Crime in Border Regions: The Scandinavian Case of Öresund, 1998–2001

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This article compares offense patterns at two points in time in Öresund, a Scandinavian border region that spans Sweden and Denmark. The aim of the analysis is to contribute to a better understanding of the relationships between crime and demographic, socioeconomic, and land use covariates in a border area that has been targeted with long-term investments in transport. The changes effected by the construction of the Öresund bridge might be expected to have an impact on both the levels and the geographies of different offenses by creating new sites for offending and new, more vulnerable, transient groups. The article focuses on identifying and explaining changes in the geography of crime before and after the bridge was built. Spatial statistical techniques and GIS underpin the methodology employed. The article shows that there have been changes in the levels and the geography of some offenses. Crime in border regions is likely to be of growing interest in Europe as a result of European Union (EU) enlargement and increasing intra-European cross-border movement facilitated by improved communication systems. *Key Words: crime trends, border region, spatial statistics and GIS.*

Introduction

Regions in the European Union, during the last decade, have been targets of large transport investments to promote social cohesion, diminish the economic disparities between countries, and improve connections between European capitals (EC 1997; EC 1998). This increase in accessibility makes cities, regions, and countries more vulnerable to crime through new patterns of mobility.

The literature on the impact of new transport links on crime patterns at or across internal borders is comparatively sparse. An exception is the study of the tunnel linking England and France where there is evidence of changes in offense patterns (Rikskriminalpolisen 1999). In July 2000, the Öresund region saw the completion of a bridge linking Copenhagen and Malmö. In this article we present our findings on geographical shifts in offenses between 1998 and 2001. In addition, we seek to explain changes in the geography of crime in Malmö in terms of demographic, socioeconomic, and land use covariates.

The Scandinavian border region of Öresund[1] has been chosen for several reasons (Figure 1). First, in the Nordic context, Öresund is an important growth region that has been moving up the European hierarchy (Matthiessen 2000, 2002). Substantial steps toward the region's economic integration were taken through large-scale, long-term infrastructural and business investments. The Öresund bridge is the first fixed link between Sweden and Denmark combining a four-lane motorway with a dual-track railway. Second, Baltic and Nordic regions, because of their geographical proximity and well-developed economic structures (in banking and transport), play an important role as receptors and transit territories for international organized crime, especially those operating from the east (Ulrich 1994; Galeotti 1995).

Third, Sweden and Denmark differ in terms of regulations and legislations. There are structural differences in, for instance, income tax, tax on products, social security, and health care, which act as a stimulus to smuggling. Finally, both in Sweden and Denmark, crime data is systematically recorded geographically and temporally by the local police authorities at a very detailed level.

The structure of this article is as follows. First, the relationship between crime and communication systems in border regions is discussed. Then, a conceptual model for examining the impact of improving cross-border communication on crime patterns is presented, and an analysis of changes between 1998 and 2001 over the whole region is reported. We then discuss changes in the geography of crime in the Swedish city of Malmö and present the results of modeling the changes in offense patterns there. Directions for future work conclude the article.

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Figure 1. The Öresund region. *Source*: Adapted from SCB, Orestad: statistik om Öresund, 2003.

Literature Overview

The Relationship between Crime and Communication Systems

Long before the establishment of modern transportation systems, Colquhoun (1800) showed how they shape crime patterns. He described how thieves preyed on valuable cargos in the Port of London (see also Tobias 1967). Today, public transport links (e.g., railways, roads) and nodes (e.g., stations, airports), together with related consumer services, generate other opportunities for crime.

A new transport terminal may have a *direct* effect on crime patterns by creating a new site for offending or altering patterns of routine activity by motivated offenders. According to Brantingham and Brantingham (1981) offenses occur where criminal opportunities intersect with areas that are cognitively known to a motivated offender. Public transportation creates impersonal spaces that bring together different social groups, attract motivated offenders, and create opportunities for crime (see, for example, Levine and Wachs 1986; Block and Davies 1996; Poister 1996; LaVigne 1997; Tremblay and Tremblay 1998; Loukaitou-Sideris 1999).

Transport sites are often crowded but lack "capable guardians"—persons who, sometimes just by their presence, discourage crime from taking place (Cohen and Felson 1979). "Guardians" may be formal (e.g., security guards or CCTV cameras) or informal (e.g., observant and concerned individuals) (Home Office 2003). Public spaces, like train stations and airports, suffer a double disadvantage. They are mostly equipped with impersonal surveillance (e.g., CCTV cameras and other forms of surveillance) that may be ineffective (e.g., staff may not have sufficient training or awareness to be an effective deterrent or may not be willing to put themselves at risk). Travelers who might be considered as informal guardians often have no sense of ownership and are unwilling to get involved. Crowding and congestion combined with a physical deterioration of the bus or railway station (e.g., poorly lit areas) may further increase the risk of certain types of offenses.

There is also an *indirect* impact of transport infrastructure on crime patterns. Tourists are often unfamiliar with the risks they face in an unknown environment and become targets. The implementation of a new transport infrastructure leads to other types of investments in the immediate area that generate land uses. As Wikström (1991) argues, land use determines both the activities found in an area and the composition of the population at any given time. Shopping areas attract temporary populations who are at high risk from so-called tourism-criminality (Rikskriminalpolisen 1999) such as pick-pocketing, shoplifting, thefts of different kinds, and, in certain cases, violence. These new groups are sometimes the ones that offend and get involved in opportunistic acts of violence and disorder (Dunning 2000; Stott, Hutchison, and Drury 2001).

Crime at a Political Border[2]

Political borders and the areas close to them are unique places for criminal activities. A border defines "the limits of executive police powers (and) states are reluctant to loosen their grip on these powers since territorial sovereignty represents an important political and psychological threshold for any European country" (Anderson et al. 1995, 124). Hajdnijak (2002), for example, points out how weakened state apparatus and political and social instability in the former Yugoslavia create opportunities for crime to the extent that a significant part of the population has been actively involved in criminal schemes (e.g., illicit trade), largely tolerated by the authorities. The borders represent a form of "safety valve" for pressures created by the ever-increasing army of the unemployed.

Table 1 provides a summary of the many factors in this context. Many of the factors relate to the states rather than being properties of the border itself. Nevertheless, it is at the border where these factors become important as triggers of crime.

Impact of Improving Cross-Border Communications on Crime: A Conceptual Framework

We distinguish between three types of offenses in border regions. First, cross-border crime, such as smuggling, where the offense involves the transport of goods or

Table 1. Susceptibility of Border Regions to Crime

Type	Factor	Description
Location and geography	Border's regional position. Border type (e.g, length, landscape, type of adjacency whether land, sea, or bridge).	This may impede or facilitate criminal activity. Field et al. (1991) illustrate how type of border adjacency influences the routes of criminal activities at the Mexican–American border. Similar examples are presented by Vagg (1992) and Hajdnijak (2002).
Societal structures and organizational differences	Economic inequality and relative deprivation between neighboring countries;	Wage differentials between countries, or significant unemployment on one side of the border stimulates marginalized groups to see illicit business as a way of survival (Galeotti 1995; Schloenhardt 1999; Ruyver, Van Impre, and Meese 2001). Sometimes economic inequalities do not need to be large between countries to stimulate criminal activities (Anderson et al. 1995, 22).
	Cultural differences and gender inequality	Gender inequality leads to traffic in women and prostitution (Ruyver, Van Impre, and Meese 2001; Di Nicola 2001).
	Weakened state apparatus and political and social instability	Criminal cross-border networks may take advantage of weak or corrupt state apparatus. Examples include the former Soviet Union countries (Galeotti 1995; Osyka 2001; Osmonaliev 2002) and former Yugoslavia (Hajdnijak 2002). Political differences and mutual hostility between adjacent states lead to criminal opportunities, e.g., between Northern and Southern Ireland (Bew and Gillespie 1993; Wilson 2003).
	Differences in taxation, tariffs, and regulations	Differences in taxation, tariffs, or regulations on products in neighboring countries encourages smuggling (Persson 1999a,b; Rikskriminalpolisen 1999; and Krajewski 2001).
	Differences in laws and law enforcement and lack of harmonization of criminal justice/legislation	For an offender, differences in laws create different levels of risk. The perception of profit from crime may also vary if punishment differs between countries (Ruyver, Van Impre, and Meese 2001). Differences in law-enforcement regimes (including cultural differences) make it difficult for cross-border police to cooperate on a daily basis (Junninen and Aromaa 2000).
Conditions for criminal activity	Symbiosis between cross-border and other forms of crime	Interaction between typical cross-border crime (e.g., smuggling and drug-related offenses) and other types of crime, may affect the volume and characteristics of the latter at or near the border. This in turn creates a particular criminogenic environment (Field, Clarke, and Harris 1991). Money laundering is one example of such interaction (Osyka 2001).
	Offenders' knowledge and perception of the border	For international criminal networks, having people with good local knowledge is crucial. Perceived distance (geographical, linguistic, cultural) "shrinks" as soon as offenders have the necessary knowledge about the other country's system to minimize the risks of being caught.

people illegally over the border. Second, crime that does not involve cross-border movement but that is at a higher level because of the consequences of cross-border crime. There may be a direct link to cross-border crime (e.g., money laundering, drugs selling) or the link may be more indirect (e.g., car theft to facilitate smuggling; burglary to pay for drug purchase). Third, crime that is largely unaffected by the border and is not expected to be significantly higher than elsewhere (e.g., domestic violence).

