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Spatial Patterns of Crime in Israel: Investigating the Effects of Inter-Urban Inequality and Proximity

Boris A. Portnov*◊ and Arye Rattner**
*Department of Natural Resources & Environmental Management,
University of Haifa, Mount Carmel, Haifa, Israel 31905
Tel: +972-4-825-8773; Fax: +972-4-824-9971
E-mail: portnov@nrem.haifa.ac.il
** Department of Sociology, University of Haifa, Israel
◊ Corresponding author

Abstract

Many crimes in Israel, specifically those that are property-related, are perpetrated by offenders who live outside the locality where the crime is committed. As a result, affluent localities surrounded by poor towns tend to experience relatively high crime rates. The Index of Relative Income (IRI) – defined as the ratio between the average per capita income of neighboring localities – is proposed here to measure the effect of urban inequality and proximity on crime rates. A multivariate analysis indicated that the proposed index helps to explain variation in property crime rates across localities, suggesting that the spatial unevenness of urban development (i.e., aerial proximity of affluent and poor localities) may spur property crimes. The findings of the present study lend support to regional development programs aimed at minimizing spatial disparities in regional and urban development.

Introduction

Inequality is a side effect of development: In any given country, there are towns and cities that are affluent and developed, and others that lag behind (Weber 1921; Park et al. 1925; Pastor et al. 2000). Such development disparities are referred to as 'interurban inequalities.'

When asked why he robbed banks, Willie 'The Actor' Sutton, known as the Babe Ruth of Bank Robbers, allegedly responded, 'That's where the money is.' For many, this phrase has become a symbol of the ultimate simplicity to be sought in things.

However, when applying Willie's logic to the main subject of our inquiry – the distribution of crime rates across urban localities – we may find that it does not always work. Assume that we have a group of neighboring towns that differ in wealth but, otherwise, are identical (population size, ethnic makeup, etc). According to Willie's logic, the highest crime rates, specifically against property, should be found in the wealthiest parts of the cluster – *that's where the money is*.

Would such a proposition be correct? Not necessarily. Clearly, the outcome would depend on the town's location. For instance, if poor towns surround a wealthy city, then, indeed, high rates of property crime in the latter might be expected. However, if affluent towns and cities are clustered together at some distance from their poor neighbors, the crime may not affect the wealthy localities uniformly. Indeed, in line with Zipf's (1949) 'Principle of the Least Effort,' which posits that human beings constantly try to maximize the outcome of their activity while minimizing the effort involved, it is likely that most crimes will occur in the 'border' towns closest to the poor neighbors.

The main hypothesis of the present study is that interurban inequality and proximity influence crime rates. As a result, the highest rates of crime, specifically against property, are likely to occur in wealthy localities surrounded by poorer ones.

Israel represents an interesting case for the testing of this hypothesis. The country's population is relatively small (some 6,500,000 residents) and 90-percent urbanized (ICBS 2001). Interurban disparities in Israel are considerable: The average monthly income per family in the wealthiest towns of the country is ten times higher than that in the poorest localities, ranging from 4,700-4,800 NIS (900-1,000 $US) to around 46,000 NIS (ISDC 2000). The present analysis is also aided by the fact that due to the country's small land area (21,400 km^2) and historical patterns of urban settlement,

poor and wealthy towns commonly neighbor each other (Gradus et al. 1993; Portnov & Erell 2001).

Though urban crime has been studied extensively (Bailey 1984; Baldwin & Bottoms 1976; Blau & Blau 1982; Blumen & Rattner 2002; Boggs 1966; Harries 1974; Herbert 1982; Schmid 1960; Wang & Minor 2002; Martin 2002; Groff & La Vigne 2001), to date, very little attention has been devoted to the effect of settlement patterns on this phenomenon.

Based on data retrieved from the Israel Police crime database covering the period between 1990 and 1999, the present paper attempts to answer the following specific questions:

- Is there a link between patterns of urban settlement and the incidence of crime in urban localities in Israel?
- To what extent can the spatial patterns of crime in Israel be explained by interurban development inequality and proximity?

Previous Studies of Urban Crime in Israel and Abroad

The earliest contribution to the study of crime and urbanization came from Shaw and McKay (1942). After observing that crime and delinquency persisted in certain urban areas even though the population changed, they concluded that three urban conditions promote high crime rates – heterogeneity, mobility, and most notably, poverty. Several other studies have reported the persistence of high crime rates in urban slum areas (Schuessler 1962; Quinney 1966; Curtis 1974; Martin 2002).

Braithwaite (1979) drew on both the normative conflict theory and differential opportunity theory in attempting to explain delinquency rates of juveniles living in poor class-mixed areas. He hypothesized that if normative conflicts produce high crime rates among juveniles with different backgrounds, juveniles in class-mixed areas should have higher rates of crime. However, if crime rates depend more on opportunities for learning criminal skills and differential associations, then juveniles who live in poor areas, where more delinquents live, will have higher crime rates. The data revealed that the delinquency rates of poor boys were higher in poor slums than in class-mixed areas.

Some other studies show that inequality and crime rates are positively related (Eberts & Schwirian 1968; Braithwaite 1979; Wang & Minor 2002). In their study of metropolitan structure and violent crime, Blau and Blau (1982) examined whether racial socio-economic inequalities are a major source of criminal violence. Their findings

showed socio-economic inequalities between and within races to be positively related to high rates of violent crime in small census areas (SCAs), and socio-economic inequality between blacks and whites to have a direct positive effect on violence.

In another early study, Boggs (1966) examined the characteristics and patterns of urban crime and developed a typology of journey to crime patterns suggesting that homicide and assault occur more frequently in offender residence areas, whereas business robbery, non-residential burglary, auto-theft, and grand larceny occur more often in high social rank areas adjacent to low social rank areas where offenders live. The findings of a later study examining the journey to crime (Philips 1980) produced a somewhat different typology: According to Philips, assault occurred mainly among low status area residents but not always in the same area, and robbery, auto-theft, grand larceny, and burglary did not reveal the low status to adjacent high status journey pattern proposed by Boggs.

The development of new analytical methodologies based on spatial analysis and Geographic Information Systems (GIS) opened up the way to new approaches to delinquency research. Wang and Minor (2002) used GIS-based methods to investigate the effect of job access on crime rates across census tracts in Cleveland, Ohio. After controlling for spatial autocorrelation, a consistent inverse relationship was obtained between gravity-based job accessibility and crime rates. These relationships appeared to be stronger for economic crimes than for crimes of violence.

