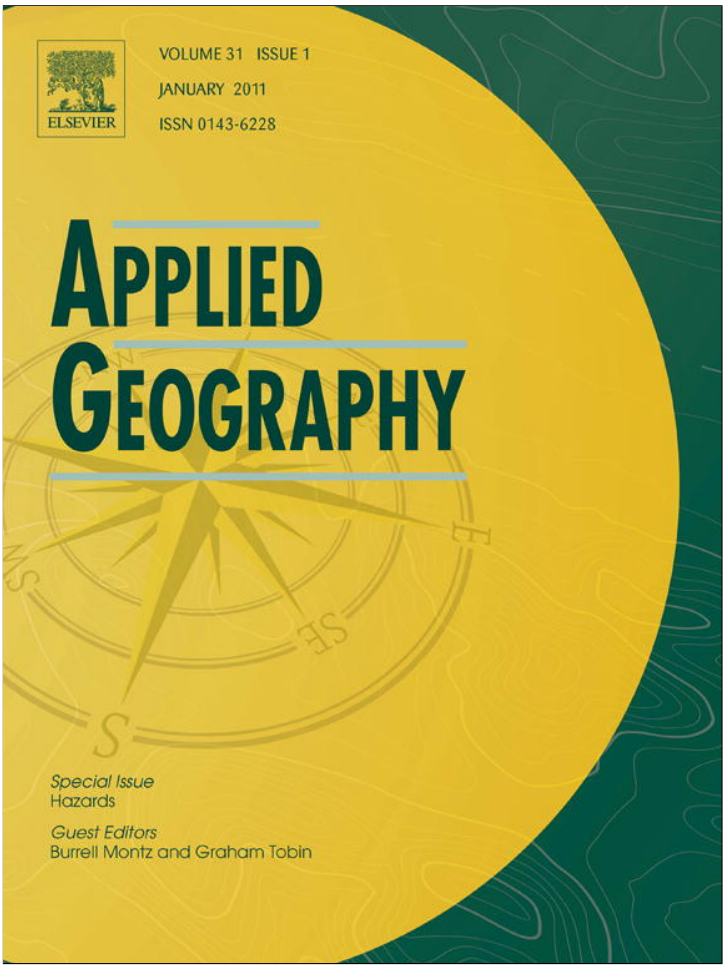

Applied Geography 31 (2011) 119–135

Contents lists available at ScienceDirect

Applied Geography

journal homepage: www.elsevier.com/locate/apgeog

Crime in rural Sweden

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Keywords:
Violence
Thefts
Countryside
Regional patterns of crime
GIS
Modelling

A B S T R A C T

The objective of this article is to assess the levels and spatial patterns of crime in rural Sweden. This involves a summary of the changing levels and composition of a selected group of offences from 1996 to 2007 in two groups of rural areas (remote and accessible) in relation to urban areas. Crime rates are modelled cross-sectionally as a function of the municipalities' structural indicators. Geographical information systems (GIS) and spatial statistics techniques are used to assess shifting patterns of concentration of thefts and violence as well as for modelling crime rates. Findings show that rural areas have become more criminogenic than they were a decade ago. Changes in the rates and geography were found using cluster techniques for both violence and theft. Although models of rural crime do not show any special 'rural dimension', the predicting variables in models containing both urban and rural areas are not exactly the same as in models with rural areas only. Crime is often linked to the presence of alcohol-selling premises, characteristics of family structure and proportion of young male population.

Introduction

Most of Swedish residents would argue that Swedish rural areas are safe places. Despite an increase in crime over the past decade, crime in Sweden is regarded as an urban rather than a rural issue. As in many other industrialised nations, Swedish rural areas are seen as a retreat from the problems of urban living, including crime; such areas are characterised as places where people reside closer to nature, in cohesive communities (Halfacree, 1993; Petterson & Westholm, 2007; Short, 1991; Valentine, 1997; Yarwood & Gardner, 2000). Are Swedish rural areas really safe? An increasing number of events portrayed by the media questions the "idyllic image" of rural Sweden:

> 'New school bus is vandalised by students between Klimpfjäll and Vilhelmina'. After this experience, the bus driver is concerned about his own safety, reported Västerbotten-Kuriren, a local newspaper from Northern Sweden. Another event occurred in Säter, Dalarna, where a serious crime against the environment took place, after four males dumped and burned 200 hundred litres of explosive fluid close to a water reservoir, reported the Swedish newspaper Dagens Nyheter. In a more extreme account, the same newspaper reported the case of a young man who admitted to kill his wife, dumping her body in an oil tank in Teckomatorp, in Southern Sweden. Dalarnas Tidningar, had an article on a 25 year old male that admitted assaulting physically another male in Vansbro, central Sweden, causing facial fractures and bleeding. Not far away, in Strömsund, parents started an association that together with the Police and school is intended to decrease alcohol consumption among local teenagers and young people.[1]

These events took place in 2007 in the heart of Swedish rural areas. Although they are not representative for all the countryside, they exemplify the nature of police records in the Swedish rural areas. For instance, a third of remote, sparsely populated regions and nearly half of other rural, more accessible, municipalities recorded an increase of reported crimes over the last decade (BRÅ database, 2007). A recent survey also shows that although the perceived risk of being a victim of violence is lower in Swedish rural areas, the actual risk is similar to the rest of the country, when the capital of Sweden, Stockholm, is excluded from the analysis (Swedish National Institute of Public Health, 2006). This is also confirmed by a Swedish victimisation survey in 2006. The

[1] Elever vandaliserade splitter ny skolbuss, http://www.vk.se/Article.jsp?article=99416, 26th January 2007. Grovt miljöbrott på väg att lösas, http://www.dn.se/DNet/jsp/polopoly.jsp?a=653148, 23rd May 2007. Mördad kvinna hittad i oljetank, http://www.dn.se/DNet/jsp/polopoly.jsp?d=147&a=716054&maNo=-1, 19th November 2007. Åtalas för misshandel, http://www.dalarnastidningar.se/nyheter/vansbro/article245141.ece, 27th October 2007. De ska stoppa ungdomarnas supande, http://www.ltz.se/artikel_standard.php?id=388852&avdelning_1=101&avdelning_2=106, 29th January 2007.

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doi:10.1016/j.apgeog.2010.03.002

proportion of individuals reporting exposure to crime is, with few exceptions, similar to the national average level. Still, Swedes (mostly those living in multi-family houses) declare feeling less safe (particularly for violent crime) in large cities than in rural areas (BRÅ, 2008a, 2008b: p. 13).

There is an urgent need for a better understanding of these increasing levels of crime in rural Sweden. Little is documented about the geographical differences in crime levels and whether such differences relate to structural indicators of rural communities, such as the population's demography, employment levels and daily commuting patterns. Research needs to be conducted to examine variations in crime between rural areas (Marshall & Johnson, 2005; Yarwood, 2001). This article contributes to the gap in the literature on the regional geography of crime in Northern Europe, using Sweden as a case study.

Sweden is an interesting case study for several reasons. From a European perspective, Sweden is a sparsely populated country (22 inhabitants per km^2; the corresponding figure for Denmark is 125). As much as 95 per cent of Sweden's area is rural and sparsely populated. Of Sweden's nine million residents, about two million live in rural areas. Of these, 200,000 live in remote rural regions. Both urban and rural municipalities have an urban core surrounded by a sparser housing pattern. The difference between urban and rural municipalities is the size of the urban core and distance between them (Fig. 1). According to the National Rural Development Agency (2005), Remote Rural (RR) areas are more than 45 min by car from the nearest urban neighbourhood with more than 3000 inhabitants, whilst Accessible Rural (AR) areas are 5–45 min by car from urban locations with more than 3000 inhabitants. Municipalities with more than 3000 inhabitants and reachable in 5 min by car are regarded as Urban Areas (UA).

Moreover, most of the literature on crime and security in rural areas is based on case studies from North American and British reports. Studies in Europe have studied regional patterns of crime but not specifically rural-urban issues (e.g., Buonanno & Leone, 2006; Ceccato, 2008; Ceccato & Haining, 2008; Cracolici & Uberti, 2009; Entorf & Spengler, 2000; Kerry, Goovaerts, Haining, & Ceccato, 2010). There is a need to extend the empirical evidence to include cases studies such as those in Sweden, which are embedded in more socially oriented forms of capitalism. Although welfare system principles still play an important role in defining policies in Scandinavia, changes in focus have had a direct impact on rural areas (Bryden, 2007). Sweden shows signs of 'rural change' as a result of a period of major restructuring in the developed market economy (Ilbery & Bowler, 1998; Marsden, 1998). Johansson, Westlund, and Eliasson (2009) suggest that this 'new rurality' is imposing new patterns of differentiation at both local and regional levels.

Finally, population changes have taken place in Sweden and this also is expected to have an impact on crime dynamics. Crime is dependent on society's convergence and distribution over time and space. A redistribution of the urban population to larger cities (e.g., Stockholm, Gothenburg and Malmö) took place concurrently with an increase in population in countrified areas around large and mid-sized cities within commuting distance. Such a shift is, according to Westlund (2002), primarily explained by income differences and the size of the local labour market.

This article has two objectives. The first is to assess the levels and geographical patterns of crime in Sweden from 1996 to 2007, with a focus on rural areas. Remote Rural areas (RRs) and Accessible Rural areas (ARs) will be compared with levels and patterns of crime in Urban Areas (UAs). The second objective is to investigate how the demographic, socio-economic and other structural factors at municipality level relate to the geography of theft and violence rates in 1996 and 2007. In order to assess the variation of crime rates in rural and urban areas in relation to their structural conditions, two set of models are used. First, a model for the whole of Sweden is applied, flagging for differences in UAs, ARs and RRs. Then, the second model strategy is to focus on rural areas only, by excluding UAs from the model but still allowing for differences between ARs and RRs. Do patterns found for UAs apply to rural areas? Do the models have the same predictors for both urban and rural crime? Geographical Information Systems (GIS) and spatial regression models are employed in the study, which make use of municipality boundaries as the unit of analysis. The reason for using spatial regression models is to check for 'spatial effects' (Baller, Anselin, Messner, Deane, & Hawkins, 2001) in the data that might help us to better understand regional patterns of crime.

In the following section, the background to the study is presented by briefly reviewing research on crime in rural areas. In this section, factors that characterise the life and dynamics of rural areas, and are expected to affect crime levels, are presented. This framework helps organise ideas and provide the groundwork for the hypotheses of this study. General trends in crime levels and patterns in Sweden are presented in section "Trends in rural crime in Sweden". The modelling work needed to meet the second objective of the paper is presented in section "Modelling crime in rural Sweden" while results are discussed in section "Results". Section "Final considerations" concludes the paper with conclusions and directions for future work.

