

# EFFECTS OF ATTRACTIVENESS, OPPORTUNITY AND ACCESSIBILITY TO BURGLARS ON RESIDENTIAL BURGLARY RATES OF URBAN NEIGHBORHOODS

WIM BERNASCO  
FLOOR LUYKX\*

Netherlands Institute for the Study of Crime and Law Enforcement (NSCR).

*This study assesses the effects of attractiveness, opportunity and accessibility to burglars on the residential burglary rates of urban neighborhoods, combining two complementary lines of investigation that have been following separate tracks in the literature. As a complement to standard measures of attractiveness and opportunity, we introduce and specify a spatial measure of the accessibility of neighborhoods to burglars. Using data on about 25,000 attempted and completed residential burglaries committed in the period 1996-2001 in the city of The Hague, the Netherlands, we study the variation in burglary rates across its 89 residential neighborhoods. Our results suggest that all three factors, attractiveness, opportunity and accessibility to burglars, pull burglars to their target neighborhoods.*

**KEYWORDS:** Residential burglary, attractiveness, opportunity, accessibility, neighborhoods.

## INTRODUCTION

Individuals who are motivated to commit a property offense and who search the urban environment for suitable target areas, have to take into account a number of relevant aspects. They must simultaneously consider the area's *attractiveness* in terms of the value of the goods that can be stolen, and the *opportunities* that the area offers in terms of the likelihood of successfully completing the offense. They must also consider the *accessibility* of the area in terms of how familiar its social and physical infrastructure are to them, and in terms of the distance they must travel to reach it.

---

\* Please direct correspondence to the first author at: NSCR, P.O. Box 792 NL-2300 At Leiden, The Netherlands, or at [bernasco@nscr.nl](mailto:bernasco@nscr.nl). We are indebted to Hanneke van Essen (NSCR), Rieny Albers (NSCR) and Astrid Patty (Haaglanden police force) for their assistance in the preparation of the data. Henk Elffers, Paul Nieuwbeerta, Wilma Smeenk and the editor and two anonymous reviewers of this journal provided helpful comments on earlier versions of the manuscript.



How residential burglars weight these criteria and how they choose amongst alternatives, has been the subject of a comprehensive stock of literature on residential burglary in general, and on target selection of burglars in particular. In this literature, however, the influence of attractiveness and opportunity on target selection has mostly been studied separately from the influence of accessibility. As a result, we are faced with two alternative explanations of neighborhood burglary rates that are neither confronted nor integrated. Consequently, an assessment of the merits of both explanations is required, i.e. an assessment of the relative impact of attractiveness and opportunity on the one hand, and accessibility to motivated burglars on the other hand. This study's purpose is thus to *assess the relative effects of attractiveness, opportunity and accessibility to burglars on the residential burglary rates of urban neighborhoods*.

The study of the effects of neighborhood features reflecting attractiveness and opportunity has a long-standing tradition in criminology. Therefore, our main challenge is to come up with a qualified measure that reflects the accessibility of neighborhoods to burglars, and to estimate whether it has explanatory value that complements the explanatory value of standard measures of attractiveness and opportunity.

The remainder of this paper is organized as follows. The next section briefly reviews the two lines of investigation in prior research that are relevant to the problem at hand. We subsequently identify a number of key factors pertaining to attractiveness, opportunity and accessibility that are expected to increase the vulnerability of neighborhoods to residential burglary. Thereafter we describe the data and methods that were used for this study, including the definition of a measure of accessibility to burglars, and present the main results. The discussion summarizes our findings and makes some cautionary remarks.

## PRIOR RESEARCH: TWO LINES OF INVESTIGATION

In the criminological literature, two separate lines of investigation can be distinguished that pertain to the roles of attractiveness, opportunity and accessibility in the location choice of burglars.

One line of investigation applies to accessibility, and comprises studies that analyze journeys-to-crime (Baldwin and Bottoms, 1976:78–98; Capone and Nichols, 1975; Gabor and Gottheil, 1984; Hesseling, 1992; Phillips, 1980; Rengert, 1975; Rhodes and Conly, 1991; Turner, 1969). These studies focus on accessibility by analyzing the distances between the burglars' homes and the homes that they burgle as the dependent variable. Typically, it is found that the frequency of burglaries decreases with the distance of the target from the burglar's home (referred to as the *distance decay pattern*). In addition, the length of a burglar's journey-to-crime has

been found to increase with the value of the stolen property, which suggests that burglars in some way weight the prospective profitability of a burglary with the effort and risk of traveling into distant and unfamiliar areas. As Kleemans (1996: 95) argues, distance is not an adequate dependent variable if the objective of the research is to assess the relative weight that burglars attach to a number of selection criteria. If we are interested in establishing the relative importance of distance, attractiveness and opportunity as choice criteria, then the analysis should use all of these aspects, and should include areas that are burgled as well as potential areas that are not. In that case, distance is not the dependent variable, but part of the explanation.

