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Demand for Public Safety

Menno Pradhan
Martin Ravallion

Is public safety of less concern to poor people? What about people in poor areas? How is demand for public safety affected by income inequality? Is there a self-correcting mechanism whereby higher crime increases demand for public safety?

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Summary findings

Is public safety of less concern to poor people? What about people in poor areas? How is demand for public safety affected by income inequality? Is there a self-correcting mechanism whereby higher crime increases demand for public safety?

Pradhan and Ravallion study subjective assessments of public safety using a comprehensive socioeconomic survey of living standards in Brazil.

They find public safety to be a normal good at the household level.

Marginal income effects are higher for the poor, so inequality reduces aggregate demand for public safety.

Less public safety generates higher demand for improving it.

Living in a poor area increases demand at given own-income. So does living in an area with higher average education.

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Demand for Public Safety

Menno Pradhan and Martin Ravallion[1]

Free University and the World Bank

1 Address for correspondence: M. Ravallion, Development Research group, World Bank, Washington DC 20433. Pradhan is with the Economic and Social Institute, Free University, Amsterdam. Ravallion is with the Development Research Group, World Bank. These are the views of the authors, and need not reflect those of the World Bank. The financial support of the World Bank's Research Committee (under RPO 681-39), the World Bank's Brazil Country Unit, and the Netherlands Organization for Scientific Research are gratefully acknowledged. For their comments the authors thank Kees Burger, Marcel Fafchamps and Dominique van de Walle.

1. Introduction

Crime can be viewed as an outcome of rational choices by criminals weighing expected gains and losses (Becker, 1968).[2] The parameters in this calculation will depend in part on how much non-criminals care about public safety. In various ways — lobbying for crime prevention by the state, being watchful neighbors, spending on private security measures — household-level demand for public safety is likely to influence the extent of crime and the appropriate policy response. However, we know rather little about the demand for public safety at household level.[3] The problem is that public safety is a public good. One cannot directly observe demand — the way one can for private (market) goods.

There are a number of possible ways one might try to identify household demand for public safety. One way is to value the human and property losses from reported crime, though naturally this is unlikely to fully capture the welfare losses, including amongst those who do not actually experience crime, but live in fear of it. Crime under-reporting is also known to be common. Another approach is to estimate the impact on local property prices, treating public safety as a local public good and assuming that housing markets work well, including that there is free mobility (Thaler, 1978; Clark and Cosgrove, 1990). Alternatively one might assume that observed levels of local public spending are optimal for the median voter in each local government area (Borcherding and Deacon, 1972). Or one might ask people to attach a value to public-safety, or some specific intervention; various survey-based methods exist for valuing

[2] For a recent overview of the main issues in the economics of crime see Ehrlich (1996). Also see the discussion in DiIulio (1996).

[3] There have been a number of studies of average crime rates, and public spending on crime prevention, across municipalities, including Greenberg et al., (1979), Behrman and Craig (1987) and Gyimah-Brempong (1989). The level of aggregation naturally clouds the interpretation of such studies.

public services (Gibson, 1980; Bohm, 1984; Jacoby, 1994). Yet another approach is to rely on qualitative questions on the importance of public-safety; there is recent experimental evidence suggesting that this type of method is more reliable in valuing social programs than open-ended willingness to pay questions (Gregory, MacGregor and Lichstein, 1992).

The present paper proposes an approach to studying the demand for public safety in the spirit of the last approach. The method is based on subjective-qualitative assessments of public safety made in the context of a comprehensive socio-economic survey. The method allows us to address a number of questions about the socio-economic determinants of the demand for public safety.

One such question of interest is whether public safety is a normal good. Since it is a public good we do not expect strong income effects, at least within neighborhoods; everyone within some geographic area presumably enjoys the same objective level of public safety (though different people may attach different subjective values to it). However, the utility value attached to public safety may well change with income via its effect on demand for complementary private goods. Also, the desire to improve public safety might well have a stronger income effect than the current level of public safety. If so, this might explain any tendency for poorer areas to enjoy less public safety, in that lower demand at the individual level makes it harder to mobilize public actions which makes those areas safer.

There are other household characteristics that one might expect to influence the demand for public safety. One's priors about how safe or unsafe one is will clearly matter. Those priors are formed in a world of incomplete information in which both psychological and social factors come into play. There is evidence from psychology that cognitive dissonance (arising from the displeasure attached to contemplating adverse events) often leads people to downplay their exposure to unsafe environments; for example, regulations are required to force people to wear safety hats in unsafe jobs.[4] One's knowledge about the true probability distribution will presumably matter to such effects. Thus it can be argued that household characteristics such as the amount of education can influence the extent to which one is vulnerable to cognitive dissonance, and so influence demand for public safety.

Another question of interest concerns the role of inequality. There is evidence that U.S. states with higher income inequality tend to have higher crime rates (Ehrlich, 1973); Fajnzylber et al. (1998) also find such a relationship across countries. The usual explanation is that inequality increases the potential gains from crime (Ehrlich, 1973). Another possiblity —which we have not seen discussed— is that the income slope of demand for public safety might fall as income rises (even if it is the rich who care most about public safety). There is presumably only so much public safety one can possibly want, so diminishing income effects must eventually set in. Then the demand for public safety will be concave in income, and hence aggregate demand will be lower (for any given mean income) when inequality is higher. Our approach allows us to test that hypothesis.

We also want to test the importance of neighborhood effects as influences on household-level demand for public safety. One issue is whether there exists a self-correcting mechanism in response to crime, as postulated by Philipson and Posner (1996). Does a low level of public safety in a neighborhood stimulate household-level demand for public safety? If the answer is yes, then this can help explain crime cycles over time.

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4 Akerlof and Dickens (1982) review the evidence and provide a choice-theoretic economic model of this form of behavior.

