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The Cost of Avoiding Crime
The Case of Bogotá

Alejandro Gaviria, Carlos Medina, Leonardo Morales, and Jairo Núñez

3.1 Introduction

Quantifying the costs of crime and violence is a useful exercise because it contributes to the quality of the public discussion about a fundamental problem, and because it helps policymakers both prioritize and design cost-effective policies to diminish the adverse effects of crime. Estimates of the cost of violence are usually based on health care expenditures and losses to national economies coming from (among other things) days away from work, law enforcement expenditures, and unrealized investments.[1]

Nonetheless, these estimations do not usually consider the cost posed by crime and violence to households within cities, in terms of both the different risks they face and the coping mechanisms used by them. Specifically, within a city, the variation of crime and violence rates across neighborhoods provides a market that is serviced by security agencies created for that purpose. Households often end up paying for security in the form of higher property and rental values.

There are two relevant issues concerning the *market* for neighborhood

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1. Other economic and personal costs are much less quantifiable, like the ones coming from the pain and suffering of victims of violence.

safety (the amenity under consideration in this chapter) that one should consider. First, one must quantify the cost of this amenity to households. Second, one must identify the impossibility of most households to meet this cost. Even though many households are willing to pay to avoid crime, just a few are actually able to, thus making neighborhood safety (a supposedly pure public good) subject to private markets, and therefore to exclusion.

In this chapter, we study the aforementioned issues for the city of Bogotá, Colombia. We find that households living in the highest socioeconomic stratum (stratum 6) are paying up to 7.2 percent of their house values in order to prevent average homicide rates from increasing in one standard deviation. For their part, households in stratum 5 are paying up to 2.4 percent of their house values to prevent homicide rates from increasing. These results indicate the willingness to pay for security by households in Bogotá, and, additionally, show the emergence of urban private markets for security. These markets imply different levels of access to public goods among the population, and actually, the exclusion of the poorest.

We now proceed to describe the levels of crime in Colombia and some previous work on the topic. Then we describe our data and present the empirical methodology and identification strategy. Finally, we present the results and offer some general conclusions.

3.2 Crime in Colombia and Previous Work

Figure 3.1 shows that in the late 1990s the homicide rate in Colombia was one of the highest in the Latin American and the Caribbean (LAC) region.[2] The Colombian rate was about six times as high as the average rate worldwide and about three times as high as the average rate in the American continent taken as a whole. As of 2002, the homicide rate in the city of Bogotá was similar to that of other large Latin American cities, but it was lower than that of the most violent cities in the Colombia, namely Medellín and Cali. In recent years, the homicide rate in Bogotá has fallen precipitously, from a rate of nearly 80 deaths per 100,000 people in 1993, to a rate of 20 per 100,000 in 2007 (Llorente and Rivas 2005).

A wide selection of literature deals with the overall cost of crime and violence (see Cohen and Rubio [2007] for a recent review). For the case of the United States, Krug et al. (2002) argue that the overall cost due to gunshot wounds is close to $130 billion, whereas the costs caused by stab wounds are close to $50 billion. For the United Kingdom, Atkinson, Healey, and Maurato (2005) find that common, moderate, and serious assaults cost about £5,300, £31,000, and £36,000 per average victim household per year, respectively.

Among the studies seeking to estimate households' willingness to pay for security, Cohen et al. (2004) use a contingent valuation methodology to find

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2. Numbers shown in figure 3.1 correspond to the late 1990s for the case of countries (top graph) and to 2002 for the case cities (bottom graph).

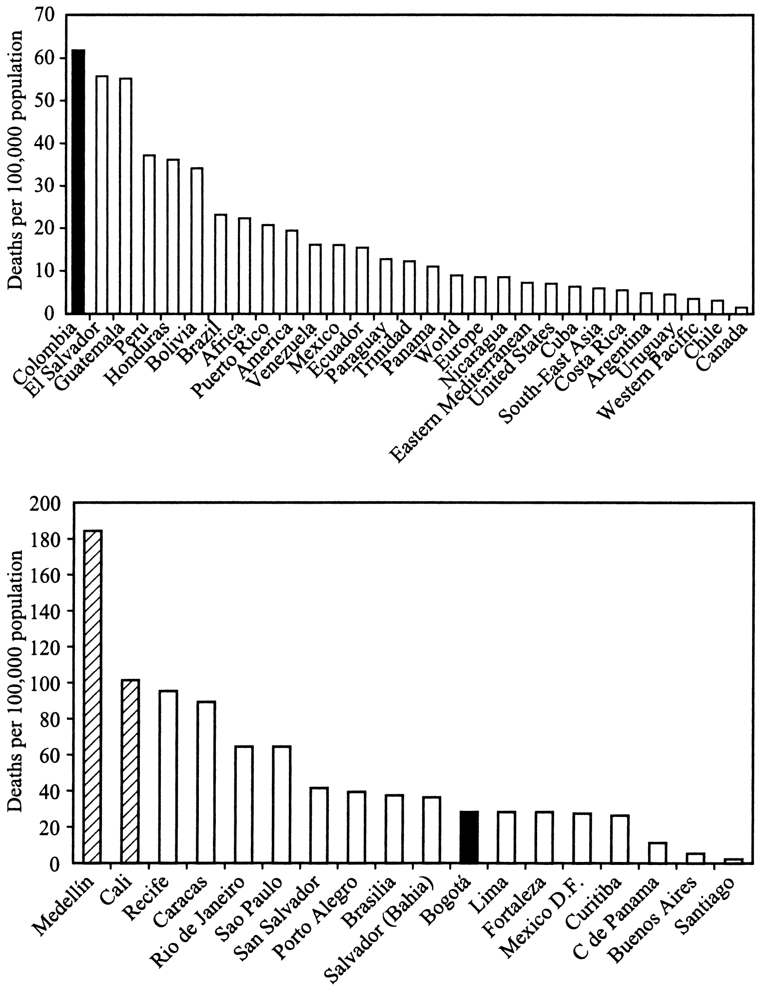


Fig. 3.1 Homicide rates in LAC countries and cities
Sources: Krug et al. (2002); Gaviria and Pages (2002); and Llorente and Rivas (2005).

that a typical American household is willing to pay between \$100 and \$150 per year for a crime prevention program that reduces specific crimes by 10 percent. The said amount increases according to the severity of crime: \$104 for burglaries and \$146 for murders. Previously, Cook and Ludwig (2000) and Ludwig and Cook (2001) argued that the average household is willing to pay as much as \$200 per year in order to reduce gun violence caused by criminals and juvenile delinquents by 30 percent.

While studies that estimate hedonic price models have often included crime variables in the empirical estimations, the identification of causal effects of these variables has not been an explicit goal in most of the literature.

Whereas Roback (1982) does not find a statistically significant coefficient of crime rates on log earnings, Gyourko and Tracy (1991) do find significant effects. Neither of them addresses explicitly the issue of causality.

For Colombia, the only previous attempt to quantify distributional effects of crime variables is that of Gaviria and Vélez (2001). These authors find that rich households are more likely to be victims of property crime and kidnapping, and are therefore much more willing to modify their behavior for fear of crime: they feel unsafe, and will heavily invest in crime avoidance. The poorest are more likely to be victims of homicides and domestic violence. Other studies have focused on the overall economic cost caused by violence in Colombia. Trujillo and Badel (1998) estimate, for the early nineties, the gross cost of urban criminality and armed conflict in Colombia at 4.3 percent of gross domestic product (GDP). Badel (1999) estimate, for the mid-nineties, the gross direct cost of violence and armed conflict at 4.5 percent of GDP. Londoño and Guerrero (2000) estimate the *direct* cost of violence on health (medical attention and lost years of life) and material losses (public and private security and justice) at 4.9 percent of GDP for a subset of Latin American and Caribbean (LAC) countries, and 11.4 percent of GDP in the case of Colombia. Furthermore, Londoño and Guerrero (2000) also estimate the *indirect* costs of violence (i.e., the effect on productivity, investment, work, and consumption) in 9.2 percent of GDP for the same sample of LAC countries, and 13.3 percent of GDP for Colombia. These authors did not quantify the willingness of households to pay in order to avoid urban violence, as we do in this chapter.

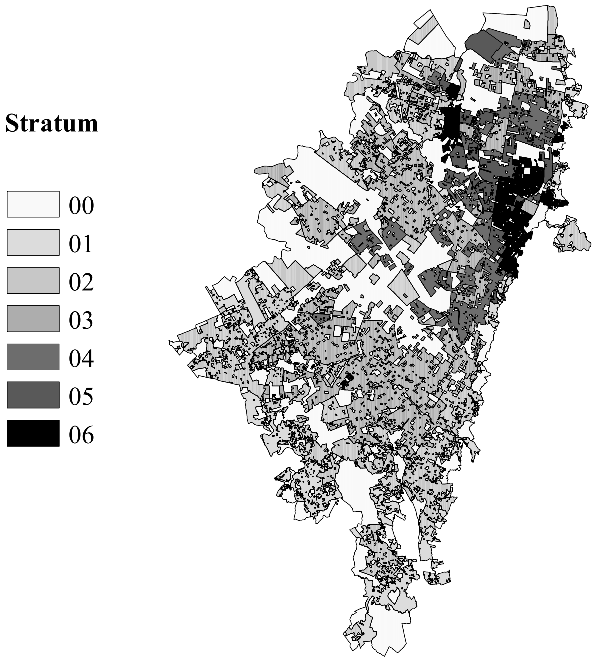
Quite a few previous studies investigate the spatial patterns of crime in Colombia in general and in Bogotá in particular. Núñez and Sánchez (2001) find statistically significant spatial correlation between assaults, auto thefts, and residential and commercial robberies. Similarly, Llorente et al. (2001) illustrate meticulously the spatial segregation of homicides in Bogotá, and, additionally, study its dynamics, finding that homicides are spatially very persistent; they take place mostly around the same areas of the city with different degrees of intensity.

In what follows, we use the previous studies and provide some additional elements that, we believe, support the estimation strategy used in the calculation of the effects of homicide rates on house values and rents. We describe the data used in the estimation before proceeding to present the methodology and the results of the empirical model.

3.3 Data[3]

We use data at the household level taken from the 2003 *Encuesta de Calidad de Vida/ECV (Survey on Quality of Life)*. The ECV is carried out at approximately five-year intervals by Colombia's Administrative Depart-

3. This section builds heavily on Medina, Morales, and Núñez (2008).



Map 3.1 Socioeconomic strata in Bogotá

ment of National Statistics, DANE.[4] The 2003 ECV (a Living Standards Measurement Study [LSMS] survey) has detailed information about living conditions of households in Bogotá, with more than 12,000 households interviewed in all nineteen subcity urban areas known as localidades.[5] The ECV was purportedly designed to compute employment and unemployment rates at the level of the locality. Within each locality, households were randomly selected. In each locality, households from each of the six different strata used in Colombia for targeting social programs were included.[6] Map 3.1 illustrates the location of the poorest and richest households in the city: the former are located mostly in the northeast, and the latter mostly in the south and on the city's periphery.

4. The survey was collected between June 6 and July 23 of 2003. Household members eighteen and older were directly interviewed.

5. See Medina, Morales, and Núñez (2008) for a detailed description of the spatial data.

6. Urban areas in Colombia are split into six socioeconomic strata: stratum 1 has the lowest socioeconomic levels and stratum 6, the highest. The strata are used to target public service subsidies and other social programs (Medina, Morales, and Núñez (2008). To estimate in which socioeconomic stratum each house is classified, the local governments take into account dwelling characteristics as well as neighborhood amenities. Based on this information, they aggregate neighborhoods into clusters of strata. The methodology allows houses in a cluster to belong to a stratum different to that of its cluster if characteristics are very different to those of its cluster.

