

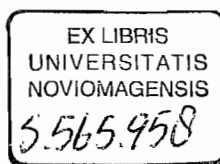
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ARMED ROBBERIES AND UNEMPLOYMENT

Robert W.J. Jansen

Peter J. van Koppen

Summary

The question of whether or not a relationship exists between crime and macro-economic conditions continues to evoke interest in the social sciences and politics. In particular, economists and criminologists discuss the relationship between crime and changes in aggregate unemployment. Economists and criminologists adhering to the strain theory predict a positive relationship. However, criminologists using the opportunity theory predict a negative relationship. In this paper we examine whether or not a relationship exists between armed robberies, aggressive crimes and unemployment in the Netherlands. To determine these relationships we apply a time series analysis and a cross-sectional analysis. The time series analysis is based on the use of quarterly data for the years 1968 up to 1994. The cross-sectional analysis is restricted to two regional units, namely the corop-areas and the provinces. This analysis covers the years 1988 through 1994.

Introduction

Since the 1830's the question of whether or not a relationship exists between crime and changing macro-economic conditions has continued to evoke a great deal of interest in the social sciences (For a review of the earliest literature we refer to Thomas, 1927). In particular, the relationship between crime and unemployment is a subject of constant academic attention and policy debate. Two main types of relationships are distinguished in the literature. The first type is a reciprocal relationship between unemployment and crime. The second type is an unidirectional relationship (Thornberry & Christenson, 1984).

Empirical research shows differing results about the existence and the direction of the unidirectional relationship. We have restricted ourselves to the unidirectional relationship. The economic theory of crime and the criminological strain theory predict a positive relationship between unemployment and armed robberies. Economists support this prediction by arguing that unemployment compels some individuals to compensate their loss of legal revenues to maintain a previous standard of living (Hellman & Alper, 1993, p. 62). This prediction competes with the economic deterrence hypothesis which states that criminal justice variables, such as the rate of detection and the rate of conviction, determine the crime rate (Cooter & Ulen, 1988, p. 528). Strain theorists argue that pressures or strains on persons result in criminal behaviour in order to attain the dominant cultural goal of material success (Taylor, 1994, p. 477). In contrast, opportunity theorists claim that unemployment decreases the opportunities for crime, because the opportunity to protect private property increases (Cohen, 1981). This argument is probably true for personal belongings, but an increase of unemployment might affect the security of commercial objects, such as banks and post offices. In this paper we investigate within a political and economic context whether or not a relationship exists between armed robberies, aggressive crimes and unemployment. To determine the direction of a possible relationship we carry out a time series analysis with quarterly data for the years 1968 up to 1994 and a cross-sectional analysis at the level of two regional units, namely the corop-area¹ and the province.

1. Political and economic context of armed robberies

Since the nineteen seventies many Western countries have experienced an economic recession and a rise in crime rates. The consequences of persistent unemployment (income inequality, poverty, and eroding tax base) have even put the social cohesion in countries such as Austria, Belgium and France at risk (OECD, 1997, pp. 3, 19).

In the Netherlands unemployment peaked in 1984. The number of aggressive crimes known to the police increased from 22 thousand in 1968 to 213 thousand in 1993, followed by a slight decline to 207 thousand in 1994.² The number of armed robberies increased from 43 in 1968 to 2626 in 1993 and then declined to 2482 in 1994. The annual reports of the Criminal Intelligence Division of the Dutch National Police Agency state that armed robberies started as a transnational phenomenon. Groups of organized French and Italian armed robbers perpetrated bank robberies and attacks against money transports in the early sixties. From 1968 the 'German type' of individually perpetrated armed robberies developed in the Netherlands.³ Armed robberies became the trade of mainly addicted perpetrators. In the mid-seventies an increasing number of (addicted) Ambonesians perpetrated armed robberies against commercial objects.⁴ The involvement of minority groups in crime is to a certain extent caused by the absence of labour market perspectives. To give an example of the severity of minority unemployment: In 1993 seventeen percent of the professional minority population was unemployed and 5 percent of the Dutch professional population (Sociaal Cultureel Planbureau, 1994, p. 116).