It is thought that strong geographic effects on crime incidence can also arise from social interactions within neighborhoods, whereby one person's decision to commit a crime positively affects his neighbor's decision (Glaeser et al., 1996). The notion of "safe" and "unsafe" neighborhoods is common.[5] But what are the "unsafe areas"? Crime is widely thought to be a bigger problem in poor areas.[6] One reason might be that living in a poor area means that one's neighbors do less to prevent crime, assuming that household demand for public safety is a normal good. Then poor areas will be less safe, which will presumably increase one's own concern about public safety at any given income level. Against this effect, rich areas will offer higher takings for robbers, which will presumably increase demand for public safety relative to poor areas. For example, a recent magazine article on crime in America wrote that "… there are signs that refugees from city centers, driven out to the suburbs by fear of crime, have drawn the criminals after them" (*The Economist*, October 3, 1998, p.38).

A related question our approach can throw light on is the role of education, as an external (neighborhood) effect as well as an internal effect (of the household's own education, as discussed above).[7] If own-education matters to demand for public safety via its effects on knowledge about the true probabilities of crime, then one's neighbors' education could well have the same effect, assuming that education fosters different knowledge sets in different people but

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5 When information about the chances of punishment is limited and geographically specific, multiple equilibria can arise such that different crime rates are observed for otherwise similar neighborhoods (Sah, 1991). This also suggests that it may be difficult to explain empirically the observed geographic differences in crime incidence and hence demand for public safety.

6 Behrman and Craig (1987) find that the allocation of police across neighborhoods of Baltimore, U.S.A., responds negatively to average income of the neighborhood, which they interpret as an effect on the demand for public safety.

7 There is evidence that the cost of producing public safety (measured by inverse crime rates) is lower in municipalities (in Florida, U.S.A.) with higher education levels (Gyimah-Brempong, 1989).

that knowledge is shared amongst neighbors. The effects of household attributes, such as income and education, could well interact strongly with neighborhood characteristics; for example, having a high household income may matter more to one's demand for public safety if one lives in a poor area.

The following section takes a preliminary look at our data from Brazil, where crime and public safety have become serious concerns, as in other countries in Latin America and elsewhere.[8] Section 3 discusses how the survey results can be interpreted theoretically. The key to our approach is to view subjective, qualitative, assessments of the importance as an ordinal indicator of the latent marginal utility of public safety. This motivates an econometric model of the demand for public safety, which is outlined in section 4. Our results are presented in section 5. Section 6 offers some conclusions.

2. A first look at the data

We shall use data gathered as part of the Brazilian Living Standard Measurement Survey for 1996 managed and collected by the Brazilian Institute of Geography and Statistics. The sample frame covered the Northeast and Southeast of Brazil, representing about 75% of the population. (The regions excluded were the Amazon and the Center/West.) The sample size was 4922 households. The survey follows the established practices for these surveys (Grosh and Munoz, 1996).

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8 For example, homicide rates have been on the rise in Latin America since the mid-1980s, and the average rate is higher than in any of the other principal regions of the world (Fajnzylber et al., 1998).

An unusual feature of the survey is that it asked for subjective information from the head of the household on self-rated welfare in terms of various categories of goods, including public safety. Specifically, the head of the household was asked:

(1) "How would you judge the living conditions of your household in relation to public safety?" The answer for each was given on a scale from one (very bad) to five (very good). We call the answers to this question, the Current Value of Public Safety (*CVPS*).

(2) "If you could improve conditions of members of this household what importance would you attach to public safety?" This time a number is given on a scale one (not important) to four (very important). We call this the Desire to Improve Public Safety (*DIPS*).

Clearly the answers respondents give to such questions will make implicit assumptions about many things, including household circumstances, place of residence, and the behavior of others (neighbors, governments, the police). Later we will try to model the determinants of *CVPS* and *DIPS*.

Descriptive statistics for public safety are in Table 1. With respect to *CVPS*, 38 percent of the respondents assessed current public safety as "bad" or "very bad". For *DIPS*, more than half thought that public safety is "very important" to improve. Those who think the current situation is worse, tend to consider it more important to improve. The Spearman rank correlation is -0.07. While this is significantly different from zero (at the 5% level), the low value of the rank correlation also shows that the assessed current level of public safety is not the only factor explaining the desire to improve public safety.

To investigate the income effect on answers to the Current Value and Desire to Improve Questions, we offer Figures 1 and 2. We use total expenditure on consumption (including imputed values of consumption from income in kind) per person as the "income" variable on the horizontal axis. The graphs are non-parametric regressions of CVPS against expenditure per person.[9] In addition we give results for the same question asked about education, health, housing, leisure, food, clothing, work and transport.

To help interpret these and other graphs in the paper, Figure 3 gives the cumulative distribution of consumption.

Figure 1 shows clear income effects for all except public safety, for which there is very little increase with rising total expenditure. Very different effects are found for *DIPS* (Figure 2). The importance to improve public safety tends to increase noticeably as expenditure rises. This "income effect" on *DIPS* is stronger than for the private goods, for which the desire to improve does not vary as much by expenditure level, and starts to decrease for most categories at high consumption levels (the upper 10-15% of people ranked by consumption).

3. A theoretical interpretation of the data

The standard model of consumer choice with a public good can be readily adapted to help interpret the answers to these subjective valuation questions. The Current Value Question can be interpreted as referring to an underlying sub-utility function for each good, while the improvement question can be interpreted in terms of marginal utilities.

Consider the case with n private goods (q_i, i=1,..,n) and one public good, namely public safety, denoted s, which we take to be objectively known. The utility derived from public safety depends on private goods consumed, which also matter to utility in their own right. The household maximizes a utility function defined on the consumptions of all goods:

[9] We used the Lowess smoother as programmed in STATA 5.0.

$$u[f_1(q_1),..,f_n(q_n);f_s(s,q_1,..,q_n)] \qquad (1)$$

where f_i (i=1,..,n; s) is the utility from good i, subject to the budget constraint:

$$y = \sum p_i q_i \qquad (2)$$

The utility maximum gives the usual indirect utility function, $v(p, y, s)$ where $p = (p_1,..p_n)$ is the price vector for the private goods.

