

Justus, Marcelo; Kassouf, Ana Lúcia

## Article

# Evidence of the effect of wealth observed by criminals on the risk of becoming a victim of property crimes

EconomiA

## Provided in Cooperation with:

The Brazilian Association of Postgraduate Programs in Economics (ANPEC), Rio de Janeiro

*Suggested Citation:* Justus, Marcelo; Kassouf, Ana Lúcia (2013) : Evidence of the effect of wealth observed by criminals on the risk of becoming a victim of property crimes, EconomiA, ISSN 1517-7580, Elsevier, Amsterdam, Vol. 14, Iss. 2, pp. 88-101, <https://doi.org/10.1016/j.econ.2013.08.006>

This Version is available at:

<https://hdl.handle.net/10419/179549>

### Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

### Terms of use:

*Documents in EconStor may be saved and copied for your personal and scholarly purposes.*

*You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.*

*If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.*



<https://creativecommons.org/licenses/by-nc-nd/3.0/>

# Evidence of the effect of wealth observed by criminals on the risk of becoming a victim of property crimes<sup>☆</sup>

Marcelo Justus<sup>a,\*</sup>, Ana Lúcia Kassouf<sup>b,1</sup>

<sup>a</sup> *Praça Santos Andrade, 1, Ponta Grossa, Paraná 84010-790, Brazil*

<sup>b</sup> *Av. Pádua Dias, 11, Piracicaba, São Paulo 13418-900, Brazil*

## Abstract

The objective of this paper is to measure the effect of wealth on property victimization risk. Using data from two household victimization surveys conducted in São Paulo city and a measure of spending as a proxy for wealth observed by criminals, the conclusion was reached that wealth level is one of the determinants of victimization risk. This risk increases with this variable, but it reaches a maximum level from which it declines as wealth levels increase.

© 2013 National Association of Postgraduate Centers in Economics, ANPEC. Production and hosting by Elsevier B.V. All rights reserved.

*JEL classification:* C35; D69

*Keywords:* Violence; Victimization; Property crime

## Resumo

O objetivo é mensurar o efeito da riqueza no risco de vitimização contra a propriedade. Utilizando dados de duas pesquisas domiciliares de vitimização realizadas na cidade de São Paulo, e uma medida de despesa realizada como proxy para a riqueza observada pelos criminosos, conclui-se que o nível de riqueza é um dos determinantes do risco de vitimização. O risco cresce com essa variável, mas atinge um ponto de máximo, a partir do qual se reduz para maior riqueza.

© 2013 National Association of Postgraduate Centers in Economics, ANPEC. Production and hosting by Elsevier B.V. All rights reserved.

*Palavras-chave:* violência; vitimização; crimes contra a propriedade

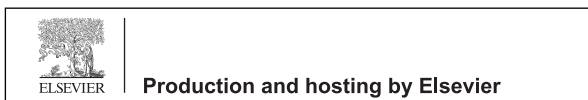
<sup>☆</sup> The authors thank the Public Policy Center of Insper – Education and Research Institute, and CNPq for their financial support. We thank Luiz Guilherme Scorzafave, and Rodolfo Hoffmann for their useful comments and suggestions. Any remaining errors and omissions are our full responsibility.

\* Corresponding author at: Economics, Ponta Grossa State University, Brazil.

*E-mail addresses:* [marcelojustus@hotmail.com.br](mailto:marcelojustus@hotmail.com.br) (M. Justus), [anakassouf@usp.br](mailto:anakassouf@usp.br) (A.L. Kassouf).

<sup>1</sup> Address: Economics, University of São Paulo/ESALQ, Brazil.

Peer review under responsibility of National Association of Postgraduate Centers in Economics, ANPEC.



## 1. Introduction

The first difficulty in investigating the causes of crime is that reliable information is hard to come by (or virtually non-existent). Existing official data, especially that available in police records, consists only in underestimated figures for actually committed crimes. The number of criminal occurrences is underestimated because many of them are not actually registered in a formal police report.<sup>2</sup>

The high amount of crimes that are not reported by their victims (underreporting of crimes), which is particularly true for some types of crimes, such as robberies, kidnappings and rapes, leads to the mismeasurement of crime indicators. This can skew the results of empirical studies if the analyst does not use an appropriate strategy to circumvent the problem.

Actually, as suggested by victimization surveys conducted in Brazil and abroad,<sup>3</sup> there is clear evidence that the actual crime rate is significantly higher than that reported based on official data. In other words, the official figures underestimate the scale of crime that has such a negative impact on the lives of citizens. Therefore, albeit useful for guiding public security actions, the data contained in police records is not sufficient for one to know the actual crime rate to which society is exposed to. As an attempt to correct this situation, victimization surveys began to be carried out in the United States in the 1960s. These surveys are based on a random sample of a given population, which is asked about instances of certain types of crimes in a given period of time. Besides allowing for better measurement of the actual crime rate, among other advantages, these surveys make it possible for one to know the characteristics of the victims and provide important inputs for empirical studies on the causes of criminal victimization.