Figure 2 shows four processes that characterize the impact of improving cross-border communication on offenses. They are presented as distinct processes, but, in fact, they interact. The first process refers to increased mobility of motivated offenders. For most offenders, behavior is unchanged—the bridge affects them very little. For this group, crime is a local activity that is committed in "familiar places" (Brantingham and Brantingham 1981) or at relatively short distances from their homes (White 1932; Porter 1996; Costello and Wiles 2001). For a minority of offenders, the border provides new opportunities. This group may consist of professional bank robbers, thieves, individuals who get involved in violence (e.g., weekend troublemakers, teenage gangs involved in vandalism), but also "wise tourists." A "wise tourist" is an individual who crosses the border and has planned in advance what to do on the other side of the bridge (e.g., purchase illegal goods or services, such as prostitution, and smuggling of alcohol and/or cigarettes). The experience with the tunnel between England and France shows that even traditional crimes may increase due to the inflow of offenders coming from the other side of the border, but the effects may be asymmetric.

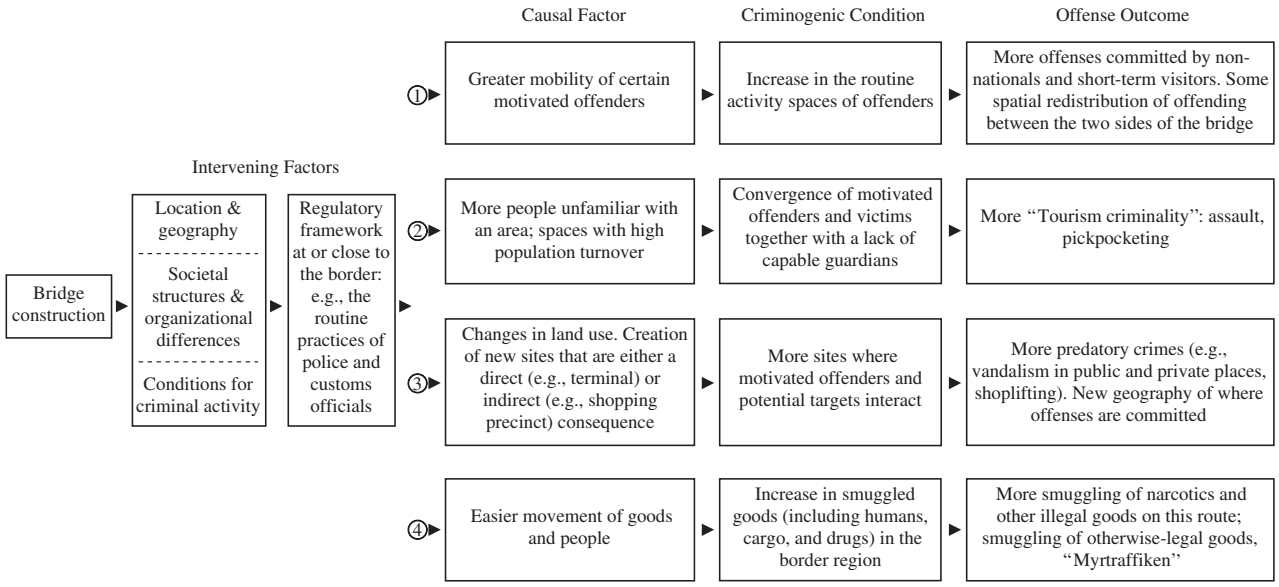

Figure 2. The impact of improving cross-border communications on crime: a conceptual framework.

The second process refers to the fact the bridge facilitates the inflow of transient groups unfamiliar with the environment, which leads to an increase in the proportion of victims who are tourists—so-called tourism-criminality (Rikskriminalpolisen 1999). More people does not mean more guardians (see above). An increase in pickpocketing, theft, and, in certain cases, violence and hooliganism directed at visitors are to be expected. Central areas and their surroundings, where most tourist attractions are located, could become hot spots. Figure 3 shows the flow of people in Öresund. The volume between Copenhagen and Malmö has increased 34 percent since 2000 when the bridge opened. Data from Öresundsbro Konsortiet et al. (2002) show that people using the bridge have a very concentrated spatial mobility pattern around the Öresund bridge. Swedish travelers traveling either by car or train over the bridge mainly had the Copenhagen area as their destination (42 percent of cars, 70 percent of train passengers). On the Swedish side, as much as 36 percent of car trips had Malmö as their destination while, of those using the trains, 72 percent went to Malmö.

The third process refers to changes in land use and, hence, crime patterns in the region. The bridge and the transport and service-related infrastructure that follow create new sites and new land uses that generate new opportunities, new patterns of activities, and, hence, new patterns of offenses (Wikström 1991). An increase in offenses (e.g., thefts and shoplifting) is expected to take place in central areas and at transport nodes such as railway stations.

The fourth process deals with the direct impact of the bridge (and new customs routines) on cross-border crime and, indirectly, on other forms of crime. It is expected that the bridge (especially through train services) will directly affect smuggling, especially drug users or small dealers who travel to Denmark with the objective of acquiring narcotics. 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 toward drugs in Denmark. In Swedish, *Myrtraffiken* (ants' traffic) refers to the repeated smuggling of small quantities of narcotics by train. Some indirect impact may be noticed on other offenses that are related to drug addiction, such as residential burglary (Wiles and Costello 1999) and theft from cars. The literature shows that drug addicts may get involved in these types of offenses in order to obtain money to buy drugs.

Intervening factors are factors that mediate the effect of the bridge on offenses (see Figure 2). The first of these is related to the nature of the border or of the countries where the border is located. The importance of this factor has already been discussed. The second group of factors includes the type of control processes employed at the border (e.g., the sampling procedure adopted) and police practices. Both of these are dependent on political agreements (e.g., Schengen agreement, Nordic countries agreement) and local resourcing and organization (e.g., staff size, cooperation arrangements with other forces). For instance, the Schengen agreement adopted in March 2000 did not change routines at the borders for Nordic citizens very much because they had access assured by previous regional agreements. The major difference involves the control of the Nordic frontiers in relation to

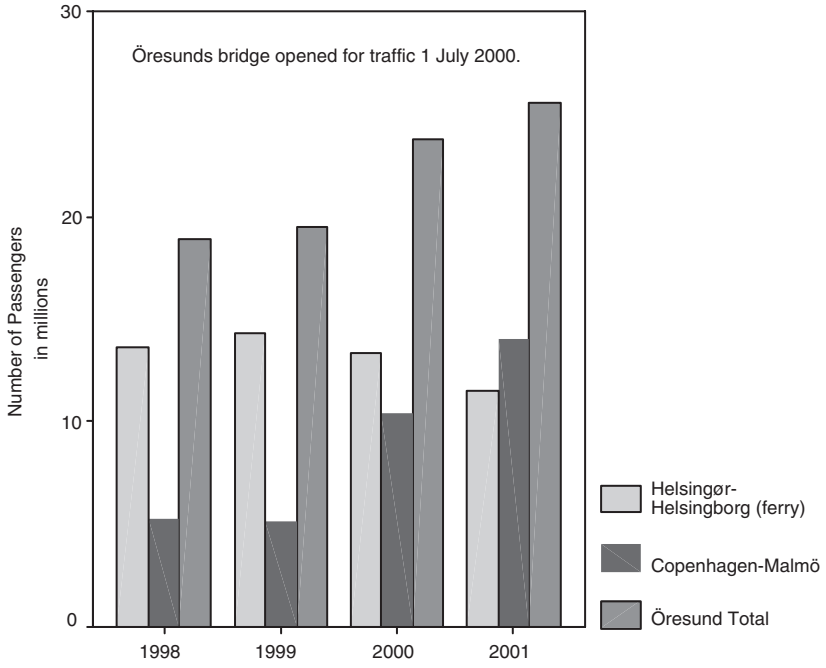

Figure 3. Number of passengers in Öresund region, 1998–2001. *Data source:* Öresundsbro Konsortiet, 2002.

nonnational Schengen citizens coming from or through continental Schengen countries.