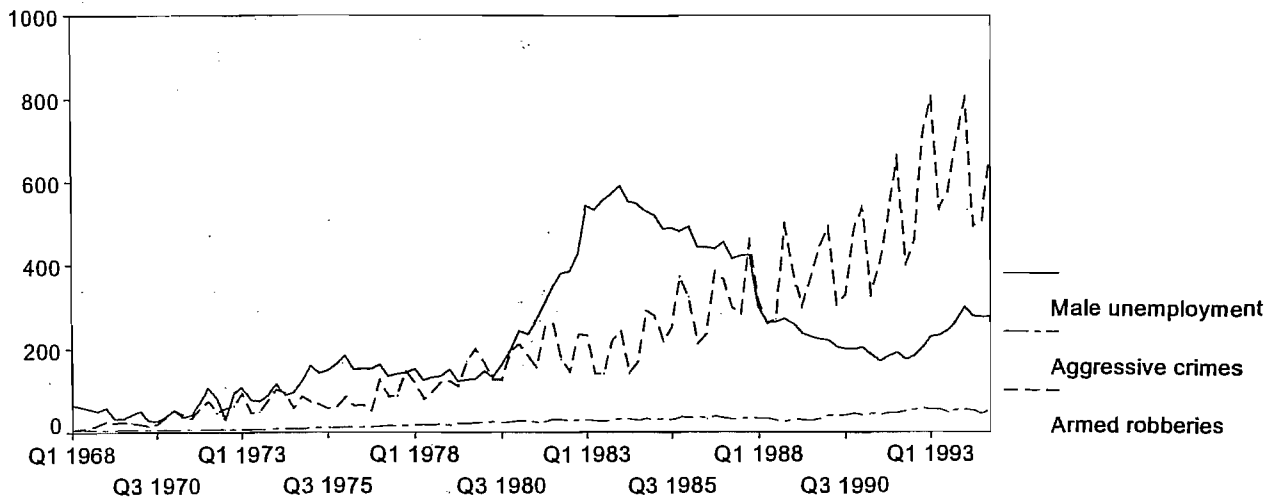
In 1982, the economic recession and the rising crime rate made the Council of Europe decide to appoint a Select Committee of Experts on the Economic Crisis and Crime to carry out a comparative study. The select committee had to restrict itself to studying Germany, France, England and Wales. The results did not confirm a correlation between unemployment and recorded crime. However, the results revealed the existence of a correlation between trends in income, distribution and employment on the one hand and crime on the other hand. For the countries examined there were indications of rises in crime being connected with the growth of an affluent society (Council of Europe, 1985, p. 82).

Our analysis starts in 1968 and includes the last five years of an era of economic success in the Netherlands (Knoester, 1989, p. 101). Figure 1 shows that armed robberies, aggressive crimes and male unemployment have similar trends in the Netherlands for the years 1968 through 1984. This figure shows a continuous increase of male unemployment up to the first quarter of 1984. At that time 590 thousand males were registered as unemployed at the Labour Exchange. Then, an economic recovery sets in (Tweede Kamer, vergaderjaar 1985-1986, 19200, hoofdstuk XV nr. 2, p. 19).

Unemployment, armed robberies and aggressive crimes

1968:1 - 1994:4

Figure 1



Male unemployment and aggressive crimes in thousands

Successive cabinets attempted to reduce short-term and long-term unemployment. For example, the growth of long-term unemployment and the absence of perspectives persuaded the second cabinet Lubbers (governing from 1986 up to 1989) to set the reduction of unemployment with 250 thousand persons as a major policy objective (Knoester, 1989, p. 148). In 1997 the OECD is moderately positive about the Dutch employment policies,⁵ although unemployment started to increase again in 1992.

2. Methodology and data

2.1 Methodology

The discussion about the relationship between crime and macro-economic conditions involves a discussion about specifying equations, removing trends, correcting heteroscedasticity, and ignoring relevant variables. Participants in the debate replicate research and test newly specified equations (Pyle & Deadman, 1994; Reilly & Witt, 1992; Wong, 1995). We restrict ourselves to discussing detrending and correcting heteroscedasticity. Most studies remove the trends by differencing the time series, without discussing in detail this approach. Cantor (1985, p. 324) for instance detrends by differencing without using correlograms and related tools to identify a plausible model. He argues that his time series are too short to make that a reliable strategy. Cook and Zarkin (1985) remove the trends by making use of moving averages. Beijers (1993) applies the same approach. However, the disadvantage of applying the moving average approach is the loss of information, because it does not allow the use of the first and last observations.⁶ Relating variables such as crime and unemployment without detrending entails the risk of spurious regression. This means that unrelated variables appear to be related. Their R^2 will tend toward unity and the Durbin-Watson statistic will be low (Granger & Newbold, 1974, p. 111).