Since crime reduces social welfare, economists have also been studying this additional issue.<sup>4</sup> The many other theories that attempt to explain the causes of crime include that of the criminal's rational choice, originated in the seminal work of [Becker \(1968\)](#), which was expanded by [Ehrlich \(1973\)](#). Although some economic studies on the causes of crime have already been carried out in the past (e.g. [Fleisher, 1963, 1966](#); [Smigel-Leibowitz, 1965](#); [Ehrlich, 1967](#)),<sup>5</sup> it was only after [Becker \(1968\)](#) and [Ehrlich \(1973\)](#) that empirical studies could be based on an economic theory. Since then, economists have been increasingly involved in surveys along these lines. However, the analyses were often focused on criminals' behavior, meaning that they were mainly intended to identify the main causes of the decision to commit a crime. Empirical evidence has usually held the arguments of the economic theory on deterrence, expected return on, and opportunity cost of crime. But little is known about the factors that influence the likelihood of an individual being victimized, namely, their victimization risk. This is so because most studies used data aggregated by countries, states or municipalities. With data from victimization surveys, however, one can study the determinants of criminal victimization using a sample of individual data. This type of data makes it possible to control for the main characteristics of individuals with a bearing on victimization risk, such as their age and gender.

Among previous studies that investigated the determinants of victimization risk, we can cite [Witte \(1980\)](#), [Sparks \(1981\)](#), [Meier and Miethe \(1993\)](#), [Miethe and McDowall \(1993\)](#) and [Levitt \(1999\)](#). In Brazil, the empirical analyses of determinants of victimization risk carried out by [Carneiro \(2000\)](#), [Beato et al. \(2004\)](#), [Gomes and Paz \(2008\)](#) and [Madalozzo and Furtado \(2011\)](#) deserve special attention. Apart from these studies, three recent Brazilian studies on the causes of victimization should be highlighted. [Gomes \(2011\)](#) investigated the importance of the spatial dimension in connection with the risk of becoming a victim of household theft or burglary in São Paulo city; [Peixoto et al. \(2011\)](#) analyzed the determinants of victimization based on a systemic perspective of criminal dynamics, with the aim of understanding the causes of changes in victimization patterns between 2003 and 2008 in the city of São Paulo; [Scorzafave et al. \(2011\)](#) carried out a general analysis of the determinants of the risk of becoming a victim of property

<sup>2</sup> A police report involves assessments and decisions of various individuals involved in an event seen as a "police matter". [Santos and Kassouf \(2008\)](#) describe the standard referral of cases seen a priori as "criminal events" and discuss key factors that influence the decision to actually register a victimization case with law enforcement.

<sup>3</sup> The two main victimization surveys carried out abroad are the *British Crime Survey*, which today is called *Crime Survey for England*, and the *National Crime Victimization Survey*. [Madalozzo and Furtado \(2011\)](#) listed victimization surveys carried out in Brazil that were finalized and disseminated until August 2009. The Special Supplements on Food Security, Victimization and Justice included in the National Household Sample Survey of 2009, carried out by IBGE, was added to that list.

<sup>4</sup> [Santos and Kassouf \(2008\)](#) briefly describe the involvement of economists, particularly in Brazil, in a research area referred to as Economics of Crime. Specifically, this study includes a section dealing with the importance of economists in investigating the causes of crime.

<sup>5</sup> The two latter studies were mentioned by [Ehrlich \(1973\)](#).

crimes and crimes against persons. This study also investigated possible causes for the underreporting of crimes along the lines of studies previously conducted by Santos and Kassouf (2008) and Madalozzo and Furtado (2011).

Victimization is a complex process and, consequently, one that is difficult to be modeled empirically. There is a no single well-structured theory to guide empirical analyses.<sup>6</sup> Studies have usually been based on two approaches that consider victims as objects of study, highlighting the importance of their “lifestyle” and creation of “opportunities” for criminals to carry out their crimes. Empirical analyses have been mainly based on the theoretical framework proposed by Cohen et al. (1981). Based on some previous studies, these authors expanded and formalized a sociological theory (which they refer to as the “opportunity model of predatory victimization”) to explain victimization risk. In this approach there are five factors which are strongly related to risk: exposure, proximity, guardianship, target attractiveness, and definitional proprieties of specific crimes.

There seems to be no empirical literature rejecting the approach proposed by these authors. The main open issue is that of which variables have a bearing on the first four factors. What can be said, for example, about the effects of being wealthy on becoming a victim of property crimes, such as theft and robbery.

Hypothetically, wealth has a twofold bearing on victimization risk according to Cohen et al. (1981). On the one hand, wealthier individuals are more economically attractive for criminals, meaning that more observed wealth implies greater victimization risk. On the other hand, wealthier individuals have stronger reasons and more money to spend on their own security.<sup>7</sup> Therefore, the effect of wealth on victimization risk is ambiguous, so only its net effect can be observed empirically.

