macdonald, J.M. Martikainen, P. & Kivivuori, J. (2013). Examining the Generality of the Unemployment-Crime Association. *Criminology*. 51. (3). 561-594.

Altindag, D.T. (2012). Crime and unemployment: Evidence from Europe. *International Review of Law and Economics*. 32. 145-157.

Anderson, D.A. (1999). The Aggregate Burden of Crime. *Journal of Law and Economics*. 42. (2). 611-642.

Becker, G.S. (1968). Crime and Punishment: An Economic Approach. *The Journal of Political Economy*. 76. (2). 169-217.

Bernasco, W. & Nieuwbeerta, P. (2005). How Do Residential Select Target Areas? A New Approach to the Analaysis of Criminal Location Choice. *British Journal of Criminology*. 44. 296-315.

Buonanno, P., Drago, F. & Galbiati, R. (2014). Response of Crime to Unemployment: An International Comparison. *Journal of Contemporary Criminal Justice*. 30. (1). 29-40.

Bushway, S. & Reuter, P. (2001). Labor Markets and Crime. In Wilson, J. & Petersilia, J. (eds.) *Crime* (pp. 191-224). Ithaca: ICS Press.

Cantor, D. & Land, K.C. (1985). Unemployment and Crime Rates in the Post-World War II United States: A Theoretical and Empirical Analysis. *American Sociological Review*. 50. (3). 317-332.

Huys (2010). Meeste ondervonden delicten niet bekend bij politie. CBS Webmagazine 1 november 2010. Consulted at December 23rd, 2014 via http://www.cbs.nl/nl-NL/menu/themas/veiligheid-recht/publicaties/artikelen/archief/2010/2010-3237-wm.htm.

Chiricos, T.G (1987). Rates of Crime and Unemployment: An Analysis of Aggregate Research Evidence. *Social Problems*. 34. (2). 187-212.

Cohen, L.E. & Felson, M. (1979). Social Change and Crime Rate Trends: A Routine Activity Approach. *American Sociological Review*. 44. (4). 588-608.

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

Ehrlich, I. (1973). Participation in Illegitimate Activities: A Theoretical and Empirical Investigation. *The Journal of Political Economy*. 81 (3), 521-565.

Entorf, H. & Spengler, H. (2000). Socio-economic and Demographic Factors of Crime in Germany: Evidence from Panel Data of the German States. International Review of Law and Economics. 20. 75-106.

Freeman, R.B. (1999). The Economics of Crime. In Ashenfelter, O. & Card, D. (eds.) *Handbook of Labor Economics* (pp. 3529-3571). Amsterdam: Elsevier Science B.V.

Gould, E.D., Weinberg, B.A. & Mustard, D.B. (2002). Crime Rates and Local Labor Market Opportunities in the United States: 1979-1997. *The Review of Economics and Statistics*. 84. (1). 45-61.

Grogger, J. (1998). Market Wages and Youth Crime. *Journal of Labor Economics*. 16 (4) 756-791.

Levitt, S.D. (1999). The Changing Relationship between Income and Crime Victimization. *FRBNY Economic Policy Review*. 5. (3). 87-98.

Lin, M.J. (2008). Does Unemployment Increase Crime? Evidence from U.S. Data 1974-2000. The *Journal of Human Resources*. 43. (2). 413-436.

Öster, A. & Agell, J. (2007). Crime and Unemployment in Turbulent Times. *Journal of the European Economic Association*. 5. (4). 752-775.

Oude Alink, A. (2010). Woninginbraak en daderkenmerken. Een onderzoek naar woninginbraken in Enschede en de persoonskenmerken van bekende verdachten van woninginbraak. Enschede: Universiteit Twente.

Papps, K. & Winkelmann, R. (2000). Unemployment and Crime: New Evidence for an old Question. *New Zealand Economic Papers*. 34 (2). 53-72.

Paternoster, R. & Bushway, S.D. (2001). Theoretical and Empirical Work on the Relationship Between Unemployment and Crime. *Journal of Quantitative Criminology*, 17 (4) 391-407.

Raphael, S. & Winter-Ebmer, R. (2001). Identifying the Effect of Unemployment on Crime. *Journal of Law and Economics*. 44. (1). 259-283.