In another recent study, Martin (2002) tested the significance of several socio-economic and location factors (such as family composition, population welfare, percent of owner-occupied housing, etc.) as predictors of neighborhood burglary rates. The study utilized advanced and newly developed statistical techniques such as the analysis of spatial autocorrelation and multivariate spatial lag models. The analysis led to the conclusion that the presence of 'community' helps to maintain order in neighborhoods even if strong 'criminogenic conditions' (such as the concentration of poverty) are present.

Ceccato et al. (2002) investigated changes in spatial patterns of residential burglary in the city of Stockholm, Sweden using newly developed analytical tools, such as the Getis-Ord local autocorrelation statistic. The findings of the study suggest that the spatial pattern of urban crime in the city have remained stable over the past decade, with only minor shifts in the geographical patterns of crime and their association with underlying socio-economic conditions of neighborhoods.

Geography of Crime in Israel

Due to its population heterogeneity and unique social structure, Israel can be considered a natural laboratory for examining issues related to crime, inequality, ethnicity, and their geographical context. Studies examining the relationship between crime and the ethnic structure of Israeli society have become part of the Israeli criminology mainstream along with other studies that have examined the impact of war and stress factors on crime and delinquency (Shoham et al. 1966; Shoham 1968; Rahav 1981; Fishman & Argov 1980; Landau 1987). However, only a limited number of studies have adopted the ecological approach and examined the geography and ecology of crime. In their study of the relationship between crime and the socio-economic characteristics of urban communities, Fishman et al. (1984) report that communities with high rates of violent crime are characterized by low level of education, high percentage of large families, high rates of people on welfare, and high percentage of Eastern Jews (i.e., Jews originating from Asia and North Africa, and often characterized by low socio-economic status). The findings suggest that there is a high association between poverty, ethnicity (being a Jew of Eastern origin), and low social standing of these communities.

In their study on urbanized peripheries, Blumen and Rattner (2002) identify three patterns of regional crime beyond the simple core-periphery dichotomy: regions that attract property offences, regions that export property offenders, and typical peripheral regions producing high rates of violence. These findings point to the need for a multi-causality approach in explaining regional variations in crime.

Settlement Patterns and Crime – Expected Links

A potential thief may prefer to steal close to home, without traveling elsewhere. However, this may not always be possible. For instance, his hometown may be too poor, with little worth stealing. Perhaps his hometown is also too small; the residents are acquainted with one another and our hypothetical thief may be concerned about being promptly exposed and apprehended. In contrast, outside his own community, a thief is more likely to enjoy a degree of anonymity and may thus expect to get away more easily after committing his/her crime. Ethic and religious considerations may also play a role. A rift between ethnic groups (such as that between Jews and Arabs in

Israel) may constitute a critical consideration. Stealing from strangers rather than one's own people may provide a kind of ethic or religious 'justification' for a criminal act.[1]

Hence, for one reason or another, a criminal may need to travel elsewhere to commit his/her crime. If the locations in which crimes are committed are spatially detached from the locations in which criminals live, Travel-to-Crime Areas (TTCAs) are formed. How large might such areas be?

Building on Zipf's (1949) 'least effort' thesis, we assume that a potential thief, upon deciding to steal outside his/her own community, will opt first, *ceteris paribus*, for nearby places. Only if there is nothing of value to be stolen there (or if religion and ethnic considerations intervene), will he/she consider more remote localities as potential targets.

The spatial extent of TTCAs may thus be quite similar (ironically!) to that of Travel-to-Work Areas (TTWAs):[2] People travel to jobs over long distances only if suitable employment cannot be found close to home, or information of such employment opportunities is not readily available (Casado-Diaz 2000; O'Donoghue 1999, 2000). Depending on local conditions (road infrastructure, motorization levels, etc.), TTWAs may extend up to 20-100 km from a central city; less in small, densely populated countries and more in large countries with highly developed road infrastructures (McNiven et al. 2000; Portnov & Erell 2001).

Although later in this paper we shall try to establish the exact size of TTCAs for Israel, given the small physical size of this country, these areas are not likely to extend beyond 20-30 km, thus enabling a criminal to get 'home free' within 15-20 minutes of committing a crime.[3] Our second expectation is that proximity between poor and

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[1] There is a proverb about the different sounds produced by an iron hammer hitting iron and wood: When the hammer hits iron, it makes a loud noise, but when it hits wood, it makes a dull sound. The explanation suggested for this phenomenon is that the hammer cries with pain when it strikes iron because it is like hitting a brother, whereas it has little pity for wood because it is like hitting a stranger.

[2] In the UK, TTWAs are defined as geographic areas in which most jobs are filled by local residents (Casado-Diaz 2000).

[3] There have been relatively few studies investigating the relationship between distance traveled and criminal behavior. In one such study, Fritzon (2001) investigated the spatial behavior of arsonists in the UK and found that the behavior of this type of criminal offender involves minimal traveling and, therefore, most arson occurs within a short distance (up to 8 km) from the offender's home. The study also demonstrated that arsonists whose behavior contained a strong emotional component tended to travel much shorter distances than arsonists who sought direct benefit from setting fires.

affluent towns should raise crime rates (specifically against property) in the latter. Following common sense logic, we might expect that the proximity of rich neighbors will tempt the 'crime-prone' residents of nearby poor localities. Unless affluent communities are well protected by fences, gates, and private security, they may represent an easy and desirable target for a potential criminal.

In order to confirm this hypothesis, we need a measure that will reflect both urban proximity and inequality (i.e., the closeness of towns as well as the extent of their income disparity). Such a measure is introduced and discussed in the following section.

Measures of Interurban Inequality and Proximity

Measures of inequality, which are commonly used in regional studies, include measures of deprivation (Atkinson index, Theil redundancy index, Demand & Reserve coefficient, Kullback-Leibler redundancy index, Hoover and Coulter coefficients, and Gini index), and measures of variation, such as the coefficient of variation and Williamson's index (Coulter 1987; Williamson 1965; Duclos 1998). Though these measures may reflect the socio-economic disparities between population groups and regions, they cannot be used to estimate the relative performance of individual localities or to account for their spatial proximity.

Population density is an important development datum whose significance is traditionally advocated by location economics (Levy 1985). However, the distribution of population densities does not provide information about the socio-economic characteristics of localities or income disparities. Moreover, mean density figures often hide considerable intra-regional variation in population densities.

Deichmann (2000) suggests a more complex index of urban location, namely, his Index of Accessibility. This index combines the population size of localities with measurements of their proximity to the transportation network. The resulting index is calculated as the sum of the square roots of population totals of adjacent towns weighted by either the travel time or distance to each of them from the closest transportation node. Although the index of accessibility reflects the spatial distribution of urban localities and their proximity to transportation nodes, it does not reveal disparities among individual towns.