Considering the level of spending of potential victims with protection and criminals with heterogeneous skills, Gomes and Paz (2008) conclude that there might be an increasing, but not monotonic, relationship between the income of a citizen and his or her property victimization risk. These authors empirically analyzed the effect of individual characteristics and size of cities on victimization risk using data for 104 cities in the state of São Paulo. The results showed that victimization risk does not increase monotonically with the victims’ income. Three possible explanations for this type of relationship are presented, among which private spending on protection is the most plausible one. In this study, per capita income levels was controlled for by five dummy variables. Using the lowest income levels (poor people) as the omitted variable, the coefficients for the other variables related to higher social classes (lower middle class, middle class, upper middle class, and high class) showed positive and statistically significant coefficients. Marginal effects on victimization risk increased up to the upper middle class, but the marginal effect for the rich was lower than that estimated for members of the upper middle class. This provides evidence that victimization risk does not increase monotonically with income. Controlling for the effect of income through dummy variables defined by social classes, Madalozzo and Furtado (2011) also observed that the marginal effect of income on the risk of victimization, albeit positive, depends on the social class under consideration.

This study focuses on analyzing the effect of wealth observed by criminals – approximated by total monthly per capita household spending – on property victimization risk, specifically victimization in the form of household theft/robbery and theft/robbery of persons.<sup>8</sup> This issue is not addressed in depth in previous empirical analyses, especially analyses carried out with data from victimization surveys conducted in Brazil. The hypothesis guiding the study is that the risk of property victimization increases with the wealth level observed by criminals as a result of its greater economic attractiveness, but such increase occurs at decreasing rates according to the victim’s capacity to spend more on private security, so much so that from a certain wealth level the risk decreases as wealth rises. In other words, the risk of criminal victimization increases with observed wealth until a maximum level is reached, from which it decreases as the wealth rises. Investigating this hypothesis is the main objective of this study. This paper is structured as follows: Section 2 presents a brief description of a useful theoretical framework for discussing the effect of wealth on victimization risk; Section 3 provides details about the empirical modelling; Section 4 presents a preliminary analysis; results are discussed in Section 5; Section 6 concludes the study.

<sup>6</sup> Summarizing the main theoretical approaches to the causes of crime, Cerqueira and Lobão (2004) says that the lifestyle theory (mainly developed in the work of Hindelang et al., 1978) is not, *stricto sensu*, a crime causation theory.

<sup>7</sup> According to data from the Special Supplement of the National Household Sample Survey of 2009, the feeling of insecurity in Brazil increases significantly as the per capita household income rises. For example, in the metropolitan area of São Paulo, 42.9% of the individuals with a per capita household income below one-quarter of the minimum wage felt safe. This percentage decreases as the income level increases, to the point of being up to 12.7 percentage points lower for people earning two or more minimum wages.

<sup>8</sup> The definition of observed wealth and justifications for the choice of a spending measure as proxy will be duly presented in Section 3.

## 2. Wealth and victimization

In the previous section, we presented factors that, according to [Cohen et al. \(1981\)](#), determine the risk of victimization. As indicated in this section’s title, we are trying to understand the effect of wealth on determining an individual’s risk of becoming a victim of property crime, admittedly seen as an economically motivated crime. In order to check any alleged effect of wealth on the risk of victimization, we specifically relied on the work of [Gaviria and Pagés \(2002\)](#), who proposed a simple victimization model that is useful for the discussion carried out in this study.

The model’s framework involves two actors (citizens and criminals) and two stages. In the first stage, citizens (who are only different from one another according to their wealth level) decide how much they will spend on private protection. In the second stage, citizens are matched with criminals who in turn decide whether or not to commit a crime upon observing the wealth ( $w$ ) of their prospective victims and their investments on private protection ( $e$ ). Assuming that criminals make their decisions on the basis mere pecuniary factors, weighing two factors: if they are successful in committing the crime, they are rewarded with a portion of the victim’s wealth given by  $\alpha$  times  $w$  ( $\alpha \leq 1$ ), and if they fail<sup>9</sup> – the probability of which is  $p$  – they pay a penalty equivalent to  $F$ .

Three additional assumptions are made: the probability of apprehension is assumed to increase monotonically with the spending in private protection (i.e.  $p = \mathbf{p}(e)$ , where  $\mathbf{p}' > 0$ ); victims and criminals are considered as risk-neutral; criminals are assumed to have complete information in that they observe their victim’s wealth and are able to correctly infer their risks of being apprehended.