Crime in rural areas: framing the Swedish case study

Although rural areas traditionally experience lower levels of crime than urban areas, international literature shows a mixed view with regards to crime type (e.g., Carcach, 2000; Marshall & Johnson, 2005: p. 26; Osgood & Chambers, 2000). One reason for these contrasting findings is that 'rural areas' are classified differently from country to country (differences in the conceptualisation of 'rural' are found even within countries, such as in the UK, see Marshall & Johnson, 2005: p. 10; Martin, Brigham, Roderick, Barnett, & Diamond, 2000; in Australia, see Alston & Kent, 2009, and in Sweden, SCB, 2005). What studies in this area often have in common is their underlying theoretical background. They are often based on complementary theoretical approaches: *social disorganisation* (e.g., Kornhauser, 1978; Sampson, Raundenbush, & Earls, 1997; Shaw & McKay, 1942) and *routine activity theories* (e.g., Felson & Cohen, 1980; Osgood, Wilson, O'Malley, Bachman, & Johnston, 1996). Based on rational choice theory, studies have also been done using Becker-Ehrlich deterrence model (Entorf & Spengler, 2000; Cracolici & Uberti, 2009). Macro theories relating crime to structure in society, such as *anomie theory*, have also been used to understand regional patterns of crime (e.g., Ceccato, 2008; Kim & Pridemore, 2005), and these in turn have a clear link with processes suggested by theories of *rural change* (e.g., Ilbery & Bowler, 1998; Marsden, 1998). Here focus is given to the following theories: social disorganisation theory, routine activity and to a less extent, anomie.

Social disorganisation theory suggests that structural disadvantage breeds crime and suggests that offending occurs when impaired social bonds are insufficient to encourage or enforce legitimate behaviour and discourage deviant behaviour (Bottoms & Wiles, 1992). Studies based on social disorganisation theory often use indicators of poverty, ethnicity and residential stability, and typically deal with expressive crimes. More recent investigations suggest that social polarisation, combined with the loss of social cohesion or collective efficacy, has a significant effect on crime levels (Hirschfield & Bowers, 1997; Sampson et al., 1997). At regional level, unemployment rates, inequality, proportion of young population and indicators of family

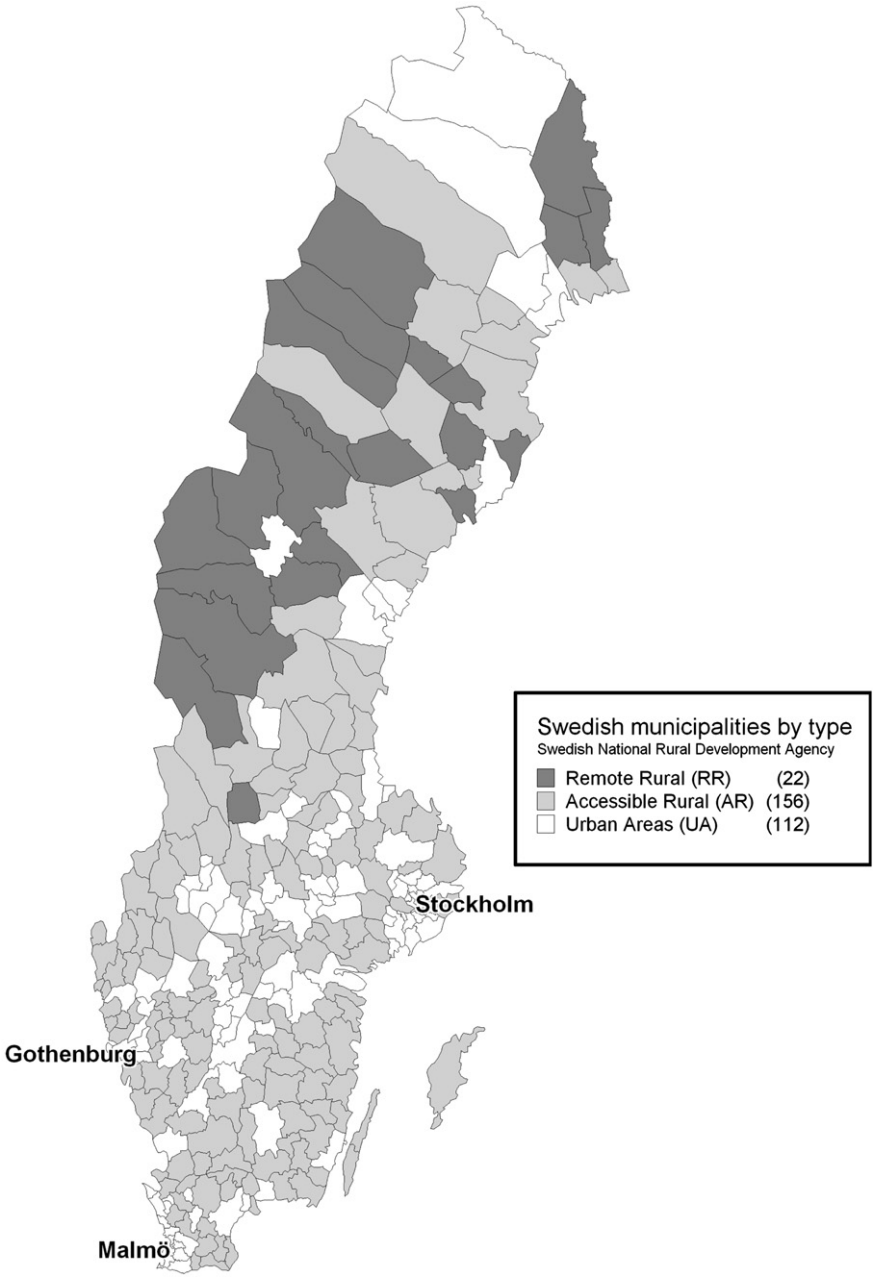

Fig. 1. Swedish municipalities by type. There are 290 municipalities (Kommun) in Sweden, with an average population size of 31 thousand inhabitants (from a minimum of 2.6 up to 766 thousand inhabitants). Municipalities are the unit of analysis in this study since it is the smallest administrative unit and it is at this level that most indicators are available for comparisons at national level. However, when comparisons between types of municipalities are required, municipalities are grouped in three types: Remote Rural (RR), Accessible Rural (AR) and Urban Areas (UA). Although far from being free of problems, these groupings of municipalities are chosen because they are useful and fairly stable representations of the difference in the dynamics generated by total population in these municipalities over time and the flow of population between them, which are of criminogenic relevance for the study of crime. For an extensive discussion about challenges in classifying rural areas, see Martin et al. (2000). An alternative way to classify Swedish rural areas was suggested by Statistics Sweden (H-regions), with six classes of municipalities, from large urban areas to remote rural ones, based on their geographical and economic homogeneity.

structure (e.g., divorce rates) can be used as general indicators of social disorganisation. As suggested by *anomie theory* (e.g., Durkheim, 1897), conditions of social disorganisation may be a result of comprehensive set of changes in rural areas (e.g., Ilbery & Bowler, 1998; Marsden, 1998) that create anomic conditions and in turn increased rates of crime and violence. In countries in which the welfare state is strong, it could be expected that these anomic conditions are mitigated by social institutions since they moderate the negative effects of rapid social changes (Messner & Rosenfeld, 1997).

Routine activity theory, on the other hand, focuses on the dynamics of crime events and the importance of opportunity in relation to crime. Crimes depend on the convergence in space and time of motivated offenders, suitable targets and absence of capable guardians (Felson & Cohen, 1980). Since the prediction of spatial human interaction is very difficult to attain empirically, routine activity studies are often based on static measurements of land use. At regional level, day/night population density, location at the border, order of centre in an urban hierarchy, transportation lines and nodes are often used as indicators of people's movement

flows (e.g., Ceccato, 2007). Location (e.g., south, north) and geography (e.g., being at border) are also considered relevant to determining an area's vulnerability to crime because of its differentiated pattern of routine activity (see e.g., Ceccato, 2007; Ceccato & Haining, 2004). For instance, rural municipalities located in southern areas of Sweden could potentially be more criminogenic than relatively isolated northern rural municipalities because of their proximity to Denmark (potential inflow of people), transport corridors from Sweden to the continent, and the region's high population density and daily commuting flows.

Rural and urban areas may differ in the processes behind criminality. For instance, evidence shows that social factors (e.g., family structure) as predictors of crime are more important than economic ones (e.g., deprivation) in non-urban areas (for a review, see Wells & Weisheit, 2004). There are reasons to believe that models set for urban areas may not fit the dynamics of rural communities and that they may vary by crime type. For instance, violent crimes, including homicides and assault, were also prevalent in rural areas in the transition states of Estonia, Latvia and Lithuania in the 1990s (Ceccato, 2007; Ceccato & Haining, 2008). Analyses of crime in rural communities in the US have focused on crime and religion or morality (Lee, 2006; Lee & Bartkowski, 2004), rapid community growth and crime (Freudenburg & Jones, 1991), socio-economic conditions (Lee & Ousey, 2001) and crime from social disorganisation (Baller et al., 2001; Barnett & Mencken, 2002; Freudenburg & Jones, 1991; Osgood & Chambers, 2000; Petee & Kowalski, 1993). In particular, residential instability, disrupted families and ethnic heterogeneity are identified as correlates with rural violence and are interpreted as an indication of weaker informal social control in rural areas.

For property crimes, official crime statistics in the UK show that rural areas experience lower levels of robbery and theft of motor vehicles than in urban areas. However, other crimes such as theft from a motor vehicle appear to be a disproportionate problem for rural residents (Marshall & Johnson, 2005: p. 26). Unlike the statistics in the UK, rural areas in Australia show a higher crime rate for violent crimes than for property ones. Carcach (2000) found that in rural Australia, violent crime outdoors was particularly prevalent in some remote rural regions. Rural areas also showed a higher crime rate for malicious damage, breaking and entering, assault, sexual assault and drug offences.

Regional patterns of crime may show large spatial patterns. In Italy, regional patterns of crime can't be assessed without looking at the geography of organised crime (Cracolici & Uberti, 2009). For instance, a distinct pattern of violent crime was found between northern and southern parts of the country (mostly in Campania, Puglia, Basilicata, Calabria, Sicilia and Sardegna). Similar geographical divide was also suggested by Entorf and Spengler (2000) between West and East Germany, where crime reflects distinct criminogenic conditions over time and space. Also in the US, Baller et al. (2001) identify a clear north–south divide in homicide patterns.

In the next section a set of criminogenic factors are discussed in relation to conditions in Sweden over the last decade (hypotheses are shown in italics). Fig. 2 summarises a conceptual framework for four possible processes affecting the crime geography in Sweden.