Nelson and Kang (1984), Maddala (1989, pp. 212-215) and Enders (1995, pp. 179-180) show that the appropriate method to remove the trend depends on whether the time series belongs either to trend stationary processes (TSP) or to difference stationary processes (DSP). The Dickey-Fuller test is recommended to determine whether a time series belongs either to trend stationary or difference

stationary processes. The former are detrended after estimating regressions on time and the latter are detrended by successive differencing. Subtracting a regression on time from difference stationary processes is inappropriate. If one of the variables belongs to a trend stationary process and the other variable belongs to a difference stationary process, both variables should not be first-differenced (Enders, 1995, p. 219).

Heteroscedasticity is a violation of the assumption of a constant variance of the residual error in regression analysis. The residual errors tend to have differing variances for the values of the independent variables. A method to correct for heteroscedasticity is the application of the weighted least squares procedure. Heteroscedasticity quite often occurs in cross-sectional analysis (Pindyck & Rubinfeld, 1991, pp. 126-137).

2.2 Data

We have obtained the quarterly data on armed robberies from the annual reports of the Criminal Intelligence Division of the Dutch National Police Agency. In addition, this agency supplied us with detailed data on armed robberies perpetrated from 1988 through 1994. These data came from the reports of the local police authorities to the Dutch National Police Agency, usually one day after the robbery. We have aggregated these data to obtain quarterly and regional data about armed robberies for the years 1988 through 1994.

The Netherlands Central Bureau of Statistics publishes monthly data on male unemployment in the *Monthly Bulletin of socio-economic statistics* and the *Monthly Bulletin of social statistics*.⁷ Male unemployment includes the number of unemployed males registered at the Labour Exchange. We have calculated the quarterly male unemployment for the years 1968 up to 1994. From 1987 the Central Bureau of Statistics publishes three-month moving averages. This bureau also publishes the number of aggressive crimes in its *Monthly Bulletin*. The item 'aggressive crime' involves crimes against public order and authority, against life and person, sexual offenses, assault, aggravated theft, extortion and malicious damage.

To carry out the cross-sectional analysis we have aggregated the data on armed robberies at two Dutch regional units, namely the corop-area and the province. A corop-area is a statistical regional unit for research purposes and includes a number of neighbouring municipalities. The province is a regional administrative unit. (The Netherlands are divided into 40 corop-areas and 12 provinces). For the years 1988 through 1994 we have collected data on unemployment and gross regional product per capita at the corop-level and the provincial level. Unemployment is expressed as a percentage of the labour force at the age of 15 to 64 years. The Netherlands Bureau of Statistics publishes the annual gross regional product as an indexnumber (the Netherlands = 100). To continue the analysis this index was adjusted by calculating as the base the average gross regional product per capita for the years 1988 through 1994⁸.

3. Results

3.1 Analysis of time series

Figure 1 in Section 1 shows that male unemployment and armed robberies move in trend together from 1968 through 1984. The first-order autocorrelations of both entire series are respectively 0.98 and 0.87. The first-order autocorrelation of aggressive crimes is 0.94. These correlations decline slowly when the number of lags increases. This means that these variables are nonstationary and entails the risk of spurious regression or spurious correlation between male unemployment and armed robberies.

Before continuing the analysis the trends have to be eliminated. The appropriate method to remove the trend depends on whether the time series belongs to trend stationary processes (TSP) or difference stationary processes (DSP). To determine whether male unemployment and armed robberies

belong to one of these processes a test developed by Dickey and Fuller in 1979 was used (Maddala, 1989, pp. 212-215; Pindyck & Rubinfeld, 1991, pp. 459-462). The unrestricted regression:

$$X_t - X_{t-1} = \alpha + \beta T + (\rho - 1)X_{t-1} + \lambda \Delta X_{t-1} + \epsilon$$

and the restricted regression:

$$X_t - X_{t-1} = \alpha + \lambda \Delta X_{t-1}$$

were estimated. The null-hypothesis is then tested with the parameters $\beta = 0$ and $\rho = 1$, which means that time series belongs to the DSP class. The acceptance of the null-hypothesis depends on whether or not the F-ratio exceeds its critical value.⁹ Table 1 shows the regression results.

Table 1 Dickey-Fuller tests: Quarterly data years 1968 through 1994.

Variable	α	β	($\rho-1$)	λ	ESS	F-ratio
Armed robberies (unrestricted)	-55.12 (17.46)	3.65 (0.61)	-0.64 (0.10)	0.19 (0.10)	574020	231
Armed robberies (restricted)	6.92 (8.50)			-0.13 (0.10)	794910	
Aggressive crimes (unrestricted)	0.06 (0.55)	0.11 (0.04)	-0.21 (0.07)	-0.34 (0.10)	747	4.50
Aggressive crimes (restricted)	0.63 (0.27)			-0.45 (0.09)	813	
Male unemployment (unrestricted)	6.28 (5.63)	0.01 (0.11)	-0.02 (0.02)	0.14 (0.09)	75080	0.82
Male unemployment (restricted)	1.76 (2.63)			0.13 (0.10)	76286	

Note. Standard errors are shown in parentheses.