In this context, a criminal will attempt to victimize citizen  $i$  who possesses a wealth of  $w_i$  and have spent  $e_i$  in private protection as long as the following inequality holds

$$(1 - \mathbf{p}[e_i])\alpha w_i - \mathbf{p}[e_i]F > 0 \tag{1}$$

Since all citizens are potential victims for criminals, a given citizen  $i$  can avoid becoming a victim if he or she spends at least  $h_i$  on private protection, where  $h_i$  indicates the spending on protection that would make a criminal indifferent between attempting to steal from  $i$  doing it because the risk involved is very high. In short,

$$h_i = \mathbf{p}^{(-1)} \left[ \frac{\alpha w_i}{\alpha w_i + F} \right] \tag{2}$$

where  $\mathbf{p}^{(-1)}$  is the inverse of function  $\mathbf{p}$  that links private spending in protection to the probabilities of punishing a criminal.

Eq. (2) gives, for each wealth level, the minimal spending on private protection required to prevent crime by deterring criminals. Therefore, citizens must decide whether they will spend  $h_i$  on their own protection or do not invest at all. They will spend  $h_i$  only if it does not exceed the prospective losses of being victimized. That is, if

$$h_i \leq \alpha w_i. \tag{3}$$

Wealthier persons would need, *ceteris paribus*, greater spending in private protection to avoid victimization. This is the conclusion reached based on the first derivative of expression (2) with respect to  $w$ ,

$$\frac{dh_i}{dw_i} = \frac{\alpha F}{(F + \alpha w_i)^2 \mathbf{p}'[h]} > 0 \tag{4}$$

But are wealthier persons willing to spend more on protection to prevent being victimized? Or will they instead prefer to bear some risk? The answer depends on the second derivative of  $h$  with respect to  $w$ ,

$$\frac{d^2 h_i}{dw_i^2} = - \frac{\alpha^2 F (2(F + \alpha w_i) \mathbf{p}'[h_i]^2 + F \mathbf{p}''[h_i])}{(F + \alpha w_i)^4 \mathbf{p}'[h_i]^3} \tag{5}$$

Eq. (5) will be negative, unless the second derivative of  $\mathbf{p}$  is both negative and large in absolute value. So the wealthy will routinely spending in private security in order to avoid being victimized unless  $\mathbf{p}$  exhibits sharp diminishing returns to scale.

<sup>9</sup> The authors have not point this out, but one must consider that failure means that the criminal was accused, arrested, convicted, and punished as provided for in the law.

If the marginal returns of an extra amount spent in private protection against crime are very low, the wealthy will find it too expensive to reach the necessary level of protection to prevent being victimized and will rationally decide to bear some crime. Otherwise, they will spend the portion of their wealth deemed necessary to avoid being victimized.

In summary, according to the approach adopted by [Gaviria and Pagés \(2002\)](#), the wealth of individuals determines both their economic attractiveness as victims and their capacity to protect themselves from criminals by paying for their protection.

According to the findings of [Becker \(1968\)](#), [Ehrlich \(1973\)](#), [Cohen et al. \(1981\)](#) and [Gaviria and Pagés \(2002\)](#) it is to be expected that, given the opportunity cost of crime, the likelihood of failure determined by government spending on public safety, the penalties provided for in the law, and the costs involved in planning and committing a crime, criminals will pick their victims based on their evaluation of those who are more economically attractive for the criminal act. In this subjective evaluation, criminals take into account both the wealth of potential victims and the likelihood of failure determined by how much they spend on their own protection. By doing this, criminals optimize the expected return on crime. Therefore, the behavior of potential victims has a direct bearing on the optimization process that is implicit in the rational choice of a criminal. Thus, if the principle of economic rationality on the part of criminals holds, the risk of victimization increases with wealth. However, as pointed out by [Gaviria and Pagés \(2002\)](#), wealthier individuals have stronger reasons and more money to spend on their own security to protect themselves from criminals. On the other hand, poorer individuals lack the financial means to pay for their protection to avoid being victimized, but are less economically attractive potential victims to criminals than wealthier individuals.

### 3. Empirical modelling

The data set used in the estimations of these models is made up of a pooled cross section of two victimization surveys conducted in São Paulo city in 2003 and 2008 by the Future Brazil Institute<sup>10</sup> and the company Ipsos Public Affairs, which carried out the sampling process and interviews and set up the database. In those surveys, the period analyzed with respect to victimizations was a one-year period.

We chose two types of crime against property to make the empirical analyses: household theft/robbery and theft/robbery of persons. For household theft/robbery, the surveyed individuals were asked whether anything had been stolen from their home during the period covered by the survey; for theft/robbery of persons, the surveyed individuals were asked whether they had had any good stolen or if they had been robbed of any good outside their home, vacation home, or vehicle during the period covered by the survey.