Another indicator of urban location – the Index of Clustering (IC) – proposed by Portnov and Erell (2001), is estimated as a simple ratio:

$$IC = IS / IR,$$

where *IS* and *IR* are respectively spatial isolation [the overall population size of urban places located within a practical range for daily commuting from a town in question], and index of remoteness [either aerial or road distance from the town to the closest major urban center, in kilometers].

This index has high values in central, densely populated areas, where distances from major cities are small and the urban settlement is dense, and its values tend to be lower in remote peripheral areas in which towns are more scattered and often lie at considerable distances from each other.

Despite its apparent simplicity, the Index of Clustering incorporates two important characteristics of urban settlement, namely, the location of a town in relation to other urban places, and commuting range. However, this index does not reflect income disparities among neighboring localities, which are essential for the present study. Therefore, in the following subsection, we shall discuss ways of adjusting the Index of Clustering for the purpose of the present analysis.

Index of Relative Income

Following the general logic of the estimation of the IC index, we can devise the Index of Relative Income (IRI), estimated as the following ratio:

$$IRI_i = \frac{\sum_{j=1}^{n}\left(I_j P_j\right) / \sum_{j=1}^{n} P_j}{I_i},$$

where I_i = the average per capita income in town *i;* I_j = the average per capita income in town *j*, located within the access range from the subject town *i;* P_j = population size of town *j*, and *n* = the overall number of towns *(j = 1,...,n),* located within the access range from town *i.*

The proposed index thus relates the average income in a subject town (i) with that in neighboring localities *(j = 1,...,n),* while taking into account the population sizes of the town's neighboring localities *(P_j).* The adjustment for population size of localities is needed to avoid the overrepresentation of small localities at the expense of the town's large neighbors.

The resulting values of IRI are easy to interpret:

- IRI > 1 means that a subject town is poorer than its surrounding towns (e.g., IRI = 2.5 indicates that average income in the surrounding towns is 2.5 times greater than in the subject town)

- IRI < 1 indicates that a subject town is richer than its neighbors (e.g., IRI = 0.5 signifies that the average income in a subject town is double that of its neighbors).

If our assumption about the effect of proximity of poor and affluent towns on crime rates is correct, we may expect to find a significant relationship between the proposed IRI index and crime rates (specifically property crimes). In particular, it may be expected that affluent towns surrounded by poor neighbors (IRI < 1) will exhibit higher crime rates than other localities.

Establishing the access range for the IRI index is an important step in the analysis. Although we may expect that the access range of a town in Israel will be limited to 20-30 km (see the previous section on settlement patterns), such a range should ultimately be established using available statistical data.

Data Sources and Mode of Analysis

Dependent Variables

As stated in the Introduction, the data on crime rates for the present analysis are drawn from the Israel Police crime database and cover the 10-year period between 1990 and 1999. Two crime categories are considered for the purpose of the current study – property offenses and violent crimes.[4]

As Appendix 1 shows, the sample covers nearly 65,000 crime cases, or nearly 50 percent of all crimes recorded in the country during the period in question. Because the present analysis does not consider individual years separately, it is important that there should be no sharp inter-year fluctuations, with a general tendency for the rates of all types of crime to increase (see Appendix 1).

Explanatory Variables

To represent development levels in individual localities, the following 10 variables are included in the analysis:

- POPULATION: Population size of locality [persons];
- INCOME: Average income per capita [$US];

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[4] Property offenses include the following types of crimes: robbery, armed robbery, burglary, breaking and entering, theft of vehicle and theft from vehicle, and other kinds of theft. The category of violent offenses includes: homicide, attempted homicide, manslaughter, causing bodily harm, assault, and aggravated assault.

- ETHNIC MAKEUP (I): 1 for Arab localities and 0 for all others;
- ETHNIC MAKEUP (II): Proportion of Jews born in Asia and North Africa [% of population];
- CHILDREN: Average number of children per family;
- HOMEOWNER: Homeownership level [% of households];
- CAR OWNERSHIP: Car ownership level [private cars per 1,000 residents];
- LABOR FORCE: Participation in labor force [% of adult population];
- UNSKILLED: Unskilled workers [% of adult population].
- AIR CONDITIONERS: Ownership of air conditioners [% of households];

The data on these variables were obtained from the 1995 Israel Census of Population and Housing, which is the most recent population census held in Israel.

The indicators selected for the analysis thus cover most major aspects of socio-economic development used in previous studies of criminal behavior – distribution of employment, demographic composition, and population welfare (Boggs 1966; Braithwaite 1979; Wang & Minor 2002; Martin 2002; Groff & La Vigne 2001). However, some measures deserve comment.

With the exception of a few population centers (Jerusalem, Lydda, Acre, and Ramle – cities with a mixed Jewish and Arab population), urban localities in Israel are ethnically unmixed (i.e., either Jewish- or Arab-populated). As widely documented, Arab localities in Israel are generally less developed and are believed to have higher than average crime rates. A recent analysis of crime trends among the Arab population in Israel confirms, (a) a general increase along the 1990's in the rates of various crime categories among Israeli Arabs and; (b) overrepresentation in the involvement of Israeli Arabs in criminal activity compared to their proportion in the general population. A significant increase has been reported especially in the northern region of the country where the share of Israeli Arab involvement in crime (measured by the total number of criminal records) reached 38.3 percent of all criminal activity during 2001, and 47.7 percent in the region of Jerusalem (Israel Police Department, 2000). The ETHNIC MAKEUP (I) variable is introduced in the analysis in order to take these differences into account.

The proportion of Jews born in Asia and North Africa – ETHNIC MAKEUP (II) – is also a measure specific to Israel and thus deserves some explanation. The mass wave of immigration of Jews to the newly established State of Israel in 1948 included large

numbers of immigrants from North Africa and Asia. Many of these immigrants found it difficult to adjust to life in the Western-oriented society established by the founders of modern Israel and, consequently, found themselves delegated to the lower socio-economic strata of Israeli society (Isralowitz & Friedlander 1999). According to previous studies, regions populated predominately by this category of immigrants tend to exhibit relatively high crime rates (Blumen & Rattner 2002).

In addition to the above-listed socio-economic variables, the IRI index, introduced in the previous section, was included in the analysis to represent proximity and income disparities among individual towns. The values of the index were calculated using the GIS ArcView 8.1 software.