The sampling procedure for border checking influences the chances of being caught (Ahlberg and Thedeen 1981). Empirical evidence (Tsebelis 1989; Sherman 1990) suggests that offenders adapt to changes in police practice and vice-versa; thus, changes in the control procedures at the border should directly affect the behavior of motivated offenders. For organized criminal leagues, any change to the new checking system affects their perception of risks and benefits.

An underlying problem in the subsequent analysis is to disentangle the bridge effect from other contextual effects, such as local and national trends in crime but also wider societal changes such as levels of criminality and changes over time of the perceived benefits from engaging in different criminal activities. The approach here will be to compare national data totals (Sweden and Denmark) in order to try to benchmark the regional data and provide a framework for separating regional from national trends.

Crime before and after the Opening of the Öresund Bridge

Regional Crime Levels in Öresund

There is a debate as to whether it is feasible to use official crime statistics for international comparative scientific research and policy-driven analyses. Nations differ widely in the way they organize their police and court systems, the way they define their legal concepts, and the way they collect and present their statistics (Aebi et al. 1999). One approach is to compare trends over time of recorded crimes as suggested by Barclay, Tavares, and Siddique (2001), instead of comparing absolute numbers. Since the Danish and the Swedish code systems differ (the total number of crime codes is 350 in Sweden, while in Denmark it is 365), we adopt a standard definition (e.g., residential burglary) and the two police authorities were invited to indicate which were the offenses that best fitted this preestablished standard.

In the discussion that follows, a distinction is drawn between offenses that were expected to be affected by the bridge's construction (OAB) for both the whole region and the two countries separately. The selection of the OAB category was suggested by the Swedish police together with the Swedish Custom Services in a 1999 report (Rikskriminalpolisen 1999). The impact assessment, to the year 2005, was based on criminological theory and professional experience of crime patterns at the border and in the largest cities of the region.

Thefts, shoplifting, and vandalism are, by far, the most common types of offenses in the Öresund region. There are some differences between the Swedish and Danish sides in the composition and ranking of the ten most frequent offenses in 1998, but they are not major ones. The rank in 2001 for both Swedish and Danish Öresund is almost identical. Marginal shifts in rank probably

reflect the opportunistic and, hence, substitutable nature of these common offenses, such as car-related thefts and shoplifting.

However, not all shifts between 1998 and 2001 can be explained by situational conditions that may increase one type of offense compared to another. One example is the significant increase in human smuggling and illegal immigration, which has become a growing business internationally. According to Schloenhardt (1999), human trafficking has become a growing business because of the restrictions on legal immigration imposed by industrialized countries, the relatively low risks of detection, and the growing demand for international migration, mostly in sending countries but also, to some extent, in receiving countries. For both Sweden and Denmark, human smuggling is a new phenomenon. In a European perspective, the so-called Baltic Route has been increasingly exploited since the collapse of the Soviet Empire (Di Nicola 2001). In Swedish Öresund, there has been an increase from two cases in 2000 to forty-nine in 2002, forty-six cases recorded in Malmö alone. In Denmark, figures from NCPD (2002) show that women from the Baltic States (particularly Latvia) and Asia (particularly Thailand) were brought to Denmark and forced into prostitution.

The category of offense that has increased most in number in Swedish Öresund between 1998 and 2001 is thefts of different types, particularly from cars and of bicycles. Traffic-related offenses, particularly driving under the influence of substances such as alcohol or narcotics, have also increased. However, such an increase may be related, at least partially, to changes in the way the offense is recorded[3] or may be linked to the increase in short weekend trips from Swedish Öresund, mostly Malmö, to Copenhagen.

In the Danish Öresund, figures for 2001 NCPD and police (2002) show that, in comparison with previous years, there was a marked increase in the number of particularly dangerous robberies primarily targeting public buildings, petrol stations, and valuables in transit, but it is difficult to associate these to the bridge.

Tables 2 and 3 summarize changes in offense totals. The overall OAB-category levels in Swedish Öresund have not changed since 1998. However, in 2001 the region had more offenses than it would have had if it had followed the national trend. In Denmark, the region had fewer offenses than it would have had if the region had followed the national trend. Among the OAB-category, vandalism, molestation, assault/mistreatment, and crime against common order increased in both Danish and Swedish Öresund between 1998 and 2001. In the case of molestation and crimes against common order, the increases exceeded the national trends in both countries.

There are differences between Swedish and Danish Öresund in shifts in OAB. This may reflect the asymmetric mobility pattern between the regions. In the

Table 2. Changes in OAB (Offenses Expected to be Affected by the Bridge) 1998 to 2001

	Swedish Öresund (%)	Sweden (%)	Observed–Expected* (Counts)	Danish Öresund (%)	Denmark (%)	Observed–Expected* (Counts)
OAB Direct Impact						
Smuggling	**	**	**	− 35.4	− 44.3	14.0
Pick pocketing	− 2.5	8.7	− 489.1	5.5	7.9	− 1107.7
Vandalism	8.2	15.1	− 958.8	4.4	4.1	40.4
Molestation	27.2	20.6	157.6	35.5	22.6	92.4
Vehicle theft	− 2.1	− 4.0	171.2	− 23.8	− 18.6	− 890.1
OAB Indirect Impact						
Residential burglary	− 25.1	− 21.6	− 297.7	− 12.8	− 4.9	− 1472.6
Narcotics	7.5	2.7	175.5	− 19.5	− 9.3	− 854.4
Assault/mistreatment	10.6	4.5	407.8	11.5	18.0	− 201.1
Personal robbery	− 2.2	8.3	− 90.9	11.3	23.5	− 113.9
Shop-related offenses	− 16.2	− 18.3	186.0	− 24.9	− 20.4	− 808.8
Theft from vehicles/burglary	6.5	− 5.8	2620.3	− 13.1	0.8	− 2719.0
Crime against common order	35.6	25.0	38.6	32.5	27.2	34.3
Robbery in banks/post offices	− 25.0	20.4	− 5.4	81.3	70.9	6.6
Theft or burglary in churches	− 23.0	7.5	− 72.8	− 19.6	− 8.8	− 147.8
Total OAB	0.0	− 0.7	1423.4	− 7.8	− 2.4	− 8127.8
Total Crimes in Sweden & Denmark		0.7			− 5.18	

*Observed = total number of offenses in the region; Expected = an estimate of the total number of offenses in the region if the region had followed the national trend in crime levels between 1998 and 2001.
**See Table 7.

Table 3. Average Percentage Change 1998 to 2001 in OAB, Other Offenses, and Total

	OAB	Others	Total
Swedish-Öresund	0.0	0.7	0.3
Danish-Öresund	− 7.8	− 7.2	− 7.7
Sweden	− 0.7	2.5	0.7
Denmark	− 2.4	− 11.9	− 5.2

Swedish Öresund, vandalism, molestation, narcotics, assault/mistreatment, theft from vehicles, and crime against common order increased between 1998 and 2001. Figure 4 illustrates the increase in two offenses that occurred at more or less the same time as the bridge was opened on 1 July 2000. By comparing the graphs of 2000 with the ones of 1998 and 2001, we confirmed that such variation does not follow seasonal patterns of variation only.

In Denmark's Öresund region, increases are recorded in pickpocketing, vandalism, molestation, assault/mistreatment, personal robbery, robbery in banks and post offices, and crime against common order. For all OAB categories, the Copenhagen metropolitan area concentrates the largest share. Although the Swedish Öresund has witnessed a slight increase for both OAB and other type of offenses, Malmö has recorded a decrease in the number of offenses between 1998 and 2001.