We interpret *CVPS* as a direct indicator of the sub-utility function f_s. By contrast, the answers given for *DIPS* can be interpreted as revealing the marginal utility of public safety:

$$\frac{\partial u}{\partial s} = \frac{\partial u}{\partial f_s}\frac{\partial f_s}{\partial s} = \frac{\partial v(p,y,s)}{\partial s} \qquad (3)$$

The above model can help interpret Figures 1 and 2. Since public safety is a normal good, we do not expect a strong income effect on the current level. The income effect is clearly much smaller for public safety than the (largely) private goods (Figure 1). There is still, however, a tendency for the current valuation of public safety to also increase with consumption per capita. This could reflect the fact that the question is asking about the value that the household attaches to public safety; that will depend on household attributes as well as the actual level of public safety. Thus an income effect on *CVPS* could arise from non-separability in the utility function. If, as in the specification in equation (1), one postulates that the sub-utility of public safety depended positively on consumption of private goods with positive income effects then one would expect to obtain a positive income effect on *DIPS*. An alternative explanation is that the income effect of *CVPS* is due to neighborhood effects, whereby richer people are better able to mobilize local public action to prevent crime or move to the safer neighborhoods. This assumes that public safety has properties of a local public good; clearly, if public safety is a pure public good nationally, then this effect would not be possible.

How can we interpret the strong income effect on *DIPS* in Figure 2? If public safety is a normal public good then the rich will want more than the poor, but will be rationed in their actual consumption, which will be determined by the average level, possibly over some geographic area. Then we can expect a strong income effect on the household's desired level of public safety. However, we have interpreted *DIPS* as an indicator of the slope of the indirect utility function with respect to public safety (equation 3), rather than the optimal level of public safety, which would clearly be a much harder interpretation to defend. Then the direction of the income effect on *DIPS* will depend on the cross-partial derivative of the indirect utility function with respect to income and public safety. If this is positive — so that greater public safety increases the marginal utility of income — then the demand to improve public safety will have a positive income slope. The curve shown in Figure 2 is consistent with this prediction. Higher total spending is associated with a stronger desire to improve public safety.

There is also a strong indication that the desire to improve public safety is a concave function of expenditure (Figure 2); the expenditure slope of *DIPS* falls as spending increases, and is noticeably lower for the richest half of the population than the poorest half (comparing Figures 2 and 3). Concavity implies that any inequality-reducing redistribution of expenditures holding the mean constant will <u>increase</u> the aggregate demand for public safety.[10] However, one should be cautious in drawing that conclusion since the concavity may well be an artifact of the fact that the Desire to Improve Question is bounded; one cannot answer more than "very important".

[10] This is an implication of Jensen's inequality, and is a well-known result from the literature on measuring inequality; see Atkinson (1970).

This property of the scale means that diminishing returns must eventually set in. Later we will test for concavity in an unbounded continuous variable consistent with answers to the Desire to Improve Question, assuming normal errors.

4. An econometric model of household demand for public safety

Following the argument of the last section, we interpret *DIPS* as an indicator of the household's marginal utility of public safety, which is a continuous function of the current objective level of public safety, prices, and total expenditure on private goods (equation 3).

We make three main assumptions in specifying our econometric model of the demand for public safety:

Assumption 1: The underlying objective level of public safety is a pure local public good, in that it is constant within suitably defined geographic areas.

Assumption 2: Differences in *CVPS* between otherwise identical households living in different areas can be attributed to differences in their objective level of public safety, and similarly for the *DVPS.*

Assumption 3: *CVPS* is a strictly increasing function of the objective level of public safety at given household characteristics.

Assumptions 1 and 3 are unlikely to be contentious. But is Assumption 2 believable? While other local public goods could clearly influence demand for public safety, this need not violate Assumption 2 as long as those other local public goods matter via their effect on the objective level of public safety in a neighborhood. It is not easy to think of a local public good that is likely to alter demand for public safety for a given household at a given actual level of public safety.

So these assumptions still allows for geographic effects on the demand for higher public safety, though these effects are assumed to operate via the latent objective level of public safety, which is a local public good, and hence affected by local area characteristics. Assumption 2 thus justifies the exclusion restriction that geographic variables do not alter *DIPS* at given household characteristics, and for a given objective level of public safety.

Under these assumptions we will be able to identify the direction of the effect of differences in the current objective level of public safety on household-level demand for improving public safety. While we do not directly observe the current level of public safety, we can use *CVPS* as an indicator. Clearly if the Current Value Question correctly reveals the sub-utility of public safety, and the function f_S is the same monotonic increasing function for everyone, then *CVPS* provides a valid proxy for the current level of public safety. However, we can weaken these assumptions considerably, by allowing f_S to be a function of consumptions of private goods, as in equation (1). Then (on optimizing out the demand for private goods), *CVPS* will depend on prices and total spending as well as the current level of public safety. This will affect the interpretation of why prices and total spending matter to the demand for public spending, but still allows us to use the self-rated assessment of current public safety as an indicator of the current level of public safety. We must however treat *CVPS* as endogenous to *DIPS.* Assumptions 1 and 2 justify using geographic dummy variables as instruments for *CVPS* in a regression model of *DIPS.*

In addition to (log) expenditure per person and a geographic price index, we include variables describing other household characteristics, notably household size and demographic composition, stage of the life cycle (age and age squared of the household head), and the gender and education of the household head. These variables allow for possible heterogeneity in preferences and measurement error in other variables. The main concern in the latter respect is probably that spending per capita may not be the right "income" metric. One way this might happen is through credit constraints; then education could matter via its effect on expected future income. Another way is via a miss-specification of the appropriate equivalence scale. For example, if we should not have normalized total spending by household size but (say) its square root (to allow for economies of scale in consumption) then household size will appear as a significant regressor, independently of consumption per person.