Geographical shifts in population

After more than two decades of relative regional stability, the 1990s saw a new wave of population concentration in Sweden. During the second half of the decade more than 200 of the 290 municipalities had a population decline. According to the Swedish National Rural Development Agency (2005: p. 6), the share of

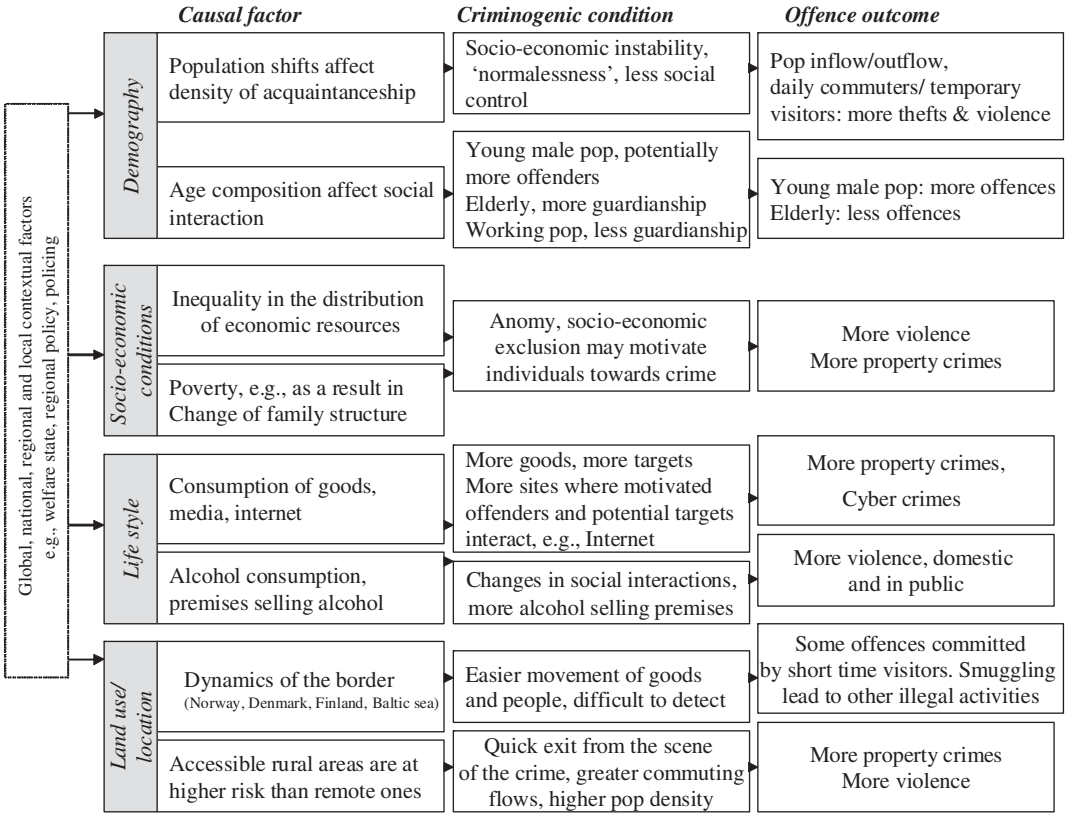

Fig. 2. A conceptual framework for the link between a municipality's crime levels and its underlying criminogenic conditions.

people living in sparsely populated areas has decreased by approximately ten per cent since 1995. The primary causes of this rural population decline are low birth-rates and out-migration, particularly of young people; in other words, populations are aging. This development is not geographically homogenous. The city regions and their hinterlands grew quickly, while rural and peripheral areas were generally worse off. In the last few years, the regional population redistribution has decreased (Amcoff & Westholm, 2007; Magnusson & Turner, 2000) but the tendency is towards regions and a more geographically concentrated population pattern. Such a development neither follows urbanisation nor counterurbanisation/gentrification processes in the strict sense, as has been found in the UK and elsewhere (Eliasson, Johansson, & Westlund, 2009; Westlund, 2002: p. 1408). The population redistribution as described above can be linked to the dynamics of crime in several ways:

Population shifts affect density of acquaintanceship, which is the degree to which members of the community know each other (Weisheit & Donnermeyer, 2000). Residents of a small community are more likely to know one another socially than in a larger city, and this informal guardianship leads to lower rates of crime in rural settings (Freudenburg, 1986). However, if people move out, such ties are broken and may generate socio-economic instability, 'normalessness' and consequently, violence (e.g. Kim & Pridemore, 2005). A particular effect on community life may occur when out-migration is selective (age, gender and education related), often leaving behind the poorly educated elderly male.

Conditions for property crimes are also affected by population shifts. Often when the population within a community grows, this may be followed by an increase in housing construction, recreational and other facilities, which offer more crime opportunities and, at least in the short term, weaker social control (Wikström, 1991). Particularly in ARs single-family houses might constitute potential targets for crime since they are not equally equipped with security devices as in typical single-family neighbourhoods in ARs. Changes in residence also mean that people's daily routine activities are altered (e.g., larger commuting distances between place of residence and workplace), putting them hypothetically at a higher risk of becoming a crime victim than they may have been previously. Population inflow might be periodical (e.g., in touristic places) but still has the potential to affect crime records. For instance, *visitors spending a short time in a city might be tempted to engage in antisocial activities (e.g., excessive drinking, public disturbance) because of the anonymity.*

A North–South divide characterises the regional criminogenic conditions in Sweden. Whilst Northern rural communities are remote, with low population density, and higher degree of isolation, Southern municipalities (although they do not constitute a homogeneous socio-economic, cultural-religious area, see for instance, Småland) are strongly interconnected by influential large UAs in Sweden and to the northern European continent. *Southern rural municipalities, particularly those within the urbanised triangle of Stockholm–Malmö–Gothenburg (the three largest UAs in Sweden), are more exposed to local and regional flows of people and goods than the Northern rural municipalities.*

Another component of demography that is relevant for crime dynamics is the age structure of a population. For instance, the percentage of the population aged 65 and above is higher than the national average in most RRs and ARs, whilst relatively few people aged 20–29 live in these areas (The National Rural Development Agency, 2008). The demography of areas might also affect social interaction and hence crime rates. At the intra-urban level, Lagrange (1999) points out that residents in early adulthood are likely to be absent from their homes more frequently and therefore guardianship may be substantially reduced. In Germany, Entorf and Spengler (2000) found that relatively large young cohorts (group 15–24 years old) increased crime rates in the majority of crime categories, particularly when they are unemployed. In Sweden it is expected, for instance, *that the risk of any offence is highest in areas with a large proportion of young males because they are regarded as potential offenders and victims for both property and violent crimes.*

Regional differences in socio-economic conditions, welfare and community life

Poverty and income inequality, whether at city, state, or national level, are powerful predictors for homicide and violent crime (Kennedya, Kawachib, Prothrow-Stitha, Lochnerb, & Guptaa, 1998; Wang & Arnold, 2008). American and British studies have long associated poverty with disorder and crime at urban levels (see, for example, the seminal work of Park & Burgess, 1925; Shaw & McKay, 1942, and later Bursik & Grasmick, 1993; Kornhauser, 1978). Indicators of absolute or relative deprivation (Burton, Cullen, Evans, & Dunaway, 1994) are known to affect negatively communities' social cohesion (Hirschfield & Bowers, 1997) and collective efficacy (Sampson et al., 1997), which are important for fostering social control and deterring crime. In rural settings, poverty is invisible (Commins, 2004) because of small community size and the use of particular methods of measurement and inappropriate indicators (Martin et al., 2000).

International literature indicates that crime results from increasing poverty and exclusion in rural areas (e.g., Petee & Kowalski, 1993). In Sweden, although there is no empirical evidence linking poverty and motivation to offend, Johansson et al. (2009) suggest that inequality in rural areas is increasing. There are two groups moving to rural areas from big cities in Sweden: those who cannot be absorbed by the labour markets and have no place to go other than smaller cities. This group is followed by a smaller but wealthier group people who are at the end of their careers and take with them their urban businesses or expertise to the countryside. From a criminogenic point of view, inequality in the distribution of resources can motivate deprived individuals towards crime. *Some of these motivated individuals might overcome lack of financial opportunities through theft/robbery or express their frustration at their incapacity to reach desired resources through violence.*

In contrast to the predominantly negative development that has affected many rural areas, new solutions have been found subsequent to Sweden's EU membership. Structural funds (e.g., LEADER II and Interreg II) have provided, although only partially, increased economic resources for local initiatives. Local action groups run by local development projects have taken over local services and found new solutions to old problems (Petterson & Westholm, 2007). International literature shows evidence of the effect of social cohesion/social capital on local development (Putnam, 1993; for a Swedish example, see Westlund & Pichler, 2005). Although not uniform in their impact, these types of pro-social actions moderate negative structural effects on the market economy and help prevent/reduce social problems, including crime (Carcach & Huntley, 2002; Ceccato & Haining, 2008; Kim & Pridemore, 2005). The same could be said of differences in resources devoted to promote democracy and social cohesion at municipal level. *The unequal distribution of material resources and lack of social care can be considered the cause for an increase in criminal offences, which can be alleviated by the existence of pro-social actions, such as investments directed to vulnerable groups.*

Changes in policing are another example. Up to the mid-1960s policing was performed by locally-based entities; which changed in 1965 when the police became a centralised authority. In the 1980s a debate against strong governmental intervention and centralisation affected many sectors of society, including the police. This development led to the reinstatement of community-based

policing in Sweden in the 1990s. Crucial for this decentralised structure was the 1996 national programme for crime prevention in which local police forces were a central actor. Local cooperation was regarded as a key instrument in successful crime prevention. However, little attention was paid to urban–rural dynamics or challenges imposed by reaching rural areas. Resources were allocated based on crime levels and population density; thus new police stations were often opened in urban areas (a similar development was found in the UK: see a review by Yarwood, 2001). Rural crime has not been a particular issue but rather considered as a problem of accessibility. According to Swedish public investigation (SOU, 2002), long police response times to a crime place have been affecting levels of fear of crime and satisfaction with the police in most Swedish remote areas. Remoteness per se is not a problem; rather, it is the size of local police areas, which can vary a great deal: Southern areas are relatively easy for police forces to cover because of the relatively high population density, whilst in the North some of the police force areas are very large. *Police resources, an indicator for formal social control, are expected to have the potential to affect crime levels and geography.*

Low participation in elections is often linked to mistrust in society, economic inequality, and a 'weakening of the norms of governing behaviour' (Sampson et al., 1997: p. 41) as well as an indicator of weak social cohesion/capital (e.g. Putnam, 1993). In Sweden, although participation in municipal elections has been constant in the last ten years, there are regional differences (the highest election turnover was found in municipalities belonging to Stockholm's metropolitan area). *Low participation in elections is interpreted here as a sign of weakening social bonds (between residents themselves and between residents and their government) and the residents' lack of engagement with social issues in general.*

Divorce rates, an indicator of family structure, have also been suggested as a strong predictor for offending (Ceccato, 2007; Sampson, 1986). Divorce rates were constant in Sweden between 1996 and 2007 (from 2.4 to 2.3 divorces per 1000 persons) and at similar rates to those of other Scandinavian countries (Eurostat, 2008). One of the mechanisms that links broken families with offending is the increase in poverty, particularly following a divorce (Corcoran & Chaudry, 1997). Recent literature in Scandinavia indicates that for children divorce is indicative of more than economic hardship, pointing out how psychological challenges following separation lead to increased risk for mortality, morbidity and antisocial behaviour (Frojd, Marttunen, Pelkonen, von der Pahlen, & Kaltiala-Heino, 2006; Weitoft, Hjern, & Rosén, 2003).

Rural change and patterns of consumption

As in other parts of the world, Sweden shows signs of an emergence of a 'post-productivist countryside' that is qualitatively different from the agri-industrialised landscapes of 'conventional' agriculture (Ilbery & Bowler, 1998; Marsden, 1998). Rural areas are becoming more similar to urban areas both socially and economically. The exchange that occurs through media, migration and daily commuting connects both the city and countryside (Eliasson et al., 2009; Westholm, 2008: p. 54), producing new opportunities to crime. Changes in life styles and patterns of consumption are just two examples of these transformations. For instance, 66 per cent of the population living in small towns had access to broadband in 2007, compared with 76 per cent in metropolitan areas (The National Rural Development Agency, 2008). In practice, the use of the Internet has made geography irrelevant from the criminogenic point of view, since even people living in remote places in North Sweden can become a target.