Rufrancos, H.G., Power, M., Pickett, K.E. & Wilkinson, R. (2013). Income Inequality and Crime: A Review and Explanation of the Time-Series Evidence. *Sociology and Criminology*. 1. (1). 1-9.

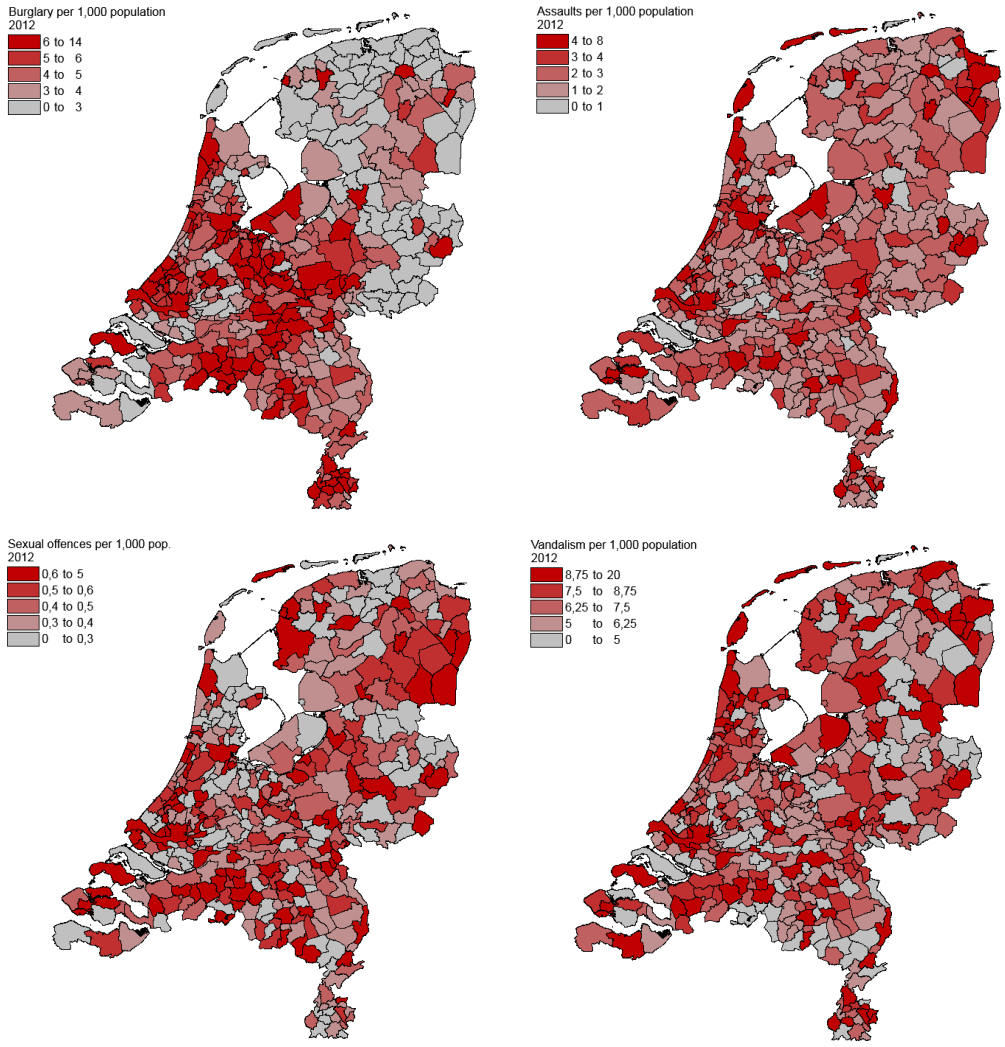
Verbruggen, J., Blokland, A.A.J. & Van der Geest, V.R. (2012). Effects of Employment and Unemployment on Serious Offending in A High-Risk Sample of Men and Women from Ages 18 to 32 in the Netherlands. *British Journal of Criminology*. 52. 845-869.

Witte, A.D. & Tauchen, H. (1994). Work and Crime: an Exploration using Panel Data. NBER Working Paper no. 4794. Cambridge: National Bureau of Economic Research.