To outline our estimation method in more formal terms, let the structural models for *CVPS* and *DIPS* be:

$$CVPS = \gamma_s s + \gamma_x x + \varepsilon_{CV} \qquad (4)$$

$$DIPS = \beta_s s + \beta_x x + \varepsilon_{DI} \qquad (5)$$

where the full set of household variables (including prices and total expenditures) is represented by the vector x and the ε's are white noise errors.

Since public safety is a pure local public good (Assumption 1), the value of s will depend on a vector of geographic variables, z:

$$s = \delta z + \nu \qquad (6)$$

where ν is another white-noise error term. The vector z comprises two sets of variables:

(i) Indicators of the area's attraction to criminals; for example, living in a high rent area will presumably increase vulnerability to property crime.

(ii) Indicators of community-level demand for public safety. The averages of the individual characteristics that influence household demand are obvious candidates. One also wants to allow for social effects. The extent of "social capital" in an area can be expected to increase public safety, by promoting forms of cooperative behavior. How long people have lived in the area may well matter. Education could also influence the ability of local residents to cooperate in crime prevention.

We can consistently estimate the coefficients on x in (4) and (5) by using (4) to solve out s. We cannot separate β_s from γ_s. We can however identify β_s / γ_s and thus use Assumption 3 to infer the sign of β_s. To see how, use (4) to eliminate s from (5), giving the conditional demand for public safety:

$$DIPS = \frac{\beta_s}{\gamma_s} CVPS + \left(\beta_x - \frac{\beta_s \gamma_x}{\gamma_s}\right)x + \varepsilon_{DI} - \frac{\beta_s \varepsilon_{CV}}{\gamma_s} \qquad (7)$$

This cannot be estimated consistently by OLS, given that *CVPS* is correlated with the error term (via equation 4). However, under Assumptions 1 and 2, equation (6) justifies the use of the geographic variables as instruments for *CVPS* in (7). We will use a complete set of geographic dummy variables as the instruments for *CVPS*.

The linearity in the above models is questionable, given that the dependent variable is discrete. This is of concern for interpreting the implications for inequality, given that the qualitative questions are bounded, as discussed in section 3. To address this concern we will start with a specification in which we assume that *DIPS* in the above model is actually a latent continuous variable, and the error terms are normal. We can then estimate an ordered probit for the qualitative answers to the Desire to Improve Question. This will allow a more robust test for concavity.

5. Results

Table 2 gives descriptive statistics for the explanatory variables. In addition to expenditure, we include the education of the household head, the age, gender and race of the head, household size and demographic composition. As an indicator of social capital we include the proportion of the population not born in the municipality. As an indicator of attractiveness to criminals we include the average rent of the dwellings in the neighborhood (actual rent paid, or imputed rent for owner occupiers).[11] External effects are also modeled by including mean consumption and education of the head in the area as explanatory variables. We also allow for interaction effects between the household and geographic variables; specifically, we shall include the interactions between "own value" and "area value" for both consumption expenditure and education.

The estimated coefficients are in Table 3. The first two columns are ordered probits based on equations (4) and (5), in which equation (6) has been used to solve out s, so that area-specific variables are included. The ordered probit imposes an ordering on *CVPS* and *DIPS* ranging from low (very bad, not important) to high (very good, very important). The remaining columns are based on regression estimates where the qualitative answers are mapped to a scale from 1 to 5 (4 for *DIPS*). The linear regression models assume that the qualitative answers are ordered and equally spaced in terms of the underlying utility function. The latter assumption can be tested by looking at the estimated threshold values of the ordered probit model. Figure 4 presents these

[11] This will presumably also be influenced by the extent of public safety in a neighborhood, via effects on housing demand. This is not of concern for the econometrics, however; if anything, it adds to the case for using average rent as an indicator of actual public safety.

estimates against a linear (equally spaced) scale. The fact that the lines for both models are almost linear supports the equal spacing assumption.[12]

As discussed in section 3, we are interested in testing whether the demand for public safety is concave in expenditure on private goods. The negative coefficients on the cross terms with mean area consumption imparts convexity, but the effect is well outside applicable consumption levels. The functional form using log per capita consumption is not sufficiently flexible to allow both convexity and concavity (at different consumption levels). To relax this, we tried adding the reciprocal of consumption per capita to the *DIPS* regressions. This extra parameter is sufficient to assure that the functional form does not impose concavity. The term in the reciprocal of consumption was insignificant by a t-test (coefficients and standard errors are reported at the bottom of the table). So concavity is confirmed, even when we allow for an unbounded latent variable.

How much does inequality contribute to *DIPS*? A simple way to measure the quantitative importance of inequality to the demand for public safety is to simulate the effect of eliminating all inequality while holding mean consumption and all other variables in our model constant. It is readily verified that the increase in the expected value of *DIPS* (for the linear model) is then the regression coefficient on log consumption times the Theil indices of inequality, given by the difference between the log of mean consumption and the mean of log consumption. From Table 2 we find that the Theil index is 0.457. From Table 3, the estimated regression coefficients on log consumption for linear models of *DIPS* range from 0.11 to 0.24. So even at the upper bound of this range the increase in the average value of *DIPS* is only 0.11,

12 It is clear from the coefficients and their standard errors that none of them are significantly different from the expected value if a straight line was fitted.

on a scale from one to four. While there is an effect of inequality in dampening the demand for public safety in Brazil, the magnitude of the effect is small.