Another important trend is the increase in alcohol and drug consumption in Sweden over the last decade. In Sweden, illegal-drug experience is considerably more common in major UAs, while the lowest rates are found in small towns and sparsely populated regions. This geographical difference also applies to the consumption of alcohol, which has increased in the last ten years despite sales being permitted only in restaurants and stores regulated by the Swedish Alcohol Retailing Monopoly (Systembolaget). This is partially due to clandestine production (more common in northern Sweden) and an increase of legal and illegal private alcohol markets following EU membership (CAN, 2007), particularly in southern Sweden. Although consumption is still underestimated by official statistics, it is known that there has been a rise in the number of major consumers and the number of 'intensive-consumption occasions' (i.e. drinking at least the approximate equivalent of a bottle of wine on a single occasion). According to Guttormsson, Andersson, and Hibell (2004), young people in rural areas consume on average 1.6 l less than youths living in large cities, Stockholm being the leader. Differences in substance abuse between rural and urban areas are more controversial elsewhere (see e.g., Forsyth & Barnard, 1999; Scheer, Borden, & Donnermeyer, 2000). Since alcohol and drug abuse are often associated with crime, particularly violent crime (for a review, see Mosher & Jernigan, 2001), it is expected that *municipalities with a higher alcohol consumption per capita (more alcohol-selling premises) will tend to have higher crime rates.*

Trends in rural crime in Sweden

Sweden often emerges as having very high levels of recorded crime. One of the reasons for this is that Swedish crime statistics cover a very wide range of offences and include crime types that are not covered by the statistics of other countries (Dolmen, 2001; Van Dijk et al., 2007). Moreover, the population willingness to report crime is relatively high in Sweden, but there are of course differences in reporting practices by crime types (violence often being less reported than property crimes) and by regions, with UAs (particularly the Stockholm region) having the highest propensity to report offences (BRÅ, 2008). Distance from the police as well as cultural factors are behind such differences in the willingness to report an offence. The perceived lack of anonymity in rural areas and the consequent worry of confidentiality might create isolation and lower reporting rates. Despite the lack of empirical evidence for Sweden, it is believed that such social isolation can be particularly problematic for ethnic minority groups when seeking advice and in reporting racial discrimination and abuse (Dhalech, 1999). This analysis will concentrate mostly on police-recorded data from 1996 to 2007 for two reasons. Firstly, it covers a period of relatively rapid transformation in rural areas that is believed to be related to changes in regional policy and Sweden's entrance to the European Community in 1995. Secondly, before the mid-1990s, it is difficult to ascertain the quality of reported police data for some of the offence categories because of the changes in statistical procedures in recording and police practices.

Table 1
Values of test for global spatial autocorrelation.

	Global Moran's I	
	1996	2007
Whole Sweden		
Theft (log)	.2472***	.2131***
Violence (log)	.1819***	.0941***
Rural areas only		
Theft (log)	.1414***	.3043***
Violence (log)	.1401**	.0242

***Significant at the 1 per cent level; **significant at the 5 per cent level; *significant at the 10 per cent level.

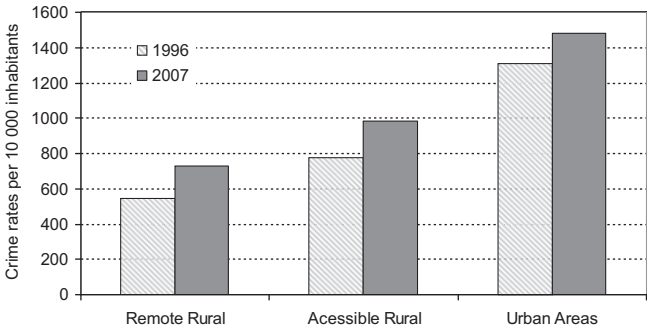

Fig. 3. Shift in crime rates per municipality type from 1996 and 2007.

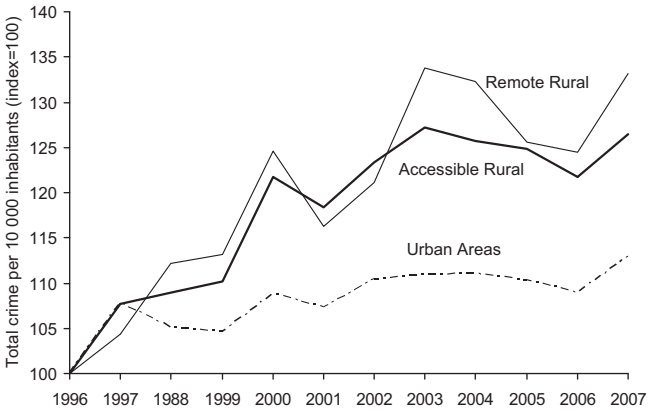

Fig. 4. Offences rates in Sweden per area: 1996–2007.

Crime clusters in space. The global measure of spatial autocorrelation Moran's I (with row-standardized binary weight matrix, queen criterion, first order neighbours in GeoDa 0.9.5-1, Anselin, 2003) indicates that theft and violence do not happen at random (Table 1).

Crime occurs more often in urban areas than in rural ones (Fig. 3) but there have been significant shifts between 1996 and 2007. Both RRs and ARs have become more criminogenic in the last decade. In ARs, crime rates increased from 776 to 982 per 10,000 inhabitants from 1996 to 2007. This trend follows a consistent pattern from 1996 to 2007 for all areas. The relative increase is significantly higher in RRs and ARs areas than in UAs (Fig. 4), and is not smooth for rural areas. There are two peaks in rural areas in 2000 and 2003 that are related to an unexpected high number of property crimes, especially in AR municipalities. The reasons behind such a development are difficult to establish, but there seem to be demographic and structural socio-economic changes that are affecting rural and urban areas differently. In order to better discuss possible reasons behind these shifts, the analysis will be split by crime types.

The categories of offences that have increased most in number in Sweden between 1996 and 2007 are drug offences, followed by violence and criminal damage (Table 2). Drug offences are highly sensitive to police practices, so such an increase may be related, at least partially, to programmes directed to substance abuse and dealing, but also to changes in the way the offence is recorded. For criminal damage, although there has been an increase, the expected number for both rural and urban regions is smaller than the national trend.

The most controversial increase relates to violence. On a national level, reported crimes of violence have increased by 66 per cent between 1996 and 2007 (286 per cent between 1975 and 2007). Although there is evidence that this rise reflects an increase in population propensity to report violence (Estrada, 2005) as a consequence of society's increased sensitivity to such behaviour (Jerre, 2008), the view is that a drastic increase in reported violence such as this should also reflect a genuine rise in levels of violence, as suggested by Kühlhorn (2007) and Andersson and Mellgren (2007). These authors suggest that overlapping societal processes such as increasing segregation, economical deprivation and most importantly, increasing alcohol consumption, are the causes of the rise of violence.

The increase in violence shows different regional patterns. In 2007, more violent offences occurred in rural areas than if they had followed the national trend; 150 more recorded cases than the expected in RRs and 87 more cases in ARs (Table 2). This trend varies by crime type and regions. For instance, for homicides in large UAs the victim is often not acquainted with the offender, and homicides are often related to criminal motives and associated with the use of fire arms. Outside large UAs, mental health problems are often the cause of homicides, which might be associated also with drinking (BRÅ, 2007).

The trend is the same when violent acts are standardized by resident population. An increase from an average of 45–83 per 10,000 inhabitants from 1996 to 2007 was detected. Despite the widespread increase in violence rates, cluster techniques show that the core clusters of violence remain fairly constant (Fig. 5). Getis-Ord

Table 2
Changes in offences 1996–2007.

	Offences per 100,000 inhabitants				Counts		
	Remote Rural – RR (%)	Accessible Rural – AR (%)	Urban Area – UA (%)	Sweden (%)	O-E (RR)[a]	O-E (AR)[a]	O-E (UA)[a]
All offences	33.1	26.5	12.9	17.0	884	735	−540
Violence	119.0	85.9	58.6	66.2	150	87	−58
Assault women	108.1	76.7	44.8	53.3	−44	−29	−19
Assault unknown outdoors	121.4	108.3	74.6	83.3	−20	−24	16
Theft	−12.4	−11.9	−21.5	−20.2	257	406	−110
Burglary	17.1	12.2	−3.7	−2.4	71	−10	−111
Car theft	8.2	−32.8	−50.2	−48.5	61	56	−13
Theft from motor vehicle	3.3	−9.5	−32.5	−29.9	152	180	−47
Robbery	21.3	63.8	49.2	43.9	−2	4	4
Burglary in cellar or attic	−64.5	−18.3	−60.2	−57.8	−2	53	−10
Theft from stores	−10.9	−5.0	−9.2	−8.6	−4	15	−5
Drug offences	−2.4	221.7	138.0	158.4	−211	96	−46
Criminal damage	52.8	53.9	54.1	56.9	−26	−26	−26

[a] Observed = total number of offences in the region; expected = an estimate of the total number of offences in the region if the region had followed the national trend in crime levels 1996–2007.