Cross-border Crime Levels in Öresund: The Case of Smuggling

Differences in taxation between Sweden and Denmark and the Baltic countries in products such as alcohol and cigarettes encourage smuggling. According to Bygvrå and Westlund (2001), Swedes increased not only the volume of trips to Denmark after the opening of the bridge, but also spent more on arrival. Swedes in 2001 spent 25 percent more than in May 2000, mostly on beer and wine. Part of this is almost certainly brought into Sweden by weekend travelers for domestic purposes. According to Rikskriminalpolisen (1999), since 1998, there were also cases of well-organized smuggling leagues caught with large quantities of goods. Cigarette smuggling also increased between 1998 and 2001. According to Persson (1999a), 3 percent of arrests in a year are responsible for about 90 percent of the total seized cigarettes in a year, often driven by organized gangs. However, most of the arrests consist of "domestic users" (husbehovsmugglarna) bringing in small but illegal quantities. The gangs, by contrast, are internationally organized groups with wholesale dealers in Northern Europe. The Baltic region states plus the Netherlands

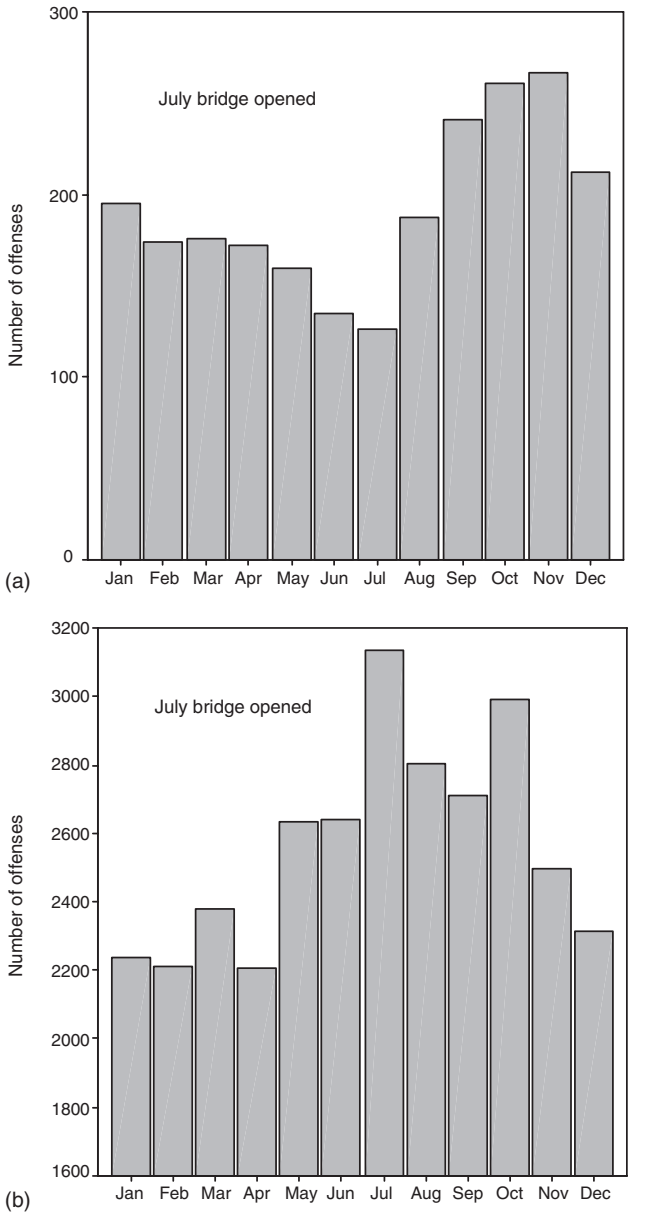

Figure 4. Increase in narcotics (a) and car-related thefts (b) in Swedish Öresund in 2000. The lack of time information varies slightly from year to year. As much as 20 percent of offenses did not have any data on month in 2000.

are the source states for this type of smuggling. From and through Denmark into Sweden, smuggling involves mostly alcohol, cigarettes, and narcotics. In absolute numbers, the total number of seized goods at Customs Services in Swedish Öresund has increased since 1998, especially in Malmö (Table 4). These findings follow the same trends as those discussed by Di Nicola (2001) for cross-border crime between Eastern Europe and the European Union.

However, if we compare the total number of seized goods with the total number of passengers or with the total

Table 4. Number of Goods Seized by Customs in 1998 and 2001 (by type and total number of passengers and vehicles)

	1998				2001			
	Malmö*	Helsingborg**	Region	Sweden	Malmö*	Helsingborg**	Region	Sweden
Seized goods	1571	2330	3901	16301	3728	1376	5104	14415
Narcotics	509	456	965	2065	1590	535	2125	3547
Fire weapon	4	1	5	60	19	5	24	1303
Tobacco	423	317	740	6859	843	40	883	3483
Others	635	1556	2191	7317	1276	796	2072	6082
Seized goods/passengers (Thousands)	0,30133	0,17056	0,20668	–	0,26677	0,00012	0,20007	–
Seized goods/vehicles (Thousands)	4,46204	0,88658	1,30899	–	1,26335	0,60439	0,97656	–

*Copenhagen-Malmö—up to 1999, ferryboats carried out the service for passengers and vehicles. In 2000, the Öresund bridge takes over this flow.
**Helsingør-Helsinborg—only ferryboats.
Data Source: Smuggling: Swedish Custom Services 2002; Passengers/Vehicles: Öresundsbro Konsortiet 2002.

number of vehicles crossing the region, then the rate is unchanged or has even decreased since 1998. Improvements in control procedures may have increased the Custom Services ability to catch smugglers. To the extent the rate has gone down, it is either due to better customs/tracking procedures or because the bridge has increased the proportion of people who do not intend to smuggle goods, or it could be that the volume is so huge that the risk of detection has actually fallen. Table 4 suggests a clear displacement from Helsingborg to Malmö as a result of the Öresund bridge, indicating that smuggling has changed its geography. Smugglers seem to prefer the bridge route between Copenhagen–Malmö rather than the ferryboat between Helsingør–Helsingborg. According to Customs, control routines have not changed significantly since the bridge was opened. This lends strength to the argument that there has been a change in the geography of smuggling. For instance, the number of personnel employed for control purposes, which could affect the number of seized goods, remained the same in Helsingborg and has only marginally increased in Malmö.

Offender Mobility after the Opening of the Bridge

It is difficult to establish the extent to which the new bridge has led offenders to cross the bridge to commit offenses. Data are available on total number of suspects committing offenses by citizenship and police authority district. There has been a slight increase since 2000 in the total number of offenders in Öresund for all selected citizenships (Danes, Germans, Poles, Latvians, Lithuanians, Estonians), with the exception of Germans and Latvians. For geographical reasons, the ferryboats are still the easiest connections from Baltic countries to southern Sweden. In the long term, new restrictive controls at harbors on the Swedish east coast may force offenders to choose the bridge as the alternative route for smuggling.

Despite the fact that data on offenders' citizenship does not provide an accurate indication of offenders' mobility pattern, since we do not know their home address, this data constitutes "a good proxy" (Rikskriminalpolisen 1999). As much as 75 percent of Polish citizens and 45 percent of Danes arrested for committing crime in Swedish Öresund in 1998 did not live in the region. Among Polish citizens, a large number come from deprived areas in northwest Poland. Although there is recent evidence of Polish organized crime leagues in Swedish Öresund, Polish offenders are often people who engage in shoplifting and smuggling of narcotics and who travel to Sweden to sell illegal goods. Danish offenders were mostly young offenders who engage in shoplifting, vandalism, fraud, and smuggling of cigarettes and narcotics. In the case of Danish drug sellers, for them, "there is no need to cross the border to reach the Swedish market since clients will come to them" (Rikskriminalpolisen 1999, 42).

Changes in the Geography of Offenses: Empirical Results for Malmö

We now examine changes in the geography of offenses in Malmö that might be a consequence of the bridge opening (Figure 5). Although crime levels have not increased in Malmö during the study period, it is expected that the geography of offenses could have been affected by changes in people's routine activity and criminogenic conditions. An increase in offenses was expected to take place in or near central areas, the Central Business District (CBD), commercial and cultural inner-city areas, and transport nodes, such as railway stations. Increased mobility would generate new clusters of so-called tourism criminality (pickpocketing, all types of thefts) in the inner-city areas. Local train