Spatial Units Employed in the Analysis

Most previous studies of crime in Israel used data based on administrative districts, sub-districts, and natural regions (Fishman et al. 1984; Blumen & Rattner 2002).[5] This high level of aggregation is attributable, in part, to their use of the readily available publications of the Israel Central Bureau of Statistics: *Statistical Abstract of Israel, Census of Population and Housing, etc.*, However, the divisions presented by these official statistics often serve to obscure internal heterogeneity. For instance, a natural region may include both affluent and poor localities, as well as localities with high and low crime rates and, therefore, comparisons of aggregates or averages based on them will inevitably obliterate important intra-regional variation.

In contrast, the present analysis deals with a finer spatial grain – individual municipalities. The present analysis covers 167 municipalities with populations of over 2,000 residents for which complete and comparable data are available.

Analysis Procedure

During the first phase of the analysis, we mapped the general pattern of crime in Israel. This task was performed using the GIS ArcView software. Then, the spatial distribution of the place of residence of criminals who committed their crimes in two major urban centers of the country – Tel Aviv and Haifa – were investigated. This

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[5] As of 1995, there are 51 natural regions, which are aggregated in 17 sub-districts and 8 administrative districts. *Natural regions* (NRs) refer to the smallest statistical divisions of the country for which comparable census data are available. The term does not necessarily imply geographic cohesion or well-defined topographic borders.

analysis was needed to establish the approximate size of Travel-to-Crime Areas (TTCAs), important for the subsequent estimation of the IRI index.

During the second phase of the analysis, the statistical significance of the factors influencing the crime rates in individual urban localities was identified and measured using Multiple Regression Analysis (MRA). The analysis was performed in two steps: First, the separate models were estimated for property and violent crimes, with the list of explanatory variables including only socio-economic measures – population, income, etc. Then, the IRI index, representing the proximity and income inequality of localities, was added to the list of explanatory variables and the analysis was repeated. During each step, the multicollinearity of explanatory variables was tested and found to be within tolerable limits (see Tables 1-2).

Results and Discussion

General Patterns

Figures 1 and 2 illustrate the patterns of distribution of violent and property crimes across individual localities.

<<< Figures 1&2 about here >>>

As the figures show, the spatial patterns of these two types of crime appear to be distinctively different.

Characteristically, localities with high rates of violent crime appear to cluster together – see, for instance, the dense clusters of large black dots in Figure 1, north-east of Haifa, and smaller clusters of black dots south-east and north-east of Tel-Aviv and around Be'er-Sheva. Some of these clusters correspond to areas populated by the Arab minority (Nazareth-Tir'an Mountains, Shefar'am Region, and the Carmi'el Region in the north; the 'Small Triangle,' north of Tel Aviv, and the Lydda-Ramle cluster, south of Tel Aviv), whereas others lie in the south, around the city of Be'er Sheva, and are formed by both Bedouin localities and Jewish development towns.[6]

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[6] In the late 1940s and during the 1950s, many new immigrants to Israel, who arrived without economic means and thus were totally dependent on the state for their absorption, were directed *en masse* to 'development towns' established primarily in the country's peripheral regions. Since the early 1970s, this national policy of population dispersal has evolved to include various incentives designed to encourage the growth of the 'development towns' indirectly. These include government loan guarantees, tax exemptions, and the provision of public housing (Lipshitz 1996).

At first glance, the spatial patterns of property crime (Figure 2) are far more complex. Localities with high rates of property crime (large black dots in Figure 2) appear to be scattered evenly throughout the country and are, most often, surrounded by localities with relatively low crime rates (small and medium-sized gray dots in the diagram).

One of such clusters is formed by the city of Tel Aviv and surrounding localities, and Haifa and environs form another cluster. Be'er-Sheva and its affluent suburb, Omer, form part of another cluster. These localities, represented by two large black dots adjacent to each other are surrounded by a number of small gray dots representing localities with relatively low property crime rates (Figure 2).

This interesting pattern – clusters of localities with high crime rates surrounded by localities with relatively low rates of property crime – may have a relatively simple explanation: The clusters of localities with mixed crime rates may be in fact the Travel-to-Crime Areas (TTCAs).

To confirm this hypothesis, we investigated the residential location of property offenders who committed crimes in two major population centers of Israel – Tel Aviv and Haifa. The results of this analysis are presented in Figure 3.

<<< Figure 3 about here >>>

As Figure 3 shows, about a half of property-related crimes in these two cities are perpetrated by their residents, and the rest (40-50 percent) of the offenders came from elsewhere. Another characteristic trend is that the percentage of outsider crime-perpetrators drops steadily with increase in the distance between the places of their residence and the central city. Thus, for instance, in Tel Aviv, 51.1 percent of offenders came from the city itself, 21.2 per cent came from a distance of about 10 km, 10.2 percent from about 20 km, and less than four percent came from places located 30 km away from the central city. Thus, the general trend fits the so-called 'distance decay' function used in urban studies to predict the decline of interurban interaction in line with growing distances between towns (see, *inter alia*, McNiven 1999; Portnov & Erell 2001).

Characteristically, most criminals (82.5 percent in Tel Aviv and 83.1 percent in Haifa) came from places located less than 20 km from these cities (see Figure 3). This 20-km threshold may thus be used to estimate the IRI index.

Multivariate Analysis

Table 1 presents the results of the regression analysis in which the rates of violent and property crimes are mutually compared with socio-economic measures, reflecting different aspects of socio-economic development of localities. Though the regression fit in both models is not particularly high ($R^2 = 0.357$ for property crimes and $R^2 = 0.299$ for violent crimes), a number of explanatory variables – home ownership, car ownership, ownership of air conditioners, and personal income – appear to be highly statistically significant ($P < 0.01$) in the expected directions. Not surprisingly, the rate of violent crime tends to decline in line with increasing personal income ($B = -3.37$; $P < 0.01$), whereas property crimes increase as the ownership of durable goods (car ownership and ownership of air conditioners) increases, and home ownership declines.

<<< Table 1 about here >>>

However, it is somewhat surprising that personal income does not appear to be statistically significant in the property crime model ($P > 0.1$; see Table 1). Could it be that a locality's per capita income is less important than income disparity, that is, its relationship to income levels in surrounding localities?

In order to test this proposition, we added the IRI index to the list of the explanatory variables and repeated the analysis. The results of the second run of the regression models are reported in Table 2.

<<< Table 2 about here >>>

Comparison of Tables 1 and 2 indicates that the introduction of the IRI (proximity-inequality) variable in the regression model affected only the property crime model. In particular, the model fit increased, as reflected by R^2 change: from 0.357 (Table 1) to 0.388 (Table 2). As indicated by the $\chi 2$ test of the regression residuals, this increase is statistically significant. However, even more importantly, the newly introduced variable (IRI) appears to be highly statistically significant in the property crime model ($|T| > 2.8$; $P < 0.01$). This implies that, in line with our initial assumption, the proximity of localities with contrastingly different levels of income does help to explain the interurban variation of property crime rates.