We also use data from the 1993 Population Census in order to collect information at the census sector level. This information allows us to split Bogotá into more than 500 sectors, with an average population of about 12,000 inhabitants per sector (see divisions in map 3.2).[7] Most of the estimation is done at the level of the census sector.

Table 3.1 presents all variables used in the estimation. Most households in Bogotá are located in socioeconomic strata 2 or 3 (75 percent), and approximately 6 percent in strata 5 and 6, or in stratum 1, respectively. Coverage of public utility services is very high in the city, with nearly 100 percent in electricity, and nearly 90 percent in fixed phone lines. We possess cadastral data for nearly 70 percent of the households. Our variables related to crime include common thefts, aggravated assaults, residential and commercial robberies, auto thefts, and homicides.[8] Figure 3.2 presents the distribution of the crime variables across census sectors. The figure shows that almost all distributions and, in particular, those corresponding to common thefts (*object* thefts herein) and homicides are not entirely reliable. Figure 3.2 also presents the spatial distribution of the Police Centers of Immediate Attention, the CAIs. This distribution has the same shape as the distribution of the crime and violence variables.

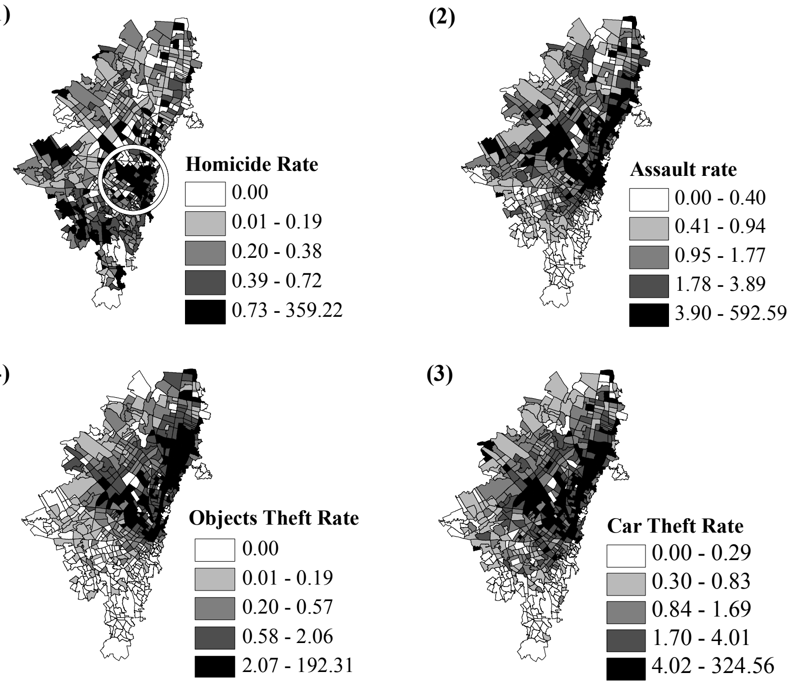
Cadastral data will be made available here on property values for close to 8,900 houses in Bogotá. In addition, we are able to provide the owners' reported values for households claiming home ownership. Reported rent prices are available for houses with tenant households ("how much do you pay"?) and for those living in their own house ("how much would you pay if the house were rented"?) Figure 3.3 presents the distribution of property values. The distribution of property values obtained using only cadastral data is similar to the one obtained when reported rent values are used to complement cadastral data.

Other variables related to quality of life, like the index of quality of life (ICV), the index of Unsatisfied Basic Needs (NBI), the Misery Index, and the Gini coefficient of education (which measures inequality in the distribution of the years of schooling in each census sector), are highly correlated with the socioeconomic strata—positively in the case of ICV, negatively in the case of NBI and the Misery Index.[9] Inequality in the distribution of education is higher in the poorest neighborhoods, which also suffer from higher

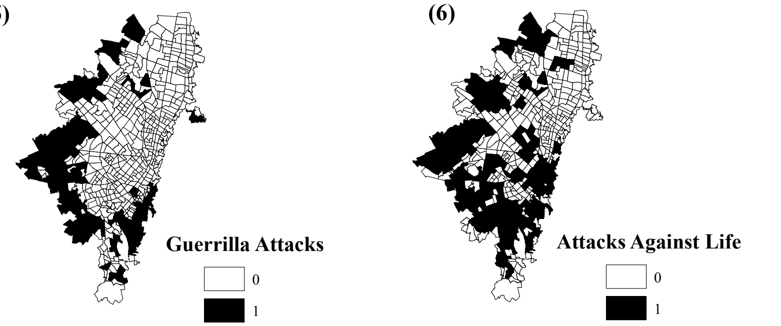
7. Figures of the 2005 Colombia Population Census have not yet been made available.

8. For the purpose of this study, we understand homicide as the activity by which one person kills another (Art. 323 Penal Code); attacks against life, as harming a person's body or health (Art. 332 Penal Code); and objects theft, as the act of expropriating someone else's goods for one's own benefit (Art. 349 Penal Code).

9. See details of the definition of the ICV in DNP (1997). The NBI index measures the share of households in a specific census sector that has at least one basic need unsatisfied: adequate housing, basic public utility services (water, sewage, and electricity), economic dependency, and/or primary school dropouts. The Misery Index is estimated as the share of households with at least two unsatisfied basic needs.



See sources in Table 1.



Map 3.2 Quintiles of variables related to crime across census sectors in Bogotá

Source: Medina et al. (2007).

Note: See sources in table 3.1.

Table 3.1 **Descriptive statistic**

Variable	*N*	Mean	Standard deviation
Stratum 2	12,744	0.325	0.468
Stratum 3	12,744	0.434	0.496
Stratum 4	12,744	0.116	0.320
Stratum 5	12,744	0.030	0.170
Stratum 6	12,744	0.032	0.175
Cadastral house value (as opposed to reported)	12,871	0.690	0.463
Number of rooms	12,771	3.37	1.52
Number of bathrooms	12,760	1.558	0.842
House with piped gas service	12,771	0.656	0.475
House with telephone	12,771	0.877	0.329
Good quality of electricity	12,746	0.899	0.302
Good quality of garbage collection	12,750	0.891	0.312
Water available 24 hrs. a day	12,678	0.982	0.133
Water available every day of the week	12,771	0.967	0.178
Good quality of phone line	12,871	0.731	0.444
House with garden	12,771	0.419	0.493
House with courtyard	12,771	0.046	0.210
House with garage	12,771	0.285	0.451
House with terrace	12,771	0.217	0.412
Parks in neighborhood	12,771	0.131	0.338
The house has suffered because of a natural disaster	12,771	0.046	0.209
House in area vulnerable to natural disasters	12,771	0.070	0.255
Factories in neighborhood	12,771	0.119	0.324
Garbage collector in neighborhood	12,771	0.030	0.172
Marketplaces in neighborhood	12,771	0.070	0.255
Airport in neighborhood	12,771	0.037	0.188
Terminals of ground transportation in neighborhood	12,771	0.033	0.178
House close to open sewers	12,771	0.103	0.304
House close to high tension lines of electricity transmission	12,771	0.018	0.132
You feel safe in your neighborhood	12,771	0.680	0.466
Provision of water is inside the house	12,771	0.973	0.163
The kitchen is an individual room	12,771	0.960	0.195
Shower bath	12,771	0.974	0.160
House[a]	12,771	0.378	0.485
Wall material is any of: brick, block, stone, polished wood	12,771	0.978	0.146
Floor material is any of: marmol, parque, lacquered wood	12,771	0.084	0.277
Floor material is carpet	12,771	0.133	0.339
Floor material is any of: floor tile, vinyl, tablet, wood	12,771	0.595	0.491
Floor material is any of: coarse wood, table, plank	12,771	0.054	0.227
Floor material is any of: cement, gravilla, earth, sand	12,771	0.134	0.341
House with toilet connected to the public sewage	12,771	0.989	0.103
House with potable water service	12,771	0.985	0.120
Number of infantile shelters	[e]12,771	0.070	0.352
Number of asylums	[e]12,771	0.140	0.456
Number of convents	[e]12,771	0.260	0.888
Objects theft rate	[e]12,861	0.869	6.088
Assaults rate	[e]12,861	3.24	22.13
Residential and commercial assault rate	[e]12,861	2.99	9.23
Cars theft rate	[e]12,861	2.48	12.53
Crime rate	[e]12,120	0.538	0.668
Land use	[e]12,861	0.002	0.017
Attacks of FARC, ELN, or other groups[b]	[e]12,871	0.232	0.422
Share of women heads of households	[e]12,861	0.275	0.051
Labor force unemployment rate	[e]12,871	3.89	1.01
Illiteracy rate	[e]12,861	0.030	0.021

Table 3.1 (continued)

Variable	*N*	Mean	Standard deviation
Average education	[e]12,861	8.365	1.896
Index of quality of life[c]	[e]12,871	82.12	7.09
Gini of education	[e]12,861	0.051	0.013
Number of CAIS[d]	[e]12,861	0.474	9.894
Medical centers	[e]12,861	0.281	1.476
Private hospitals	[e]12,861	0.243	1.384
Police headquarters	[e]12,861	0.241	17.64
Local security funds	[e]12,861	6.95	60.45
Public hospitals	[e]12,861	0.572	19.630
Religious centers	[e]12,861	1.12	3.45
Social welfare centers	[e]12,861	2.30	7.39
Cultural centers	[e]12,861	2.91	11.48
Prisons	[e]12,861	0.032	0.966
Attacks against life	[e]12,861	0.844	18.082
Attacks against wealth	[e]12,861	1.30	22.17
Bars	[e]12,861	1.179	18.727
Brothels	[e]12,861	0.630	17.689
Casinos/places for bets	[e]12,861	0.288	17.659
Places selling drugs/narcotics	[e]12,861	0.879	20.300
People 0–4 years old	[e]12,771	1,183	980
People 5–9 years old	[e]12,771	1,156	929
People 10–14 years old	[e]12,771	1,168	910
People 15–19 years old	[e]12,771	1,092	793
People 20–24 years old	[e]12,771	1,211	890
People 25–29 years old	[e]12,771	1,217	898
People 30–34 years old	[e]12,771	1,132	814
People 35–39 years old	[e]12,771	898	638
People 40–44 years old	[e]12,771	696	499
People 45–49 years old	[e]12,771	506	352
People 50–54 years old	[e]12,771	413	270
People 55–59 years old	[e]12,771	299	186
People 60+ years old	[e]12,771	700	415
Unsatisfied Basic Needs (NBI): Dependency	[e]12,771	37.01	43.36
Accumulation	[e]12,771	418.35	410.15
Dropouts	[e]12,771	6.04	9.18
Public utility services	[e]12,771	37.71	76.72
Housing in	[e]12,771	69.09	97.20
NBI in municipality where born	[e]12,871	26.86	17.34
NBI in municipality where born	[e]12,871	0.097	0.296
Born in urban area	12,771	0.753	0.431
Share of women in household	12,771	0.535	0.268
Household with children	12,771	0.716	0.451
Age of mother minus age of oldest children	12,771	17.13	12.77
Logarithm of rent values	12,669	12.44	0.771
Logarithm of cadastral house values	8,879	17.48	0.777
Logarithm of cadastral or reported house values	10,845	17.50	0.792

Sources: Encuesta de Calidad de Vida 2003, Real State Appraisal of Bogotá, National Police-DIJIN 2000, Paz Pública (2000). Colombian 1993 Population Census.

[a]Dummy variable equal to 1 if house, zero otherwise (apartment, etc.).

[b]Dummy variable equal to 1 if there have been attacks in census sector by FARC, ELN, or other such illegal armed groups.

[c]A-Theoretical estimation of QoL (see methodology in DNP [1997]).

[d]Centros de Atencion Inmediata, CAIS: Centers of Immediate Police Attention.