We find significant effects of the geographic variables on both *CVPS* and *DIPS*. Holding real per capita consumption constant, higher prices for private goods have a negative influence on *CVPS* and positive on *DIPS*. The negative effect on *CVPS* implies that higher consumption of private goods (with downward sloping demand curves) generates a higher utility from public safety. The positive effect of *DIPS* implies that living in more costly areas increases the marginal utility of public safety. More immigrants in the area reduces *CVPS* and increases *DIPS*. No significant effects of the local rents are found in the *CVPS*. The positive significant effect of local rents on *DIPS* indicates a higher willingness to pay for public safety when living in a high rent area. Living in an urban (rather than rural) area does not have a significant effect on either *CVPS* or *DIPS*, holding the other geographic variables constant.

To investigate external effects on the *DIPS* we have made Figures 5 and 6. Figure 5 shows the predicted *DIPS* as a function of per capita consumption for a poor and a rich area, holding all other explanatory variables constant at the mean levels. The poor area is set at the 25th percentile while the rich is set at the 75th percentile of the consumption distribution. *DIPS* is higher in the poor area than in the rich area. As income rises, *DIPS* increases in both areas but more so in the poor than in the rich. In rich areas, which are relatively safer, the income slope for *DIPS* is lower.

Notice that the difference in the expected *DIPS* between poor and rich areas (as illustrated in Figure 5) controls for (amongst other things) average dwelling rent in the area, which we interpret as an indicator of the area's attractiveness to potential thieves. The effect in Figure 5 we can interpret as arising from positive external effects of local demand for public safety on individual demand.

Figure 5 also gives the corresponding results when we delete average dwelling rent from the model. This can be given a reduced-form interpretation, treating average dwelling rent as a function of mean consumption in the area. The difference between the demand curves in poor and rich areas has narrowed, but we still find that demand for public safety is higher in poor areas, ceteris paribus.

Very different effects are found for education. As shown in Figure 6, there is little effect of own education for people living in an area in which the average education level is high. Even poorly educated people living in these areas have a high desire to improve public safety. In areas where average education is low, in contrast, the effect of own education on *DIPS* is strong.

Since both higher own education and higher education in the area of residence increase demand for public safety, it is natural to ask which is more important. From Table 3 (column 4) we find that the marginal effect of higher own education on *DIPS* is 0.30 minus 0.31 times mean education in the area. The marginal effect of higher education in the area is 0.05 minus 0.31 times own education. Thus own education has the higher marginal impact if and only if own education exceeds education in the area of residence plus 0.061 years. The latter term is small, so our results suggest that own education has the higher (lower) impact when the household is better (worse) educated than its neighbors.

However, it is clear that there are geographic effects on demand that we have not been able to identify. This is indicated by the fact that including area dummies instead of geographic variables in the regression models improves the fit considerably. The adjusted R^2 for *CVPS* increases from 0.022 to 0.301. For *DIPS*, the adjusted R^2 goes from 0.101 to 0.443 (Table 3).

The two stage least squares estimates are reported in the last column of Table 3. Assumption 2 justifies using the *CVPS* regression with geographic fixed effects (5th column) as the first stage regression (since, under that assumption, geographic variables do not matter independently of the objective level of public safety and individual characteristics, including budget constraints). The coefficient on *CVPS* is negative and significant in the final 2SLS regression for *DIPS* (last column). Given Assumption 3, this implies that $\beta_s<0$ (recalling equation 9). Higher current public safety reduces the desire to improve public safety, consistent with diminishing returns.

So there is evidence of a corrective mechanism, operating via demand for public safety. However, the size of the marginal effect of *CVPS* on *DIPS* is small; a one standard deviation increase in the *CVPS* is predicted to result in a drop of 0.14 of a standard deviation in *DIPS* (using Tables 2 and 3).

6. Conclusions

We have analyzed the demand for public safety in Brazil using a household survey containing information on subjective-qualitative assessments of the perceived current level and the desire to improve public safety. Compared to private goods, we find strong income effects on the desire to improve public safety. There is a much lower, though still positive, income effect for the current level of public safety. The desire to improve public safety is a concave function of consumption expenditure. Thus higher inequality reduces demand for public safety, though the quantitative effect of inequality on aggregate demand appears to be small.

Using geographic dummy variables as instruments we have been able to estimate the effect of the current level of public safety on demand for improving public safety. The partial effects indicate that, conditional on individual characteristics, the desire to improve public safety is a decreasing function of the current level. This is consistent with the self-correcting mechanism in response to crime postulated by Philipson and Posner (1996). We also estimate the effects of household characteristics on the conditional demand for public safety. The conditional demand (controlling for actual public safety) has a positive income effect and is higher for better educated and larger households.

We find evidence of strong neighborhood effects, controlling for individual characteristics. Living in a well off area has an ambiguous effect on household demand for public safety; on the one hand, high-rent neighborhoods offer more to potential thieves; on the other hand, individuals living there can free-ride on their neighbor's greater efforts to prevent crime. We find evidence of both effects. However, the latter effect dominates; while being poor lowers household demand for public safety, living in a poor areas increases it. Having well educated neighbors increases demand for public safety, and reduces the marginal effect of own education of demand. However, it is clear that there are other neighborhood effects on demand for public safety that we have not been able to explain with the data available.