The second line of investigation, generally referred to as the “ecological approach,” uses burglary incidence rates from police records, from victimization surveys, or from both sources, and relates neighborhood attributes that signal attractiveness and opportunity to their rates of residential burglary (a non-representative sample of studies includes Hakim, Rengert and Shachmurove, 2001; Miethe and McDowall, 1993; Rountree and Land, 2000; Rountree, Land and Miethe, 1994; Sampson and Wooldredge, 1987; Sampson and Groves, 1989; Smith and Jarjoura, 1989; Vélez, 2001). As such studies include both areas with low burglary rates and areas with high rates, they do not select on the dependent variable, and they allow us to draw conclusions on the relative importance of target area attributes as criteria for the burglar’s choice. Most of these latter studies, however, do not use information on where the burglars live (or use it as a separate dependent variable, i.e. they study delinquency rates), and therefore they do not allow us to make inferences on whether distance is a relevant criterion for burglars. As a result, these studies must assume either that the spatial distribution of burglars’ home addresses is random, or that distance does not constitute a constraint for burglars. Both assumptions are questionable. The first assumption is questionable because since Shaw and McKay’s (1942) pioneering work it has consistently been found that the homes of offenders cluster in deprived neighborhoods, often located in transition zones around central business districts (Baldwin and Bottoms, 1976:99–122; Bursik and Grasmick, 1992; Morris, 1958). The second assumption is questionable because the phenomenon of distance decay is very prevalent, not only in criminal behavior, as shown by studies of the journey-to-crime, but in virtually all human activities.

Thus, rather than ignoring distance as a factor that limits the accessibility of potential target neighborhoods to burglars, what is needed is a measure that allows us to estimate its effect, and relate it to the effects of attractiveness and opportunity.

To this end, we specify a spatial measure of the accessibility of a neighborhood to burglars, and evaluate its effect on burglary rates, in addition

to the effects of standard measures of attractiveness and opportunity. In doing so, we follow Sampson's (2002, p. 121) suggestion to "elucidate spatial dynamics arising from neighborhood interdependence" by incorporating inter-neighborhood spatial dynamics in the "traditional" ecological approach that views neighborhoods as independent observations. This approach has a precursor in the work of Heitgerd and Bursik (1987), who studied the effects of racial change in adjoining areas on local delinquency rates, and has been used recently by Morenoff et al. (2001) to study inter-neighborhood effects on homicide rates. In contrast to the work of Morenoff et al., where spatial interdependence is viewed in terms of a diffusion process driven by spatially channeled sequences of retaliatory events of interpersonal violence, in our implementation spatial interdependence is simply viewed in terms of offenders traversing neighborhood borders in order to commit crimes elsewhere. Stated clearly but slightly too boldly: our approach views neighborhood burglary rates not to be influenced by the burglary rates of nearby neighborhoods, but by the number of burglars living in nearby neighborhoods.

The strength of the accessibility-to-burglars measure that we propose in the Data and Methods section, is that it is based on the first law of geography, which asserts that "everything is related to everything else, but near things are more related than distant things" (Tobler, 1970: 236). Accordingly, the measure takes into account that burglars are mobile, and thus it recognizes that a neighborhood is threatened not only by local burglars but also by burglars who live elsewhere. The measure also takes into account that the mobility of burglars is limited (i.e. near targets are more accessible than distant targets). Accordingly, it incorporates the notion that neighborhoods are safer from burglary if they are located farther away from the locations where burglars reside, or, phrased in another way, that burglars pose a greater threat to a neighborhood if they live nearby than if they live far away.

## THEORY

The purpose of this section is to elaborate on theoretical notions regarding target selection of residential burglars, to identify criteria that residential burglars consider when they choose a target area for burgling, and to formulate testable hypotheses.