[e]At the census sector level.

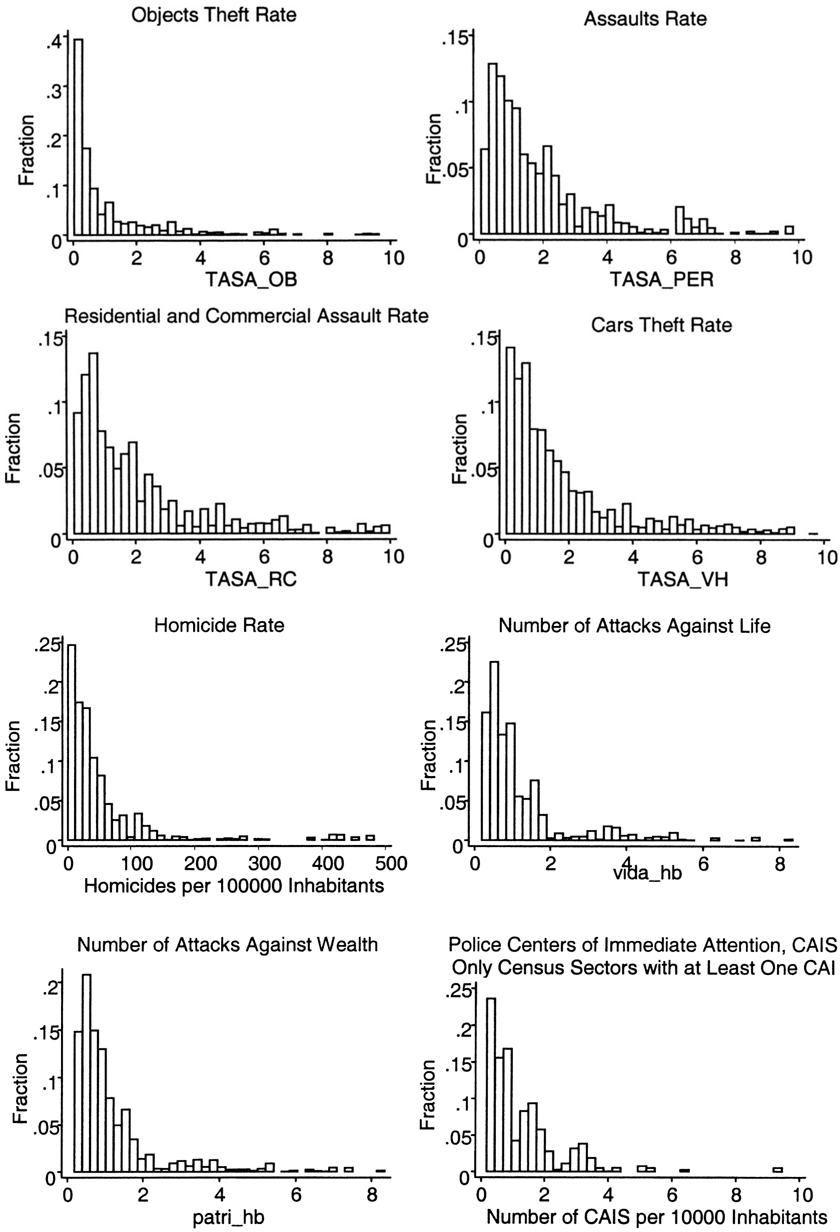


Fig. 3.2 Distribution of variables related to crime by census sector (Bogotá)

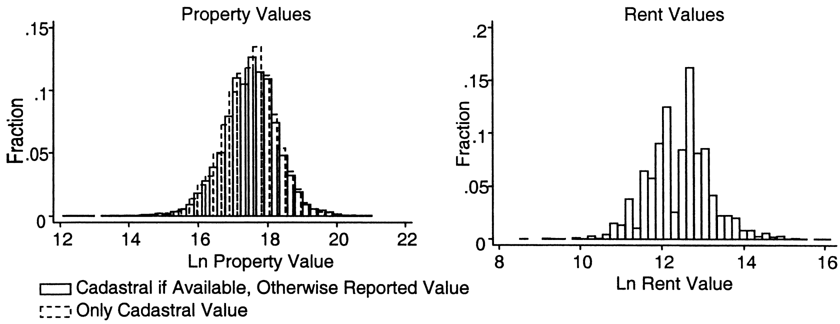


Fig. 3.3 Property and rent values

rates of violent crime as well as from higher incidence of attacks both by guerrillas and other groups (see map 3.2).[10]

We can now illustrate graphically the spatial correlation between quality-of-life indicators and crime variables. Map 3.2 illustrates the spatial patterns of crime variables at the census sector level (quintiles are also used). The circled area, which comprises downtown Bogotá, is the area with the highest homicide rate in the city. If we compare maps 3.1 with map 3.2, it becomes apparent that the highest assault, car, and object theft rates correspond to the highest stratum neighborhoods. On the contrary, homicides, guerrilla attacks, and attacks against life are all much more common in the periphery of the city, which is also much poorer. Spatial correlations suggested by the overlapping of the maps are consistent with the survey data described by Gaviria and Vélez (2001).

3.4 Empirical Analysis

In this section, we present the empirical strategy and the estimation of the effect of crime and violence upon house values and rental prices. We estimate a hedonic regression model of the logarithm of house values on a battery of both household and *amenity* variables. The specification used takes the following form:

$$\ln(P_{ij}) = \alpha_0 + \alpha_1 H_i + \alpha_2 A_j + u_{ij}, \tag{1}$$

where P_{ij} is either the value of the house (cadastral or reported by household) or the corresponding rental price (also reported by household), H_i is a vector

10. See Fajnzylber, Lederman, and Loayza (1998, 2000, 2002a, 2002b). These authors find a positive relation between income inequality and the homicide and robbery rates. A review of this regularity for Latin American and Caribbean Countries can be found in Heinemann and Verner (2006). For the Colombian case, Sanchez and Nuñez (2002) find that inequality in land distribution is positively related to the homicide rate, although it explains just a small fraction of the cross-sectional variation in the homicide rate.

of household characteristics, and A_j is a vector of amenities in census sector j. As customary in the literature, the model assumes that house values incorporate amenities, including access and quality of public goods and services (roads, parks and other green space, transport, security, etc.). In equilibrium, amenities would be capitalized into house values and rents.[11]

Table 3.2 presents the results of estimating equation (1), using three different dependent variables. The first dependent variable takes the cadastral value of a house, if it is available, and takes the value reported by the household if it is not. In this case, we have up to 10,290 households in our sample. The second variable is restricted to the available cadastral values (8,435 observations). Finally, the third variable equals the rental values reported by households (12,024 observations). Each set of results contains both ordinary least squares (OLS) and instrumental variables (IV) results. For all regressions, we estimate robust standard errors, correcting for clustering at the census sector level.

We focus first on the OLS estimates. Overall, the reported estimates have the expected signs. As shown, property values increase for houses located in higher socioeconomic strata, for houses with better characteristics, including the number of rooms, the number of bathrooms, the availability of piped gas, the presence of parks in the neighborhood, the absence of open sewers, and so on. In the first panel, where cadastral values are used if available, and reported values otherwise, we include a dummy variable equal to 1 if cadastral values are used, and to zero otherwise. The estimated coefficient on the dummy implies that cadastral values are on average 10.6 percent lower than the reported commercial values.

Regarding crime variables, the common theft rate (*object* theft) is negatively related to house value. This variable is significant only when rent values are used (panel 3). Homicides rates are negatively related to house values. Attacks by the Revolutionary Armed Forces of Colombia (FARC) or National Liberation Army (ELN) guerrillas and other illegal armed groups are also negatively related to house rental values but the coefficients are hardly significant. On the other hand, residential and commercial assaults and car thefts are unrelated to house values. Finally, property crimes (attacks against wealth) are positively related to house values.

Although we expect all crime variables to be negatively related to house values and rents, there are several sources of endogeneity that can bias the results. On the one hand, if some types of crime occur more often in better neighborhoods—as it is generally the case with property crime—omitted characteristics might be positively correlated with this type of crime. For example, the coefficient of auto theft may be picking up some unobserved

11. See Rosen (1974, 1979, 2002); Thaler and Rosen (1976); Blomquist, Berger, and Hoehn (1988); Roback (1982, 1988); and Gyourko, Kahn, and Tracy (1999), among others. Thaler and Rosen (1976) develop a model that estimates the premium workers' demand for working in riskier occupations.

Table 3.2 Hedonic regression for Bogotá

	Homicide rate (1st stage)		Ln house price[a]				Ln house price[b]				Ln house rent			
			OLS		2SLS		OLS		2SLS		OLS		2SLS	
Variable	Coefficient	*t*	Coefficient	*t*	Coefficient	*t*	Coefficient	*t*	Coefficient	*t*	Coefficient	*t*	Coefficient	t
Stratum 2	0.0461	0.53	0.1449	2.83	0.1419	2.58	0.1722	3.06	0.1721	2.84	0.0197	0.62	0.0342	1.01
Stratum 3	0.0826	0.70	0.3047	4.56	0.2980	4.08	0.3087	4.18	0.3061	3.80	0.1105	3.05	0.1362	3.25
Stratum 4	0.2040	1.24	0.3822	4.18	0.3630	3.16	0.3518	3.43	0.3411	2.65	0.2078	4.32	0.2711	3.81
Stratum 5	0.1735	0.91	0.4643	3.78	0.4469	3.22	0.3599	2.59	0.3481	2.22	0.4267	7.09	0.4803	6.45
Stratum 6	0.0469	0.20	0.6254	4.21	0.6206	4.12	0.5027	3.11	0.5011	3.05	0.7254	9.63	0.7390	9.70
Cadastral house value (as opposed to reported)	0.0148	0.65	–0.1066	–5.00	–0.1078	–4.92	0.0000	0.00	0.0000	0.00	–0.0297	–2.67	–0.0251	–2.14
Number of rooms	–0.0013	–0.16	0.0116	1.67	0.0116	1.66	0.0083	1.13	0.0083	1.12	0.1395	24.80	0.1394	24.73
Number of bathrooms	0.0037	0.24	0.2011	12.83	0.2007	12.57	0.1968	11.66	0.1965	11.46	0.1290	11.63	0.1301	11.50
House with piped gas service	–0.0300	–1.00	–0.0046	–0.26	–0.0015	–0.08	–0.0047	–0.24	–0.0026	–0.11	0.0459	3.97	0.0363	2.41
House with telephone	–0.0541	–1.76	–0.1483	–4.89	–0.1430	–3.79	–0.1522	–4.79	–0.1494	–3.75	0.2016	11.35	0.1839	7.40
Good quality of electricity	0.0027	0.16	–0.0197	–1.00	–0.0197	–0.99	–0.0220	–0.97	–0.0224	–0.99	–0.0285	–1.96	–0.0277	–1.91
Good quality of garbage collection	0.0081	0.26	0.0371	1.95	0.0366	1.90	0.0320	1.70	0.0319	1.66	–0.0136	–0.96	–0.0111	–0.78
Water available 24 hrs. a day	0.0098	0.21	0.1238	2.83	0.1218	2.78	0.1526	2.99	0.1512	2.92	0.0223	0.61	0.0255	0.69
Water available every day of the week	0.0126	0.16	0.0318	0.77	0.0311	0.76	0.0398	0.87	0.0401	0.89	–0.0065	–0.29	–0.0022	–0.10
Good quality of phone line	0.0074	0.49	0.0301	2.13	0.0292	2.03	0.0242	1.56	0.0236	1.50	0.0174	1.40	0.0199	1.55
House with garden	–0.0017	–0.07	0.1391	8.23	0.1389	8.23	0.1383	7.67	0.1381	7.67	–0.0055	–0.50	–0.0061	–0.55
House with courtyard	–0.1146	–3.68	0.1441	3.77	0.1551	3.09	0.1610	3.61	0.1661	2.78	–0.0236	–0.81	–0.0598	–1.55
House with garage	–0.0546	–2.17	0.0742	3.84	0.0793	2.92	0.0681	3.38	0.0705	2.40	0.1023	7.11	0.0851	4.05
House with terrace	–0.0221	–0.90	0.1328	7.86	0.1352	7.20	0.1118	6.24	0.1134	5.54	0.0380	3.14	0.0311	2.27
Parks in neighborhood	0.0172	0.47	–0.1084	–3.54	–0.1107	–3.56	–0.1731	–4.75	–0.1763	–4.73	0.0284	1.56	0.0335	1.81
The house has suffered because of a natural disaster	–0.0836	–1.47	0.0916	1.92	0.0994	1.87	0.0293	0.57	0.0345	0.59	0.0180	0.56	–0.0080	–0.21