In each case there are 106 quarterly observations. Hence, for male unemployment the F-ratio is 0.82. Comparing this to the critical value (6.49 at the 5 percent level) for a sample size of 100 we cannot reject the null hypothesis. Male unemployment belongs to a difference stationary process. The trend is removed by differencing. For armed robberies the F-ratio is 231.11 and belongs to a trend stationary process. The trend is removed by regressing on time. The ratio for aggressive crimes is 4.50 and means that aggressive crimes belong to the DSP class. To determine the relationship between these variables we use detrended time series.¹⁰ Considering the rise and decline of male unemployment in Figure 1 two periods can be distinguished. The first period includes the first quarter of 1968 through the first quarter of 1984, and shows an increase in male unemployment. The second period is a period of economic recovery and covers the first quarter of 1984 up to the last quarter of 1994. The social effects of unemployment do not appear immediately, because of temporary unemployment benefits and social security payments. For this reason

we introduce a one-year lag and a two-years lag of unemployment. Table 2 shows the Pearson correlations and contingency coefficients.

Table 2 Pearson correlations and contingency coefficients male unemployment and various crimes (Quarterly data)

Variables	Male unemployment:			Contingency coefficients
	First differences	Lag		
		One year	Two years	
Armed robberies (1968.1-1994.4)	0.26 (p=0.0007)	-0.29 (p=0.002)	-0.21 (p=0.002)	-0.29 (p=0.03)
Armed robberies (1968.1-1984.1)	0.43 (p=0.00)	0.07 (p=0.61)	0.07 (p=0.61)	
Armed robberies (1984.1-1994.4)	0.47 (p=0.001)	0.09 (p=0.58)	0.03 (p=0.85)	
Aggressive crimes (1968.1-1994.4)	-0.0003 (p=0.99)	-0.03 (p=0.78)	-0.01 (p=0.92)	0.13 (p=0.18)
Aggressive crimes (1968.1-1984.1)	-0.04 (p=0.78)	0.13 (p=0.29)	0.16 (p=0.22)	
Aggressive crimes (1984.1-1994.4)	0.03 (p=0.83)	-0.11 (p=0.48)	-0.07 (p=0.65)	

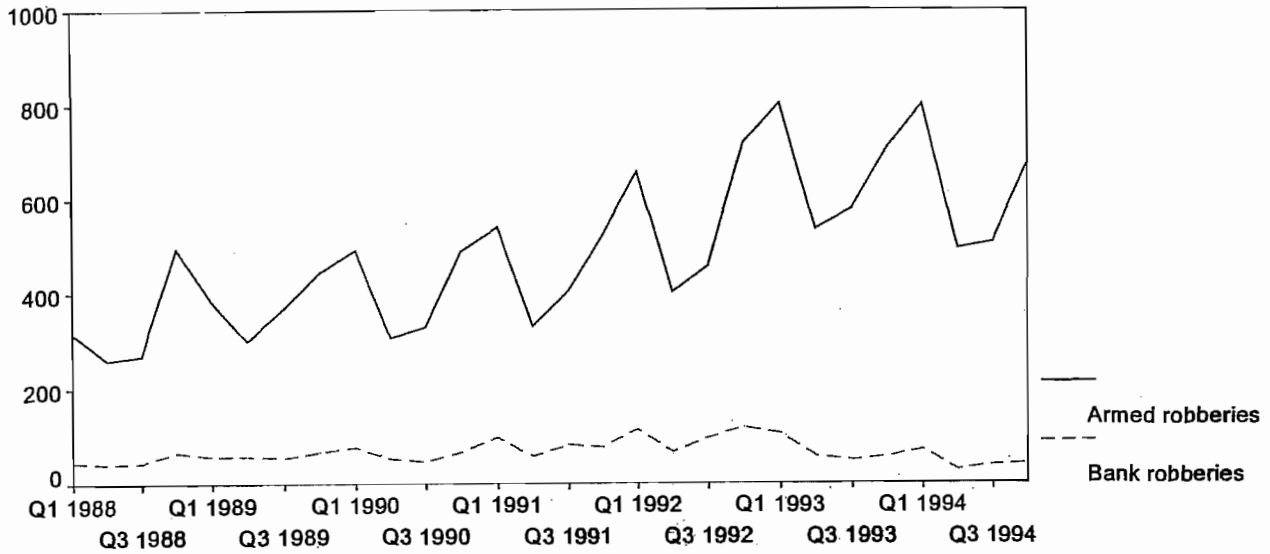
Note. Two-tailed significance levels of the correlations are shown in parentheses.