In addition to the two lines of investigation that we distinguished in the introduction, a third line of investigation of burglars' target selection uses accounts of detained or active burglars in order to describe their motives, cognitions and behaviors (Bennet and Wright, 1984; Cromwell et al., 1991; Maguire and Bennet, 1982; Nee and Taylor, 2000; Rengert and Wasilchick, 1985; Reppetto, 1974; Scarr, 1973; Taylor and Nee, 1988; Wright and

Decker, 1994). Based on accounts of the burglars themselves, these studies suggest that most burglars burgle for material profit, that they select their target areas and targets with care, that they plan their act, and that they take a number of environmental factors into account when deciding on where and when to attack. Rengert and Wasilchick (1985: 61) further suggest that distance and familiarity are important criteria for target selection as well. Although these findings provide important cues for identifying location choice criteria, their descriptive nature and their reliance on verbal accounts of the offenders themselves makes it difficult to assess the behavioral importance of these criteria in the real world. In order to convincingly test models of location choice, additional evidence is required in terms of behavioral data that can be interpreted as “revealed preferences” (Hakim et al., 2001).

Notwithstanding this cautionary remark concerning the plausibility of verbal accounts of burglars themselves, in our view the above-mentioned findings provide sufficient support for a theoretical stance that portrays the burglar as a rational agent, burglary as a form of purposeful action, and target choice as the process of output optimization that is constrained by limited resources (information, time, mobility). In other words: we use a rational choice approach to target selection. To pursue this approach, it is not necessary to assume that the decision making process is always a matter of extensive conscious calculation: it can equally be applied to cases of target selection where decision-making is virtually instant, including cases where the choice is apparently instantaneous and based on pre-existing knowledge of specific targets or target areas.

The main assumption underlying our model is that it takes the existence of motivated burglars for granted. It does not attempt to explain how people become burglars, it attempts to explain why they burgle where they burgle, instead of somewhere else. The model is, therefore, a model of burglary location choice by motivated burglars. To construct such a model, we will first argue that burglars’ target selection is a sequential decision process in which the choice of a specific object (residential unit) is conditional on the choice of an area (neighborhood). Next we enumerate the three main aspects of neighborhoods that we expect to make them vulnerable to burglary: attractiveness for burglary, opportunities for burglary, and accessibility to motivated burglars. We also link neighborhood variables to each of these three aspects.

Consider a motivated burglar who scans the environment for potential targets. Even if his or her knowledge of the environment is limited, the number of potential objects is overwhelmingly large. Several authors (Brantingham and Brantingham, 1978; Brown and Altman, 1991; Cornish and Clarke, 1996; Kleemans, 1996:52–53) argue that burglars follow a spatially structured, sequential and hierarchical decision process in selecting



their targets. In the first stage they select a suitable area, and only in the second stage they select a suitable object. This sequential process implies that it makes sense to study location choice of burglars at the neighborhood level, and to ask which features of neighborhoods make them more likely to be chosen by burglars as their working sites.

Thus, the location selection process starts with a set of implicit or explicit rules regarding which areas are suitable for burglary and which areas are not. The ethnographic literature referenced above suggests that three general criteria play a role when burglars compare the features of alternative areas.

The first criterion is the attractiveness of a neighborhood in terms of the prospective profitability of a burglary if it is successful. It is asserted that, other things being equal, affluent neighborhoods are preferred over poor neighborhoods because the expected proceeds of the offence tend to be larger there. Residential units have visible cues that signal their value and thus the prosperity of their occupants. As indicators of the affluence of neighborhoods we use the percentage of owner-occupied dwellings and the average real estate value (of residential units) in the neighborhood.

The second criterion is the likelihood of successful completion of a burglary. It is suggested that burglars prefer neighborhoods characterized by unstable and non-cohesive social structures because the anonymity in such neighborhoods implies a lower level of territoriality (Brown and Altman, 1981). In this view, neighborhood residents are primarily viewed as potential bystanders of crimes, who may or may not be able or willing to guard their neighbors, their neighbors' properties and the public properties of the community against attacks by offenders. In contrast to authors who view "social organization" or "collective efficacy" in terms of its role in preventing delinquency of local youth, our focus is on its role in the prevention of crime, irrespective of whether the offenders come from local or from distant areas.