Figure 4 illustrates this relationship between the proposed index of inequality-proximity (IRI) and property crime rates in individual localities more clearly.

<<< Figure 4 about here >>>

As expected, the general pattern of this relationship is more or less straightforward: Affluent localities surrounded by poor neighbors (IRI < 1) tend to

exhibit higher rates of property crime than poor localities surrounded by wealthier settlements (IRI > 1). However, a small group of towns (marked by hollow triangles in the diagram) appear to deviate from the general pattern: All of these towns have lower property crime rates than would be expected from their location and relative income levels alone. A closer look at these towns produces a quite simple explanation of their outlier status: All of them are small (<5,000 residents) and have high average incomes (at least double the national average). Thus, their residents may be able to afford private security, sophisticated alarm systems, and other measures, keeping away potential intruders and, thus, lowering their property crime rates.

Conclusions and Policy Implications

Inequality and urban crime are interlinked. The findings of the present study indicate that the aerial proximity of poor and wealthy towns tends to increase crime rates (particularly against property) in wealthy localities.

In Israel, localities with high rates of property crime are scattered throughout the country and are, most often, surrounded by localities with relatively low crime rates. The underlying cause of this interesting spatial pattern may have a simple explanation: Wealthy places may become magnets for the 'crime-prone' living in poor neighboring towns. Unless affluent communities are well protected by fences, gates, and private security, such communities are easy and desirable targets for potential criminals. These relations result from government policy in the 1950s and 1960s to settle many of the new immigrants (especially those of Asian and North African origin) in peripheral areas. These new settlements, called 'development towns,' lacked the infrastructure and resources to absorb large groups of new immigrants. Lack of economic and industrial opportunities soon created large pockets of unemployment. The social and educational systems were ill equipped for the task of preparing people living in these areas to participate in the labor force and live productive lives. School dropout rates became endemic, resulting in growing despair both among the parental and the younger generation. Among the problems that have prevailed in these places, crime, violence, drugs, prostitution became distinctive features and part of their identity, together with many other social problems. In contrast to the relative deprivation, which has dominated the life of those living in these places, other not so distant communities have grown and developed together with the expanding Israeli economy.

An interesting finding of this study is that nearly a half of property-related crimes in major cities of Israel are perpetrated by offenders who live outside these cities. Characteristically, the percentage of crime-perpetrators drops steadily as distances between the places of their residence and the central city increase. As a result, less than 15-20 percent of crimes are committed by those who reside more than 20 km from the central city. This general trend fits the so-called 'distance decay' function, which is used in urban studies to predict the decline of interurban interaction in line with growing distances between towns.

The Index of Relative Income (IRI) was developed and introduced in order to measure the effect of interurban inequality and proximity on the frequency of crimes in urban localities. The proposed index relates the average income in a subject town to that in neighboring localities, taking into account population size. This index is easy to interpret: A value greater than 1 indicates that a subject town is poorer than its surrounding towns, and a value of less than 1 signifies that a subject town is richer than its neighbors.

As expected, the values of IRI are linked to the rates of property crime. In general, the frequency of such crimes increases in line with dropping values of IRI. This indicates that settlement patterns do indeed appear to influence crime rates: Affluent localities surrounded by poor neighbors (IRI < 1) tend to exhibit higher rates of property crime than poor localities surrounded by wealthier settlements (IRI > 1). However, small affluent communities deviate from this trend: They have lower property crime rates than would be expected from their location and income levels alone. The explanation for their outlier status is that their residents can probably afford private security, sophisticated alarm systems, and other measures, thus keeping away potential intruders and lowering the property crime rates.

Whether it is concern for the safety of our possessions or the desire to choose the best place to buy a home, crime is a feature of society that everyone wishes to avoid. Therefore, it is in the best interests of society as a whole to minimize the spatial unevenness of urban development wherever possible. However, it may be neither feasible nor desirable to achieve this goal by 'moving' poor residents into affluent areas or by forcing well-off residents to move into poor towns. Instead, the development disparity in urban areas should be mitigated by encouraging development in the least developed localities, and by enhancing the sense of well being of their residents.

Urban and regional development studies (see, *inter alia*, Parr 1999; Portnov & Erell, 2001) provide a number of strategies that can be used to this end. For instance, these studies tell us that an urban locality may start to grow in a sustainable way only if it becomes sufficiently attractive to both investors and migrants. A number of preconditions may help in the attempt to attain this goal. The two most essential of these are: achieving a critical mass of urban population,[7] and provision of unique urban functions, such as universities and large hospitals, whose role in the formation of cities is profound.

Finally, we need to acknowledge that this study's findings on the effects of spatial proximity and interurban inequality are specific to Israel at this time. However, a similarly strong relationship between urban proximity and crime rates may exist elsewhere. If it does, then this research may help planners and decision-makers formulate informed regional policies, especially in countries experiencing severe interregional inequalities and socio-economic degradation of the periphery.

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[7] Upon reaching a certain population threshold, many urban places start to grow faster. Such a threshold may be termed, 'critical mass.' The main reason for this change in the pace of growth is simple. Residents of smaller localities are often denied access to social amenities that are concomitant with a larger settlement size. As the population of a community increases, it crosses the threshold for higher-level services and offers more varied opportunities for employment, social services, and leisure (Portnov & Erell 2001).