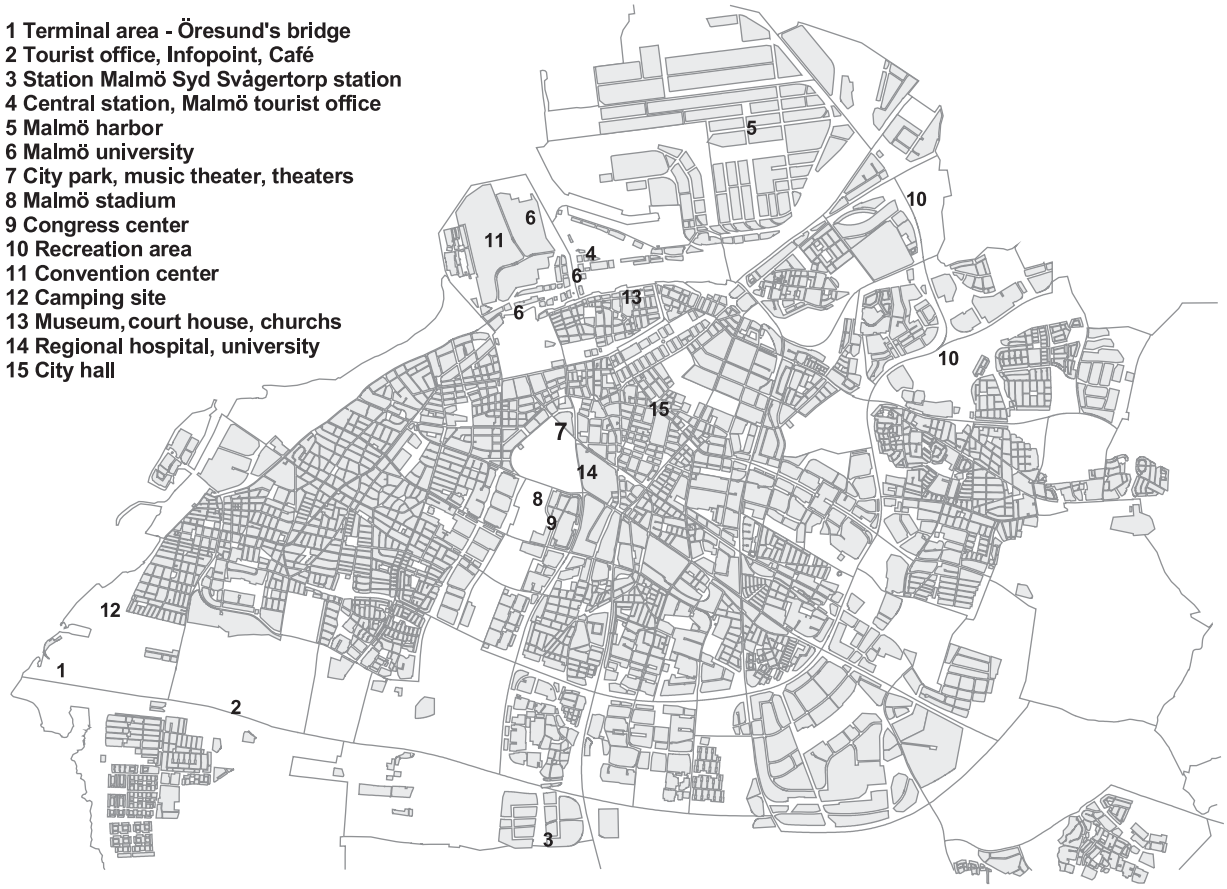

Figure 5. Main landmarks in Malmö, the Swedish border municipality in Öresund.

stations and other meeting points in Malmö would become sites for vandalism. An increase in smuggling of narcotics should have an impact not only on the geography of narcotic-related offenses in the central areas but also on crimes, such as car-related thefts and residential burglary.

The methodology involved, first, the geocoding of the offense data; second, the creation of a spatial framework, which merged spatial units with small populations into larger zones; third, the calculation of changes and standardized offense ratios on this spatial framework; and finally, the detection of clusters of offenses before and after the bridge was built. Two symmetric time intervals were compared, eighteen months before and eighteen months after the bridge was built (1999 and 2001). Robbery in banks and post offices and theft/burglary in churches and museums were not analyzed in this section since there were too few events.

The Öresund dataset required the geocoding of over 300,000 addresses for each year. The quality of the geocoding process depended on the quality of the crime records, the quality of the address dictionary, and the chosen method for geocoding. In terms of quality of the crime records, a significant problem was the variable level of detail either on where the event took place, or the time that it happened, or both. There were also cases where the crime site was unidentifiable, for example, when it took place between A and B, on a train, bus, airplane, or through the Internet. Geocoding also depends on the quality of the reference database. In the Swedish case, the mismatch between crime record and background database has restricted the automatic geocoding into a GIS to only 30 percent of all crime records, demanding an exhaustive process of data cleaning. Misspelling or contracted forms of words contributed greatly to the mismatching. As much as 70 percent of the addresses were geocoded manually using Interactive Mode in GIS, which provides "a suggestion" for each address that is not matched automatically. The closest street number was used using the zone boundary as the reference. In order to improve the matching rate of offenses in known areas (e.g., shopping malls, the central train station), addresses were gathered from the municipality or by using Internet searching tools and then geocoded. When no street number was attached to the address, the zone centroid was used in the geocoding. From the original datasets,

about 10 percent of the addresses were not geocoded (11.7 percent of the 1998 dataset, 9.8 percent of the 1999 dataset, and 10.2 percent of the 2001 dataset).

In order to create robust units for analysis, the initial 400 zones in Malmö were aggregated using the zone design software ZDES[4] (Openshaw, Alvanides, and Whalley 1998). Aggregating small regions or merging them into larger ones produces area rates that are more robust and have smaller standard errors when interpreted as estimators of the underlying relative risk (Haining 2003). Of the three criteria available in ZDES, population homogeneity was used, combined with a shape-constraint function. The homogeneity criterion ensures that the population in the new spatial units is as similar as possible while the shape-constraint function produces polygons that are similar in shape to the original ones. This is an advantage, but there is a risk that the minimum population constraint may be violated when using the shape-constraint function. From a set of maps containing 50, 60, 70, 80, and 90 new units obtained from ZDES, a map with 70 zones was chosen. This map was chosen based on a subjective assessment of what the minimum population ought to be. Only one zone violated the population minimum, so it was manually aggregated to a neighboring polygon. The final number of zones was 69 from the original 400. The final set of zones was created in which the minimum population size was 998, the maximum was 7,836, the mean was 3,748, and the standard deviation was 1,617. The final stage of the process involved the creation of a new set of boundaries by removing the boundaries between zones in the same region and merging their values using GIS. Figure 6 illustrates the final set of regions containing the 69 new spatial units. Of course, this is only one spatial representation of the city of Malmö. Other spatial frameworks could have been created either at the same scale or at other scales. All results below are conditional on the chosen spatial representation.

Six out of the eleven OAB increased slightly during this time period. When aggregated across all eleven OAB, the count remains almost the same between 1999 and 2001. Figure 6 illustrates the areas with an increase for one or more OAB offenses. Car-related thefts (both theft from vehicles and vehicle thefts) have the highest increase in areas surrounding Malmö's Syd Svågertorp station, possibly as a result of the increase in parked cars in this area. Shop-related thefts had the highest increase in the harbor and central areas, mostly in the northeast where a big retailer is located. The increase in residential burglary was concentrated in the southern part of Malmö, including Fosie, which is one of the most ethnically heterogeneous and segregated residential areas

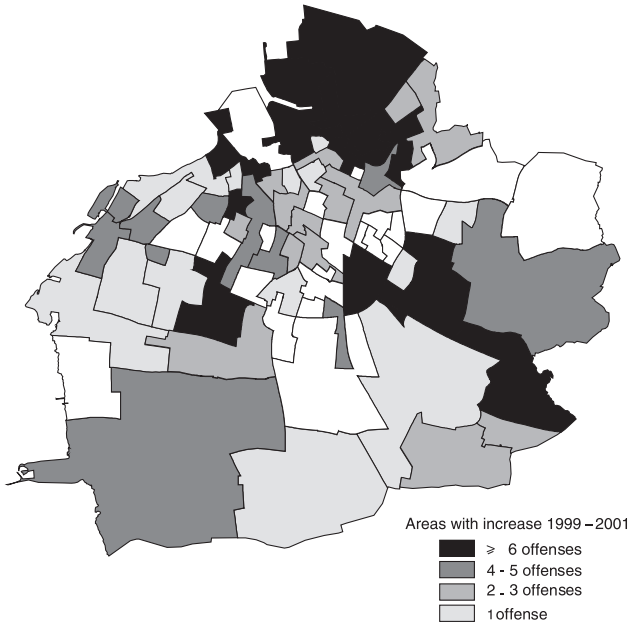

Figure 6. Areas with an increase in one or more OAB offenses in Malmö eighteen months before and after the bridge.

(Bevelander, Carlsson, and Rojas 1997). The geography of increases is similar for robbery, assault, and narcotics, with the inner city and the parts of Hyllie having the largest increases. These findings suggest that the increase in narcotics, a typical cross-border-related offense, may have affected the dynamics of violent offenses, such as robbery and assault.

A standardized offense ratio (SOR) for all selected offenses was calculated. This includes both those offenses where it was hypothesized the bridge might have an effect (OAB) and other offenses. The later were to be used as "controls." This type of standardization is a useful way of representing data for a set of areas where the areas differ in size (absolute values would tend to overemphasize large areal units) and where it is necessary to allow for differences in population characteristics between areas (Haining 2003). The SOR for region i is given by:

$$\mathrm{SOR}(i) = [\mathrm{O}(i)/\mathrm{E}(i)] \times 100$$

O(i) is the observed number of offenses of a given type and E(i) is the expected number of offenses of a given type. The number of offenses per individual at risk was obtained by dividing the total number of offenses in the study area (Malmö) by the total population. The influx of population into Malmö as a consequence of the bridge opening does raise questions about the appropriateness of this chosen denominator but there was no alternative available. The choice of the appropriate denominator for particular offenses is a problem of long standing; for a discussion, see

Wikström (1991). For each area *i*, this average rate is multiplied by the size of the chosen denominator in area *i* to yield E(*i*). E(*i*) can be interpreted as the expected number of cases of the particular offense in area *i* under the assumption of a random distribution of offenses across the whole population at risk in the study region (Malmö). It provides a baseline from which to analyze the variation in O(*i*) since the expected value of O(*i*), under the assumption of a Poisson (spatially random) process for the distribution of offenses, is the product of E(*i*) and the quantity *r*(*i*). The quantity *r*(*i*) is called the area specific effect or relative risk (see, for example, Haining 2003). SOR(*i*) is, therefore, an estimator of *r*(*i*) expressed as a percentage.