In the first and second editions, 5000 and 2967 households were surveyed, respectively. The observations were filtered to derive appropriate samples for the estimates. There are missings in some of the variables. Moreover, unlike previous studies using the same database as the one used in this study, only observations related to respondents who reported that they and their families had been living in their current home for at least one year, which is the period covered by the questions on criminal occurrences involving people living in the household, were kept in the sample that was used in the theft/robbery estimations. Although it implied the exclusion of 676 observations, this filter was applied to reduce imprecision in the estimates. The numbers of remaining observations for estimating the statistical models for the crimes of household theft/robbery and theft/robbery of persons was 5076 and 5581, respectively.

The response variable of the models is binary, defined by the occurrence of at least one type of crime analyzed over the period covered by the victimization surveys (*victim<sub>i</sub>*). It assumes value 1 if the individual *i* was victimized and 0 otherwise. Given this characteristic of the dependent variable, the empirical modelling of the determinants of property victimization is made through the probit models estimated by the maximum likelihood method.<sup>11</sup> The general specification of the estimated statistical models is as follows:

$$\Pr(\text{victim}_i = 1) = \Phi(\mathbf{x}_i\boldsymbol{\beta}) \quad (6)$$

$\Phi$  is the normal cumulative distribution,  $\mathbf{x}$  is a row vector that contains the control variables and a constant, and  $\boldsymbol{\beta}$  is the column vector of coefficients.

<sup>10</sup> As of February 2009, all the activities carried out by this institute were transferred to the Public Policy Center (CPP), which was incorporated into Insuper – Institute of Education and Research. Once again, we thank the CPP for its support.

<sup>11</sup> For a review of binary choice models, we suggest [Cameron and Trivedi \(2005, 2009\)](#).



In [Section 1](#), it was highlighted that this study is interested in the hypothetical relationship between wealth and victimization risk. In the previous section, which deals with the existence of this relationship theoretically, three additional hypotheses assumed by [Gaviria and Pagés \(2002\)](#) were pointed out. We believe that the strongest one is that “criminals are assumed to have complete information in that they observe their victim’s wealth and are able to correctly infer their risks of being apprehended”. It should also be recalled that the probability of apprehension is assumed to increase monotonically with the spending in private protection, which is a share of actual wealth. It is obvious that criminals are not aware of the actual wealth of their prospective victims and much less can they know how much they spend on protection. It is more likely that they can estimate and compare wealth among prospective victims based on what they can actually observe. In this regard, we use a measure of spending incurred by potential victims to reflect the wealth observed by criminals.

In this context, the variable of interest for this empirical analysis is the total monthly per capita household spending (hereinafter just spending) as measured in reals in 2003 (*spending*).<sup>12</sup> And in order to control for and test any possible nonlinearity in the relationship between observed wealth and victimization, the square of this variable is also used.

The other control variables, which are common to the two types of crime are: age in years (*age*); a dummy variable to distinguish gender, which assumes value 1 for males and 0 for females (*gender*); a dummy variable to distinguish color or race (*race*), which assumes value 1 for white or Asian (yellow) and value 0 for black, mulatto or indigenous people.

In the household theft/robbery victimization model, there are two specific controls: a dummy variable to distinguish place of residence, which assumes value 1 if the residence is located in a slum, in a project or near a slum or 0 if there is a slum nearby; a dummy variable to distinguish the type of residence, which assumes value 1 if it is a regular house and 0 if it is a house or apartment in a gated community.

In the household theft/robbery victimization model, there are two specific controls: a dummy variable to distinguish place of residence (*place*), which assumes value 1 if the residence is located in a slum, in a project or near a slum or 0 if there is a slum nearby; a dummy variable to distinguish the type of residence (*house*), which assumes value 1 if it is a house and 0 if it is a house/apartment in a gated community.

And in the victimization model for theft/robbery of persons, the specification contains: a dummy variable to distinguish the occupation status (*works*), which assumes value 1 if the individual works outside the home and 0 otherwise; and an interaction dummy variable ( $age \times gender$ ).

Finally, in order to control for time effects on both types of crime, the specifications contain a dummy variable to distinguish the year of the victimization survey (*time*), which assumes value 1 if the observation refers to the 2008 survey and 0 if it refers to the one carried out in 2003.

Still for household theft/robbery, unlike previous studies based on the same database used in this study, information about the head of the household with regard to gender, age and color is used.<sup>13</sup>

Once all variables are defined, the model expressed in Eq. (6) is rewritten for each of the types of crime under analysis. The specifications of the victimization models for household theft/robbery and theft/robbery of persons are as follows, respectively:

$$\Pr(victim_i = 1) = \Phi(\beta_0 + \beta_1 spending_i + \beta_2 spending_i^2 + \beta_3 age_i + \beta_4 gender_i + \beta_5 race_i + \beta_6 place_i + \beta_7 house_i + \beta_8 time) \quad (7)$$

<sup>12</sup> The figures for 2008 were deflated using the National Consumer Price Index (INPC). We opted for a measure of spending rather than for a measure of income for three reasons. First, because the questions on the income of people living in the household were closed questions by income brackets, which makes them inappropriate to test the hypothesis guiding this study. This could be circumvented by using the measure of personal income of the respondents (from work and other sources). But because it was only related to the respondent, using it was seen as inappropriate for measuring wealth observed by criminals, especially in the case of household theft/robbery. Second, measures of income are admittedly biased. Third and most importantly in our opinion, we believe that spending reflects wealth observable by criminals better than income. It is recognized, however, that the measure of spending that was used is only an approximation of the true amount spent by members of the household. However, since the question asked to the respondents allowed them not to report total spending or not to be aware of this total spending, it substantially reduced the likelihood of measurement errors in connection with this variable.