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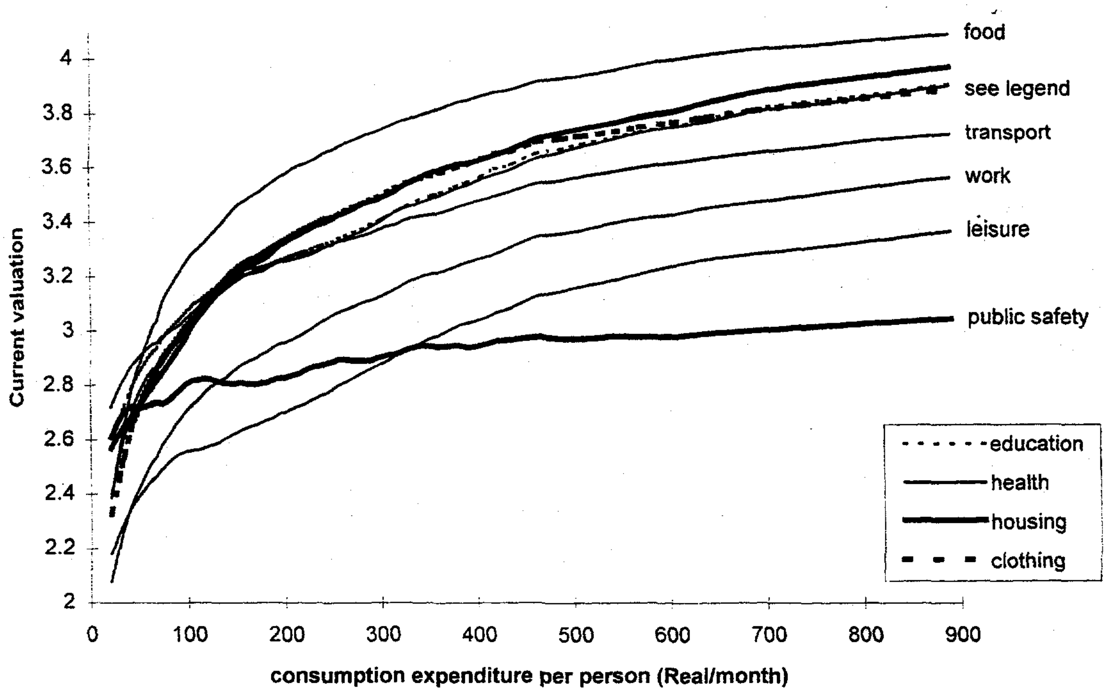