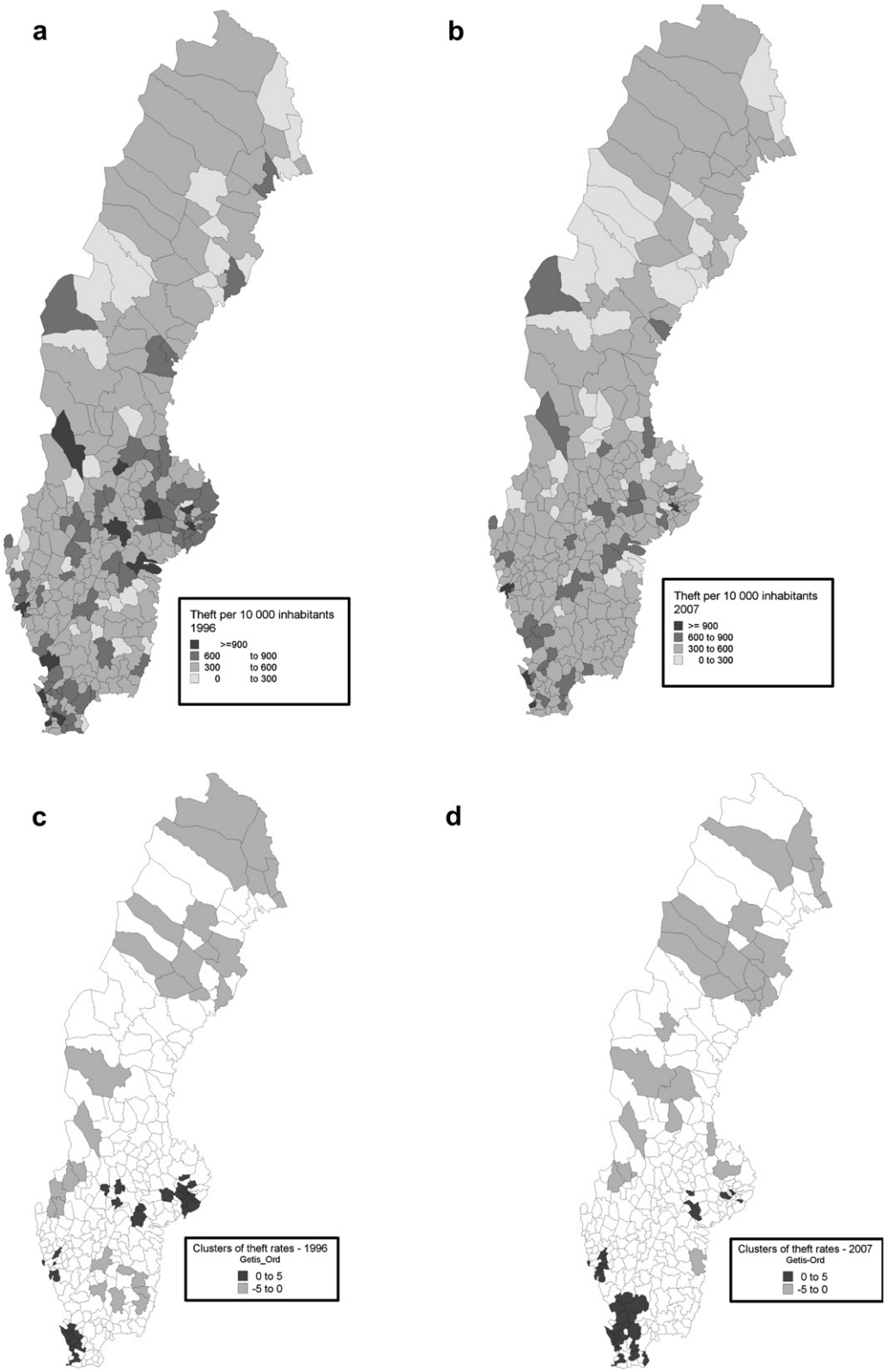

Fig. 5. (a) and (b) Theft rates per 10,000 inhabitants: 1996 and 2007. (c) and (d) Clusters of theft rates:1996 and 2007. Dark grey areas are hot spots, light grey areas are cold spots (Getis-Ord values significant at the 10% or less). The islands of Öland and Gotland do not belong to any cluster and were excluded from the map.

statistics was used (Anselin, 1995) to check the geographical distribution of areas with both high and low crime rates. Row-standardized binary weight matrices (W) were used that comprised nonzero entries where i and j refer to areas that are adjacent (criterion was queen, first order neighbours) in Spacestat 1.91 (Anselin, 1992). Swedish islands in the weight matrix were manually linked to the mainland by replacing the zero values to a known neighbour (Öland was linked to Kalmar, and Gotland to Oskarsham and Nynäsham) but

they do not belong to any cluster, and are excluded from Fig. 5. 'Hot' spots of violence (municipalities with high violence rates close together) were found mostly in Stockholm County and surrounding areas, whilst 'cold' spots (municipalities with low violence rates close by) were concentrated in northern Sweden.

Whilst reported violent crimes have increased by 59 per cent between 1996 and 2007 in Sweden, a drop in property crimes was observed in the same period (513–443 per thousand inhabitants). However, this trend is not homogenous, as it varies by crime type and is particularly concentrated in urban areas. Whilst rural areas record increases in burglary, car theft and robbery, urban areas have experienced a reduction of almost all types of thefts. ARs, for instance, had 406 more thefts in 2007 than if they had followed the national trend. These were for nearly all property crime categories (five out six offence types).

Three possible reasons might explain the decrease of reported thefts in Sweden between 1996 and 2007. The first cause is related to the fact that a substantial share of theft records are car-related thefts, so any improvement of car-related crime prevention initiatives is bound to have an effect on total figures of thefts. Technologies implemented in new cars after the mid-1990s made them more difficult targets to steal from or to be stolen (e.g., use of immobilisers). The second possible cause is related to the fact that insurance companies have increased their excess charges. If the value of stolen goods does not exceed the minimum value at which reimbursement can be claimed, there is a strong chance that a victim of crime will not bother to report the offence to the police. Finally, it is believed there has been a displacement from more traditional types of crimes (such as car thefts) to other types of offences, such as fraud. More frequent use of bank cards or bank account details (e.g., through the Internet) may have risen with new opportunities.

There have, however, been clear shifts in the clusters' geography of property crimes that are important to note (Fig. 5c and d). For instance, the number of 'hot' spots in urban municipalities (municipalities with high theft rates close together) dropped from 32 in 1996 to 23 municipalities in 2007, whilst some AR municipalities became the core of these 'hot' spots, particularly in south-western parts of the country. Among AR municipalities, there has been a drop of one-fourth in the number of 'cold' spots of thefts (municipalities with low violence rates close by) between 1996 and 2007, whilst in RRs the number was nearly constant in the same period.

The change in geography of 'hot' spots of property crimes from Stockholm to Sweden's southern municipalities can be related to a couple of factors. One important factor was the completion of the Öresund bridge in July 2000, linking Copenhagen and Malmö. By 2001, Ceccato and Haining (2004) had shown that the category of offence which had increased most in number in the Swedish Öresund region after the bridge construction was theft of different types, particularly from cars and bicycles but also drug-related crimes. It is possible that the bridge increased the car stock in these areas and, consequently, the number of targets for possible vehicle thefts and thefts from vehicles.

The concentration of acquisitive crimes in the region can also be related to new criminogenic conditions in the area, triggered by the intensification of drug and alcohol smuggling. Drug addicts may become involved in residential burglary (Wiles & Costello, 2000) and theft to obtain money to buy drugs. Ceccato and Haining (2004: p. 810) reported that 'the drug trade between Denmark and Sweden is a consequence of drugs in Denmark being cheaper, of better quality, and easier to buy than in Sweden'. In addition, there is a more liberal attitude towards drugs in Denmark. The result is that local and decentralised criminal organisations take advantage of these conditions to repeatedly smuggle small quantities of narcotics by train. This intense but localised trafficking is known in the region as Myrtrafiken (ants' traffic) and may also involve other products, such as large-scale quantities of alcohol.

Modelling crime in rural Sweden

We now model the levels of offences in Sweden in 1996 and 2007. We assess the differences in crime geography between UAs, ARs and RRs in two different models (Fig. 6):

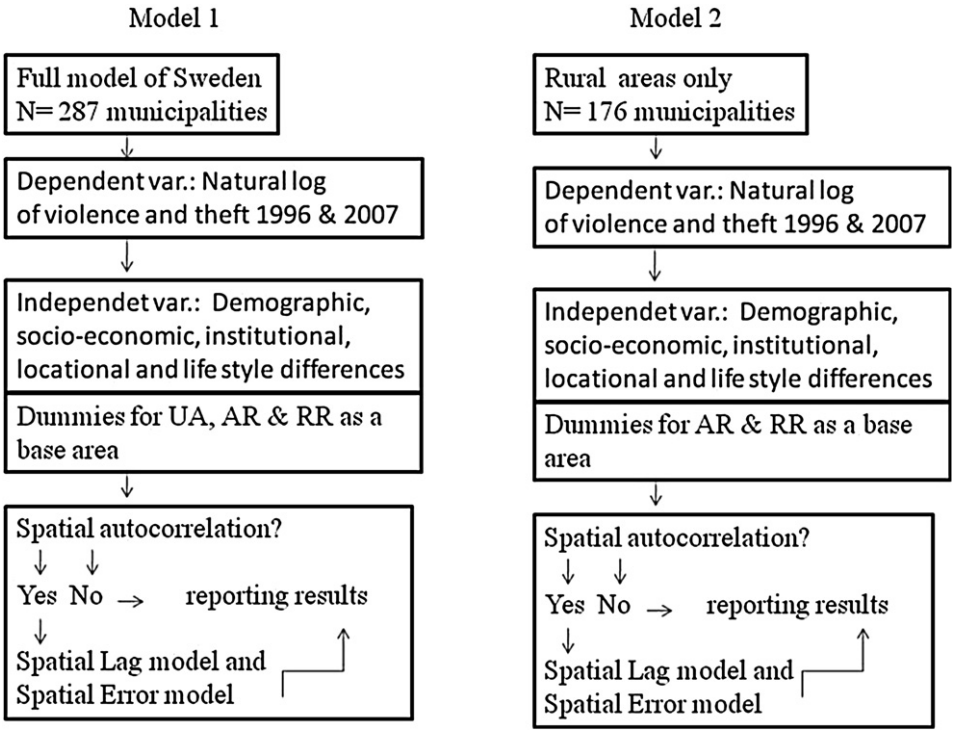

Fig. 6. Modelling strategy.

(1) by fitting models for the whole of Sweden that contrast 1996 and 2007 data using dummies for ARs and UA (the variable RR was used as a base area). In the first model we expected that the model would be highly dominated by UAs despite the fact that dummies for rural areas were an integral part of the analysis, and,
(2) by having the model rural areas only (ARs and RRs), using a dummy for AR and having RR as a base area, also for 1996 and 2007. This strategy has been tested to ensure that only the rural dynamics would be captured here.

Our modelling strategy was to start with a OLS model. If autocorrelation was presented, then spatial lag and spatial error model would be used to address problems of spatial autocorrelation on residuals (see Haining, 2003; Anselin, 2002 for a discussion of when these different models are appropriate to consider). The matrix W was used to specify these models, which take the form of a lag operation on the response variable (spatial lag model) and the form of spatial correlation in the errors term (spatial error model).

There are two reasons for using spatial lag and error models. The first is theoretically driven. Crime goes beyond a specific area (there is evidence of a spillover effect or diffusion for certain types of crime) because offenders and victims/targets are mobile. At regional level, spatial lag models could be efficient to indicate pockets of offences that go over municipal boundaries, such as over a metropolitan area. Thus, lots of crime events in one municipality predict an increased likelihood of similar events in neighboring areas. The spatial error model could help to evaluate "the extent to which the clustering of crime rates not explained by measured independent variables can be accounted for with reference to the clustering of error terms. In this sense, it captures the spatial influence of unmeasured independent variables" (Baller et al., 2001). The second motive for using spatial lag and error models is data driven, because it is indicative of data problems. As Anselin (2002) suggests, for example, the scale and location of the process under study does not necessarily match the available data. This mismatch will tend to result in model error structures that show a systematic spatial pattern. Moreover another problem is that spatial autocorrelation on residuals goes against the basic assumptions of OLS regression. One way to deal with it is to use spatial lag and spatial error models. The use of these models is necessary to ensure more reliable results, in other words, to obtain unbiased and efficient estimates for the regression parameters in the model.

Dependent variables

The dependent variables are the theft and violent crime rates in 1996 and 2007. The set of standardized crime rate values showed a highly skewed distribution. The raw rates were transformed using the log transformation to produce a dataset close to normal. Histograms of the new logged rates showed that in all cases the distribution improved after the transformation. In order to test for spatial autocorrelation on the residuals, row-standardized binary weight matrices (W) were used that comprised nonzero entries where i and j refer to areas that are adjacent (criterion was queen, first order neighbours). For the sake of having a contiguous study area, Swedish islands in the weight matrix were manually linked to the mainland by replacing the zero values to a known neighbour (Öland was linked to Kalmar, and Gotland to Oskarshamn and Nynäsham, following their bridge/boat connections). Although this weight matrix is not free of problems (see e.g., Cracolici & Uberti, 2009 for relational weights matrix), its use has been a common practice in international literature of spatial data analysis (e.g., Ceccato et al., 2002; Haining, 2003).