<sup>13</sup> [Scorzafave et al. \(2011\)](#) kept in the sample only the respondents who were heads of household; [Peixoto et al. \(2011\)](#) used the attributes of the respondents regardless of their status in the household; [Gomes \(2011\)](#) did not control for any of these attributes in the estimates; [Madalozzo and Furtado \(2011\)](#) considered the respondents’ gender and color and the average age in the household.

Table 1  
Definition, mean and standard deviation (SD) of the variables by type of theft/robbery.

| Variable        | Definition  | Household |        | Persons |        |
|-----------------|---|-----------|--------|---------|--------|
|                 |   | Mean      | SD     | Mean    | SD     |
| <i>victim</i>   | 1 if victimized and 0 otherwise   | 0.0660    | 0.2483 | 0.08385 | 0.2772 |
| <i>spending</i> | Total monthly per capita household spending in reals in 2003                  | 359.13    | 445.64 | 360.03  | 442.77 |
| <i>age</i>      | Age in years  | 38.56     | 15.85  | 38.03   | 15.66  |
| <i>gender</i>   | 1 if man and 0 if woman   | 0.5228    | 0.4995 | 0.5212  | 0.4996 |
| <i>race</i>     | 1 if white or Asian (yellow) and 0 otherwise                                  | 0.6032    | 0.4893 | 0.5967  | 0.4906 |
| <i>time</i>     | 1 if the observation is from the 2008 survey and 0 if it is from the 2003 one | 0.4050    | 0.4910 | 0.3931  | 0.4885 |
| <i>place</i>    | 1 if the residence is in a slum, near a slum or in a project and 0 otherwise  | 0.4143    | 0.4926 |         |        |
| <i>house</i>    | 1 if the residence is a regular house and 0 otherwise                         | 0.7843    | 0.4114 |         |        |
| <i>works</i>    | 1 if works outside the home and 0 otherwise                                   |           |        | 0.5078  | 0.4999 |

Note: The number of observations are 5076 and 5581, respectively.

and

$$\Pr(\text{victim}_i = 1) = \Phi(\beta_0 + \beta_1 \text{spending}_i + \beta_2 \text{spending}_i^2 + \beta_3 \text{age}_i + \beta_4 \text{gender}_i + \beta_5 \text{race}_i + \beta_6 \text{works}_i + \beta_7 (\text{age} \times \text{gender})_i + \beta_8 \text{time}) \quad (8)$$

It should be remembered that the hypothesis to be tested is: the risk of criminal victimization increases as the spending rises, but it reaches a maximum level from which the risk drops as spending levels increase. This hypothesis will not be rejected if coefficients  $\hat{\beta}_1$  and  $\hat{\beta}_2$  in the two models specified above are statistically significant and have positive and negative signs, respectively. Moreover, maximum spending should remain within the interval of the data analysis. For both types of theft/robbery, the figures for minimum and maximum spending are, respectively, 6 and 7000 reals.

Expectations about the signs of the other coefficients in the model expressed in Eqs. (7) and (8) are compared with empirical evidence in Section 5. Except for the proxy for observed wealth, expectations for the other variables are limited to the patterns identified in the descriptive analyses presented in the next section. This is so because apart from the fact that there is no well-structured theoretical model to guide expectations, it is almost impossible to identify the channels through which these control variables influence the risk of victimization, as they are determinants, to a greater or lesser degree, of the factors that hypothetically have a bearing on the risk of criminal victimization, described in Section 2.

Table 1 shows the names, definitions, means, and standard deviations of the variables.

#### 4. Preliminary analyses

For household thefts/robberies, we see that 5.1% of individuals were victimized once in the one-year interval considered in the surveys; 1.0% were victimized twice and 0.5% were victimized at least three times. For crimes of theft/robbery of persons, the percentages were, 6.8%, 1.2%, and 0.4%, respectively (Table 2).