The standard error for SOR(*i*) under the Poisson assumption is given by $SE(i) = [O(i)^{1/2}/E(i)]$. A 95 percent confidence interval is obtained by multiplying SE(*i*) by 1.96 to provide a 95 percent confidence interval for the estimate of *r*(*i*). This quantity is added and subtracted to SOR(*i*). A significant difference between SOR(*i*) and SOR(*j*), for example, at the 5 percent significance level, assuming a two-tailed test, would be indicated if their 95 percent confidence intervals did not overlap. Preliminary comparisons of SORs for the 69 spatial units showed there was no significant change in their geography before and after the bridge for any type of offense. Note that this does not mean there was no significant change in the volume of the offenses in *each* spatial unit.

A cluster-detection technique was applied to investigate local changes in the pattern of SORs. In order to detect changes in the geographical clustering of offenses, Kuldorff's scan test was used (SaTScan version 2.1[5]; Kuldorff 1997). This technique has a rigorous inference theory for identifying statistically significant clusters (Haining and Cliff 2003). The test here uses the Poisson version of the scan test since under the null hypothesis of a random distribution of offenses (with no area-specific effects) the number of events in any area is Poisson distributed. This test adjusts for heterogeneity in the background population. Because of the nonlongitudinal data and because we are interested in comparing the situation before and after the bridge, the spatial scan statistic was used on the two time periods separately. For details on the scan test see Kulldorf (1997), Hjamlars et al. (1998) and for an overview see Haining and Cliff (2003).

There have been some small shifts in the geography of the selected offenses, notably in relation to the location and size of the hot spots. The geographical pattern of seven offenses out of eleven has changed, becoming either larger or smaller than it was eighteen months before the bridge (Table 5, Figure 7). However, it is very difficult to argue that these shifts are due to the effects of the bridge. There are two reasons for this conclusion. First, there were shifts not only in the selected OAB offenses, but also in the control offenses. This indicates that variation in the geography of offenses may be related to changes in other intraurban criminogenic conditions (e.g., a rise in unemployment in certain areas, housing turnover). Second, no cluster was found in the immediate vicinity of the terminal of the bridge itself or in the surroundings of the secondary train station (Malmö Syd station).

Among the offenses that the new bridge was expected to have had a short-term impact on, only the pickpocketing cluster is unchanged. This means that any change in the rate of this offense was not strong enough

Table 5. Most-Likely and Secondary Clusters before and after the Öresund Bridge: Malmö

Type	Offenses	18 Months before (1999) No. Significant* High-Value Clusters/ No. Polygons	18 Months after (2001) No. Significant* High-Value Clusters/ No. Polygons
OAB	Pick pocketing	1/5	1/5
	Vandalism	1/6	1/13
Direct impact	Molestation	0	1/5
	Vehicle theft	1/6	2/6; 5
OAB	Residential burglary	0	0
	Narcotics	1/13	1/5
Direct impact	Assault	2/6; 11	1/5
	Personal robbery	1/6	1/6
	Shop-related offenses	1/5	1/5
	Theft from vehicles	1/6	2/6; 5
	Crime against common order	1/6	1/9
"Control" offenses	Domestic violence	1/5	1/32
	Fraud	1/5	1/6

*at the 10% or 5% level of significance.

Note: 2/6; 5 means two clusters, the most likely cluster is composed of 6 polygons and the secondary one is composed of 5 polygons.

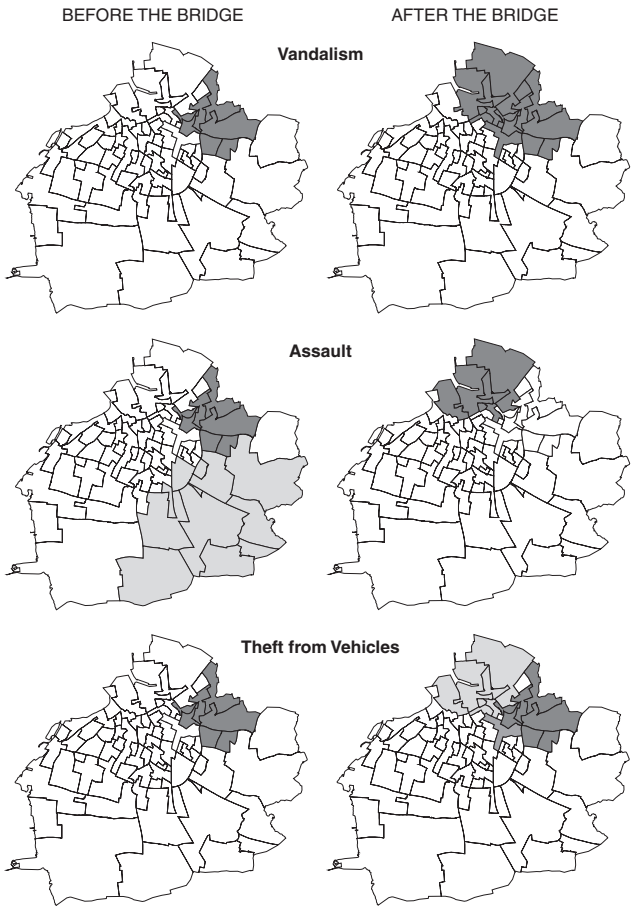

Figure 7. Most-likely (dark shading) and secondary clusters (light shading) in Malmö: (a) vandalism, (b) assault, and (c) theft from vehicles, before and after the Öresund bridge.

to affect its geography. For car-related thefts, the most likely cluster was not only larger in 2001 but a secondary cluster appeared. The first cluster includes the Kirseberg district (Figures 5 and 7), particularly the recreational and industrial areas and in the vicinities of a large retailer. After the bridge was built, the surroundings of the central station, the harbor, and its surroundings all became significant. It is possible that the bridge indirectly increased the car stock in these areas and, consequently, the number of targets for possible vehicle thefts and thefts from vehicles. Travelers can now easily go by train to the continent and, therefore, cars need to be parked close to the station and its surrounding area.

The vandalism cluster became larger. For the offense of molestation the only significant hot spot appeared after the bridge had been built, in both cases in the inner-city area, including central station, old town, eastern parts of the harbor, and the Kirsberg/Husie's recreational areas (Figures 5 and 7). Only clusters of narcotics and assaults have become smaller and more concentrated geographically in the city center, railway station, and harbor areas. Contrary to what was expected, no changes were found in the location of clusters for shop-related offenses (shoplifting, robbery, or burglary) and personal robbery; both are also very concentrated in the inner-city areas. The most surprising shift was in the geography of assault/mistreatment. Before the bridge, clusters were located in southern and eastern parts of the city; after the bridge, the most likely cluster had moved to northern parts of Malmö. It is not clear why this should have happened.

Modeling Changes in the Geography of Offense Patterns

We now model the geography of offense patterns before and after the bridge using demographic, socioeconomic, and land use covariates. The purpose is to explain the variation in area-specific or relative risk ($r(i)$) for various offenses in Malmö.

The dependent variables in this study are the standardized offense ratios for the eleven selected offenses that were expected to be affected by the bridge. Two other offenses were used as controls (*domestic violence* against women and children and *fraud* in hotels and restaurants, fraud against disabled people, and fraud-other). The control variables were chosen because they were high volume and were not expected to be affected by the bridge's construction. Analyzing these offenses provides a check on the regression modeling in relation to the OAB category.

We assess the impact of the bridge in two ways: (1) by fitting a single model that contrasts 1998 and 2001 data and (2) by including in the model a measure of distance of each spatial unit from the bridge (through the variable Access). The model controls for built form and land use features of Malmö and for population characteristics. Variables were chosen drawing on the existing urban criminology literature on social disorganization, routine activities, and the role of social capital. (For an extensive discussion of these theories, see Entorf and Spengler 2002.) To evaluate the bridge's effect we must at least control for those variables that characterize differences within Malmö (e.g., demographic and socioeconomic variables) that are known to have an impact on offense patterns. Because of data limitations, the values of explanatory variables, although from one time period, are not from the same year. The statistics for households are from the beginning of the 1990s while the statistics for local leisure associations are for 2002. For a further description of the variables, see the Appendix.