(continued)

Table 3.2 (continued)

Variable	Homicide rate (1st stage)		Ln house price[a]				Ln house price[b]				Ln house rent			
			OLS		2SLS		OLS		2SLS		OLS		2SLS	
	Coefficient	*t*	Coefficient	*t*	Coefficient	*t*	Coefficient	*t*	Coefficient	*t*	Coefficient	*t*	Coefficient	t
Airport in neighborhood	–0.1967	–2.52	–0.0485	–1.13	–0.0282	–0.36	–0.0609	–1.26	–0.0473	–0.54	0.0640	2.45	0.0023	0.04
Terminals of ground transportation in neighborhood	0.0012	0.02	–0.0103	–0.26	–0.0101	–0.26	–0.0708	–1.54	–0.0725	–1.58	0.0541	1.98	0.0546	2.00
House close to open sewers	–0.0642	–1.80	–0.0516	–2.01	–0.0455	–1.38	–0.0489	–1.67	–0.0452	–1.17	–0.0034	–0.21	–0.0234	–1.04
House close to high tension lines of electricity transmission	0.0069	0.09	0.0667	1.35	0.0667	1.35	0.0861	1.54	0.0871	1.56	–0.0222	–0.64	–0.0195	–0.56
You feel safe in your neighborhood	–0.0675	–4.44	–0.0076	–0.58	–0.0005	–0.02	–0.0119	–0.86	–0.0077	–0.27	–0.0189	–2.00	–0.0401	–1.93
Provision of water is inside the house	0.0367	0.68	0.0085	0.12	0.0033	0.05	0.0086	0.11	0.0049	0.06	0.2043	3.51	0.2159	3.62
The kitchen is a individual room	0.0561	0.92	0.1194	2.73	0.1123	2.24	0.1043	2.19	0.0991	1.82	0.1254	4.49	0.1444	4.36
Shower bath	–0.0551	–1.49	0.0318	0.63	0.0356	0.61	0.0107	0.20	0.0131	0.21	0.0921	2.29	0.0749	1.74
House[c]	0.0166	0.59	–0.1797	–8.23	–0.1808	–8.29	–0.1953	–8.36	–0.1958	–8.35	0.0583	4.46	0.0632	4.67
Walls material is any of: brick, block, stone, polished wood	0.0599	1.07	0.1004	1.41	0.0925	1.27	0.0908	1.01	0.0841	0.92	0.1432	3.61	0.1626	3.82
Floor material is any of: marmol, parque, lacquered wood														
Floor material is carpet	0.0268	0.77	–0.2370	–7.68	–0.2408	–7.58	–0.2397	–6.57	–0.2427	–6.48	0.0097	0.49	0.0177	0.85
Floor material is any of: floor tile, vinyl, tablet, wood	0.0330	0.86	–0.0290	–1.06	–0.0334	–1.12	–0.0134	–0.44	–0.0166	–0.50	–0.0167	–0.98	–0.0063	–0.33
Floor material is any of: coarse wood, table, plank	0.1531	2.47	0.0487	1.21	0.0307	0.45	0.0638	1.47	0.0519	0.69	–0.0835	–3.07	–0.0355	–0.72

Floor material is any of: cement, gravilla, earth, sand	−0.0218	−0.60	−0.2331	−5.99	−0.2318	−5.84	−0.2084	−4.84	−0.2078	−4.72	−0.1473	−5.65	−0.1538	−5.68
House with toilet connected to the public sewage	0.0886	0.69	−0.1361	−1.09	−0.1489	−1.16	−0.1925	−1.24	−0.2009	−1.26	0.0742	0.74	0.1015	0.99
House with potable water service	0.1759	1.22	0.2373	2.13	0.2212	1.72	0.3368	2.41	0.3253	2.06	−0.0368	−0.55	0.0188	0.22
Number of infantile shelters[g]	0.0073	0.12	−0.0594	−1.75	−0.0600	−1.76	−0.0994	−1.96	−0.0992	−1.97	0.0019	0.09	0.0042	0.21
Number of asylums[g]	−0.0107	−0.18	0.0009	0.03	0.0019	0.07	0.0116	0.37	0.0123	0.39	0.0209	1.25	0.0175	1.05
Number of convents[g]	−0.0459	−1.35	−0.0035	−0.25	0.0014	0.07	0.0072	0.40	0.0108	0.43	−0.0057	−0.78	−0.0201	−1.41
Objects theft rate[g]	−0.0991	−1.21	−0.0281	−1.37	−0.0182	−0.47	−0.0141	−0.66	−0.0081	−0.18	−0.0252	−3.10	−0.0562	−1.96
Assaults rate[g]	0.0913	3.95	−0.0053	−0.71	−0.0147	−0.46	−0.0035	−0.46	−0.0095	−0.27	0.0035	1.17	0.0322	1.29
Residential and commercial assault rate[g]	0.0693	1.51	0.0129	1.00	0.0062	0.24	0.0127	0.90	0.0089	0.30	0.0020	0.45	0.0236	1.20
Cars theft rate[g]	−0.0721	−2.75	−0.0017	−0.23	0.0056	0.21	−0.0064	−0.70	−0.0019	−0.06	0.0030	0.88	−0.0197	−0.99
Homicide rate (deaths per 10,000,000 people)[g]			−0.0470	−1.70	0.0555	0.17	−0.0411	−1.45	0.0224	0.06	−0.0115	−1.43	−0.3253	−1.18
Land use[g]	−0.5262	−0.44	−0.0725	−0.15	−0.0094	−0.02	−0.1376	−0.28	−0.0813	−0.16	−0.2480	−0.61	−0.4099	−0.95
Attacks of FARC, ELN, or other groups[d,g]	−0.0237	−0.31	−0.0461	−1.26	−0.0441	−1.15	−0.0366	−0.91	−0.0362	−0.87	−0.0324	−1.60	−0.0400	−1.91
Share of women heads of households[g]	−0.2071	−0.21	−2.2102	−5.45	−2.1998	−5.33	−2.4374	−5.40	−2.4475	−5.33	−0.1445	−0.60	−0.2130	−0.84
Labor force unemployment rate[g]	0.0296	0.57	−0.1002	−4.75	−0.1037	−4.40	−0.1260	−5.84	−0.1288	−5.33	−0.0161	−1.61	−0.0069	−0.50
Illiteracy rate[g]	−5.7389	−1.80	0.0479	0.03	0.6566	0.27	−0.3278	−0.20	0.1107	0.04	1.2972	1.69	−0.5061	−0.29
Average education[g]	−0.3234	−2.73	−0.0380	−0.96	−0.0050	−0.04	−0.0497	−1.10	−0.0282	−0.21	0.0983	4.95	−0.0035	−0.04
Index of quality of life[e,g]	0.0565	2.11	0.0442	4.75	0.0384	1.80	0.0440	4.14	0.0399	1.67	0.0076	1.42	0.0253	1.52
Gini of education[g]	11.0243	1.44	0.2304	0.09	−0.9956	−0.22	−1.8934	−0.63	−2.8396	−0.55	2.8591	1.70	6.3087	1.73
Number of CAIS[f,g]	0.0065	0.14	0.0014	0.10	0.0004	0.03	0.0037	0.27	0.0028	0.20	0.0127	2.10	0.0147	2.30
Medical centers[g]	−0.0655	−2.95	−0.0109	−1.10	−0.0044	−0.18	−0.0131	−1.26	−0.0091	−0.34	−0.0037	−0.87	−0.0243	−1.35
Private hospitals[g]	0.0654	1.89	0.0048	0.30	−0.0017	−0.06	0.0114	0.58	0.0076	0.24	0.0092	1.53	0.0297	1.57
Police headquarters[g]	0.0688	0.58	0.0543	1.04	0.0481	0.91	0.0818	1.50	0.0778	1.40	0.0313	2.48	0.0529	2.36
Local security funds[g]	−0.0064	−1.80	0.0018	1.41	0.0025	1.06	0.0018	1.26	0.0022	0.81	0.0010	1.61	−0.0010	−0.53
Public hospitals[g]	0.0405	0.71	0.0008	0.06	−0.0036	−0.19	−0.0056	−0.41	−0.0093	−0.47	0.0016	0.20	0.0142	1.02
Religious centers[g]	0.0288	0.76	0.0171	1.56	0.0145	0.93	0.0195	1.65	0.0178	1.05	0.0021	0.45	0.0112	1.22
Social welfare centers[g]	0.0266	1.67	0.0084	1.41	0.0054	0.50	0.0110	1.55	0.0091	0.73	−0.0010	−0.40	0.0074	0.97

(*continued*)

Table 3.2 (continued)