For the rural-only model, the weight matrix also had to be rebuilt, since many municipalities were deleted and we had therefore to reconnect the remaining ones manually to their closest neighbours. Since a binary weight matrix was used previously in the analysis (to testing for clusters and in the full model), we decided to use a weight matrix that was similar to the previous one. This 'artificial' binary weight matrix succeeded as much as possible in representing the real world spatial arrangement (particularly proximity), but excluding urban areas. For instance, two rural areas that belonged to the hinterland of an urban area are now in this weight matrix closer to each other than they would have been if they were depicted by a 'real world' weight matrix (with urban areas in it). Distance matrices were tested in relation to this artificial binary weight matrix and showed very similar results (coefficients, t-values, R^2). The regression analysis was implemented in GeoDa 0.9.5-1 (Anselin, 2003) since it has regression modelling capabilities with a range of diagnostics not available in traditional statistical packages.

Independent variables

The models include individual variables with data from two periods in time cross-sectionally, 1996 and 2007[2]. The selection of the independent variables follows the conceptual framework presented in Fig. 2 and its discussion in Crime in rural areas: framing the Swedish case study section. These variables are proven to be associated with a place's criminogenic conditions. They might be demographical (e.g., age, gender, population in/out flow, citizenship), geographical (e.g., location, rural-urban), institutional (police, polity, divorce, democracy) or associated with a population's socioeconomic conditions (e.g., income, unemployment), and life style (e.g., alcohol consumption). For a further description of the variables and their data sources, see Appendix 1. Due to data limitations, the values of some explanatory variables, although from one time period, are not from the same year. The statistics for Voter Turnout are from 1998 and 2006, while the statistics for Young Male Population are from 1996 and 2007. Correlation between the independent variables has been checked for both set of models. Appendix 2 illustrates the correlation between the independent variables for whole Sweden-model in 1996 and 2007.

Tables 3 and 4 summarise the findings of regression models, including the significant variables. Despite performing transformations to try to correct distortion of the dependent variable, non-normality of the residuals was still a problem in five of eight of the models (Jarque–Bera test on normality of errors). Heteroskedasticity was also tested (Koenker–Bassett test and Breusch–Pagan test) and was a problem in three models. For some of the theft models, the Ordinary Least Squares regression model diagnostics revealed significant spatial autocorrelation on the residuals. Spatial lag and error models were then fitted to address the problem. When spatial autocorrelation was not present (e.g., models for theft 1996 and violence 1996 and 2007 in Table 4), only OLS results are shown. Tables 3 and 4 show the results from OLS and spatial error models. Spatial error models provided the best fit based on diagnostic tests (AIC values, R2, Log likelihood, Schwarz criterion).

Results

Although there has been an increase in crime levels and rates in rural areas, crime is an urban phenomenon in Sweden. The dummy variable urban areas (UAs) came out significant to explain the variation of theft and violence in most models (Tables 3 and 4). This

[2] The difference in thefts between 1996 and 2007 was tested as dependent variable, but the results were poor.

Table 3
Regression results for crime rates for 1996 and 2007, Sweden ($N = 287$).

	Theft 1996		Theft 2007		Violence 1996		Violence 2007	
	OLS	Error	OLS	Error	OLS	Error	OLS	Error
YoungMale	.1205*** (4.46)	.1097*** (4.23)	.1057*** (3.59)	.0979*** (3.94)	.0804* (1.92)	.0804** (1.99)	.1643*** (4.83)	.1610*** (4.87)
Divorce	.1680*** (8.98)	.158*** (8.34)	.0768*** (4.55)	.1070*** (6.23)	.1868*** (6.44)	.1864*** (6.40)	.1627*** (8.32)	.1614*** (8.10)
Foreigner	−.0160** (−2.38)	−.0135** (−2.01)	.0085 (1.23)	−.0031 (−.457)	.0089 (.860)	.0072 (.702)	.0061 (.760)	.0037 (.469)
Unemp	.0087 (.951)	.0130 (1.38)	.0331 (1.60)	.0674*** (3.20)	.0259* (1.82)	.0283 (1.96)	.0854*** (3.57)	.0943*** (3.87)
PopIncrease	.0009*** (2.88)	.0008*** (3.05)	.0004* (1.92)	.0005*** (2.95)	.0003 (.849)	.0004 (.964)	.0004 (1.52)	.0004* (1.73)
Income	.0006 (.492)	.0011 (.870)	.0001.(154)	.0024*** (2.69)	.0018 (.875)	.0022 (1.07)	.0009 (.906)	.0009 (.841)
VoterTurnout	.0032 (.461)	.0016 (.297)	.0066 (1.10)	−.0038 (−.752)	−.0136 (−1.51)	−.0137 (−1.57)	−.0017 (−.246)	−.0012 (.861)
Demo	.0479 (1.27)	.0471 (1.33)	.0048 (.133)	.0246 (.865)	.0830 (1.42)	.0866 (1.56)	.0671 (1.59)	.0637 (1.58)
Police	.0166** (2.19)	.0175** (2.50)	.0347*** (3.36)	.0306*** (3.91)	.0218* (1.86)	.0211*** (1.91)	.0281** (2.35)	.0243** (2.16)
AlcoServ	.0060*** (3.33)	.0070*** (4.02)	.0075*** (4.26)	.0059*** (3.92)	.0058** (2.09)	.0061*** (2.24)	.0031 (1.51)	.0029 (1.44)
AlcoPurch	.1091** (2.19)	.1235** (2.56)	.0005 (.006)	.1917** (3.03)	.1865** (2.32)	.1870** (2.45)	.0836 (.993)	.1002 (1.21)
PopDens	−.0007 (−1.45)	−.0008 (−1.43)	−.0002 (−.455)	−.0006 (−.010)	−.0006 (−.737)	−.006 (−.722)	−.0004 (−.729)	−.0003 (−.516)
Border	.0075 (.223)	.0119 (.345)	−.0309 (−.889)	−.0436 (−1.27)	−.0167 (−.320)	−.0183 (−.346)	−.0134 (−.333)	−.0065 (.8722)
Triangle	.1491*** (4.13)	.1460*** (3.66)	.1592*** (4.09)	.1285** (2.45)	.1488*** (2.66)	.1369** (−2.31)	.1039** (2.26)	.0999** (2.05)
UA	.2190*** (2.85)	.2547*** (3.39)	.4457*** (5.97)	.3123*** (4.77)	.1196 (1.00)	.1431 (1.22)	.2392*** (2.76)	.2773*** (3.25)
AR	.1540** (.242)	.1894*** (2.86)	.3593*** (5.40)	.2194*** (3.76)	.1092 (1.10)	.1281 (1.32)	.1763** (2.29)	.2064*** (2.72)
Lambda	–	.2314*** (2.75)	–	.6478 (11.75)***	–	.1577* (1.80)	–	.1662* (1.91)
R-square	.6346	.6457	.5081	.6418	.5056	.5126	.5291	.5362
AIC	6.742	.987	26.611	−35.020	258.17	255.461	110.817	107.995
Log Likelihood	13.628	16.506	3.694	34.510	−112.085	−110.730	−38.408	−36.997
Schwarz criterion	68.954	63.198	88.822	27.191	320.38	317.672	173.028	170.206
Moran's I on residuals	.08***	−.0007	0.25***	−.016	.06**	.002	.05**	−.003

Notes: *t* and *z*-values with brackets, respectively. ***Significant at the 1 per cent level; **significant at the 5 per cent level; *significant at the 10 per cent level.

is corroborated by the fact that some of the variables that show significantly in both sets of models also contain a high degree of urbanisation (for instance, the dummy variable 'triangle' that indicates the southern municipalities between the triangle Stockholm–Malmö–Gothenburg, size of the police force and alcohol-serving licenses per inhabitants).

Crime might be an urban phenomenon but it does not mean that offences are concentrated only in urban areas. Rural municipalities, particularly those close to urban areas (ARs), are particularly criminogenic environments for theft both in 1997 and 2007 and violence in 2007. The effect of being an 'AR' is higher on crime in 2007 than in 1996, particularly in the set of models that deal with rural areas only (Table 4), which indicates a rise in the vulnerability of these municipalities to some types of crimes.

Crime in rural municipalities does not show any particular 'rural dimension'; at the same time, however, the variables predicting crime rates in both urban and rural municipalities are not exactly the same as those predicting rural crime only. From the covariates that are based on social disorganisation theory, divorce rate and young male population are by far the most important ones to explain the variation of both violence and theft for rural areas and Sweden as a whole. It seems that the social dynamics of crime is related to a kind of social instability that spans a wide range of municipality types, for both for violent and property crimes. Other forms of instability, such as economic ones (e.g., triggered by long term unemployment), are less consistent and only in a few cases (violence in the full model and thefts in rural areas model) associated with crime rates. Similar results were found by Wells and

Table 4
Regression results for crime rates for 1996 and 2007, Swedish Rural areas only ($N = 176$).

	Theft 1996	Theft 2007	Theft 2007	Violence 1996	Violence 2007
	OLS	OLS	Error	OLS	OLS
YoungMale	.1045** (2.45)	.1007** (2.21)	.0466 (1.24)	.0650 (.896)	.1646*** (2.61)
Divorce	.1664*** (5.70)	.0642*** (2.74)	.1116*** (4.98)	.1480*** (2.98)	.1373*** (4.80)
Foreigner	−.0129 (−1.53)	.0092 (1.09)	−.0119 (−1.45)	.0074 (.514)	.0093 (.911)
Unemp	.0052 (.427)	.0266 (.974)	.0728*** (2.86)	.0262 (1.26)	.0614 (1.84)
PopIncrease	−.0002 (−.163)	.0002* (1.72)	.0004*** (3.50)	−.0003 (1.186)	.0002 (1.10)
Income	.0006 (.262)	−.0006 (−.339)	.0022 (1.45)	.0048 (.129)	.0036 (1.64)
VoterTurnout	.0009 (.107)	.0015 (.167)	−.0072 (−.988)	−.0189 (−1.30)	.0012 (.111)
Demo	.0372 (.609)	−.0578 (−1.26)	−.0214 (−.620)	.0669 (.643)	.1058 (1.90)
Police	.0313* (1.95)	.0300 (1.50)	.0295** (2.01)	.0630** (2.31)	.0831*** (3.43)
AlcoServ	.0077*** (3.76)	.0095*** (4.76)	.0080*** (5.13)	.0079** (2.79)	.0055** (2.28)
AlcoPurch	.0909 (1.47)	.0004 (.049)	.1720** (2.42)	.1332** (1.27)	−.0379 (−.363)
PopDens	.0018 (1.54)	.0005 (.498)	.0003 (.038)	.0018 (.895)	−.0016 (−1.23)
Border	−.0478 (−.996)	−.1261 (−2.54)	−.1339*** (−3.04)	−.0122 (−.149)	−.0340 (−.564)
Triangle	.1519*** (2.99)	.1578*** (3.01)	.0639 (.928)	.2260*** (2.62)	.0920 (1.44)
AR	.1065 (1.44)	.3521*** (4.85)	.2320*** (3.77)	.0658 (.521)	.1794** (1.98)
R-square	.5127	.4342	.5910	.3412	.3780
AIC	21.420	25.172	−13.516	208.458	93.884
Log Likelihood	5.289	3.412	22.758	−88.229	−30.942
Schwarz criterion	72.148	75.899	37.211	259.186	144.612
Moran's I on residuals	−.004	0.25***	−.139	.027	−.005

Notes: *t* and *z*-values with brackets, respectively. ***Significant at the 1 per cent level; **significant at the 5 per cent level; *significant at the 10 per cent level.