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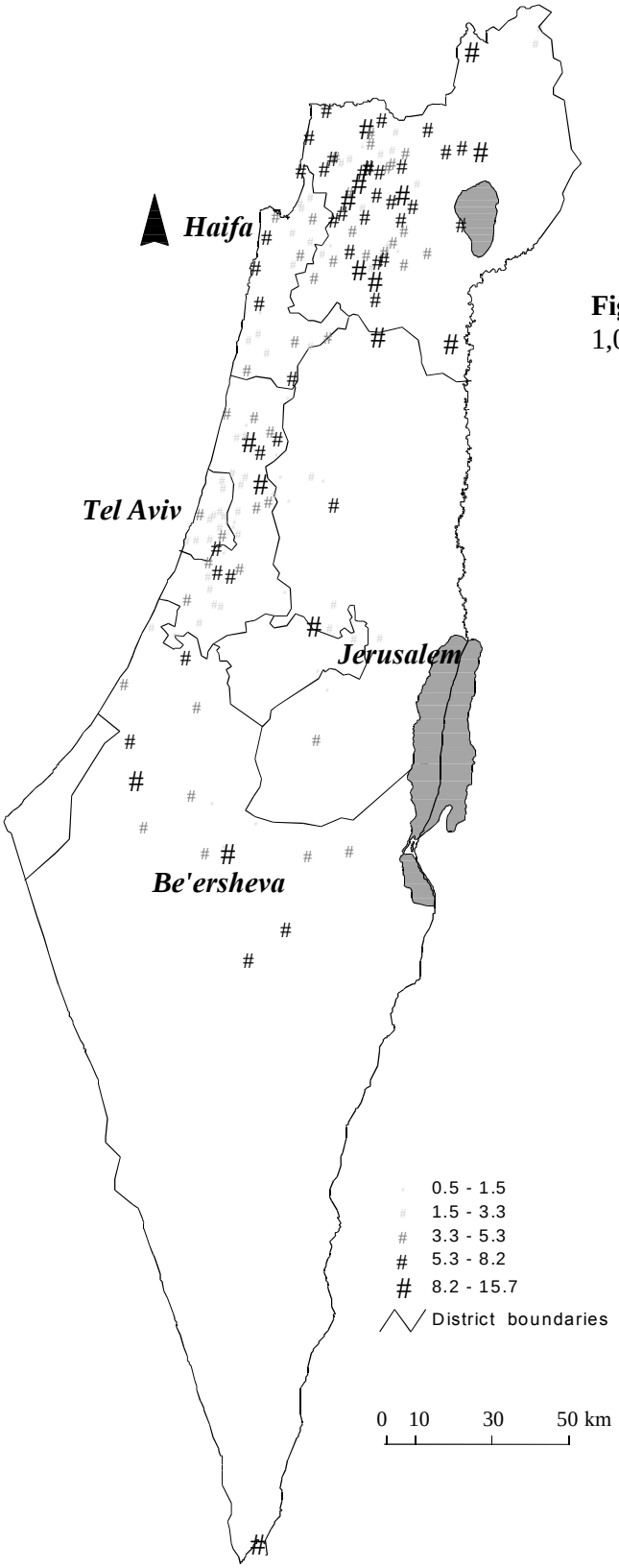

Figure 1: Violent crime rates in 1990-99 (per 1,000 residents)

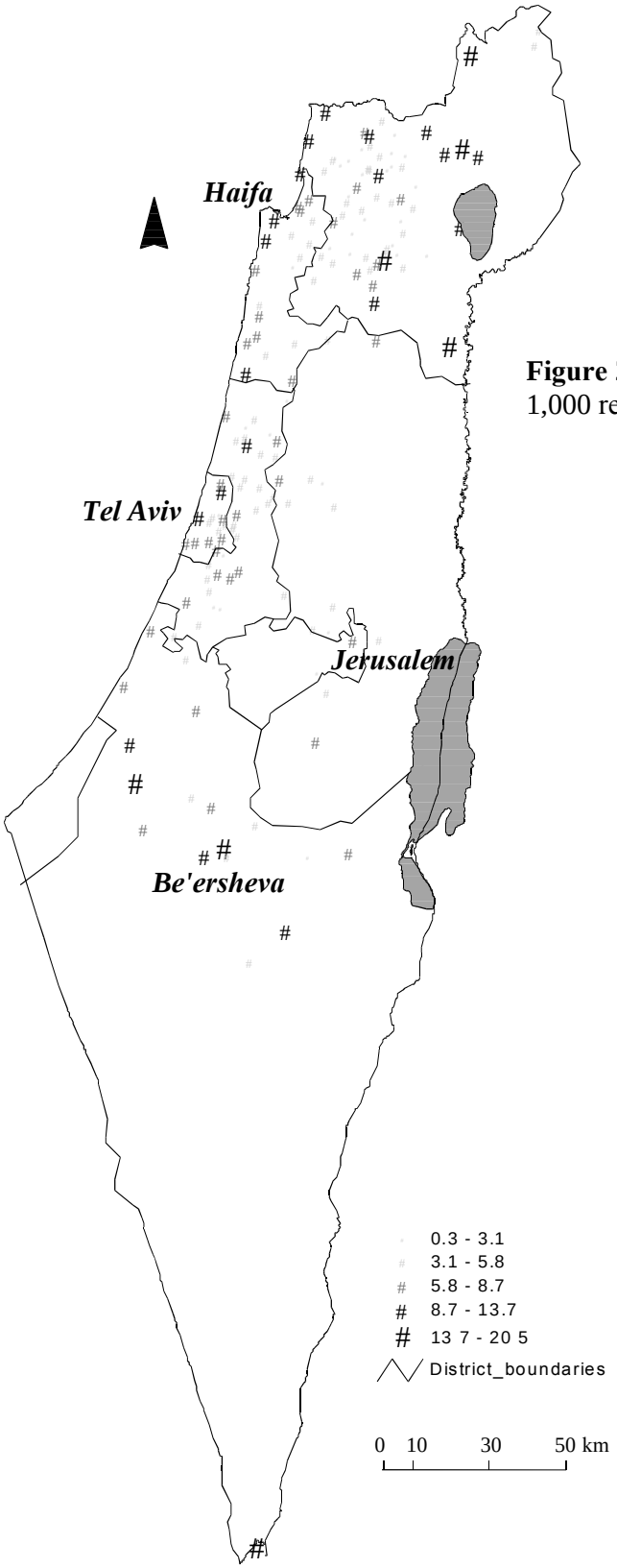

Figure 2: Property crime rates in 1990-99 (per 1,000 residents)