Variable	Homicide rate (1st stage)		Ln house price[a]				Ln house price[b]				Ln house rent			
			OLS		2SLS		OLS		2SLS		OLS		2SLS	
	Coefficient	t	Coefficient	t	Coefficient	t	Coefficient	t	Coefficient	t	Coefficient	t	Coefficient	t
Attacks against life[g]	0.0425	0.80	–0.0460	–2.60	–0.0508	–2.24	–0.0606	–3.23	–0.0637	–2.61	–0.0067	–0.72	0.0068	0.45
Brothels[g]	–0.1068	–1.98	0.0024	0.13	0.0133	0.35	0.0148	0.77	0.0215	0.50	–0.0179	–1.64	–0.0515	–1.70
Casinos/places for bets[g]	0.0310	0.53	–0.0034	–0.18	–0.0080	–0.37	–0.0192	–1.02	–0.0232	–1.05	–0.0033	–0.30	0.0066	0.50
Places selling drugs/ narcotics[g]	–0.0593	–1.15	–0.0198	–1.16	–0.0135	–0.53	–0.0207	–1.16	–0.0162	–0.58	–0.0002	–0.02	–0.0187	–1.02
People 10–14 years old[g]	–0.0012	–2.86	–0.0004	–1.73	–0.0002	–0.59	–0.0004	–1.85	–0.0003	–0.69	0.0000	–0.12	–0.0004	–1.13
People 15–19 years old[g]	0.0004	0.67	0.0000	–0.15	–0.0001	–0.28	0.0000	–0.15	–0.0001	–0.25	–0.0004	–2.68	–0.0003	–1.54
People 20–24 years old[g]	0.0000	0.07	–0.0001	–0.46	–0.0001	–0.45	–0.0001	–0.22	–0.0001	–0.21	0.0001	0.58	0.0001	0.67
People 25–29 years old[g]	–0.0005	–1.21	–0.0001	–0.26	0.0000	–0.06	–0.0002	–0.64	–0.0001	–0.41	0.0000	0.43	–0.0001	–0.65
People 30–34 years old[g]	0.0004	1.00	0.0002	0.91	0.0002	0.61	0.0003	1.01	0.0002	0.72	–0.0001	–0.58	0.0001	0.44
People 35–39 years old[g]	0.0000	0.05	–0.0004	–1.62	–0.0004	–1.60	–0.0004	–1.50	–0.0004	–1.50	–0.0001	–1.03	–0.0001	–0.99
People 40–44 years old[g]	0.0010	1.23	0.0004	1.18	0.0003	0.58	0.0004	1.19	0.0003	0.65	0.0003	1.76	0.0006	1.79
People 45–49 years old[g]	–0.0004	–0.44	0.0002	0.51	0.0002	0.59	0.0001	0.34	0.0002	0.42	0.0002	1.42	0.0001	0.59
People 50–54 years old[g]	0.0005	0.52	–0.0001	–0.19	–0.0001	–0.29	0.0000	–0.10	–0.0001	–0.17	0.0000	–0.02	0.0002	0.64
People 55–59 years old[g]	0.0005	0.54	–0.0003	–0.88	–0.0004	–0.94	–0.0002	–0.51	–0.0002	–0.52	–0.0001	–0.44	0.0001	0.20
People 60+ years old[g]	–0.0004	–1.79	0.0005	5.08	0.0005	3.07	0.0005	4.35	0.0005	2.71	0.0001	2.21	0.0000	–0.12
Unsatisfied Basic Needs (NBI): Dependency[g]	–0.0008	–0.33	0.0012	0.94	0.0013	0.96	0.0013	0.96	0.0013	0.95	0.0010	1.79	0.0008	1.20
Accumulation[g]	0.0007	2.27	0.0006	4.44	0.0006	2.11	0.0007	3.95	0.0006	1.98	0.0001	0.74	0.0003	1.35
Dropouts[g]	0.0176	2.32	–0.0022	–0.77	–0.0039	–0.63	–0.0015	–0.50	–0.0025	–0.36	–0.0016	–1.07	0.0040	0.80
Public utility services[g]	0.0006	1.79	–0.0002	–0.81	–0.0002	–0.77	0.0000	–0.14	–0.0001	–0.21	–0.0002	–1.68	0.0000	0.13
Housing in[g]	–0.0001	–0.14	0.0003	1.25	0.0003	1.26	0.0005	1.57	0.0005	1.57	–0.0001	–0.53	–0.0001	–0.70
NBI in Municipality where were born[g]	0.0010	1.60	0.0008	1.85	0.0007	1.43	0.0011	2.24	0.0011	1.81	–0.0006	–2.07	–0.0003	–0.81
NBI in Municipality where were born[g]	0.0353	1.74	0.0468	2.21	0.0431	1.87	0.0531	2.23	0.0507	1.97	0.0155	0.90	0.0260	1.31
Born in urban area	0.0219	1.22	–0.0078	–0.51	–0.0104	–0.61	–0.0067	–0.42	–0.0083	–0.45	–0.0056	–0.48	0.0016	0.12
Household with children	0.0673	2.60												

Age of mother minus age of oldest children	–0.0020	–2.52												
Constant	–2.5129	–1.32	14.2025	19.87	14.4826	13.33	14.4844	18.14	14.6996	12.12	9.3414	23.29	8.5617	10.37
Number of observations	12,120		10,290		10,290		8,435		8,435		12,024		12,024	
R^2	0.557		0.578		0.577		0.586		0.585		0.683		0.683	

Sources: Encuesta de Calidad de Vida 2003, Real State Appraisal of Bogotá, National Police-DIJIN 2000, Paz Pública (2000). Colombian 1993 Population Census.

Notes: All regressions include dummy variable of father's and mother's education levels and their interactions. The t-statistics computed based on robust standard errors corrected by clustering at the census sector level.

[a] Cadastral values if available; otherwise, the value reported by households surveyed.

[b] Only includes households for which cadastral values are available.

[c] Dummy variable equal to one if house, 0 otherwise (apartment, etc.).

[d] Dummy variable equal to one if there have been attacks in census sector by FARC, ELN, or other groups.

[e] A-Theoretical estimation of QoL (see methodology in DNP [1997]).

[f] Centros de Atención Inmediata, CAIS: Centers of Immediate Police Attention.

[g] At the census sector level.

characteristics that make houses more expensive but also increase the probability of the crime in question. On the other hand, some crimes, like homicides or aggravated assaults, take place more often in poor neighborhoods because wealthier households are more likely to have much better security and the security measures (not always observed) should be already capitalized in house values and rents.

We estimate equation (1) interacting the crime variables included in table 3.2 with the socioeconomic strata. Since households differ from one another according to the socioeconomic strata in which they are located, we expect to take into account these differences and thus attenuate the omitted bias problem.[12] Households differ not only in material well-being but also in their perceptions about crime and safety. Results are presented in table 3.3 for the crime-related variables. Once we include the interactions, the *object* theft rate reveals a pattern of negative capitalization as one moves from the lower to the higher strata. The higher the stratum, the higher the negative effect of theft upon house values. Other variables (assaults, residential and commercial assaults, and attacks by FARC, ELN, and other groups) show no discernable relationship to house or rent values.

As shown in table 3.2, households who report that they feel safe in their neighborhoods pay less rent for their houses. This finding is replicated once interactions are included, especially for the higher strata. This result should be interpreted cautiously, however, because it might be conditioned by differences of perception between the wealthier and the poorer households: if the wealthier homes are located in safer neighborhoods and yet their owners feel more unsafe than the poorer do, the coefficient would be capturing these differences in perception rather than the effect of greater security on capitalized house values.

The variable that measures the number of Centers of Immediate Attention (CAIs)—an indicator of police presence—which previously appeared positively related to house rents but not to house values, become positively and significantly related to house values when interactions are included in the specification.

Even though we already possess a formidable amount of data for control purposes, we are well aware of the desirability of obtaining a much more complete database, one with longitudinal information on which we could exploit the dramatic decrease in the homicide rate that took place during

12. The variables "Cadastral"; "You feel safe in Neighborhood"; "Land use"; "Attacks of FARC, ELN, or other groups"; "Number of medical centers"; "Number of private hospitals"; "Number of police headquarters"; "Number of local security funds"; "Number of public hospitals"; "Number of religious centers"; "Number of social welfare centers"; "Number of cultural centers"; "Number of prisons"; "Number of attacks against life"; "Number of attacks against wealth"; "Number of bars"; "Number of brothels"; "Number of casinos/places for bets"; "Number of places selling drugs/narcotics"; "Number of people by age range"; and the dummy variables of father's and mother's education levels and their interactions, are not interacted with the socioeconomic strata.

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Table 3.3 **Hedonic regression for Bogotá (Instrument: Age difference between mother and oldest child)**

Variable	Homicide rate (1st stage)		Ln house price[a]				Ln house price[b]				Ln house rent			
			OLS		2SLS		OLS		2SLS		OLS		2SLS	
	Coefficient	*t*	Coefficient	*t*	Coefficient	*t*	Coefficient	*t*	Coefficient	*t*	Coefficient	*t*	Coefficient	*t*
Cadastral value	0.0146	0.69	–0.1135	–5.54	–0.1147	–5.51					–0.0232	–2.15	–0.0221	–1.95
You feel safe in your neighborhood	–0.0250	–0.68	0.0541	1.21	0.0565	1.23	0.0433	0.87	0.0423	0.83	–0.0095	–0.35	–0.0130	–0.47
[c]Stratum 2	–0.0277	–0.73	–0.0411	–0.80	–0.0361	–0.70	–0.0167	–0.30	–0.0177	–0.31	–0.0181	–0.54	–0.0215	–0.62
[c]Stratum 3	–0.0398	–0.97	–0.0629	–1.32	–0.0686	–1.39	–0.0632	–1.20	–0.0780	–1.41	–0.0160	–0.53	–0.0186	–0.58
[c]Stratum 4	–0.0022	–0.04	–0.0732	–1.48	–0.0749	–1.50	–0.0637	–1.15	–0.0714	–1.27	–0.0256	–0.67	–0.0281	0.74
[c]Stratum 5	0.0538	1.23	–0.1112	–1.57	–0.1088	–1.47	–0.1210	–1.77	–0.1122	–1.53	0.0382	0.82	0.0439	0.90
[c]Stratum 6	0.0430	0.95	–0.0809	–0.91	–0.0618	–0.71	–0.0738	–1.12	–0.0510	–0.75	–0.0867	–1.50	–0.0755	–1.27
Objects theft rate	[g]–0.5349	–3.57	0.0891	1.02	0.0910	0.39	0.0669	0.69	–0.0311	–0.12	–0.0695	–1.77	–0.1229	–0.72
[c]Stratum 2	0.5236	1.73	–0.0541	–0.34	–0.0744	–0.29	–0.0198	–0.12	0.0507	0.18	0.0202	0.31	0.0733	0.43
[c]Stratum 3	0.4175	1.75	–0.0645	–0.72	–0.0738	–0.38	–0.0440	–0.44	0.0225	0.10	0.0545	1.36	0.0950	0.70
[c]Stratum 4	0.5246	3.38	–0.1225	–1.36	–0.1245	–0.54	–0.1114	–1.13	–0.0083	–0.03	0.0677	1.56	0.1174	0.69
[c]Stratum 5	0.5335	3.23	–0.1667	–1.56	–0.1688	–0.72	–0.1063	–0.93	–0.0058	–0.02	0.0608	1.15	0.1131	0.65
[c]Stratum 6	0.4705	4.06	–0.1566	–1.72	–0.0905	–0.43	–0.0364	–0.32	0.0016	0.01	0.0074	0.16	0.0927	0.60
Assaults rate	[g]0.0332	1.65	–0.0174	–0.93	–0.0211	–0.93	–0.0120	–0.59	–0.0119	–0.47	0.0061	0.75	0.0102	0.74
[c]Stratum 2	0.0141	0.23	0.0106	0.39	0.0025	0.09	–0.0006	–0.02	–0.0055	–0.20	0.0029	0.29	0.0066	0.53
[c]Stratum 3	0.1020	2.70	–0.0135	–0.67	0.0006	0.01	–0.0196	–0.86	0.0173	0.34	–0.0111	–1.22	–0.0019	–0.06
[c]Stratum 4	–0.0150	–0.45	0.0021	0.10	0.0069	0.33	–0.0188	–0.82	–0.0146	–0.63	–0.0119	–0.95	–0.0161	–1.18
[c]Stratum 5	–0.0152	–0.45	0.0035	0.13	0.0079	0.33	0.0210	0.80	0.0280	1.09	0.0045	0.26	0.0000	0.00
[c]Stratum 6	–0.0367	–1.28	0.0023	0.10	0.0109	0.41	0.0131	0.54	–0.0013	–0.04	–0.0033	–0.22	–0.0050	–0.23
Residential and commercial assault rate	[g]0.2908	5.96	0.0358	0.58	–0.0194	–0.13	0.0262	0.41	0.0210	0.13	–0.0093	–0.53	0.0253	0.27
[c]Stratum 2	0.0164	0.16	0.0414	0.60	0.0134	0.13	0.0478	0.68	0.0217	0.20	0.0239	0.94	0.0372	0.91
[c]Stratum 3	–0.2549	–3.18	–0.0275	–0.44	0.0297	0.22	–0.0094	–0.15	0.0060	0.04	0.0202	1.06	–0.0111	–0.13
[c]Stratum 4	–0.2107	–4.12	0.0156	0.26	0.0706	0.59	0.0420	0.67	0.0700	0.54	0.0254	1.29	–0.0049	–0.07
[c]Stratum 5	–0.2774	–5.14	0.0192	0.28	0.0775	0.54	0.0011	0.02	0.0109	0.07	–0.0052	–0.21	–0.0385	–0.42
[c]Stratum 6	–0.2890	–4.29	–0.0487	–0.69	–0.1159	–0.76	–0.0803	–0.90	–0.0716	–0.42	0.0287	0.82	–0.0647	–0.63
Cars theft rate	[g]–0.0655	–3.14	–0.0006	–0.04	0.0202	0.54	0.0109	0.47	0.0225	0.56	0.0125	1.32	0.0036	0.15
[c]Stratum 2	–0.1964	–2.94	–0.0398	–1.09	0.0060	0.07	–0.0453	–1.13	–0.0331	–0.35	–0.0184	–0.98	–0.0497	–0.77
[c]Stratum 3	–0.0098	–0.27	0.0083	0.43	–0.0189	–0.68	–0.0083	–0.34	–0.0413	–1.44	–0.0084	–0.83	–0.0067	–0.46
[c]Stratum 4	0.0229	0.72	–0.0003	–0.01	–0.0218	–0.76	–0.0042	–0.16	–0.0275	–0.91	–0.0155	–1.20	–0.0088	–0.52
[c]Stratum 5	0.0048	0.08	–0.0094	–0.30	–0.0348	–1.05	–0.0437	–1.26	–0.0735	–2.08	–0.0028	–0.14	0.0017	0.08
[c]Stratum 6	0.1320	2.77	0.0602	2.12	0.1769	2.31	0.0359	0.97	0.1053	1.29	–0.0334	–1.43	0.0422	0.77
Homicide rate	[g]		–0.1541	–2.57	0.0261	0.06	–0.1335	–1.93	–0.1050	–0.21	0.0061	0.20	–0.1157	–0.36
[c]Stratum 2			0.1281	1.71	0.1469	0.64	0.1141	1.34	0.1106	0.44	0.0160	0.47	–0.0054	–0.06
[c]Stratum 3			0.1249	1.99	–0.1129	–0.65	0.1084	1.53	–0.1752	–0.92	–0.0198	–0.63	0.0031	0.04
[c]Stratum 4			0.0452	0.47	–0.1160	–0.58	0.0422	0.40	–0.2800	–1.33	–0.0395	–0.76	0.0517	0.51
[c]Stratum 5			–0.1817	–0.85	–0.4501	–2.14	–0.1569	–0.76	–0.3674	–1.60	–0.0673	–0.37	–0.0956	–0.55
[c]Stratum 6			0.7461	2.64	–1.1070	–2.63	0.0634	0.19	–0.7913	–1.91	0.9072	4.25	0.2016	0.78