Two core variables that are traditionally associated with lack of social cohesion and collective efficacy are residential mobility and ethnic heterogeneity (Sampson and Groves, 1987). Both variables appear to capture quite well the increased likelihood of successful burglary in anonymous environments, because both high residential mobility and high levels of ethnic heterogeneity are conditions that provide relatively few opportunities for neighborhood residents to get to know each other and integrate. Weak integration and low levels of cohesion will generally lead to situations of decreased territoriality. Neighborhood residents who are not closely affiliated with their neighbors will generally be less easily alarmed by suspect situations, and even if they are alarmed, will be less eager to intervene in order to protect their neighbors' properties.

In contrast to many other studies in the "ecological approach" (e.g.,

Sampson and Groves, 1987) we do not include low economic status and family disruption as explanatory variables, i.e., as indicators of territoriality. This is because we contend that these structural variables are theoretically related to *family* cohesion and thereby to supervision of youth (and are thus well chosen if they are used to explain delinquency rates rather than crime rates), while residential mobility and ethnic heterogeneity apply much more directly to *neighborhood* cohesion and thereby to the willingness of neighborhood residents to intervene in criminal acts on behalf of their neighbors.

The third criterion is the accessibility of a neighborhood to potential burglars (as far as we are aware, the term accessibility was first used in this sense by Rengert, 1991). According to ethnographic and theoretical studies, burglars prefer familiar neighborhoods over unfamiliar neighborhoods, because in familiar neighborhoods they are better able to move around without being viewed as “strangers.” Furthermore, familiar areas provide advantages because burglars have better knowledge of the physical infrastructure (e.g., knowledge of escape routes) and of the inhabitants and their routines. In addition, burgling in remote and unfamiliar areas requires more time and effort than burgling in nearby areas. In general, then, neighborhoods that are familiar to many prospective burglars are more vulnerable to burglary than neighborhoods that are unfamiliar to most of them. As we do not have information on the familiarity of individual burglars with their city’s neighborhoods, we will measure familiarity by proxy, i.e., by proximity to the own neighborhood of the burglar.

In addition, familiarity is also measured by proximity to the central business district. Neighborhoods situated in the central business district or its close proximity have concentrations of public facilities and are therefore likely to be familiar to burglars, both to burglars who live in the city itself as to those who come from outside the city.

The six testable hypotheses that follow from the arguments outlined above can be summarized as follows:

#### *Attractiveness*

1. Higher percentages of home ownership increase residential burglary rates
2. Higher average real estate values increase residential burglary rates

#### *Opportunity*

3. Higher levels of ethnic heterogeneity increase residential burglary rates
4. Higher residential mobility rates increase residential burglary rates

#### *Accessibility*

5. Greater proximity to homes of burglars increases residential burglary rates



6. Greater proximity to the central business district increases residential burglary rates

## DATA AND METHODS

The hypotheses are tested using data on the city of The Hague, the Netherlands. With a population of about 440,000, it is a large city according to Dutch standards. The Hague is the “administrative capital” of the Netherlands, as it hosts the Dutch national parliament, the government departments, and many semi-governmental organizations as well. The city is situated at the North Sea coast, and its current boundaries include the former coastal villages of Scheveningen, Loosduinen and Kijkduin. The city comprises 94 neighborhoods. We used data on 89 neighborhoods, as 5 neighborhoods are almost or completely non-residential (industrial areas, parks, dune area). Counting the 89 neighborhoods analyzed, the average neighborhood has a surface of 0.65 square kilometers, is the home to 4950, residents and contains 2350 residential units.

Our measures of *ethnic heterogeneity*, *residential mobility*, *real estate value of residential units* and percentage of *owner-occupied residential units* all were taken from a statistical publication of the municipality of The Hague (DSO, 2001).

The measure of *ethnic heterogeneity* was constructed from data on the ethnic composition of neighborhoods. Ethnicity was defined on the basis of country of birth of the persons and their parents, such that their origin was coded in a non-native category if they were born abroad or if at least one of their parents was born abroad. The data allowed us to distinguish between groups having their origin in The Netherlands (native category, including origin in other West European countries), Surinam, the Dutch Antilles, Turkey and Morocco.