The data obtained from the Dutch National Police Agency enable us to get a more detailed view on several types of armed robberies, such as bank robberies and attacks against post offices and catering companies. Figure 2 shows an increasing trend of armed robberies with seasonal peaks and troughs. A first graphical but subjective inspection shows that bank robberies move almost horizontally.

Armed robberies

1988:1 - 199:4

Figure 2



The previous 'stepwise' procedure is again followed. The autocorrelations of male unemployment, armed robberies, bank robberies, attacks against post offices and catering companies are respectively 0.84, 0.50, 0.46, 0.23 (not significant) and 0.74. These correlations indicate the presence of trends except for post offices. Table 3 contains the regression results.

Table 3 Dickey-Fuller tests: Quarterly data years 1988 up to 1994.

Variable	α	β	$(\rho-1)$	λ	ESS	F-ratio
Armed robberies (unrestricted)	428.96 (68.34)	22.87 (3.97)	-1.59 (0.22)	0.70 (0.16)	170434	26.28
Armed robberies (restricted)	17.06 (30.46)			-0.13 (0.21)	577605	
Bank robberies (unrestricted)	35.86 (16.33)	-0.30 (0.59)	-0.47 (0.23)	-0.11 (0.22)	10362	2.63
Bank robberies (restricted)	-0.09 (4.54)			-0.33 (0.19)	12848	
Post offices (unrestricted)	25.94 (11.84)	0.29 (0.48)	-0.67 (0.30)	-0.21 (0.22)	5220	2.75
Post offices (restricted)	0.08 (3.23)			-0.54 (0.17)	6524	
Catering (unrestricted)	15.32 (10.17)	4.68 (1.27)	-1.06 (0.25)	0.38 (0.20)	10475	9.14
Catering (restricted)	4.64 (5.57)			-0.16 (0.20)	19179	
Male unemployment (unrestricted)	8.00 (19.20)	0.70 (0.43)	-0.08 (0.08)	0.09 (0.20)	4441	1.88
Male unemployment (restricted)	0.69 (2.89)			0.23 (0.18)	5198	

Note. Standard errors are shown in parentheses.

The critical value of F is 7.24, which implies that bank robberies and male unemployment belong to difference stationary processes, and armed robberies and attacks against catering companies are trend stationary processes. Table 4 shows the correlations between total number of armed robberies, bank robberies, attacks against post offices and catering companies, and lagged male unemployment.

Table 4 Pearson correlations types of armed robberies and male unemployment: quarterly data years 1988 up to 1994

Categories	Male unemployment (DSP):		
	First differences	One year	Lag Two years
Armed robberies (TSP)	0.68 (p=0.00)	0.56 (p=0.005)	0.58 (p=0.01)
Bank robberies (DSP)	0.40 (p=0.04)	0.35 (p=0.10)	0.56 (p=0.04)
Post offices (DSP)	0.18 (p=0.37)	0.20 (p=0.35)	0.31 (p=0.19)
Catering (TSP)	0.65 (p=0.001)	0.40 (p=0.05)	0.52 (p=0.02)

Notes. a. DSP: Difference stationary process
b. TSP: Trend stationary process
c. Two-tailed significance levels of the correlations are shown in parentheses

The results of Table 4 show that there is a significant relationship between differenced male unemployment and the detrended number of armed robberies, even if male unemployment is lagged. No significant correlations exist between armed attacks against post offices and male unemployment.

3.2 Cross-sectional analysis

The analysis at the corop and provincial level has to cope with the problem that an increase of the number of independent variables capitalizes on the number of observations and interrupts the continuity of the time series, which includes the years 1988 through 1994. Our analysis is restricted to the dependent variable number of armed robberies, and the independent variables recorded unemployment as a percentage of the labour force, and gross regional product per capita. A first inspection of the data reveals the existence of heteroscedasticity, because the variances of the residuals correlate significantly with the gross regional product per capita (corop-level: $r=0.43$, $p<0.01$; provincial-level: $r=0.54$, $p<0.01$). To correct for heteroscedasticity we apply the weighted least squares procedure. Table 5 shows the regression coefficients.

Table 5 Unemployment and armed robberies at the Corop level and the provincial level, 1988-1994: weighted least squares.