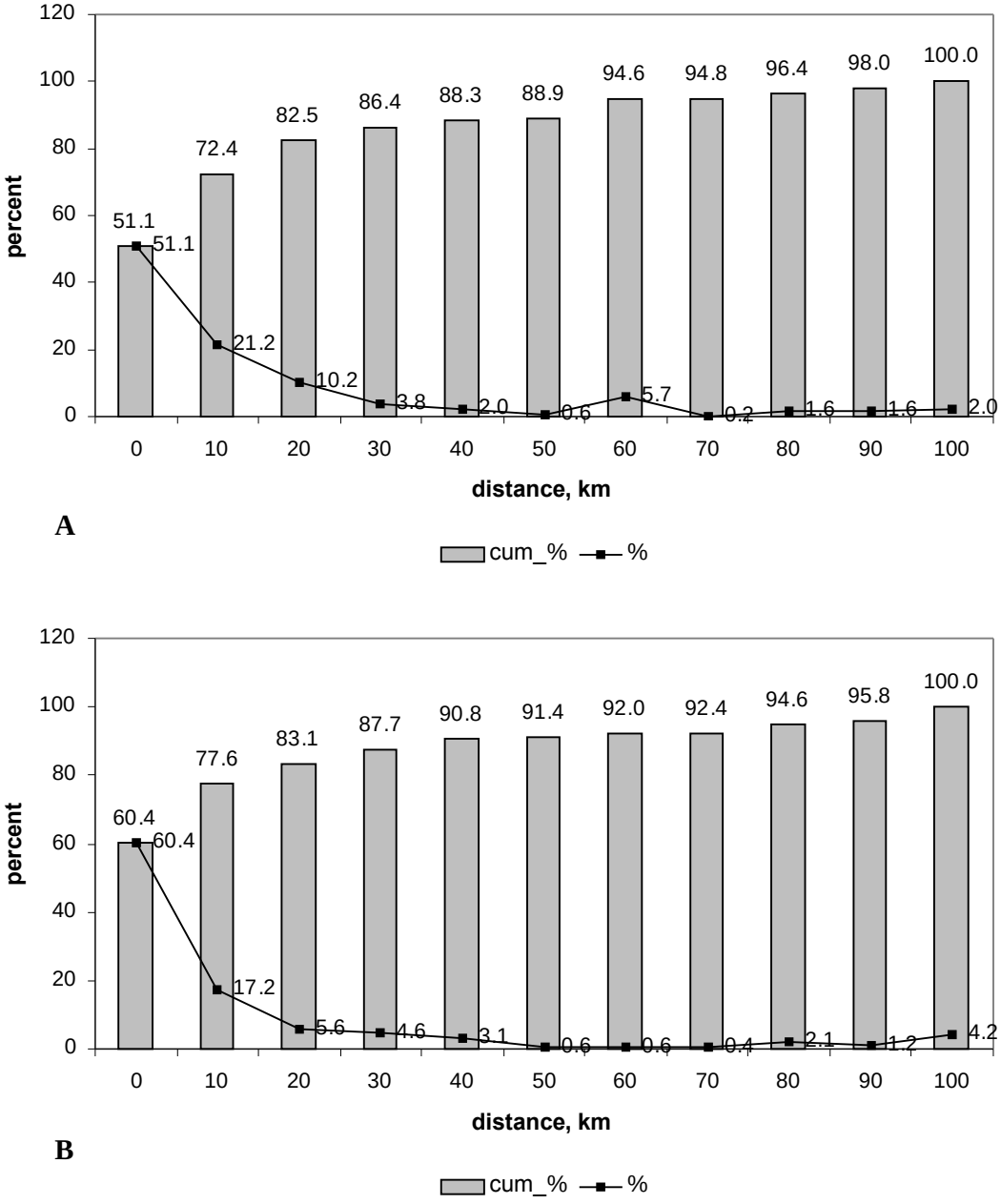

Figure 3: Distribution of places of residence of crime-perpetrators as a function of aerial distance from the central city – Tel Aviv (A) and Haifa (B).

Percentage of property crimes committed by residents of towns located at a given distance from the central city (lines) and cumulative percentage of crimes (bars).

Source: Compiled from the Israel Police Database, 1982-92.

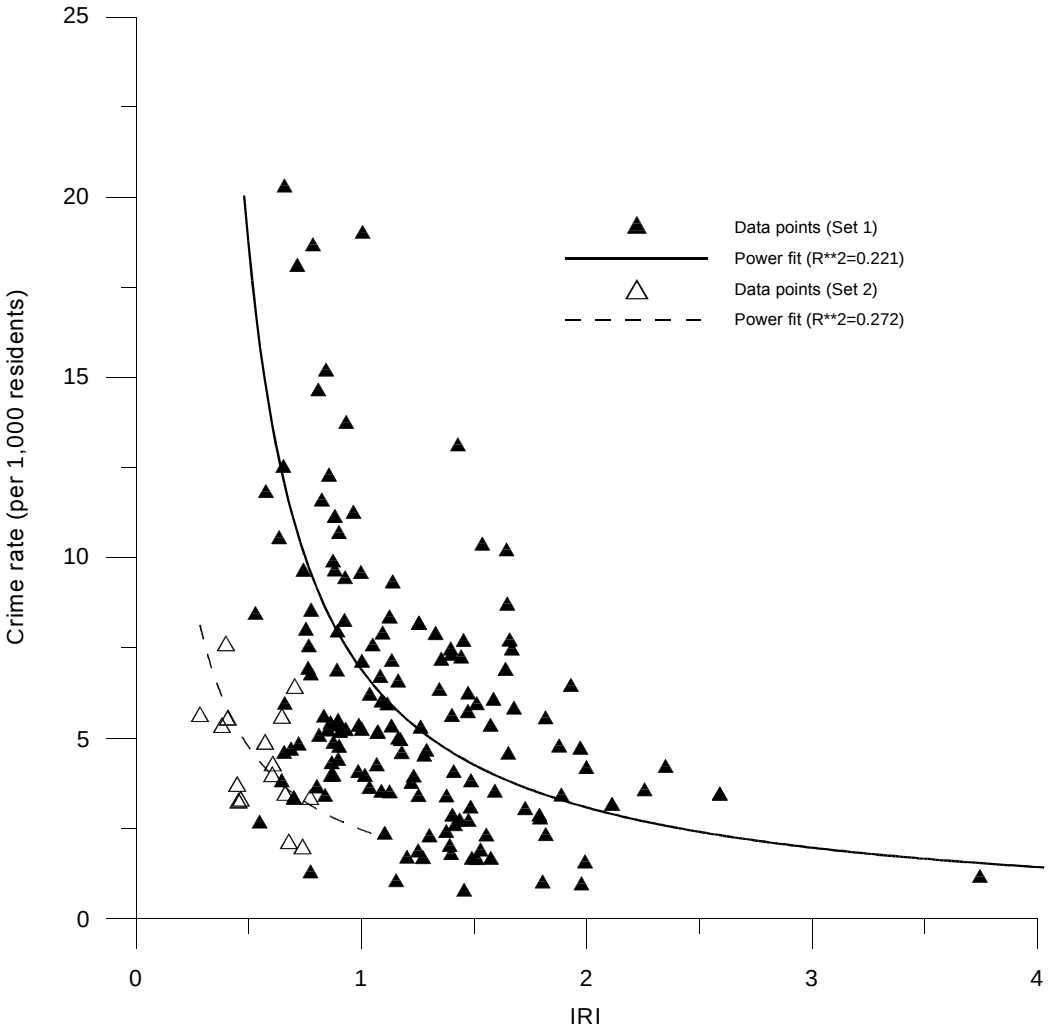

Figure 4: Property crime rates vs. Index of Relative Income (IRI)
IRI = AIN/AIL, where AIN = average income in a locality's neighborhood; AIL = average income in the locality itself (IRI >1: poor locality – wealthy neighborhood; IRI < 1: wealthy locality with poor hinterland).