The measure of ethnic heterogeneity we use is an index for qualitative variation (Agresti and Agresti, 1978). In the present context, the index represents the likelihood that two randomly selected members of a neighborhood are of different ethnic origin.<sup>1</sup> Being a probability, the index of ethnic heterogeneity varies (theoretically) between zero (complete homogeneity) and unity (complete heterogeneity). The index was calculated for each of the years 1996–2001 separately, and then averaged for use in the analysis. We should note that the particular operationalization chosen is

1. For example, in case of three ethnic groups with sizes A, B and C with sizes 100, 80 and 40 respectively, the measure is

$$1 - \frac{100 \times 99 + 80 \times 79 + 40 \times 39}{220 \times 219} \approx 1 - \frac{A^2 + B^2 + C^2}{(A+B+C)^2}$$



not critical to our results; alternative measures, including the simple percentage of non-native neighborhood residents, have correlations of 0.95 and above with the measure used, and yield virtually the same results.

*Residential mobility* was calculated as the sum of the relative annual number of residents who moved out of the neighborhood and the relative annual number who moved into the neighborhood. This measure was calculated for each of the years 1996–1999 separately (no mobility data were available for 2000–2001), and then averaged for use in the analysis.

The *average real estate value of residential units* was based on the real estate tax administration of the municipality of The Hague. The value assessment applies to all residential units, either rented or owned, and the assessment procedure is the same for both types. Our data contain, for each neighborhood, the average assessed value of residential units in 1993 and in 1999. The average real estate values in all neighborhoods have increased between 1993 and 1999, but in some neighborhoods they have increased more than in others. In order to obtain an estimated value for all years, we assumed a linear trend in real estate value within neighborhoods, and imputed the values for the years 1996–1998 and for 2000–2001 accordingly. In the analysis, the data of the separate years were averaged.

*Home ownership* was also established using the real estate tax registration. In the analysis, home ownership refers to the proportion of residential units that are owned by the persons or households who live there. The proportion was calculated for each year separately. In the analysis, we use the average proportion over the period 1996–2001.

*Proximity to the central business district* of The Hague was defined in terms of a concentric zone model. First, the *Zuidwal* neighborhood was taken as the core neighborhood of the city. This is the neighborhood that includes the city hall, a number of government offices, and a concentration of shops, restaurants and theatres. It is situated between the two main railways stations of The Hague. This neighborhood and the neighborhoods whose centroids are within a radius of one kilometer of the centroid of *Zuidwal* were assigned to the central business district zone. This is labeled zone 6. All other neighborhoods with a centroid lying within two kilometers of *Zuidwal* were assigned to zone 5. Zone 4 includes neighborhoods within three kilometers of *Zuidwal* and not yet in zone 5 or zone 6, and so on until zone 1, the suburban zone.

Information on attempted and completed burglaries was obtained from the police force of *Haaglanden* (greater The Hague area). The police registers all offenses that are officially brought to their attention by victims, by bystanders or by police officers themselves. The information system classifies offenses according to a scheme that includes residential burglary (attempted or completed) as a separate type of crime. The location where a crime occurs is also registered. In case of residential crimes the location



is an address (street and number). By assigning all addresses where residential burglaries took place in the period 1996–2001 to one of the 89 neighborhoods, and by subsequently counting the numbers of burglaries per neighborhood, we obtained neighborhood burglary counts. Our analysis uses burglary rates rather than burglary counts. Burglary (incidence) rates were obtained by dividing the counts by the average number of residential units in the neighborhood during this period, and then multiplying the result by 100 for convenience. The burglary rate of a neighborhood is thus defined as the annual number of attempted or completed residential burglaries in that neighborhood per 100 residential units. The total number of residential burglaries in The Hague during the six-year period 1996–2001 was about 26,000, which amounts to an average annual number of about 50 per neighborhood, and an annual rate of about 1 residential burglary per 100 dwellings for the city as a whole. As noted above, 5 of the 94 neighborhoods are excluded from the analysis because they contain very small numbers of residential units or no residential units at all.

Our measure of a neighborhood's proximity to potential burglars, i.e. its vulnerability for burglary due to its proximity to the homes of burglars, is somewhat more complex than the other measures. In the remainder, we refer to this measure as *SWEBER*, an acronym for *spatially weighted burglar exposition rate*. Let us first present the formal definition, and then explain its logic. The formal definition of the *SWEBER* measure for neighborhood  $j$  is given by the formula:

$$\text{SWEBER}_j = \frac{\sum_{i=1}^N M_i \times D_{ij}^{-2}}{U_j} \times 100$$

where  $\text{SWEBER}_j$  is the spatially weighted burglar exposition rate of neighborhood  $j$ ,  $N$  is the total number of neighborhoods,  $U_j$  is the number of residential units in  $j$ ,  $M_i$  is the number of burglaries committed by residents of neighborhood  $i$ ,  $D_{ij}$  is the distance between neighborhood  $i$  and neighborhood  $j$ .