Variable	Corop:		Province:	
	Parameter B	βeta	Parameter B	βeta
Unemployment	-0.0009** (0.0004)	-0.13	-12.78 (10.56)	-0.12
Gross regional product	1.87** (0.24)	0.48	6.89** (1.36)	0.56
Year	-1.73 (2.60)	-0.05	-11.93 (10.56)	-0.12
Intercept	3327.54 (4091.99)		23345.00 (21179.38)	
	R = 0.45 R ² = 0.20 F = 22.84		R = 0.52 R ² = 0.28 F = 10.14	
	N = 275		N = 84	

Note. Standard errors in parentheses. ** p<0.01, two-tailed; * p<0.05, two-tailed.

The results in table 5 show at the corop-level a significant negative relationship between armed robberies and unemployment, but a positive relationship between gross regional product per capita and armed robberies for the years 1988 through 1994.

4. Discussion

Several reviews of the available literature on crime and macro-economic conditions show little evidence of a strong relationship between crime and unemployment. This relationship is considered as complex.¹¹ However, in the past fifteen years several economists and social scientists have published important contributions on this subject. Table 6 summarizes the main characteristics of their research.

Table 6 Studies on crime and unemployment.

Year	Authors	Number of equations	Dependent variable	Explanatory variables	Country Time span	Type of analysis
1985	Cantor Land	4	Homicide Rape Assault Robbery Larceny-theft Auto-theft	Unemployment	United States 1946-1982	Ordinary least squares: Differencing Log-transformation then differencing Cochrane-Orcutt ¹
1985	Cook Zarkin	1	Homicide Robbery Burglary Auto theft	Unemployment	United States 1935-1979 1949-1979	Ordinary least squares: moving averages
1992	Reilly Witt	6	Crime rate	Unemployment Public housing	Scotland 6 regions 1974-1988	Generalized least squares: Ordinary least Squares Differencing Cochrane-Orcutt Prais-Winsten ² Dummyvariable model Random effects model
1993	Young	0	Theft rate	Unemployment	20 countries 1985	Pearson correlation
1994	Pyle Deadman	6	Total crimes Aggressive crimes (non-sexual)	Unemployment Public housing	Scotland 1974-1991	Ordinary least squares: Differencing
1994	Britt	1	Homicide Rape Assault Robbery Larceny Car theft	Unemployment Change in unemployment	United States 1958-1990	Ordinary least squares: Differencing
1995	Wong	4	Indictable offences	Apprehension Punishment Economic risk Gains (il)legal activities	England Wales 1857-1892	Dickey Fuller tests Ordinary least squares: Differencing

Notes. 1. Cochrane-Orcutt method is a procedure to correct for autocorrelation.
2. Prais-Winsten method is a procedure to correct for autocorrelation.

Cantor and Land (1985, p. 329) have determined significant though small relationships between various crimes and unemployment, with the exception of rape and aggravated assault. Cook and Zarkin conclude that armed robberies have an anti-cyclical pattern, which means that a decline in armed robberies correlates with an increase in employment and vice versa. Recessions result in small increases in the

number of armed robberies (Cook & Zarkin, 1985, pp. 124-125, 128). Reilly and Witt (1992), Britt (1994), and Wong (1995) have measured a significant positive relationship between the rate of unemployment and the rate of crimes. Wong has determined that cyclical economic fluctuations as proxied by the unemployment rate are determinants of the crime rate. Young (1993) and Pyle and Deadman (1994) have not found any significant relationships.

In the Netherlands Beijers has investigated the relationship between property crime and unemployment as a reaction on the statistical analysis of five-yearly data in a study on the developments in Dutch conviction rates carried out by Jongman (1988, pp. 7-8). Beijers has not tested hypotheses derived either from the economic theory of crime or the opportunity theory. After removing the trends from the annual data he finds a Pearson correlation of 0.67 ($p < 0.01$) and after introducing a one-year lagged unemployment he also determines a correlation of 0.67 ($p < 0.01$). His use of a two-year lag did not result in a significant correlation (Beijers, 1993, p. 67). Our analysis of quarterly data from 1968 through 1994 confirms Beijers' results. We have determined significant positive Pearson correlation coefficients between one-year lagged male unemployment and armed robberies for the first quarter of 1968 through the first quarter of 1984, a period of severe recession, but also for the entire period. Like Beijers we have not found a significant correlation between two-year lagged male unemployment and armed robberies for the years 1968 through 1994. The analysis of aggressive crimes does not show any significant correlations, neither during the years of recession nor during the period of economic recovery.