Appendix A

This paper analyses crime at a low aggregated municipality-level. Figure A.1 shows crime distributions across the Netherlands. Burglary is highly concentrated in the provinces of the Randstad[7] and the southern part of the Netherlands. Assaults not only occur in urban areas, but are more spread across the country. The North-eastern part of the Netherlands stands out for a large density of violent offences. As for assaults, sexual offences also relatively frequently take place in the Northern part of the Netherlands. Vandalism offences are widely spread across the country. Municipalities that border to the North Sea seem to have higher vandalism rates than other municipalities. A potential source of high vandalism rates is the large inflow of groups young tourists during summer time.

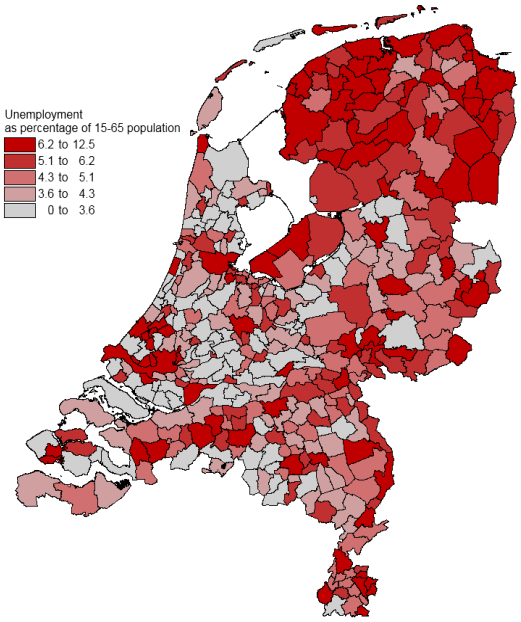
Figure A.1 Crime is concentrated in urban areas



7 The area between the cities of Amsterdam, Rotterdam, The Hague and Utrecht is called 'Randstad'.

The map below shows the spatial distribution of unemployment rates across the Netherlands in 2012. Unlike crime rates, unemployment is more concentrated in larger geographical parts of the Netherlands. Especially in large parts of the North-located provinces Friesland and Groningen unemployment rates were high in 2012. Unemployment was rather low in municipalities located close to biggest cities. A large part of that population works in surrounding cities like Amsterdam, Rotterdam, The Hague and Utrecht.

Figure A.2 Unemployment is higher in Northern and Eastern located municipalities



Source: CBS Statline.

Appendix B

The economic impact calculations in Section 4 rely on previous work of Anderson (1999) and Altindag (2012). Anderson (1999) estimated the aggregate burden of crime:

Table B.1 Aggregate burden of crime

	Value
Crime-induced production ($ billion)	397
Opportunity costs ($ billion)	130
Risk to life and health ($ billion)	574
Transfers ($ billion)	603
Gross Burden ($ billion)	1,705
Net of transfers ($ billion)	1,102
Per capita ($)	4,118

Source: Anderson (1999)

The economic impact of crime is considered to be the sum of the crime-induced production, opportunity costs and the risk to life and health. Following Altindag (2012), I assume the costs of risk to life and health only to count for violent crime. The remaining costs ($ 527 billion) are equally divided over all crime types. The total of offences in the United States in 1999 was 11,500,000. That implies a mean cost of $ 46,000 per offence (1999 US dollars).

Table B.2 Increase of burglaries due to unemployment increase

	unemployment rate	% unemployment increase (base year 2008)	% increase in burglaries (based on coefficient 0.297)	burglaries	extra burglaries due to unemployment increase
2008	4%			70,770	
2013	7%	75%	22.3%		15,770

Source: own calculations

During 2009-2013 the share of burglaries in total offences in the Netherlands was 7.235 percent. The number of burglaries was 70,770 in 2008. Consequently, a 22.3 percent increase in burglaries led to a mean of 15,770 extra burglaries due to unemployment increase between 2009-2013.

The total cost of extra burglaries due to unemployment are estimated at $ 725 million (1999 dollars).

seo economic research

Roetersstraat 29 . 1018 WB Amsterdam . T (+31) 20 525 16 30 . F (+31) 20 525 16 86 . www.seo.nl