The information system of the police contains information on the home addresses of all registered offenders. In order to obtain the number of residential burglars living in a neighborhood, we selected all registered offenders who lived in The Hague and who were apprehended for at least one case of residential burglary in the period 1996–2001. This includes residential burglars who burgled in The Hague as well as those who committed burglaries anywhere else in the Netherlands. In order to take into account that some burglars are more active than others, the number of

residential burglars in the neighborhood was multiplied by the mean number of residential burglaries they committed during the period covered<sup>2</sup>. Thus, the resulting number,  $M_i$ , is the number of known residential burglaries committed by residents of neighborhood  $i$ . In order to implement the (limited) mobility of burglars, it is assumed that the threat that a burglar poses to a potential target neighborhood is some inverse function of the distance between the burglar's home and the target neighborhood. This is reflected in the spatial weight term  $D_{ij}^{-2}$ , which asserts that the likelihood that a motivated burglar living in neighborhood  $i$  will choose a target in neighborhood  $j$  decreases proportionally to the squared distance between the two neighborhoods<sup>3</sup>. In order to obtain a measure that applies to burglary vulnerability per 100 residential units, we divide by the number of residential units in neighborhood  $j$  and multiply by 100.

Because we do not have exact coordinates of the homes of burglars and burglary victims, but only know in which neighborhoods they are located, the  $D_{ij}$  are approximated distances. For all  $i \neq j$ , the distances  $D_{ij}$  are calculated as the Euclidian distances in kilometers between the centroids of neighborhoods  $i$  and  $j$ . For  $i = j$ , thus for those cases where the target neighborhood is the same as the burglar's neighborhood,  $D_{ij} = 0.5 \sqrt{S_i}$ , where  $S_i$  is the neighborhood's surface in square kilometers (i.e. this is the mean distance between two random locations in the neighborhood if the neighborhood's surface were square). A mathematical treatment of mean distances within and between rectangles and other geometric figures is provided by Ghosh (1951).

It is well known that the estimated parameters of regression models may

2. All analyses were also performed with  $M_i$  defined as the number of residential burglars living in the neighborhood (counting every residential burglar only once, irrespective of the number of committed burglaries). This definition of the SWEBER measure could be legitimate if sequences of multiple burglaries by the same offender are directed against the same object (repeat victimization of the target), so that apparently the target is chosen once, but it is attacked several times in a row. Because the residential burglars on average were apprehended for two residential burglaries in 1996–2001, the resulting values of  $M_i$  are lower. This alternative definition, however, did not yield results different from those presented below. In addition, we performed all analyses for all burglars (not restricted to residential burglars). The resulting values of  $M_i$  are obviously higher, but again the results are virtually the same as when only residential burglars are selected.

3. The choice of this specific form of "distance decay" for spatially weighting the proximity of burglars is based on gravity models of crime trips in the literature. Alternative functional forms are discussed by Smith (1976) and Levine (2000, Ch. 8). For convenience, we have followed the original law of gravity formulation (which states proportionality to the inverse of the squared distance). Experimentation with other shapes showed that regression parameters estimates varied only very slightly across alternatives, and thus our results do not appear to depend crucially on the specific shape that was chosen.

be biased or inefficient when the observations are interdependent in ways that are not accounted for by the model. If the observations are neighborhoods in a single city or region, as in our case, spatial dependence is a plausible possibility. There are two approaches to control for spatial dependence (Anselin, 1988; Anselin et al., 2000). The first approach is to diagnostically test whether the residuals of the regression model display spatial autocorrelation. The second approach is to impose some spatial structure on the model by estimating regression models that contain an extra spatial autocorrelation parameter. Because we did not have a priori reasons to assume spatial dependence other than the dependence that is already accounted for by the spatial variables in the model (the *SWEBER* measure, and proximity to the CBD), we utilized the first approach. We tested the residuals of each of the estimated models for spatial autocorrelation using a statistic known as Moran's *I*.<sup>4</sup> Significant positive values of this statistic signal that the error terms of contiguous neighborhoods tend to be positively correlated, while significant negative values of the statistic signal that they are negatively correlated. In both cases, significant values imply that the model does not account for spatial dependence adequately, and that consequently the model parameters may be biased.