Figure 1: Current value as a function of consumption expenditure

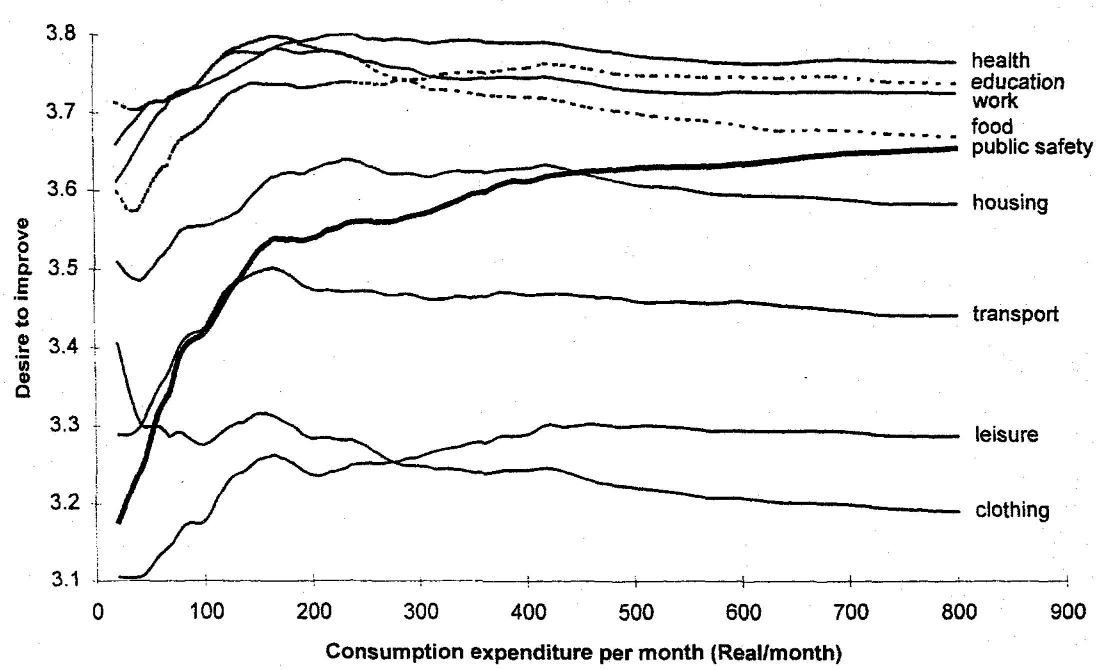

Figure 2: Desire to improve as a function of consumption expenditure

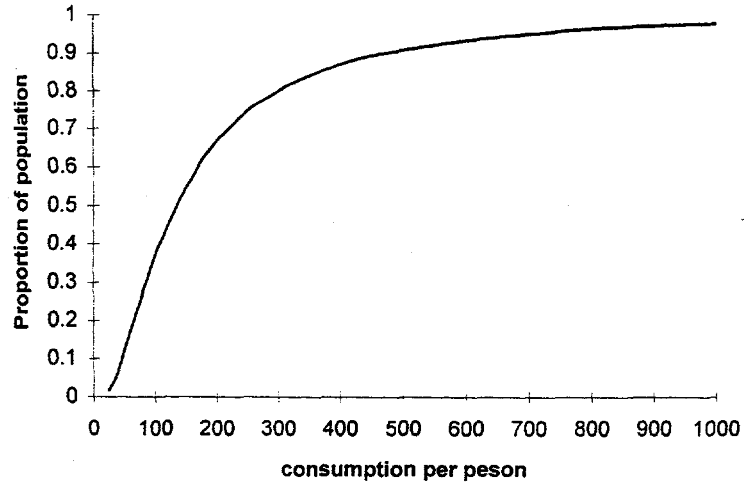

Figure 3: Empirical distribution function of consumption in Brazil

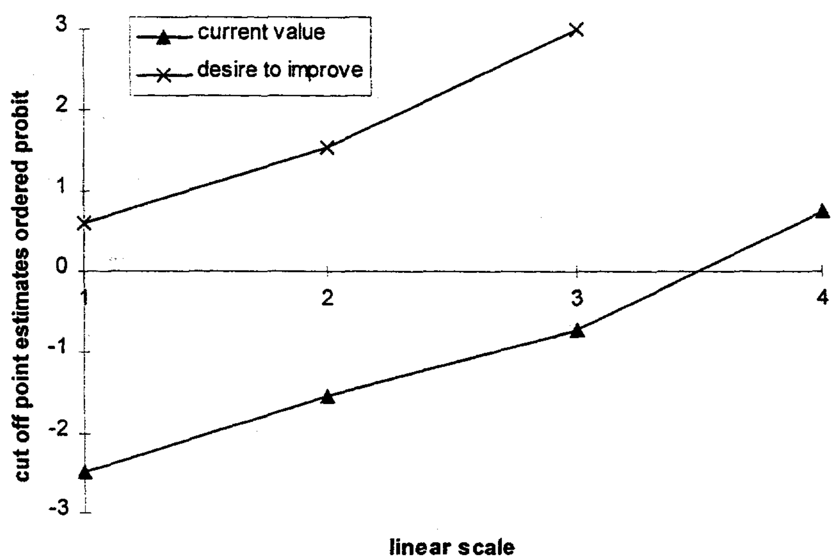

Figure 4: Estimated cut-off points for the ordered probit models

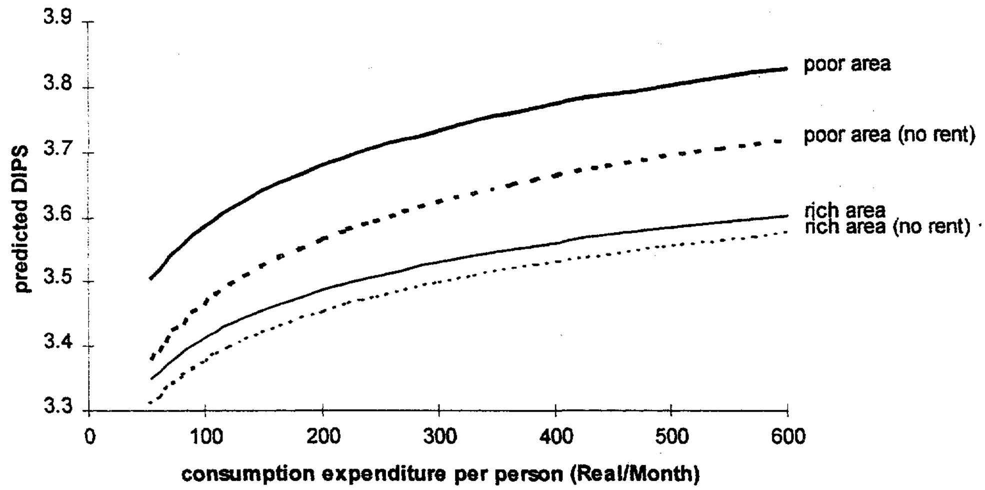

Figure 5: Predicted desire to improve public safety as function of consumption

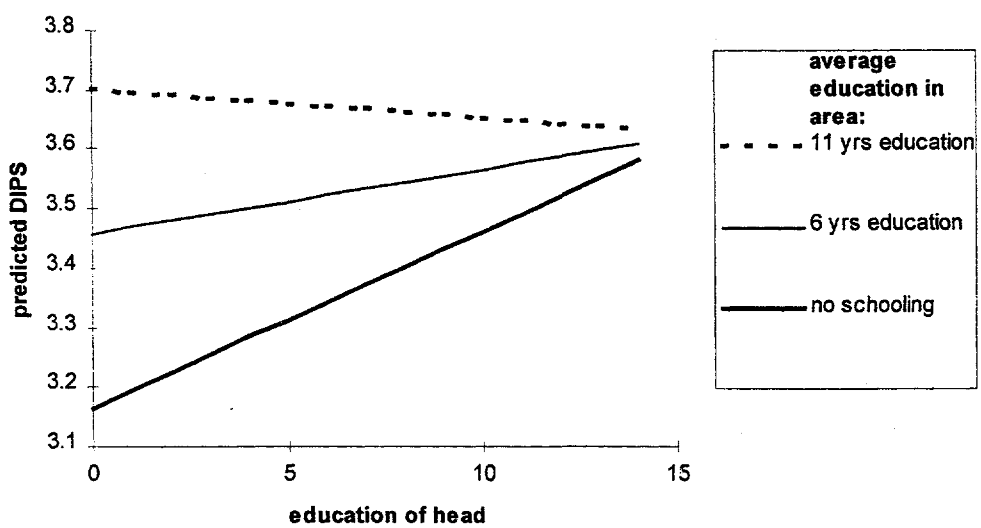

Figure 6: Predicted desire to improve public safety as function of education

Table 1: Subjective assessments of public safety

	Desire to improve (%)				
	Very important	Important	Little importance	Not important	Total
Current value					
very good	2.07	0.43	0.16	0.08	2.74
Good	14.7	11.08	2.17	0.49	28.43
Regular	17.42	11.73	1.63	0.12	30.89
Bad	15.57	10.41	1.22	0.06	27.26
very bad	7.36	2.78	0.43	0.1	10.67
Total	57.11	36.42	5.61	0.85	100