Table 2  
Frequency of victimizations by type of theft/robbery.

| Number of victimizations | Household |             | Persons   |             |
|--------------------------|-----------|-------------|-----------|-------------|
|                          | Frequency | Frequency % | Frequency | Frequency % |
| 0                        | 4741      | 93.40       | 5113      | 91.61       |
| 1                        | 257       | 5.06        | 378       | 6.77        |
| 2                        | 51        | 1.00        | 66        | 1.18        |
| ≥3                       | 27        | 0.53        | 24        | 0.43        |



Table 3  
Frequency of victimizations conditional on the categories of the qualitative control variables by type of theft/robbery.

| Variable      | Categories | Household |      | Persons |       |
|---------------|------------|-----------|------|---------|-------|
|               |            | 0         | 1    | 0       | 1     |
| <i>gender</i> | 0          | 93.60     | 6.40 | 91.28   | 8.72  |
|               | 1          | 93.22     | 6.78 | 91.92   | 8.08  |
| <i>race</i>   | 0          | 94.24     | 5.76 | 92.05   | 7.95  |
|               | 1          | 92.85     | 7.15 | 91.32   | 8.68  |
| <i>time</i>   | 0          | 93.18     | 6.82 | 91.91   | 8.09  |
|               | 1          | 93.73     | 6.27 | 91.16   | 8.84  |
| <i>house</i>  | 0          | 95.71     | 4.29 |         |       |
|               | 1          | 92.77     | 7.23 |         |       |
| <i>place</i>  | 0          | 92.70     | 7.30 |         |       |
|               | 1          | 94.39     | 5.61 |         |       |
| <i>works</i>  | 0          |           |      | 93.48   | 6.52  |
|               | 1          |           |      | 89.80   | 10.20 |

Note: The definitions of the variables are reported in Table 1.

Table 4  
Percentage of repeat victimizations conditional on the categories of the qualitative control variables by type of theft/robbery.

| Variable      | Categories | Household                |      |      |      | Persons |      |      |      |
|---------------|------------|--------------------------|------|------|------|---------|------|------|------|
|               |            | Number of victimizations |      |      |      |         |      |      |      |
|               |            | 0                        | 1    | 2    | ≥3   | 0       | 1    | 2    | ≥3   |
| <i>gender</i> | 0          | 93.60                    | 4.62 | 1.16 | 0.62 | 91.28   | 7.00 | 1.35 | 0.37 |
|               | 1          | 93.22                    | 5.46 | 0.87 | 0.45 | 91.92   | 6.57 | 1.03 | 0.48 |
| <i>race</i>   | 0          | 94.24                    | 4.07 | 1.09 | 0.60 | 92.05   | 6.71 | 0.93 | 0.31 |
|               | 1          | 92.85                    | 5.72 | 0.95 | 0.49 | 91.32   | 6.82 | 1.35 | 0.51 |
| <i>time</i>   | 0          | 93.18                    | 5.33 | 0.99 | 0.50 | 91.91   | 6.52 | 1.15 | 0.41 |
|               | 1          | 93.73                    | 4.67 | 1.02 | 0.58 | 91.16   | 7.16 | 1.23 | 0.46 |
| <i>house</i>  | 0          | 95.71                    | 3.38 | 0.64 | 0.27 |         |      |      |      |
|               | 1          | 92.77                    | 5.53 | 1.11 | 0.60 |         |      |      |      |
| <i>place</i>  | 0          | 92.70                    | 5.75 | 1.14 | 0.40 |         |      |      |      |
|               | 1          | 94.39                    | 4.09 | 0.81 | 0.71 |         |      |      |      |
| <i>works</i>  | 0          |                          |      |      |      | 93.48   | 5.39 | 0.84 | 0.29 |
|               | 1          |                          |      |      |      | 89.80   | 8.12 | 1.52 | 0.56 |

Note: The definitions of the variables are reported in Table 1.

The low frequency of individuals who were victimized more than once during the period covered by the surveys made it impossible to develop a robust modelling of the determinants of repeat victimization through the estimation of count models as made, for instance, by Ybarra and Lohr (2002) and Carvalho and Lavor (2008). Nevertheless, for the sole purpose of visualizing patterns in the data, apart from calculating certain statistics conditional on victimization, we calculated other conditionals on the number of victimizations involving the same type of crime during the period covered by the surveys.

Tables 3 and 4 show the frequency of victimization and repeat victimization, respectively, conditional on the categories of qualitative control variables.

Among individuals living in an apartment or gated community, 4.3% were victims of household theft or robbery. But among those who lived in regular houses the percentage was 7.2%. Therefore, living in an apartment or gated community seems to reduce the risk of victimization. It was also observed that the percentage of individuals who were victims of household theft/robbery was about 1.7 percentage points (pp) higher in areas with no slums nearby. This suggests that these crimes tend to be committed at a distance from slums, in areas where wealth levels tend to be higher.

Regarding theft/robbery of persons, it was observed that the percentage of victimized individuals was much higher in the group of individuals who worked outside the home (10.2%) than in the group of individuals who did not (6.5%).