(continued)

Table 3.3 (continued)

Variable	Homicide rate (1st stage) Coefficient	t	Ln house price[a] OLS Coefficient	t	Ln house price[a] 2SLS Coefficient	t	Ln house price[b] OLS Coefficient	t	Ln house price[b] 2SLS Coefficient	t	Ln house rent OLS Coefficient	t	Ln house rent 2SLS Coefficient	t
Attacks of FARC, ELN, or other groups[d]	[g]–0.0443	–0.60	–0.0064	–0.19	–0.0027	–0.07	0.0175	0.46	0.0098	0.23	–0.0171	–0.85	–0.0213	–0.89
Number of CAIS[f]	0.0528	0.33	–0.1519	–1.88	–0.1384	–1.57	–0.1614	–1.42	–0.0931	–0.73	0.0093	0.18	0.0151	0.28
[c]Stratum 2	0.0052	0.03	0.1831	2.06	0.1647	1.74	0.1965	1.61	0.1349	1.00	0.0204	0.38	0.0222	0.40
[c]Stratum 3	–0.0588	–0.34	0.1732	2.12	0.1607	1.80	0.1784	1.56	0.1093	0.85	0.0024	0.04	–0.0042	–0.07
[c]Stratum 4	–0.1729	–0.91	0.1726	1.94	0.1558	1.32	0.1852	1.53	0.0799	0.54	–0.0128	–0.22	–0.0235	–0.31
[c]Stratum 5	–0.0201	–0.11	0.1765	1.83	0.1676	1.77	0.1629	1.29	0.0923	0.68	–0.0201	–0.33	–0.0136	–0.22
[c]Stratum 6	–0.0615	–0.35	0.3128	3.46	0.3226	3.29	0.2461	1.79	0.1667	1.15	0.0995	1.61	0.1040	1.68
Number of police headquarters	[g]0.0661	0.61	0.0731	1.54	0.0793	1.51	0.0896	1.57	0.1153	1.85	0.0380	2.99	0.0363	1.43
Number of local security funds	[g]–0.0037	–1.05	0.0019	1.42	0.0016	0.85	0.0023	1.50	0.0013	0.60	0.0007	1.06	0.0003	0.19
Number of prisons	[g]0.2143	0.80	0.0230	0.82	0.0165	0.18	0.0246	0.73	0.0734	0.73	0.0060	0.28	0.0221	0.31
Number of attacks against life	[g]–0.0041	0.08	–0.0332	–1.95	–0.0349	–2.02	–0.0569	–2.99	–0.0576	–2.98	–0.0076	–0.81	–0.0068	–0.73
Number of attacks against wealth	[g]0.0954	1.63	0.0195	1.20	0.0177	0.43	0.0294	1.62	0.0469	1.02	0.0031	0.37	0.0125	0.41
Number of bars	[g]–0.0093	–0.15	0.0070	0.45	0.0070	0.44	0.0043	0.26	0.0037	0.22	0.0143	1.77	0.0136	1.57
Number of brothels	[g]–0.0817	–1.57	0.0060	0.34	0.0069	0.20	0.0185	0.99	0.0013	0.03	–0.0117	–1.13	–0.0205	–0.78
Number of casinos/ places for bets	[g]0.0431	0.70	0.0017	0.09	–0.0042	–0.17	–0.0149	–0.73	–0.0121	–0.45	–0.0061	–0.58	–0.0010	–0.07
Number of places selling drugs/narcotics	[g]–0.0512	–1.09	–0.0330	–2.00	–0.0366	–1.35	–0.0354	–2.03	–0.0487	–1.66	0.0002	0.02	–0.0046	–0.25
Age of mother minus age of oldest child	–0.0017	–2.32												
Constant	4.9914	1.56	13.2273	7.40	12.5977	4.33	13.7531	5.92	14.2756	4.08	9.0278	7.60	9.6076	5.08
Number of observations	12,120		10,290		10,290		8,435		8,435		12,024		12,024	
R^2	0.6314		0.6361		0.6357		0.6508		0.6510		0.7017		0.7012	

Sources: Encuesta de Calidad de Vida 2003, Real State Appraisal of Bogotá, National Police-DIJIN 2000, Paz Pública (2000). Colombian 1993 Population Census.

Notes: All regressions include dummy variable of father's and mother's education levels and their interactions. The *t*-statistics are computed based on robust standard errors corrected by clustering at the census sector level.

[a]Cadastral values if available; otherwise, the value reported by households surveyed.

[b]Only includes households for which cadastral values are available.

[c]Dummy variable equal to one if house, 0 otherwise (apartment, etc.).

[d]Attack by guerrilla groups FARC, ELN, or other groups.

[e]A-Theoretical estimation of QoL (See methodology in DNP [1997]).

[f]Centros de Atención Inmediata, CAIS: Centers of Immediate Police Attention.

[g]At the census sector level.

our period of study, and that could allow us to control for time invariant characteristics. In order to account for the endogeneity of our crime variable, we now proceed to present an instrumental variable strategy.

3.4.1 Instrumenting the Crime Rate

In this section, we attempt to identify the capitalization effect of crime on house values and rents by using an instrumental variable approach. As always, finding a good instrument is the key aspect of this approach. In this case, we need a variable that (a) affects the decision of the household to live in a neighborhood with a determined crime rate, and (b) does not affect the value or rent of the house in a direct fashion.

We use as instruments two variables related to the likelihood that the household head (or his spouse) is a teenage mother. Our instrument choice is based on the following rationale: (a) children of teenage mothers are more likely to become criminals; (b) households harboring a teenage mother are more likely to live in neighborhoods with high crime and homicide rates; and (c) house values are not directly affected by teenage mother residence. If the previous rationale is true, then we can argue that our instrument is related to crime or homicide rates but not to the house value or rent.

The first element of our reasoning, namely that children of teenage mothers are more likely to become criminals, is supported by a wealth of evidence. For example, Krug et al. (2002) enumerated, among the many factors associated with violence in youths, the influence of families. These authors enumerate, in turn, parental conflict in early childhood and poor attachment between parents and children among the relevant family variables.[13] Households headed by teenage mothers are likely to be characterized by a family environment that includes all said factors. Furthermore, Krug et al. (2002) mention "a mother who had her first child at an early age" and "a low level of family cohesion" as important risk factors. In the same vein, Donohue and Levitt (2000) provide indirect evidence, for the United States, to the effect that children being born out of unwanted pregnancies are more likely to become criminals, and in particular, violent offenders. Hunt (2003) provides evidence, also for the United States, that children of teenagers are more likely to commit assaults later in their lives.

If children of teenage mothers are more likely to become criminals and their households are more likely to be poor, then it seems reasonable to expect that these households will sort themselves out in neighborhoods where youth crime is high. These high levels of crime tend to reinforce themselves through social interactions (another risk factor cited by Krug et al. 2002). Again, teenage mothers are more likely to inhabit a neighborhood

13. Other studies supporting the relationship between teenage motherhood and their children's likelihood to commit crime in the future are Farrington (1998), Morash (1989), and Nagin, Pogarsky, and Farrington (1997).

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with high crime and homicide rates. Of course, one could argue that teenage motherhood is related to socioeconomic level. But the point is that teen pregnancies should be related to violent crime rates even after controlling for several socioeconomic status variables.

As proxy variables for teenage mothers in a household or neighborhood, we use the difference between the age of the spouse of the household (or alternatively the age of the head where the household is female-headed) and her oldest coresiding child. This variable is equal to the age of the woman at the time of her first childbearing, when all the children live in their respective households at the moment of the survey; otherwise, the variable in question would be an upper bound of the age at each woman's first childbearing. We also use the share of mothers between age thirteen and nineteen in all populations of that age range in their respective census sector population.[14]

Figure 3.4 shows the distribution of the variables we use as instruments. Nearly 13 percent of households have a child that was born when his or her mother was between thirteen and nineteen years old. The median of the share of young mothers is 0.07, and about 14 percent of young women are mothers. The average age difference between the mother and the oldest children at home is twenty-five, conditional on having at least one child at home; the unconditional mean is 17 (see table 3.1).

Map 3.3 shows the quintiles of the homicide rate, and of the proxy variables used as instruments: the age difference between the oldest child and his or her mother, and the share of teenage mothers in the relevant census sector (quintiles are also used). As expected, the age difference variable is negatively correlated to the share of teenage mothers in the census sector. There is a high spatial correlation between the age difference and the share of teenage mothers in the census sector, and between these two variables and the quintiles of the homicide rate.

To assess the existence of spatial correlation we compute local Moran I_i estimates by census sector for the three variables shown in map 3.3.[15] When

14. Note that if women were exactly half the population in each census sector, the share of mothers between age thirteen and nineteen on total number of women in that age range would be twice as large.

15. The *local Moran index* is used to identify spatial clusters and it is defined as

$$I_i = \frac{Z_i}{\Sigma_i Z_i^2/N} \sum_{j \in j_i} W_{ij} Z_{i}.$$

Where $Z = [I - E(I)]/[V(I)]1/2 \sim N(0,1)$, and is the *Moran index*

$$I = \frac{N}{S_0} \frac{\Sigma_{ij}^N W_{ij}(x_i - \bar{x})(x_j - \bar{x})}{\Sigma_{i=1}^N (x_i - \bar{x})^2},$$

where x_i is the variable of interest on which we are interested to test spatial correlation, W_{ij} is a matrix of weights, and $S_0 = \Sigma_i \Sigma_j W_{ij}$. Matrix W will be defined depending of the variable of interest, using immediate neighbors with their respective neighbors. Positive (negative) values of the I_i index imply the existence of similar (different) values of the phenomenon of interest around area *i*.