Table 2: Descriptive statistics

	Mean	Standard deviation
Current value of public safety (*CVPS*)	2.853	1.035
Desire to improve public safety (*DIPS*)	3.498	0.643
Consumption per person per month /a	275	373
log consumption /a	5.160	0.912
Years of education of household head/b	6.494	4.471
Age head of household (/100)	0.463	0.154
Dummy head=female	0.229	0.420
Dummy head=white	0.485	0.500
Household size	3.929	2.010
log(household size)	1.230	0.555
Fraction boys 0-17	0.155	0.183
Fraction girls 0-17	0.150	0.181
Fraction females 18-60	0.299	0.213
Fraction old males 61+	0.052	0.159
Fraction old females 61+	0.069	0.189
Urban	0.767	0.423
log(mean monthly dwelling rent) /c	5.111	0.974
Percentage immigrants	0.418	0.192

/a Monthly, deflated to Sao Poalo prices , in Brazilian Real.
/b Constructed variables based on the educational attainment
/c Includes imputed rent for home owners

Table 3: Determinants of current value and desire to improve public safety

Estimation method	1	2	3	4	5	6	7
	Ordered probit		OLS	OLS	OLS	OLS	2SLS
Dependent variable	*CVPS*	*DIPS*	*CVPS*	*DIPS*	*CVPS*	*DIPS*	*DIPS*
Area fixed effects?	No	No	no	no	yes	yes	no (used as instruments)
CVPS	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	-0.090*
							(0.015)
log per capita consumption	-0.160	0.483*	-0.119	0.244*	0.071*	0.111*	0.115*
	(0.119)	(0.134)	(0.123)	(0.075)	(0.029)	(0.017)	(0.015)
years of education of head	0.016	0.044*	0.016	0.030*	0.003	0.009*	0.021*
	(0.010)	(0.011)	(0.010)	(0.006)	(0.005)	(0.003)	(0.003)
age head (/100)	-0.814	-0.929	-0.756	-0.451	-0.586	-0.442	-0.502
	(0.622)	(0.701)	(0.578)	(0.368)	(0.524)	(0.308)	(0.369)
head's age squared (/10000)	1.164	0.958	1.123	0.450	0.715	0.409	0.484
	(0.649)	(0.729)	(0.598)	(0.368)	(0.538)	(0.326)	(0.388)
Dummy head=female	-0.073	-0.042	-0.074	-0.018	-0.022	-0.035	0.013
	(0.048)	(0.055)	(0.046)	(0.028)	(0.040)	(0.024)	(0.028)
Dummy head=white	0.049	0.031	0.050	0.017	0.046	0.023	0.001
	(0.033)	(0.038)	(0.033)	(0.019)	(0.032)	(0.017)	(0.019)
log(household size)	0.028	0.144*	0.024	0.076*	0.021	0.091*	0.104*
	(0.044)	(0.050)	(0.042)	(0.027)	(0.039)	(0.023)	(0.026)
Fraction boys 0-17	0.036	0.273*	0.040	0.132*	0.064	0.126*	0.074
	(0.118)	(0.135)	(0.113)	(0.067)	(0.101)	(0.055)	(0.068)
Fraction girls 0-17	-0.064	0.313*	-0.043	0.139*	0.074	0.122*	0.079
	(0.119)	(0.136)	(0.116)	(0.069)	(0.102)	(0.057)	(0.069)
Fraction females 18-60	0.234*	0.097	0.238*	0.039	0.119	0.090	0.068
	(0.100)	(0.113)	(0.098)	(0.058)	(0.088)	(0.049)	(0.059)
Fraction old males 61-	-0.156	-0.078	-0.153	-0.040	-0.045	-0.023	-0.032
	(0.131)	(0.144)	(0.126)	(0.079)	(0.112)	(0.068)	(0.080)
Fraction old females 61+	0.216	-0.093	0.215	-0.056	0.083	0.022	-0.025
	(0.128)	(0.143)	(0.123)	(0.080)	(0.110)	(0.065)	(0.080)

(Continued next page)

	Ordered probit		OLS	OLS	OLS	OLS	2SLS
Dependent variable	*CVPS*	*DIPS*	*CVPS*	*DIPS*	*CVPS*	*DIPS*	*DIPS*
Area fixed effects?	no	No	no	No	yes	yes	no
log (mean consumption in area)	-0.133	-0.051	-0.084	-0.032			
	(0.133)	(0.149)	(0.135)	(0.089)			
log(own consumption)*log(mean consumption in area)	0.041	-0.048*	0.032	-0.024			
	(0.021)	(0.024)	(0.022)	(0.013)			
Mean years of education in area	0.007	0.077*	0.009	0.049*			
	(0.015)	(0.017)	(0.014)	(0.009)			
years own education x mean years of education in area (/100)	-0.110	-0.393*	-0.122	-0.314*			
	(0.125)	(0.143)	(0.123)	(0.080)			
Dummy urban=1	0.048	0.062	0.057	0.050			
	(0.053)	(0.060)	(0.051)	(0.031)			
Regional price deflator	-0.691*	0.684*	-0.681*	0.290*			
	(0.238)	(0.278)	(0.227)	(0.122)			
log(average rent in area)	-0.027	0.158*	-0.041	0.082*			
	(0.045)	(0.050)	(0.044)	(0.029)			
Percentage immigrants in area	-0.340*	0.228*	-0.336*	0.124*			
	(0.083)	(0.096)	(0.080)	(0.047)			
Constant	n.a.	n.a.	3.864*	1.891*	2.464*	2.795*	2.967*
			(0.709)	(0.466)	(0.197)	(0.111)	(0.116)
Threshold 1	-2.485	0.589					
	(0.710)	(0.800)					
Threshold 2	-1.539	1.541					
	(0.710)	(0.799)					
Threshold 3	-0.727	2.991					
	(0.710)	(0.800)					
Threshold 4	0.732	n.a.					
	(0.710)						
(pseudo) R squared	0.010	0.057	0.026	0.104	0.382	0.507	0.075
F(553,4354)					4.615	7.037	
test for concavity : (coefficient on 1/consumption per person)		1.033				-1.488	
		(3.166)				(1.368)	

Note: Robust (White correction) standard errors in parentheses.

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