Our cross-sectional analysis covers the period of economic recovery and shows significant relationships between unemployment, gross regional product per capita and armed robberies at the level of the corop-units. The negative relationship between armed robberies and unemployment fits the prediction of the opportunity theory. The relationship between the number of armed robberies and gross regional product is in the opposite direction. An increase of affluence, as measured by the gross regional product per capita, might be an incentive to achieve the cultural goal of material success. Van Tulder who investigated various aggregated crimes at this level determined some significant relationships between on the one hand crimes and demographic, social and economic variables on the other hand. However, he did not find a significant relationship between violent crimes and male unemployment (Van Tulder, 1994, pp. 73-75, 100-101).

An important criticism on research with aggregate data is the neglect of the individual history of labour, because not every unemployed person commits crimes. Neglect of this criticism entails the risk of considering the relationship between unemployment and crime as too deterministic. Our research of the criminal records of 401 convicted armed robbers has revealed that 30 percent received social security payments or other benefits, such as sickness-benefits and grants. For 54.4 percent the records do not reveal whether or not any benefits were received.

Conclusion

Considering the years 1968 through 1994, a first conclusion of this paper is that the results from the analysis of detrended quarterly data confirm with regard to armed robberies the predictions of the economic theory of crime and the criminological strain theory. An increase in male unemployment correlates positively with the total number of armed robberies perpetrated from 1968 through 1994. Our analysis of the period 1988 up to 1994 also reveals significant correlations for bank robberies and attacks against catering companies. To put it differently, male unemployment is one of the factors to be considered for explaining the perpetration of armed robberies. Our analysis does not reveal any significant correlations between male unemployment and aggressive crimes.

The cross-sectional analysis at the level of the corop-units shows that unemployment and gross regional product per capita have opposite effects on the number of armed robberies. Unemployment has a negative effect on the number of armed robberies as predicted by the opportunity theory. The positive effect of an increase of gross regional product confirms the idea that affluence is one of the causes to perpetrate property crimes.

We agree that our use of aggregate data prevents to determine whether or not an individual history of labour predicts the perpetration of armed robberies against commercial institutions. This requires a different research design, which should include the possibility of determining a reciprocal relationship. Our research of the criminal records of 401 convicted armed robbers has revealed that 30 percent received social security payments or other benefits. For 54.4 percent we have not been able to find whether or not any benefits were received.

References

- Beijers, W.M.E.H. (1993), 'Jongman nagerekend: werkloosheid versus criminaliteit op macro-niveau'. In Nijboer, J.A. & Berghuis A.C. (eds.), *Criminaliteit als politiek probleem* (57-68), Arnhem: Gouda Quint.
- Box, S. (1987), *Recession, crime and punishment*. Basingstoke, Hampshire: MacMillan.
- Britt, C.L. (1994), 'Crime and unemployment among youths in the United States, 1958-1990: a time series analysis', *American Journal of Economics and Sociology* 53 (1): 99-109.
- 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: 317-332.
- Chiricos, T.G. (1987), 'Rates of crime and unemployment: An analysis of aggregate research evidence', *Social Problems* 32: 187-212.
- Cohen, L.E. (1981), 'Modeling crime trends: A criminal opportunity perspective', *Journal of Research in Crime and Delinquency* 18: 138-164.
- Cook, P.J. & Zarkin, G.A. (1985), 'Crime and the business cycle', *Journal of Legal Studies* 14: 115-128.
- Cooter, R. & Ulen, T. (1988), *Law and economics*, London: Scott, Foresman and Company.
- Council of Europe (1985), *Economic crisis and crime*, Strassbourg.
- Enders, W. (1995), *Applied econometric time series*, New York: John Wiley & Sons.
- Gillespie, R. (1978), *Economic factors in crime and delinquency*, Urbana, Illinois: University of Illinois.
- Hellman, D.A. & Alper, N.O. (1993), *Economics of crime: theory and practice*, Needham Heights, MA: Ginn Press.
- Jongman, R.W. (1988), 'Over macht en onmacht van sociale controle', *Tijdschrift voor Criminologie* 1: 4-31.
- Kendall, M., Stuart, A., & Ord, J.K. (1983), *The advanced theory of statistics: Design and analysis and time series*, vol. 3, London: Charles Griffin and Company.
- Knoester, A. (1989), *Economische politiek in Nederland*, Leiden: Stenfert Kroese.
- Maddala, G.S. (1989), *Introduction to econometrics*, New York: Macmillan Publishing Company.
- Nelson, C.R. & Plosser, C.I. (1982), 'Trends and random walks in macroeconomic time series', *Journal of monetary economics* 10: 139-162.
- Nelson, C.R. & Kang, H. (1984), 'Pitfalls in the use of time as an explanatory variable in regression', *Journal of business and economic statistics* 2: 73-82.
- Netherlands Central Bureau of Statistics, *Monthly Bulletin of social statistics*, 1968-1987.
- Netherlands Central Bureau of Statistics, *Monthly Bulletin*, 1968-1994.
- Netherlands Central Bureau of Statistics, *Monthly Bulletin of socio-economic statistics*, 1988-1994.
- Netherlands Central Bureau of Statistics, *Economic annual figures by region*.
- OECD (1997), *Implementing the OECD jobs strategy: lessons from member countries' experience*, Paris.
- Orsagh, T. & Witte, A. (1981), 'Economic status and crime: implications for offender rehabilitation', *Journal of Criminal Law and Criminology* 72: 1055-1071.
- Pindyck, R.S. & Rubinfeld, D.L. (1991), *Econometric models and economic forecasts*, New York: McGraw-Hill.
- Pyle, D. & Deadman, D. (1994), 'Crime and unemployment in Scotland: some further results', *Scottish Journal of Political Economy* 41: 314-324.
- Reilly, B. & Witt, R. (1992), 'Crime and unemployment in Scotland: an econometric analysis using regional data', *Scottish Journal of Political Economy* 39: 213-218.