Weisheit (2004) in North America. In Germany, for instance, unemployment has a strong effect when combined with proportion of young male population.

Across areas and crime types, divorce rate is a strong predictor for offending. It is associated with mechanisms that link broken families with increased levels of poverty and hardship, but Barber (2004) indicates that such links might be more complex than expected. In Sweden, growing up with a single parent has become increasingly common, and seems to imply disadvantages in terms of socio-economic circumstances and health. Despite institutional support, difficulties in adjusting to changes following a divorce are quite common among adolescents even in a welfare state country (Frojd et al., 2006). Weitoft et al. (2003) show, using a longitudinal individual database, that children of single parents run higher risks of mortality, severe morbidity (including addiction), and injury, after demographic and socio-economic characteristics have been controlled for, which suggests that the effects of a divorce go beyond financial hardship. An alternative interpretation for the effect of divorce on crime is through the parent-child relationship. Social control theory suggests that ineffective socialisation processes or weak parental attachment (in this case, following a divorce) may lead to a breakdown in social conformity, as manifested, for example, in lawbreaking. In this article, there is no way to test for causal relationships of this kind, since the analysis is based on cross-sectional ecological data. However, what can be said here is that divorce rates relate to crime rates at aggregated levels (municipalities).

Crime rates are also affected by the proportion of young males in the population both in 1996 and 2007 (Tables 3 and 4). There is plenty of evidence that the risk of any offence is highest in areas with a large proportion of young males since they are regarded as potential offenders for both property and violent crimes. As Entorf and Spengler (2000) suggests being young increase the risk of getting into the bad company of a group with harmful social interactions. In rural areas the proportion of a young population is important to explain the variation of crime for both theft and violence. Shucksmith (2004) and Alston and Kent (2009) suggest a number of ways how young people become an excluded group from mainstream rural society, and perhaps could see crime as an alternative.

Proportion of police resources (police employees) has an unexpected impact (a rise) on rates of violence and thefts in Sweden (Tables 3 and 4). It was hypothesised that as the welfare state in Sweden shifted its focus towards a more market-oriented system, public resources would shrink, and certainly affect formal social control in rural communities (fewer police) and less support for bottom-up initiatives, and consequently, crime would increase. However, the variable for police resources did not function as an indicator for the moderating factor of social institutions on crime. Instead, it functioned as a proxy for high population density (as opposed to ruralness and remoteness), which is often associated with crime opportunities. This finding might be related to the fact that police resources do partially reflect the municipalities' population sizes (the larger the population, the greater the number of police officers and related administration[3]) and therefore it is actually unsurprising that it showed positively in relation to offence rates. Furthermore, high crime rates relate to more police in models for both 1996 and in 2007, which indicates that the distribution of police resources has not altered much in the last decade despite changes in the welfare system and regional policy. This was confirmed when the number of employees within the police force in 1996 was plotted against 2007 and showed a nearly perfect linear distribution. Cherry and List (2002) also found positive relationship between police per capita and crime rates in the US when using aggregated crime rates but reverse (and expected) sign when models were disaggregated into crime types.

Among the routine activity covariates, the dummy 'triangle' (that highlights differences in population density and degree of urbanisation between North and South Sweden) and alcohol-serving licenses per inhabitants at municipal level are important in explaining the variation of crime rates in both 1996 and 2007. The significance of the dummy variable 'triangle' in eleven of the thirteen models indicates that the regional criminogenic conditions in Sweden follow a North–South divide. Southern rural municipalities are more criminogenic because they are often AR communities, and more exposed to local and regional flows of people and goods than Northern rural municipalities. Population increase had a weak but significant effect on crime in both set of models. Contrary to what was initially hypothesised, crime takes place where population increases and not where population move out (crime being a result of anomic conditions). This finding therefore lends weight to routine activity theory instead of anomie.

The link between alcohol consumption and outdoor life and violence outdoors is indicated by the significance of the variable alcohol-serving licenses per inhabitants and to a less extent, alcohol purchase (Tables 3 and 4). These findings might indicate that outdoor violence is more related to differences in patterns of routine activity (e.g., violent encounters after work hours, weekends, outside home) than alcohol consumption alone. When people are often away from home, there is a greater risk of victimisation (especially when the perpetrator is unknown to the victim). 'Being on the move' means that there is a greater chance that potential victims or targets (e.g., a car) are in the same place at the same time as motivated offenders. Moreover, some of the rural municipalities that show relatively high rates of premises selling alcohol per inhabitant are often touristic places. Crime takes place when changes in routine activities in these communities are imposed by the inflow of large numbers of an external population at particular times of the year. Ski resorts in the winter (e.g., Åre and Sälen) and summer destinations, such as Gotland and municipalities in the 'cottage belt' around Stockholm, are examples of this dynamic. Findings also show that being located at the border has no effect on crime, the only exception being theft in rural municipalities in 2007 (with unexpected effect). The impact of the border on crime in each region was assessed by including in the model a dummy variable for municipalities located at the border (land and sea). Outliers for a diversity of offences were found for some municipalities at the border. One example is Strömstad, at the border with Norway.

Voter turnout, the indicator for social cohesion, turned out to be a poor indicator for social cohesion. Resources earmarked for democratic issues seem not effect on crime rates. This is disappointing, since it undermines the initial hypothesis that communities which are cohesive (and therefore able to cope with social problems, including crime) often show higher voter turnout and might show clear evidence of the existence of pro-social institutions.

Final considerations

Rural areas in Sweden showed higher and increasing total reported offence rates than urban areas between 1996 and 2007 according to official police statistics. Whilst violence, criminal damage and drug-related offences increased, cases of most types of theft offences analysed here dropped during this time period. While ARs have

[3] Exceptions are municipalities that contain police academies and police administration bodies.

become more criminogenic (based on evidence on proportion of crime rates by areas and how rates relate to structural covariates), RRs have experienced the highest increases in crime rates. Although crime rates remained lower in rural municipalities than urban ones, this gap has been narrowed between 1996 and 2007.

The increase of reported violence is controversial, and although some would suggest that it is related to changes in reporting practices, the view taken here is that such an increase must reflect a genuine rise in levels of violence. This suggestion is grounded by overlapping and simultaneous societal processes on crime that have taken place in the last decade, such as increasing overall alcohol consumption and segregation, as suggested by Kühlhorn (2007) and Andersson and Mellgren (2007). Despite the increase in violence rates, the core clusters of violence remain close to consistent between 1996 and 2007. Hot spots of violence were found mostly in Stockholm County and surrounding urban areas, whilst cold spots were concentrated in northern Swedish rural areas.[4] For theft, however, there have been shifts in the geography. The number of urban areas comprising the core hot spots dropped, whilst some AR municipalities instead became part of the new cores. In line with these shifts, there has been a decrease in the number of cold spots of theft between 1996 and 2007.

Based on the evidence gathered in the modelling section, the following conclusions can be drawn:

1. Crime might be an urban phenomenon in Sweden, but findings here show evidence that rural municipalities, particularly those closer to urban areas, can also be criminogenic environments for both theft and violence outdoors. Rural areas are more criminogenic now than they were ten years ago (Figs. 3 and 4). RRs, for instance, have had the highest increase in reported crime levels in comparison with ARs and UAs (Fig. 4), but do not impact on the model as did the variable AR. There is evidence that ARs are at higher risk to crime than RRs. This is unsurprising since, as suggested in Hypotheses 1, municipalities close to larger urban centres, such as the AR, were largely affected by changes in population over the last decade (Amcoff & Westholm, 2007). Larger commuting distances between their place of residence and the workplace means more people are at risk of becoming a crime victim than previously. The increase in society seeking a more urban life style suggests that within ARs there are more goods to be stolen and more potential victims. More temporal and/or permanent population indicates that ARs have become particularly targeted by robberies and burglaries, but also by offences indicating an increase in public disturbance, such as criminal damage and drug-related offences.
2. Divorce rate and young male population are by far the most important covariates based on social disorganisation that explain the variation of both violence and theft. Among the routine activity covariates, the dummy that flags for differences in urbanisation between North and South Sweden and alcohol-serving licenses per inhabitants emerged significant for both 1996 and 2007 for most crimes.
3. The regional criminogenic conditions in Sweden follow a North–South divide. Southern rural municipalities are more criminogenic because they are often AR communities, and more exposed to local and regional flows of people and goods than Northern rural municipalities.
4. No moderating effect was found for social institutions on crime. The variables (e.g., earmarked resources for democracy) did not function as expected. Instead, they behave as proxies for urbanity or have an impact that is not geographically homogenous, which is not captured by the model employed here.
5. Significant shifts in the regional geography of crime took place between 1996 and 2007, particularly for theft. The core of a hot spot was, in the mid-1990s, concentrated around the Stockholm region, whilst in 2007 the largest cluster has its core located in the Scandia region, close to Denmark. Although changes in local inherent criminogenic conditions are behind such shifts, evidence from elsewhere shows that the establishment of an external fixed link in Sweden with Denmark in 2001 (through the Öresund's bridge) and resulting intensification of population shifts and flows in the area may have also played a role on this crime reconfiguration. Rural areas in Southern Sweden, particularly within the triangle Stockholm, Gothenburg and Malmö, are clearer exposed to criminogenic conditions (regardless whether they are local inherited or brought by new external developments) that are not found elsewhere in Sweden.
6. In a more technical account, spatial error and lag models performed better than OLS regression models (Spatial error produced the best models). The dependent autoregressive term (W_Y) turned out to be non significant for thefts and violence in the two set of models (Sweden and rural areas only), showing no evidence of a suggested diffusion process of crime at municipal level. The spatial patterning of crime rates is more consistent with a spatial error model, which implies that results indicate clustering of unmeasured variables.

What does this study tell us about rural society in Sweden? Findings are indicative that, from a criminogenic point of view, Swedish rural areas need to be examined in a slightly different way than previously. Although there is no place totally free of crime, low crime rates in rural areas are far too often taken for granted. The way policing and crime prevention are implemented in rural areas must change and become more sensitive to the needs of rural communities. In the past, three distinct crime levels separated RRs from ARs and UAs, whereas now some rural areas have become more like urban areas. Such similarity has to do with the increasing links between the city and the countryside with regard not only to the population's demographic and socio-economic characteristics but also its life style and criminogenic conditions. Crime rates are higher where urban criminogenic conditions emerge, not necessarily in urban areas but in settings that have strong links with urban centres. This implies that the current conceptualisation of security in Sweden must take the internal dynamics of rurality into account if interventions of any kind are to be implemented.