The linear regression model was used in order to explain the variation in offense ratios. This model is given by:

$$Y = X\beta + \varepsilon$$

where Y is the vector of standardized offense ratios for 1999 and 2001 (eighteen months before and eighteen months after the bridge was built) for a particular offense ($N = 69 \times 2$). X is an $N \times (p+1)$ matrix with $p+1$ explanatory or predictor variables, including the constant term. β is a $p+1$ vector of regression coefficients ($\beta_0, \beta_1, \ldots, \beta_p$) where β_0 is the (intercept) parameter associated with the constant term and ε is the N vector of random errors with mean 0 and variance $\sigma^2 I$. A dummy variable D was incorporated into the model. This is to assess the effect of the bridge, both on the intercept term and on each of the regression coefficients, so:

$D(i) = 1$ if the observation is from 1999, that is before the bridge was built ($i = 1, \ldots, N$)
$= 0$ if the observation is from 2001, that is after the bridge was built ($i = 1, \ldots, N$)

In practice the first 69 values of the dummy vector consist of 1s and the second 69 consist of 0s. The full model is given by

$$Y = \beta_0 1 + \beta_{0;D} D + \beta_1 X_1 + \beta_{1;D} D^T X_1 + \ldots + \beta_P X_P + \beta_{p;D} D^T X_P + \varepsilon$$

where D^T denotes the transpose of the vector D and 1 is the N vector of 1s. The intercept coefficient is given by β_0 after the bridge and $(\beta_0 + \beta_{0;D})$ before the bridge. The regression coefficient for the k^{th} covariate is given by β_k after the bridge and $(\beta_k + \beta_{k;D})$ before the bridge. We test for statistically significant differences before and after the building of the bridge by testing the significance of $\beta_{0;D}$, $\beta_{1;D}, \ldots, \beta_{p;D}$ from 0.

The regression analysis was implemented in SpaceStat 1.91 (Anselin 1992) since the software has regression-modeling capabilities with a range of diagnostics (including heteroskedasticity tests) that are appropriate for spatial analysis (see also Ma, Haining, and Wise 1997). In order to test for spatial autocorrelation on the residuals, a row standardized binary weight matrix (W) was used that comprised non-zero entries where i and j refer to areas that are adjacent and the SOR data refer to the same time period. The diagonal elements in W are all zero. The full weight matrix can be represented in partitioned form as follows:

$$\begin{array}{cc} 1999 & 2001 \\ \begin{bmatrix} W & 0 \\ 0 & W \end{bmatrix} & \end{array}$$

For five offenses (vandalism, vehicle theft, residential burglary, assault, and shop-related offenses) the OLS regression model diagnostics revealed significant spatial autocorrelation in the residuals. Spatial lag and spatial errors models were fitted in order to address these problems (see Haining 2003 for a discussion of when it is appropriate to consider these models). 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 error term (spatial error model). Table 6 summarizes findings including the significant variables at the 1 percent, 5 percent, and 10 percent levels. After extensive analysis, heteroskedasticity remained in the residuals of most of the models, and this is an area for further research.[6] Not having a constant error variance means that the regression estimates are not efficient. In the particular case of Malmö this problem is a consequence of using data from spatial units with different sizes of population at risk. For an extensive discussion of this diagnostic, see Anselin (1992) and Haining (2003).

Only vehicle-related crimes (vehicle theft and theft from vehicles) out of the eleven OAB-category crimes have regression coefficients that are significantly different before and after the bridge's construction. Model results indicate that the regression coefficient for central and local stations (and their surrounding areas) are significantly different before and after the bridge (DStat and Stat). We note that vehicle-related crimes increased after the bridge opened. An explanation for this might be that the use of the bridge as a means to reach the continent (either by train or car) results in an increase in traffic flow not only in Malmö in general but, especially, close to transport nodes, such as stations. It may also indicate an increase in the stock of cars parked around the stations and surrounding areas that become vulnerable targets for theft and burglary. However, there are other variables that help explain vehicle-related crimes. Vehicle thefts, for instance, are concentrated in areas with a large share of population aged twentyfive and younger, high housing mobility, low foreign populations, and, surprisingly, with many local leisure associations. In the case of Malmö, local leisure associations, especially those related to sport events, may attract young motivated offenders who hang around and blend in with the local environment. Thus, the presence of local leisure associations shows little buffering effect on theft-related crimes, which corroborates the findings of Ross and Jang (2000) but goes against results of Rosenfeld, Messner, and Baumer (2001) and Martin (2002) on the impact of local organizations on crime.

The presence of commercial areas (Shop) explains three out of the four OAB where the effect is expected

Table 6. Results of the Regression Analysis: Y = Standardized Offense Ratios

			Significant Variables		
			All significant at the 10% level, except * = 5% level, ** = 1% level		
Type	Offense	R^2	Bridge Effect Variables	Other	Unsolved Problems
OAB	Pickpocketing	32.0		Urb*(+), Univ**(+), Shop(+), Pbus(+)	Het
Direct Impact	Vandalism	42.2		W_Van**(+), Urb**(+), Shop(+), Pbus(−)	Het
	Molestation	26.4		Pfore**(−), Punemp*(−), Univ**(+), Hosp**(−), Shop**(+)	−
	Vehicle theft	44.1	DStat *(−)	W_Veh*(+), Pout *(−), Pfore **(−), P25**(+), Plass **(+), Stat **(+)	Het
OAB	Residential burglary	43.5		W_Res (+), Pfore **(−), Pvill **(+)	Het
Indirect Impact	Narcotics	25.0		Pfore *(−), Ppfo *(+), Univ *(+), Stat **(+)	Het
	Assault	28.9		Pfore**(−), P25**(+), Univ(+), Lambda **(+)	Het
	Personal robbery	24.4	Access (−)	Pfore *(−), Ppfo * (+), Univ **(+), Shop **(+)	−
	Shops-related offenses	15.9		W_Shop **(+), Pfore * (−), Univ **(+)	Het at 90 per cent
	Theft from vehicles	40.0	Dstat (−)	W_Tve*(+), Pin*(+), Pfore **(−), Plass *(+), Stat **(+)	Het
	Crime against common order	25.9		Punemp *(−), Univ **(+), Shop *(+)	Het
Control	Domestic violence	38.5	DNws *(−), DUniv (+)	Pin**(+), P25 **(+),	Het
	Fraud	42.5		Pout **(+), Univ**(+), Centre **(−)	Het

Access = Inverse distance to the bridge; **Centre** = Dummy for central areas; **Hosp** = Dummy for hospital and surroundings (1st order neighbors); **Nws** = Proportion of Neighborhood Watch Schemes; **P25** = Proportion of population aged twentyfive years and younger; **Pbus** = Proportion of bus stops per population; **Pfore** = Proportion of population born abroad; **Pin** = Proportion of population moving into the area; **Plass** = Proportion of Local Leisure Associations; **Ppfo** = Proportion of population with parents born abroad; **Pin** = Proportion of population moving into the area; **Pout** = Proportion of population moving out; **Pvill** = Proportion of single family houses (detached, semidetached); **Punemp** = Proportion of unemployed labor force; **Shop** = Dummy for commercial areas and surroundings (1st order neighbors); **Stat** = Dummy for railway stations and surroundings (1st order neighbors); **Univ** = Dummy for university campus and surroundings (1st order neighbors); **Urb** = Dummy for urban and urbanized areas. **D_** represents the product of the time dummy (D) with the corresponding variable (e.g., Dstat). In the spatial lag model, W_variable denotes the lagged independent variable while Lambda belongs to the spatial Error model. **W_Van** is the lagged dependent variable of Vandalism, **W_Veh** is the lagged dependent variable of Vehicle theft and **W_Res** is the lagged dependent variable of Residential burglary. **Het** = Heteroskedasticity.

to be direct (Table 6). Most pickpocketing occurs in the city's main core, in commercial areas, close to the university campus and surroundings, and areas with relatively large numbers of bus stops. These areas and locations bring people together, creating an opportunity for crime (potential offenders and victims) (Tremblay and Tremblay 1998).

However, while these places stimulate pickpocketing, they might discourage other types of offenses, such as vandalism. High standardized vandalism rates are found in central areas, mostly commercial ones but in less guarded places, possibly with fewer bus stops. Areas with a high risk of molestation are associated with shopping areas. Population characteristics of the areas are also important—areas with a low proportion of unemployed people and population born abroad have higher vandalism ratios.

Among those offenses selected where the bridge was expected to have an indirect or long-term impact, the presence of the university campus and its surroundings (Univ) explains five out of these seven offenses. As the variable is represented (the polygon and its first-order neighbors), it signals the importance of educational environments on crime patterns. Other central areas, old town, and the harbor area of Malmö are also important sites. A typical example is personal robbery. The model suggests that the closer an area is to a shopping area, the university campus and harbor areas, the higher the relative risk of robbery. Another example is narcotics. Areas with a high relative risk of narcotic-related offenses are the ones close to the stations (central and secondary) and the university campus. As in the case of personal robbery, population characteristics are also important in explaining the geography of relative risk.