- Sociaal Cultureel Planbureau (1994), *Sociaal en cultureel rapport 1994*, Den Haag: Vuga.
- Taylor, I. (1994), The political economy of crime. In M. Maguire, R. Morgan & R. Steiner (eds.), *The Oxford handbook of criminology* (467-510), Oxford: Clarendon Press.
- Thomas, D.S. (1927), *Social aspects of the business cycle*, New York: Gordon & Breach.
- Thornberry, T.P. & Christenson, R.L. (1984), 'Unemployment and criminal involvement: an investigation of reciprocal causal structures', *American Sociological Review* 49: 398-411.
- Tweede Kamer, *vergaderjaar 1985-1986*, 19200, Hoofdstuk XV, nr. 2, 19.
- Tweede Kamer, 16 oktober 1985, *Rijksbegroting 1986*.
- Van Tulder, F.P. (1994), *Van misdaad tot straf*. Rijswijk: Sociaal Cultureel Planbureau.
- Wong, Y.C.R. (1995), 'An economic analysis of the crime rate in England and Wales, 1857-92', *Economica* 62: 253-246.
- Young, T.J. (1993), 'Unemployment and property crime: not a simple relationship', *American Journal of Economics and Sociology* 52: 413-415.

Notes

- ¹ Corop is a Dutch abbreviation of Coördinatie-commissie Regionale Onderzoeks Programmering.
- ² Netherlands Central Bureau of Statistics. *Monthly Bulletin*, 1968 and 1994.
- ³ Criminal Intelligence Division, Dutch National Police Agency, Annual report 1968, p. 2.
- ⁴ Criminal Intelligence Division, Dutch National Police Agency, Annual report 1977, p. 2.
- ⁵ Dutch policy included general wage moderation through central bargaining, lowering minimum wages, and tax reductions (OECD, 1997, p. 13).
- ⁶ For detrending with moving averages we refer to Kendall, Stuart, & Ord (1983, pp. 450-500).
- ⁷ A problem with using unemployment data is that changes in the definition are possible and the opportunity exists for manipulating the number of recorded unemployed. Successive Dutch cabinets have extended the definition of calculating the number of unemployed persons. One method of manipulating the number of unemployed persons was to increase the age of compulsory education (Tweede Kamer, 16 oktober 1985, *Rijksbegroting 1986*, p. 508). Reilly and Witt (1991, p. 221) argue with regard to using unemployment data that one can do nothing more than assume that the definitional changes do not alter the nature of the relationship under consideration.
- ⁸ The annual average gross national products per capita in Dutch guilders are respectively: 30989 (1988), 32639 (1989), 34395 (1990), 35957 (1991), 37148 (1992), 37863 (1993) and 40056 (1994).
- ⁹ The F-ratio is calculated as follows: $(N-k)ESS_r - ESS_{ur}/q(ESS_{ur})$, where ESS_r and ESS_{ur} are the sums of squared residuals in the restricted and unrestricted regressions. The number of observations is N. The number of estimated parameters in the unrestricted regression is k, and the number of parameter restrictions is q (Pindyck & Rubinfeld, 1991, p. 461).
- ¹⁰ The detrended data are obtained by subtracting the results of estimating the linear trend.
- ¹¹ For surveys of the literature we refer to Gillespie (1975) and Orsagh & Witte (1981), Box (1987), and Chiricos (1987).