The value of this approach for rural studies is that it provides a comparative framework between urban and rural areas that is often lacking in the literature of crime geography on a national scale. More importantly, the approach allows for differences between ARs and RRs. Another important feature of this study is the incorporation of the 'spatial dimension of crime', which is often missing in studies of this type. Using crime data at municipal level, it has been possible to identify and assess shifts in crime geography in 1996 and 2007 using cluster techniques. Regional shifts of crime clusters are indicative of changes in the criminogenic conditions of a certain region that cannot be identified when municipalities are analysed in isolation from each other. Although spatial lag models did not show evidence of a diffusion process in space, spatial error ones are indicative that some unexplained variance follow a spatial structure.

[4] No data was available here about clandestine alcohol production in these Northern municipalities or possible links between alcohol consumption and this crime geography.

This article, however, shares limitations with other ecological studies of crime and it is relevant to mention them here. The analysis of the dynamics of crime is limited by the use of 'municipality' as a unit of study. The use of municipalities as a unit of analysis makes it difficult to speculate in any detail on the role of social and behavioural processes in understanding offence rate variation. As with any other study which employs aggregated cross-sectional data, it is possible to ascertain the links between the occurrence of crime and municipalities' characteristics, but not within. Moreover, people's daily commuting flows between municipalities may not be captured by crime data at municipal level; this might be a problem particularly for Swedish Southern municipalities, where commuting inter-municipal flows are common. It is possible that some criminals travel between municipalities to commit a crime, but no evidence is available for how far offenders travel in Sweden. International evidence based on urban environments suggests, however, that the majority of criminals commit a crime close to where they live (Rengert, Piquero, & Jones, 1999; Wiles & Costello, 2000), which could for most crime types be an area smaller than municipal boundaries. Data on the location of offences, offenders and victims (or targets) would be necessary to assess whether rural crime is committed by people living in rural municipalities or by those travelling to such municipalities for the purpose of crime. Moreover, future research should test for disaggregated data on crime to be able to disentangle possible differences in the dynamics of each offence type.

This research deals with police-recorded crime only, and does not discuss fear of crime as declared by individuals, which is also a relevant source of information when assessing security. In future studies, a comparison of trends based on police-recorded data and data from victimisation surveys by municipality type could provide a complement to analyses that originate from police statistics only, such as this article has done. Until recently, victimisation surveys were not systematically available for Sweden. Since 2006, data on victimisation are gathered yearly but still cannot be broken down by municipalities.

This article is an example of how aggregated covariates can be used to explain the geography of crime as two snapshots in time, in this case 1996 and 2007. One of the main challenges is to elucidate the mechanisms by which rural communities, relatively demographically and economically disadvantaged, cope with social problems, in this case, crime. For instance, little is known about the effect of 'rural change' on different types of rural areas (industrial, blue-collar versus university municipalities) and how such effects relate to levels of crime. Also, better indicators of social cohesion for rural areas could perhaps reveal an intrinsic rural dimension of crime that so far is hidden in this current analysis.

Acknowledgements

Research was financed by FORMAS, the Swedish Research Council for Environment, Agricultural Sciences and Spatial Planning, Grant 251-2007-1954. The authors thank Mats Johansson and Hans Westlund for valuable comments on a previous version of this paper.

Appendix 1. Characteristics of the dataset.

Data	Description	Codes	Year	Source
Offences	All offences	0303–0388, 9301–9348	1996–2007	The Swedish
	Violence	0355, 0356, 0365, 0366, 0375,		National Council for
	Assault, women	0376, 0385, 0386		Crime Prevention
	Assault, unknown outdoors	0355, 0357, 0375, 0377		
	Theft	0801–0899, 9801–9813		
	Burglary	0857, 0874, 9801, 9802		
	Car theft	0801, 0802		
	Theft from motor vehicle	840		
	Robbery	0862–0873, 0892–0897, 9806–9813		
	Burglary involving cellar or attic	0825		
	Theft from stores	0853		
	Drugs offences	5001–5011		
	Criminal damage	1201–1209		
Socio-economic, welfare and life style indicators	Proportions of		1996–2007	Statistics Sweden
	Young male population (13–25 years) – Variable "YoungMale"		1995–2007	Statistics Sweden
	Divorced population – Variable "Divorce"		1995–2007	Statistics Sweden
	Foreign population – Variable "Foreigner"		1995–2007	Statistics Sweden
	Total unemployed population – Variable "Unemp"		1995–2007	Statistics Sweden
	Population increase – Variable "PopIncrease"		1995–2006	Statistics Sweden
	Average income – Variable "Income"		1998–2006	Statistics Sweden
	Voter turnout – Variable "Voterturnout"		2001–2003	Statistics Sweden
	Resources earmarked for democratic issues (1/0) – Variable "Demo"		2001–2003	Statistics Sweden
	Employed in the Police by municipality – Variable "Police"		1996–2006	Statistics Sweden
	Alcohol-serving licenses per 10,000 inhabitants – Variable "AlcoServ"		1996–2005	*Swedish National*
	Alcohol purchase per inhabitants – Variable "AlcoPurch"		1996–2004	*Institute of Public Health*
	Population density – Variable "PopDens"		1996–2007	Statistics Sweden
Land use indicators	Dummy for border regions – Variable "Border"			*Swedish National Rural*
	Dummy for North–South (triangle Stockholm,			*Development Agency*
	Malmö and Gothenburg) – Variable "Triangle"			Statistics Sweden
	UA = Dummy for urban areas (Variable "UA"), RR = Remote rural (Variable "RR") and AR = Accessible rural (Variable "AR")			
Geographical data	Model for whole Sweden – 287 municipalities (3 new municipalities were excluded Knivsta, Heby and Nykvarn, lack of data)		2008	Statistics Sweden
	Model for rural areas only – 176 municipalities			

Appendix 2. Bivariate correlations for independent variables.

Full model 1996, $N = 287$

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. YoungMale	1															
2. Divorce	−.066	1														
	.262															
3. Foreigner	.180**	.524**	1													
	.002	.000														
4. Unemp	−.214**	.195**	−.018	1												
	.000	.001	.766													
5. PopInc	.091	.401**	.320**	−.019	1											
	.122	.000	.000	.751												
6. Income	.133*	.427**	.300**	−.233**	.260**	1										
	.024	.000	.000	.000	.000											
7. VoterTurn	.075	−.222**	−.229**	−.203**	.013	.325**	1									
	.208	.000	.000	.001	.829	.000										
8. Demo	.205**	.129*	.114	−.004	.124*	.107	−.062	1								
	.000	.029	.054	.940	.036	.071	.292									
9. Police	−.003	.363**	.244**	.133*	.239**	.080	−.206**	.105	1							
	.954	.000	.000	.025	.000	.179	.000	.077								
10. AlcoServ	−.272**	.025	−.132*	.076	.005	−.151*	−.109	.009	.027	1						
	.000	.671	.025	.202	.936	.010	.064	.883	.643							
11. AlcoPurc	−.077	.100	.104	.149*	−.025	−.031	.062	.087	.046	.240**	1					
	.196	.090	.079	.012	.673	.605	.294	.140	.433	.000						
12. PopDens	−.115	.532**	.376**	−.090	.615**	.426**	.012	.116*	.280**	−.019	−.070	1				
	.052	.000	.000	.127	.000	.000	.846	.050	.000	.745	.234					
13. Border	−.106	.029	−.087	.238**	.043	−.080	−.073	−.032	.051	.365**	.065	−.078	1			
	.072	.625	.140	.000	.466	.175	.215	.586	.391	.000	.271	.186				
14. Triangle	.325**	.069	.292**	−.406**	.240**	.267**	.191**	.133*	.027	−.207**	−.137*	.236**	−.274**	1		
	.000	.243	.000	.000	.000	.000	.001	.025	.644	.000	.020	.000	.000			
15. UA	.318**	.504**	.323**	−.077	.282**	.369**	−.016	.241**	.169**	−.198**	.010	.312**	−.108	.238**	1	
	.000	.000	.000	.192	.000	.000	.786	.000	.004	.001	.867	.000	.067	.000		
16. AR	−.180**	−.353**	−.201**	−.030	−.238**	−.237**	.043	−.195**	−.122*	.032	.048	−.259**	.007	−.070	−.855**	1
	.002	.000	.001	.617	.000	.000	.467	.001	.039	.589	.416	.000	.903	.235	.000	

Full model 2007, $N = 287$

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. YoungMale	1															
2. Divorce	−.197**	1														
	.001															
3. Foreigner	.026	.366**	1													
	.665	.000														
4. Unemp	−.038	.316**	.060	1												
	.523	.000	.308													
5. PopInc	.083	.218**	.268**	−.004	1											
	.159	.000	.000	.944												
6. Income	−.039	.094	.130*	−.291**	.277**	1										
	.512	.111	.027	.000	.000											
7. VoteTurn	.054	−.216**	−.240**	−.301**	.084	.570**	1									
	.361	.000	.000	.000	.155	.000										
8. Demo	.042	−.050	.063	−.004	−.029	−.110	−.050	1								
	.480	.395	.286	.949	.629	.063	.395									
9. Police	.138*	.247**	.195**	.240**	.373**	.130*	−.055	.002	1							
	.019	.000	.001	.000	.000	.028	.355	.972								
10. AlcoServ	−.256**	.076	−.052	.100	−.048	−.224**	−.164**	−.021	.045	1						
	.000	.201	.385	.090	.416	.000	.005	.722	.446							
11. AlcoPurc	−.057	.164**	.285**	.110	−.057	−.082	−.080	−.051	.191**	.394**	1					
	.335	.005	.000	.063	.340	.166	.177	.386	.001	.000						
12. PopDens	−.155**	.291**	.293**	−.106	.673**	.448**	.126*	−.016	.330**	−.053	−.101	1				
	.009	.000	.000	.074	.000	.000	.033	.791	.000	.374	.089					
13. Border	−.176**	.084	.006	.198**	−.007	−.099	−.066	−.038	.113	.373**	.187**	−.077	1			
	.003	.156	.925	.001	.903	.095	.267	.526	.056	.000	.001	.192				
14. Triangle	.200**	−.145*	.138*	−.404**	.266**	.354**	.335**	.025	−.005	−.295**	−.320**	.235**	−.274**	1		
	.001	.014	.019	.000	.000	.000	.000	.678	.928	.000	.000	.000	.000			
15. UA	.200**	.260**	.176**	−.008	.302**	.332**	.098	−.074	.244**	−.259**	−.045	.309**	−.108	.238**	1	
	.001	.000	.003	.889	.000	.000	.098	.211	.000	.000	.447	.000	.067	.000		
16. AR	−.147*	−.140*	−.114	−.109	−.245**	−.202**	.007	.065	−.202**	.061	.022	−.256**	.007	−.070	−.855**	1
	.013	.018	.053	.065	.000	.001	.909	.270	.001	.301	.708	.000	.903	.235	.000	

**Correlation is significant at the .01 level (2-tailed).
*Correlation is significant at the .05 level (2-tailed).

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