It should be noted that in the case of one control variable (domestic violence), there was a significant difference in two of the variables before and after the bridge. The relative risk of domestic violence was higher eighteen months before the bridge was constructed close to the harbor/university campus and lower in areas with neighborhood watch schemes. This is disappointing in terms of the overall analysis since it undermines the regression findings on the OAB category. It is possible, but unlikely, that the construction of the bridge may have had an effect on domestic violence, but any link is likely to be tenuous.

Conclusions

This article has reported findings on the short-term effects on offenses by the establishment of an improved transportation link between two bordering European countries. Results reported here suggest that new, improved transportation systems that cross "open" borders generate an increase in mobility, but do not necessarily trigger a rise in the total number of offenses. However, the easy access to places may generate new geographical patterns of offenses by creating new sites for offending in areas that, despite being crowded places, may lack capable guardians.

Thefts, shoplifting, and vandalism are, by far, the most common types of offenses in the Öresund region. It is suggested that there have been no dramatic changes in the total number of crimes between 1998 and 2001. However, changes in the transport system in the region have led to changes in smuggling routes. Smugglers seem to prefer the Öresund bridge route between Copenhagen and Malmö than the ferryboat between Helsingør and Helsingborg. There are also indications that the bridge has facilitated human trafficking.

Results from the Swedish city of Malmö illustrate the fact that there have been some shifts in the geography of the selected offenses, notably in relation to the location and size of clusters of high rates. The modeling of the changes in crime patterns shows that only a few minor shifts in their association with underlying demographic, socioeconomic, and land-use characteristics took place before and after the bridge was built. Only vehicle-related crimes out of the eleven selected crimes seemed to be affected by the bridge. Space-time variation in one of the two control offenses was influenced by the bridge. This later finding is not, at the present time, easy to rationalize and raises questions about the interpretation of the findings from the other regression models.

Discussion and findings of this article raise questions that point to the need for a new conceptual model at the regional level that goes beyond existing criminological theory about the role of space and place. The regional scale implies, for instance, that routine activity theory (Cohen and Felson 1979) should be expanded to incorporate notions of mobility across borders (perhaps more complex than the ones applied to intraurban patterns) for offenders and targets (and potential guardians). The offenders' perception of an international border (and the risks involved in crossing it) is likely to be very different from other types of local barrier. All the characteristics that make an object a "suitable target" (value, inertia, visibility, and access) should be adapted to the context of borders. In this case, cross-border crime could be assessed as any other economic activity involving risk and reward. Rational choice theory should contribute to our understanding of why certain offenders make the decision to cross a border. Notions of "capable guardians" should take into consideration the behaviors

of people when they are in an unfamiliar environment and new forms of interaction occur in places that are well populated, but that have a wide range of impersonal forms of surveillance.

The main challenge in assessing the effect of a new transport link is to combine individual or group-level data on offense, victim, and offender from both sides of the border. In this study, only aggregated data on offenders by citizenship for Swedish Öresund was available and was used to illustrate offenders' mobility. The individual data should refer to offenders who cross the bridge to commit crime as well as persons who are victimized on the other side of the bridge. Linking data on offense, victims, and offenders is one of the core issues in modern criminology, and the findings of this study are an example of where the linkage is crucial to understanding process. However, much work remains to be done in solving problems of data access and data comparability between countries. The fact that crime records in most countries are regarded as very sensitive at the coordinate level makes the process of acquiring the datasets long, difficult, and costly. Combining crime data from different countries raises additional challenges.

There is also a need to separate the effect of changes taking place at a border from other structural changes taking place at national and international scales. The increase in cases of human trafficking in both Denmark and Sweden is an example of how processes operating at international scales have implications for locally observed offense patterns. To take one example, EU enlargement has added new member states to the former fifteen. The EU's new frontier now abuts Russia and former Soviet republics. How these new borders are policed will have implications for crime patterns throughout the EU.

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Appendix: Characteristics of the Dataset

Type of Data	Description			Year	Source
Offenses	*Type*	*Swedish Code*	*Danish Code*		
	Smuggling[1]	4002, 4022, 4003	76501, 71282	1998–2001	Skåne Policy Authority
	Pickpocketing	845	75607, 75609, 75611, 75613, 75551		Copenhagen Policy Authority
	Vandalism	1201–3, 1205, 1207	77111–5, 77121		
	Molestation	403, 407, 408, 410	74265, 74266, 74271		Swedish Customers Services
	Vehicle theft[2]	801–806	75411, 75421, 75441, 77271–77, 77279, 77311		
	Residential burglary[3]	825–826, 843–844, 857, 874 (9801–9802 in 2001)	75211–75213, 75311		
	Narcotics	5004–5006, 5010–5012	71281, 84110–84111, 75312–75313		
	Assault	351–358, 361–368, 371–378, 381–388	73215–16, 73241, 73251, 73261–73262		
	Personal robbery	877–879, 890, 894–895 (2001)	76319, 76329		
	Shops-related offenses	864, 870, 818, 853	76313, 76323, 75152–75153, 75560,75562–3		
	Theft from cars	840	75512–75514		
	Crime against common order	1602–1607	70421, 70423		
	Robbery in banks and post offices	862–863, 868–869	76311[4]		
	Offenses in places of tourism[5]	886–887	75114, 75184		
	Domestic violence	381–384	-		
	Fraud	903–906	-		
Demographic and Socioeconomic Indicators	Proportions of				
	Population younger than age 18 (P18, DP18)			2000	Malmö Municipal Database (Statistics Sweden)
	Population older than age 65 (P25, DP25)			2000	
	Unemployed labor force (Punemp, DPU nemp)			2001	
	Population with (at least) a parent born abroad (Ppfo, Dppfo)			2001	Region Skåne
	Population born abroad (Pfore, Dpfore)			2001	
	Population moving into the area (Pin, Dpin)			2000	

continued

Type of Data	Description	Year	Source
	Population moving out the area (Pout, Dpout)	2000	
	Rental public housing apartments (Ppho, Dpho)	1990	
	Apartments owned by private companies (PPc, DPPc)	1990	
	Privately owned single-family houses (Pvill, Dpvill)	1990	
	Families average disposable income (Pinc, DPInc)	1999	
	Households receiving social allowance (Psal, DPSal)	1999	
	Local leisure associations by pop (Plass, DPLass)	2002	
	Neighborhood Watch Schemes by pop (PNws, DPNws)	1998	
Land Use Indicators	Dummy for urban and urbanized areas (Urb, Durb)		Skåne Traffic Authority
	Dummy for university campus and surroundings, 1st order neighbors (Univ, Duniv)		Swedish National Road Association
	Dummy for commercial areas and surroundings, 1st order neighbors (Shop, Dshop)		
	Dummy for central/railway station and surroundings, 1st order neighbors (Stat, Dstat)		
	Dummy for hospital and surroundings, 1st order neighbors (Hosp, Dhosp)		
	Dummy for Centre (Centre, Dcentre)		
	Dummy for areas of tourism attraction, (Turis, Dturis)		
	Proportion of bus stops by population (Ppuss, Dpbuss)		
	Access to the bridge—Inverse distance to bridge (Acess, Dacess)		

[1]For Sweden, the data is incomplete; data on seized goods from the Customers Services was used instead;
[2]This excludes bicycle, boat, other;
[3]This includes cellar, attic, leisure house for Sweden;
[4]This does not include post offices;
[5]For Sweden, this data includes theft or burglary in churches, museums, sport arenas, cinemas, hotels, while for Denmark, the category chosen was "Burglary in general, others" (Indbrud i øvrig, inkl. Kirke/museum).

Notes

1. Our definition of Öresund includes the Copenhagen metropolitan area (Hovedstadsregionen), and Scania (Skåne) in the southern part of Sweden. Thus, in this study, we exclude the low-density populated parts of the Danish Öresund, such as Västra Själland, Lolland and Bornholm.
2. For a general review of studies dealing with borders, see Van Houtum (2000), Leimgruber (1981, 1998, 1999), and Bucken-Knapp and Schack (2001).
3. Driving under the influence of substances was recorded separately from other types of offenses, but lately there has been a common practice to record it in the same database as other offenses. One reason is that driving under the influence of alcohol in combination with narcotics has become very common—a fact that confirms the increase of narcotics in general but that may have inflated the number of cases because the offense was possibly recorded in both databases.
4. http://www.geog.leeds.ac.uk/software/zdes/ (last accessed 1 July 2004).
5. http://dcp.nci.nih.gov/BB/SaTScan.html (last accessed 1 July 2004).
6. One possibility is to model the observed counts as a Poisson or binomial response using the expected counts as the offset variable. The evidence here suggests that the analysis will need to deal with overdispersion.

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