## RESULTS

Table 1 displays the descriptive statistics of all variables used in the analysis, and Table 2 displays their correlations. The first column of Table 2 shows that all variables, except the two that measure neighborhood affluence, are strongly positively associated with the burglary rate. In the second column, we see that *SWEBER* correlates positively with proximity to the central business district, with ethnic heterogeneity and residential mobility, and negatively with neighborhood affluence. Although this finding is not central to our concerns here, we like to note that all these correlations are in line with the results of a number of ecological studies that relate structural neighborhood attributes to delinquency rates. Further, the distance to the central business district is strongly associated with both measures of social disorganization, but not with affluence.

In Table 3, we present the results of three regression models of burglary rates. Model 1 is a very simple model that only includes the proximity to burglars (the *SWEBER* measure) as an independent variable. It shows that

4. To calculate the Moran's *I* statistic, a 89 by 89 "weight matrix" of contiguities between pairs of neighborhoods is used to represent spatial structure. We report the statistics based on a calculation that uses a weight matrix based on the queens criterion (to be contiguous, two neighborhoods must share a border or a single point). Alternative specifications of the weight matrix, including those based on the rooks criterion (to be contiguous, two neighborhoods must share a border) yielded very similar results.

Table 1. Mean, Standard Deviation, Minimum and Maximum Values of the Variables. The Hague Neighborhoods ( $N = 89$ ), Excluding Three Non-residential Neighborhoods and Two Neighborhoods with Less Than 200 Residential Units

Variable	Mean	S.d.	Min.	Max.
Burglary rate	2.07	1.01	0.54	4.99
SWEBER <sup>1</sup>	0	1	-0.86	3.88
Proximity to Central Business District	2.52	1.44	0	5
Residential mobility	0.37	0.12	0.13	0.63
Ethnic heterogeneity	0.36	0.22	0.02	0.81
Avg. value of residential units € 10.000	1.12	0.74	0.44	3.75
Home ownership	0.40	0.25	0.00	0.91

<sup>1</sup> Spatially weighted burglar exposition rate (standardized, because it has no natural scale).

Table 2. Correlations Between the Variables ( $N = 89$ )

Variable	1	2	3	4	5	6
1 Burglary rate						
2 SWEBER <sup>1</sup>	0.77*					
3 Proximity to CBD	0.73*	0.57*				
4 Residential mobility	0.75*	0.59*	0.68*			
5 Ethnic heterogeneity	0.70*	0.72*	0.60*	-0.69*		
6 Value residential units	-0.04	-0.28*	0.09	-0.26*	-0.52*	
7 Home ownership	-0.20	-0.41*	-0.17	-0.37*	-0.62*	0.64*

<sup>1</sup> Spatially weighted burglar exposition rate

\*  $p < .01$ , two-sided

60% of the variation in burglary rates across neighborhoods can be explained by its relative proximity to the homes of burglars. The Moran's I statistic, measuring residual spatial autocorrelation, is highly significant, signaling that burglary rates tend to cluster spatially after the effect of SWEBER is controlled for.

In model 2, proximity to the central business district is added, and the resulting model is a model that incorporates the two variables that are assumed to completely represent the neighborhood's accessibility to residential burglars. Comparison with the estimates of model 1 shows that that a considerable part of the explained variance is shared by both variables.



Table 3. Multivariate Regression Analysis of Burglary Rates in The Hague Neighborhoods ( $N = 89$ ). Unstandardized Coefficients (B), T-values (T) and Standardized Coefficients ( $\beta$ )

	Model 1			Model 2			Model 3		
	B	T	$\beta$	B	T	$\beta$	B	T	$\beta$
SWEBER <sup>1</sup>	0.78**	11.34	0.77				0.40**	6.03	0.39
Proximity to CBD				0.53**	7.68	0.53	0.10*	2.19	0.14
Residential mobility				0.31**	6.36	0.44	2.43**	4.31	0.30
Ethnic heterogeneity							1.64**	4.07	0.36
Value residential units							0.33**	4.02	0.24
Home ownership							0.69*	2.61	0.17
Constant	2.06**	30.02		1.29**	9.61		-0.33	-1.40	
$R^2$	0.60			0.73			0.84		
Moran's I (residual autocorrelation)	0.25**	3.85		0.01	0.15		-0.07	1.08	

<sup>1</sup> Spatially weighted burglar exposition rate; \*  $p < 0.05$  two-sided; \*\*  $p < 0.01$  two-sided