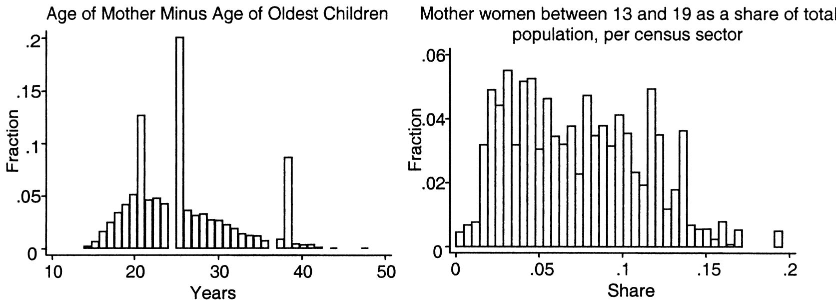
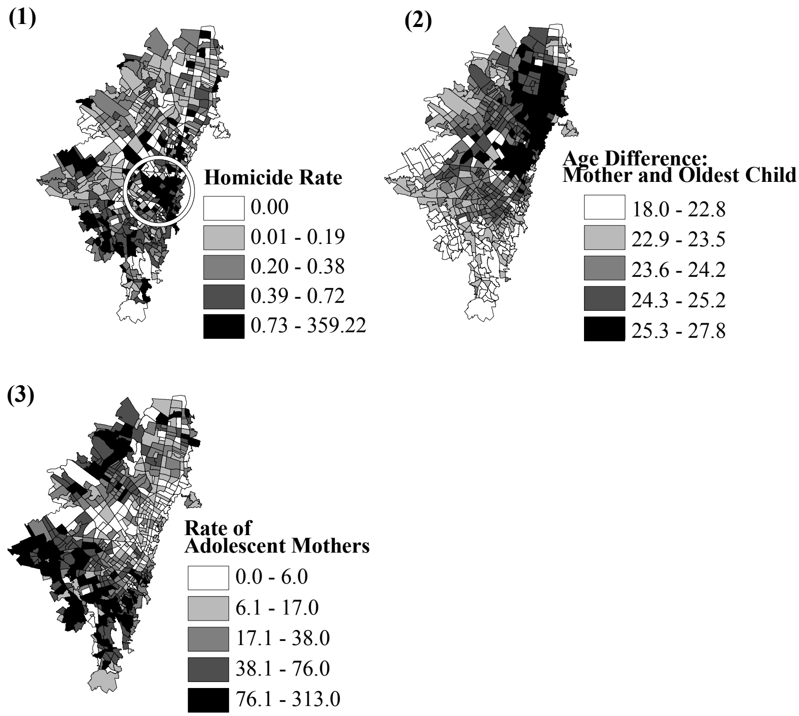


Fig. 3.4 Relative frequencies of instrumental variables



Map 3.3 Quintiles of key variables at the census sector level

constructing the local Moran estimates, we compare the homicide rates at each census sector with those of its neighbors and with those of the neighbors of its neighbors.[16]

According to the results (not reported), there are only a few clusters with high homicide rates in the city, most of them located in downtown Bogotá

16. See Ansellin (1988) and Moran (1948).

(around the circled area shown in map 3.3). On the other hand, we find that there is a wide area in the north of the city that exhibits a very low homicide rate. Finally, we find evidence that allows us to confirm that the southern part of the city is characterized by clusters of women having children at a much younger age and also by a high incidence of teen pregnancies. The opposite is true for the northeastern area of the city.

We also assess the spatial covariance between our instrumental variables and the homicide rate at the census sector level. Our results (not reported) show that our instrumental variables are significantly correlated to the homicide rate in the south and northeast of the city. Results at the northeast of the city are evident: we find clusters of low homicide rates with high (low) age differences (share of teen mothers), meaning that the homicide rate is negatively (positively) spatially correlated to our first (second) instrument. At the south of the city, we find some clusters of higher homicide rates with low (high) age differences (share of teen mothers), meaning that the homicide rate is spatially correlated to our instruments in some census sectors.

The global spatial autocorrelation is 0.044 (p-value: 0.0302) between the share of teen mothers and the homicide rate, and –0.0254 (p-value: 0.2101) between the age difference and the homicide rate.[17] Finally, it is worth stressing that our choice of instruments is based on the assumption that individuals commit a good part of their crimes in the neighborhoods where they live (i.e., we assume that in a particular neighborhood the residence of criminals is associated with the incidence of crimes).

In short, we find that, in the city of Bogotá, our instrumental variables are spatially correlated with the homicide rate. Since households are spatially segregated according to these variables, we expect them to be correlated with the homicide rate in the census sector. On the other hand, we do not expect the instruments to affect house values directly, since they constitute neither relevant house characteristics nor amenities people care about when deciding where to live. In other words, we assume that the teenage pregnancies in the neighborhood are not likely to be capitalized into house values or rents.

Tables 3.2 and 3.3 present the results of the instrumental variables estimation. Table 3.2 presents the estimation results of a specification that does not incorporate interactions, whereas table 3.3 presents the results of a specification that incorporates interactions between the crime variables and the strata. We will focus on table 3.3. The first column presents the first stage results. These results indicate that our instrument (the age difference) is

17. Our $W(\bullet)$ is built using the closest neighbors and their closest neighbors. Results for the share of teen mothers are very robust to the $W(\bullet)$ chosen, although those for the age difference are more sensible. When we perform simple averages among the four closest neighbors the spatial correlations become –0.0526 (p-value: 0.0132) and –0.0310 (p-value: 0.1375) for the spatial correlations between the homicide rate and the share of teen mothers and age difference variables, respectively.

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statistically significant, and has the expected negative sign. When we use the combination of cadastral and rental values as the dependent variable, we find that the coefficient of the interactions between the homicide rate and strata 3 and 6 are positive in the OLS regression, whereas the coefficients of the interactions between the homicide rate and strata 5 and 6 are significant and negative in the IV regression. When we use only cadastral data as the dependent variable, we find that the coefficient of the interaction between the homicide rate and stratum 6 becomes significant, and negative. When rental values are used, the results are more erratic, and neither of the interactions is significant in the IV regression.

Table 3.4 summarizes the results of the IV estimations. The upper panel of table 3.4 shows that the elasticity of house values to the homicide rate for houses located in socioeconomic stratum 6 is about –0.90 percent. Put differently, if the homicide rate in stratum 6 were to increase by one standard deviation—an increase of 7.3 times the mean value—house values would fall between 5.8 percent and 7.0 percent. In the case of stratum 5, the elasticity is between –0.23 percent and –0.26 percent, which implies a decrease of between 2.3 percent and 2.5 percent in the value of the house if homicides increase by one standard deviation.

The other crime variables (common theft, assaults, residential and commercial assault rates, attacks by guerilla groups, and attacks against wealth) are not significant in the IV estimation. The car theft variable is negative and significant only for its interaction with stratum 5. Finally, "attempts on a person's life" is negative and statistically significant in almost all specifications.

Finally, table 3.5 presents the results of instrumenting the homicide rate with the share of teenage mothers in the census sector. The first column presents the first stage results, and the other columns the second stage results. The first column shows that the instrument variable is statistically significant, and has the expected positive sign.

Turning now to the effects of the homicide rate on property values, we find that in the IV regression the coefficients of the interactions between the homicide rate and strata 5 and 6 are significant, and negative, when we use either house value. When we use only cadastral values, the coefficients of the interactions with strata 3 to 6 are all significant.

The IV results imply that the elasticity of the house value to homicide rate in socioeconomic stratum 6 is between –0.8 percent and –0.95 percent. That is, if the homicide rate in stratum 6 were to increase by one standard deviation, house values would fall between 5.8 percent and 6.9 percent. In the case of strata 3, 4, and 5, the elasticites are –6.9 percent, –0.72 percent, and –0.26 percent, respectively, which imply a fall of 13.5 percent, 4.4 percent, and 2.5 percent in house values after an increase of one standard deviation in homicide rates. Moving a household formerly living in a particular stratum, from an average neighborhood in that stratum, to one with a homicide

Table 3.4 **Summary results of the effects of the homicide rate on house values**

	Instrument: Age difference					
Variable	Coefficient	Elasticity	D homicide rate (1st dev)/Homicide rate	D House value/ house value	D House value/monthly hhold per capita income	Amount (USD)[a]
Results with house values coming from cadastral or self-reported data						
Homicide rate	0.02608	0.0104	1.31	0.014	1.15	112
Homicide rate interacted with:						
Stratum 5	–0.45010	–0.0023	9.81	–0.023	–1.49	–1,015
Stratum 6	–1.10701	–0.0096	7.29	–0.070	–3.35	–4,884
Results with house values coming only from cadastral data						
Homicide rate	–0.10497	–0.0420	1.31	–0.055	–4.67	–456
Homicide rate interacted with:						
Stratum 5	–0.36745	–0.0026	9.81	–0.025	–1.59	–1,086
Stratum 6	–0.79130	–0.0080	7.29	–0.058	–2.55	–3,714

Instrument: Share of teenage mothers						
Results with house values coming from cadastral or self reported data						
Homicide rate	0.11250	0.0450	1.31	0.059	4.96	484
Homicide rate interacted with:						
Stratum 3	–0.25556	–0.0354	1.95	–0.069	–7.70	–1,280
Stratum 4	–0.17383	–0.0011	6.19	–0.007	–0.48	–199
Stratum 5	–0.64121	–0.0029	9.81	–0.028	–1.85	–1,266
Stratum 6	–1.17334	–0.0095	7.29	–0.069	–3.29	–4,793
Results with house values coming only from cadastral data						
Homicide rate	–0.10497	–0.0420	1.31	–0.055	–4.63	–452
Homicide rate interacted with:						
Stratum 3	–0.17516	–0.0693	1.95	–0.135	–15.08	–2,507
Stratum 4	–0.28005	–0.0072	6.19	–0.044	–3.02	–1,248
Stratum 5	–0.36745	–0.0026	9.81	–0.025	–1.66	–1,131
Stratum 6	–0.79130	–0.0080	7.29	–0.058	–2.78	–4,049

[a]The amount is a once and for all change in the house value due to moving from an average neighborhood to one with a homicide rate one standard deviation higher. The dollar amount estimated was based on the exchange rate in December 2003 ($2,778.2/USD).