TABLE 1
Factors Affecting the Crime Rates across Urban Localities in Israel (First Run)

Variable	B[a]	t[b]	t-sign.[c]	Collinearity statistics		B	t	t-sign.	Collinearity statistics	
				Tolerance	VIF[d]				Tolerance	VIF
	Property crime (per 1,000 residents)					**Violent crime (per 1,000 residents)**				
(Constant)	4.371	1.192	0.235			1.626	0.588	0.557		
Population	0.000	0.405	0.686	0.874	1.144	0.000	-0.916	0.361	0.874	1.144
Income	-0.001	-1.281	0.202	0.153	6.533	-0.001	-3.370	0.001	0.153	6.533
Ethnic makeup (I)[f]	-0.601	-0.627	0.531	0.269	3.716	1.139	1.576	0.117	0.269	3.716
Ethnic makeup (II)[g]	0.025	0.441	0.660	0.255	3.922	0.051	1.202	0.231	0.255	3.922
Children	-0.582	-0.819	0.414	0.297	3.370	-0.170	-0.316	0.752	0.297	3.370
Home ownership	-0.106	-3.381	0.001	0.170	5.890	-0.010	-0.429	0.669	0.170	5.890
Car ownership	0.103	3.532	0.001	0.226	4.427	0.034	1.570	0.118	0.226	4.427
Labor force	0.049	1.152	0.251	0.259	3.858	0.047	1.479	0.141	0.259	3.858
Unskilled	0.039	1.226	0.222	0.666	1.501	0.034	1.398	0.164	0.666	1.501
Air conditioners	0.055	2.554	0.012	0.249	4.011	0.020	1.223	0.223	0.249	4.011
No of cases	167					167				
R**2	0.357					0.299				
F	8.712					6.693				
SEE[e]	3.098					2.236				

[a] unstandardized regression coefficient; [b] t-statistic; [c] significance of t-statistic; [d] variance inflation factor; [e] standard error of estimate; [f] Arab locality; [g] percent of Asian and North African born.

TABLE 2
Factors Affecting the Crime Rates across Urban Localities in Israel (IRI Added)

Variable	B[a]	t[b]	t-sign.[c]	Collinearity statistics		B[a]	t[b]	t-sign.[c]	Collinearity statistics	
				Tolerance	VIF[d]				Tolerance	VIF[d]
	Property crime (per 1,000 residents)					**Violent crime (per 1,000 residents)**				
(Constant)	8.252	2.146	0.033			2.366	0.797	0.426		
Population	0.000	0.782	0.435	0.859	1.164	0.000	-0.814	0.417	0.859	1.164
Income	-0.001	-2.223	0.028	0.134	7.484	-0.001	-3.390	0.001	0.134	7.484
Ethnic makeup (I)	-1.037	-1.091	0.277	0.262	3.818	1.056	1.439	0.152	0.262	3.818
Ethnic makeup (II)	0.036	0.652	0.515	0.254	3.942	0.053	1.247	0.214	0.254	3.942
Children	-0.084	-0.117	0.907	0.279	3.589	-0.074	-0.134	0.893	0.279	3.589
Home ownership	-0.079	-2.428	0.016	0.154	6.500	-0.005	-0.195	0.846	0.154	6.500
Car ownership	0.076	2.530	0.012	0.203	4.925	0.029	1.266	0.207	0.203	4.925
Labor force	0.020	0.460	0.646	0.244	4.100	0.042	1.264	0.208	0.244	4.100
Unskilled	0.052	1.636	0.104	0.653	1.532	0.036	1.479	0.141	0.653	1.532
Air conditioners	0.060	2.840	0.005	0.248	4.040	0.021	1.276	0.204	0.248	4.040
Index of Relative Income (IRI)	-2.380	-2.807	0.006	0.329	3.039	-0.454	-0.694	0.489	0.329	3.039
No of cases	167					167				
R**2	0.388					0.301				
F	8.983					6.108				
SEE	3.336					2.340				

APPENDIX 1

Crime Rates by Year and Religious Group

Year	Population	Property crimes			Violent crimes			Other crimes			Total		
		No. of cases	Percent	Per 1,000	No. of cases	Percent	Per 1,000	No. of cases	Percent	Per 1,000	No. of cases	Percent	Per 1,000
1990	4841.5	3375	7.9	0.70	1476	6.7	0.30	7032	9.6	1.45	11883	8.6	2.45
1991	5070.2	3709	8.7	0.73	1532	7.0	0.30	6763	9.2	1.33	12004	8.7	2.37
1992	5207.0	4377	10.2	0.84	1724	7.9	0.33	6999	9.5	1.34	13100	9.5	2.52
1993	5338.3	4621	10.8	0.87	1870	8.5	0.35	7244	9.8	1.36	13735	9.9	2.57
1994	5483.6	4070	9.5	0.74	2165	9.9	0.39	7044	9.6	1.28	13279	9.6	2.42
1995	5624.0	4406	10.3	0.78	2244	10.2	0.40	7805	10.6	1.39	14455	10.5	2.57
1996	5769.3	4130	9.7	0.72	2288	10.4	0.40	7897	10.7	1.37	14315	10.4	2.48
1997	5911.3	4804	11.2	0.81	2966	13.5	0.50	7627	10.4	1.29	15397	11.1	2.60
1998	6052.6	5039	11.8	0.83	2967	13.5	0.49	7893	10.7	1.30	15899	11.5	2.63
1999	6221.6	4227	9.9	0.68	2685	12.3	0.43	7297	9.9	1.17	14209	10.3	2.28
Total:		42758	100		21917	100		73601	100		138276	100	

Religious group	Population (as of 1995)	Property crimes			Violent crimes			Other crimes			Total		
		No. of cases	%	Annual rate	No. of cases	%	Annual rate	No. of cases	%	Annual rate	No. of cases	%	Annual rate
Jews	4522.3	25483	61.4	0.56	14178	64.7	0.31	40669	56.46	0.90	80330	59.5	1.78
Muslims	811.2	14629	35.3	1.80	6191	28.2	0.76	28730	30.75	3.54	49550	36.7	6.11
Other	212.8	1382	3.3	0.65	1025	7.1	0.48	2637	2.82	1.24	5044	3.7	2.37
Total	5546.3	41494	100	0.75	21394	100	0.39	72036	77.10	1.30	134924	100	2.43