Table 3.5 **Hedonic regression for Bogotá (Instrument: Share of teenage mothers in census sector)**

			Ln house price[a]				Ln house price[b]				Ln house rent			
	Homicide rate		OLS		2SLS		OLS		2SLS		OLS		2SLS	
Variable	Coefficient	*t*	Coefficient	*t*	Coefficient	*t*	Coefficient	*t*	Coefficient	*t*	Coefficient	*t*	Coefficient	*t*
Cadastral value	0.0152	0.73	–0.114	–5.54	–0.112	–5.40					–0.0232	–2.15	–0.0234	–2.17
You feel safe in your neighborhood	–0.022	–0.55	0.054	1.21	0.057	1.29	0.043	0.87	0.042	0.85	–0.009	–0.35	–0.007	–0.26
[c]Stratum 2	–0.020	–0.49	–0.041	–0.80	–0.040	–0.79	–0.017	–0.30	–0.011	–0.19	–0.018	–0.54	–0.020	–0.59
[c]Stratum 3	–0.038	–0.85	–0.063	–1.32	–0.072	–1.52	–0.063	–1.20	–0.068	–1.29	–0.016	–0.53	–0.017	–0.57
[c]Stratum 4	–0.0003	–0.01	–0.073	–1.48	–0.074	–1.51	–0.064	–1.15	–0.065	–1.17	0.026	0.67	0.025	0.67
[c]Stratum 5	0.048	1.01	–0.111	–1.57	–0.109	–1.57	–0.121	–1.77	–0.118	–1.71	0.038	0.82	0.035	0.75
[c]Stratum 6	0.042	0.86	–0.081	–0.91	–0.062	–0.72	–0.074	–1.12	–0.048	–0.74	–0.087	–1.50	–0.084	–1.45
Objects theft rate	[g]–0.542	–3.53	0.089	1.02	0.109	0.88	0.067	0.69	0.103	0.78	–0.069	–1.77	–0.059	–0.98
[c]Stratum 2	0.661	2.15	–0.054	–0.34	–0.084	–0.46	–0.020	–0.12	–0.074	–0.39	0.020	0.31	0.009	0.11
[c]Stratum 3	0.432	1.83	–0.065	–0.72	–0.096	–0.83	–0.044	–0.44	–0.093	–0.74	0.054	1.36	0.044	0.80
[c]Stratum 4	0.539	3.41	–0.123	–1.36	–0.145	–1.16	–0.111	–1.13	–0.142	–1.06	0.068	1.56	0.054	0.88
[c]Stratum 5	0.552	3.30	–0.167	–1.56	–0.188	–1.41	–0.106	–0.93	–0.142	–1.01	0.061	1.15	0.048	0.71
[c]Stratum 6	0.503	4.09	–0.157	–1.72	–0.106	–0.87	–0.036	–0.32	–0.135	–0.95	0.007	0.16	0.035	0.53
Assaults rate	[g]0.031	1.37	–0.017	–0.93	–0.027	–1.61	–0.012	–0.59	–0.025	–1.34	0.006	0.75	0.004	0.39
[c]Stratum 2	0.027	0.49	0.011	0.39	0.014	0.56	–0.001	–0.02	0.002	0.08	0.003	0.29	0.004	0.34
[c]Stratum 3	0.094	2.53	–0.014	–0.67	0.014	0.56	–0.020	–0.86	0.010	0.38	–0.011	–1.22	–0.010	–0.78
[c]Stratum 4	–0.014	–0.42	0.002	0.10	0.012	0.61	–0.019	–0.82	–0.007	–0.33	–0.012	–0.95	–0.012	–0.92
[c]Stratum 5	–0.018	–0.53	0.003	0.13	0.009	0.42	0.021	0.80	0.030	1.30	0.005	0.26	0.003	0.16
[c]Stratum 6	–0.031	–1.06	0.002	0.10	0.018	0.80	0.013	0.54	0.010	0.43	–0.003	–0.22	0.002	0.09
Residential and commercial assault rate	[g]0.298	5.20	0.036	0.58	–0.049	–0.53	0.026	0.41	–0.084	–0.90	–0.009	–0.53	–0.016	–0.49
[c]Stratum 2	–0.0397	–0.40	0.041	0.60	0.081	0.80	0.048	0.68	0.097	0.94	0.024	0.94	0.017	0.48
[c]Stratum 3	–0.258	–3.04	–0.027	–0.44	0.061	0.68	–0.009	–0.15	0.105	1.17	0.020	1.06	0.026	0.83
[c]Stratum 4	–0.213	–3.71	0.016	0.26	0.099	1.19	0.042	0.67	0.160	1.88	0.025	1.29	0.027	0.88
[c]Stratum 5	–0.300	–4.91	0.019	0.28	0.108	1.15	0.001	0.02	0.116	1.23	–0.005	–0.21	0.002	0.07
[c]Stratum 6	–0.319	–4.34	–0.049	–0.69	–0.087	–0.86	–0.080	–0.90	0.040	0.36	0.029	0.82	–0.022	–0.42
Cars theft rate	[g]–0.072	–3.03	–0.001	–0.04	0.033	1.32	0.011	0.47	0.054	2.12	0.013	1.32	0.013	1.05
[c]Stratum 2	–0.207	–3.12	–0.040	–1.09	–0.038	–0.61	–0.045	–1.13	–0.037	–0.59	–0.018	–0.98	–0.009	–0.29
[c]Stratum 3	0.003	0.08	0.008	0.43	–0.036	–1.42	–0.008	–0.34	–0.061	–2.36	–0.008	–0.83	–0.008	–0.67
[c]Stratum 4	0.024	0.75	0.000	–0.01	–0.034	–1.36	–0.004	–0.16	–0.049	–1.93	–0.016	–1.20	–0.013	–0.92
[c]Stratum 5	0.017	0.28	–0.009	–0.30	–0.044	–1.44	–0.044	–1.26	–0.089	–2.76	–0.003	–0.14	0.000	0.02
[c]Stratum 6	0.149	3.18	0.060	2.12	0.162	2.77	0.036	0.97	0.073	1.32	–0.033	–1.43	0.024	0.66

Homicide rate	[g]		–0.154	–2.57	0.112	0.60	–0.134	–1.93	0.238	1.16	0.006	0.20	0.041	0.43
[c]Stratum 2			0.128	1.71	–0.044	–0.22	0.114	1.34	–0.119	–0.53	0.016	0.47	0.019	0.23
[c]Stratum 3			0.125	1.99	–0.256	–1.72	0.108	1.53	–0.373	–2.23	–0.020	–0.63	–0.042	–0.60
[c]Stratum 4			0.045	0.47	–0.174	–0.98	0.042	0.40	–0.415	–2.18	–0.039	–0.76	0.016	0.17
[c]Stratum 5			–0.182	–0.85	–0.641	–3.22	–0.157	–0.76	–0.648	–2.84	–0.067	–0.37	–0.178	–1.00
[c]Stratum 6			0.746	2.64	–1.173	–2.73	0.063	0.19	–1.174	–2.67	0.907	4.25	0.178	0.71
Attacks of FARC, ELN, or other groups	[g]–0.016	–0.21	–0.0064	–0.19	–0.0042	–0.12	0.0175	0.46	0.0184	0.47	–0.0171	–0.85	–0.0137	–0.68
Number of CAIS[f]	0.019	0.11	–0.1519	–1.88	–0.1408	–1.55	–0.1614	–1.42	–0.0760	–0.53	0.0093	0.18	–0.0121	–0.23
[c]Stratum 2	0.027	0.16	0.1831	2.06	0.1715	1.74	0.1965	1.61	0.1098	0.74	0.0204	0.38	0.0409	0.77
[c]Stratum 3	–0.039	–0.21	0.1732	2.12	0.1628	1.78	0.1784	1.56	0.0927	0.64	0.0024	0.04	0.0241	0.46
[c]Stratum 4	–0.141	–0.70	0.1726	1.94	0.1621	1.61	0.1852	1.53	0.0882	0.59	–0.0128	–0.22	0.0184	0.32
[c]Stratum 5	0.039	0.20	0.1765	1.83	0.1859	1.88	0.1629	1.29	0.0907	0.61	–0.0201	–0.33	0.0157	0.25
[c]Stratum 6	0.009	0.05	0.3128	3.46	0.3217	3.21	0.2461	1.79	0.1377	0.87	0.0995	1.61	0.1316	2.24
Number of police headquarters	[g]0.047	0.48	0.0731	1.54	0.0768	1.70	0.0896	1.57	0.1017	1.88	0.0380	2.99	0.0275	1.84
Local security funds	[g]–0.004	–1.01	0.0019	1.42	0.0014	0.97	0.0023	1.50	0.0018	1.16	0.0007	1.06	0.0007	0.97
Prisons	[g]0.213	0.79	0.0230	0.82	0.0238	0.51	0.0246	0.73	0.0405	0.82	0.0060	0.28	–0.0042	–0.15
Attacks against life	[g]0.002	0.03	–0.0332	–1.95	–0.0335	–1.93	–0.0569	–2.99	–0.0572	–2.96	–0.0076	–0.81	–0.0079	–0.85
Attacks against wealth	[g]0.089	1.50	0.0195	1.20	0.0200	0.93	0.0294	1.62	0.0291	1.26	0.0031	0.37	0.0015	0.14
Bars	[g]0.003	0.04	0.0070	0.45	0.0091	0.59	0.0043	0.26	0.0079	0.48	0.0143	1.77	0.0150	1.82
Brothels	[g]–0.083	–1.60	0.0060	0.34	0.0014	0.06	0.0185	0.99	0.0123	0.50	–0.0117	–1.13	–0.0107	–0.86
Casinos/places for bets	[g]0.043	0.72	0.0017	0.09	–0.0033	–0.16	–0.0149	–0.73	–0.0205	–0.96	–0.0061	–0.58	–0.0078	–0.71
Places selling drugs/ narcotics	[g]–0.050	–1.09	–0.0330	–2.00	–0.0393	–2.38	–0.0354	–2.03	–0.0408	–2.39	0.0002	0.02	0.0008	0.08
Share of teenage mothers in census sector	5.892	2.43												
Constant	5.725	1.44	13.2273	7.40	12.1418	5.68	13.7531	5.92	12.2925	4.59	8.9398	7.32	9.5284	7.17
Number of observations	12,111		10,290		10,281		8,435		8,428		12,024		12,015	
R^2	0.6382		0.6361		0.6348		0.6508		0.6499		0.7017		0.7011	

Sources: Encuesta de Calidad de Vida 2003, Real State Appraisal of Bogotá, National Police-DIJIN 2000, Paz Pública (2000). Colombian 1993 Population Census.

Notes: All regressions include dummy variable of father and mother's education levels and their interactions. The t-statistics are computed based on robust standard errors corrected by clustering at the census sector level.

[a]Cadastral values if available; otherwise, the value reported by households surveyed.

[b]Only includes households for which cadastral values are available.

[c]Dummy variable equal to one if house, zero otherwise (apartment, etc.).

[d]Attacks by guerrilla groups FARC, ELN, or other groups.

[e]A-Theoretical estimation of QoL (See methodology in DNP [1997]).

[f]Centros de Atención Inmediata, CAIS: Centers of Immediate Police Attention.

[g]At the census sector level.

rate one standard deviation higher in the same stratum, would allow it to move to a house whose value would be lower in a magnitude equivalent to between 2.5 and 3.4 times its monthly per capita income, or saving for once between $3,700 and $4,900. The same figure for a stratum 5 household would be between 1.5 and 1.85 of its monthly per capita income, or between $1,015 and $1,266. Results for the other variables were very similar to those obtained when the age difference was the instrument of choice.

3.5 Conclusion

In this chapter, we use hedonic price models to estimate the value households located in the city of Bogotá (Colombia) are willing to pay to avoid crime, and in particular, to avoid high homicides rates. We find that households living in the highest socioeconomic stratum (stratum 6) are willing to pay up to 7.0 percent of their house values to avoid an increase of the homicide rate in one standard deviation. Households in stratum 5 are willing to pay up to 2.8 percent of their house values, and those in stratum 4 up to 4.4 percent.

The results reveal the willingness to pay for security by households in Bogotá, and, additionally, reveal the emergence of urban private markets that auction security. These markets imply different levels of access to public goods among the population, and, in fact, the exclusion of the poorest. We find, as well, evidence of negative capitalization of aggravated assaults, and of positive capitalization of the presence of police authority in the form of Centers of Immediate Attention (CAIs).

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Comment Alfredo Canavese

The chapter by Gaviria, Medina, Morales, and Nuñez uses an econometric model with hedonic prices to estimate the value households are willing to pay to avoid crime in Bogotá. They find that households living in the highest socioeconomic stratum are paying up to 7.2 percent of their house values to keep their average homicide rates constant and households living in the next stratum of richest population in the city would be paying up to 2.4 percent of their house values for the same purpose. They write, "The result reveals the willingness to pay for security by households in Bogotá, and additionally, reveals that a supposed pure public good like security ends up propitiating urban private markets that auction security. These markets imply different levels of access to public goods among the population, and actually, the exclusion of the poorest."

The purpose of this comment is to build a very simple model to make

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