Table 5  
Mean of the qualitative control variables conditional on victimization by type of theft/robbery.

| Variable        | Household |        | Persons |        |
|-----------------|-----------|--------|---------|--------|
|                 | 0         | 1      | 0       | 1      |
| <i>age</i>      | 38.72     | 36.17  | 38.53   | 32.69  |
| <i>spending</i> | 356.75    | 392.72 | 352.08  | 446.83 |

Note: The definitions of the variables are reported in Table 1.

Table 6  
Mean of the qualitative control variables conditional on repeat victimization by type of theft/robbery.

| Variable        | Household                |        |        |        | Persons |        |        |        |
|-----------------|--------------------------|--------|--------|--------|---------|--------|--------|--------|
|                 | Number of victimizations |        |        |        |         |        |        |        |
|                 | 0                        | 1      | 2      | ≥3     | 0       | 1      | 2      | ≥3     |
| <i>age</i>      | 38.72                    | 36.53  | 36.53  | 32.11  | 38.52   | 33.06  | 30.76  | 32.17  |
| <i>spending</i> | 356.75                   | 386.22 | 402.29 | 436.43 | 352.08  | 455.41 | 424.52 | 373.01 |

Note: The definitions of the variables are reported in Table 1.

This difference suggests that individuals engaged in a professional activity outside their home are exposed to a greater risk of victimization.

With regard to gender, color and time, no differences that could be deemed relevant or significant for both type of crimes were detected.

The same preliminary analyses about victimization, with changes only in the percent values presented, are valid for repeat victimizations.

As for the average age of individuals, a clear pattern was detected both for victimizations and repeat victimizations (Tables 5 and 6). Regardless of the type of crime, the average age of victimized individuals is lower than the average age of non-victimized ones. The difference is more pronounced for theft/robbery of persons, whose victims are about 5.8 years younger than non-victimized individuals in average. Because this difference is relatively large, it is suspected that younger individuals are more exposed to the risk of having something stolen/being robbed outside the home. This suspicion grows stronger when one observes the behavior of age averages according to the number of victimizations and sees that the average age is lower as the number of times that individuals are victimized increases.

As regards spending, the proxy for wealth observed by criminals, it can be seen that the mean of this variable is higher among victimized individuals than among non-victimized ones. It can be observed that this difference is more pronounced among victims and non-victims of theft/robbery of persons (Table 5). Specifically, in the case of repeat victimization to household theft/robbery, it can be observed that the average spending is higher in the group of individuals who were victimized twice than in that of individuals who were victimized once and that it is higher in the group of individuals who were victimized at least three times than in the group of those who were victimized twice. However, for theft/robbery of persons, a clear pattern can be observed between spending and repeat victimization (Table 6). The differences observed in average spending among groups of victimized and non-victimized individuals might indicate that wealth, proxied by spending, is one of the determinants of the risk of property victimization.

## 5. Results

The results of the probit regressions by type of theft/robbery are reported in Table 7. Clearly, there are statistically significant signs at conventional levels, positive and negative for the coefficients associated to the variables *spending* and *spending*<sup>2</sup>, respectively. Thus, there is evidence in favor of the hypothesis tested in this study. This is a result that supports the theoretical notes made by Gomes and Paz (2008).

Table 7  
Results of the estimations by type of theft/robbery and specification.

| Variable                      | Household                |                           |                          | Persons                   |                           |                         |
|-------------------------------|--------------------------|---------------------------|--------------------------|---------------------------|---------------------------|-------------------------|
|                               | Linear                   | Quadratic                 | Logarithmic              | Linear                    | Quadratic                 | Logarithmic             |
| <i>spending</i>               | 0.001593*<br>(0.0000541) | 0.0007279*<br>(0.0002016) |                          | 0.0002597*<br>(0.0000486) | 0.0004771*<br>(0.0000995) |                         |
| <i>spending</i> <sup>2</sup>  |                          | −2.56e−07**<br>(1.07e−07) |                          |                           | −6.97e−08**<br>(3.22e−08) |                         |
| ln( <i>spending</i> )         |                          |                           | 0.1417*<br>(0.03584)     |                           |                           | 0.1994*<br>(0.02953)    |
| <i>age</i>                    | −0.007175*<br>(0.00177)  | −0.007762*<br>(0.001798)  | −0.007876*<br>(0.001799) | −0.016295*<br>(0.002664)  | −0.01669*<br>(0.002655)   | −0.01742*<br>(0.002669) |
| <i>gender</i>                 | 0.002216<br>(0.05573)    | −0.004562<br>(0.05605)    | −0.005743<br>(0.05607)   | −0.1722<br>(0.1391)       | −0.1677<br>(0.1391)       | −0.1811<br>(0.1398)     |
| <i>race</i>                   | 0.1178**<br>(0.05911)    | 0.0853<br>(0.06025)       | 0.0866<br>(0.06018)      | 0.07101<br>(0.007231)     | 0.05114<br>(0.0524)       | 0.02761<br>(0.053)      |
| <i>time</i>                   | −0.03578<br>(0.05649)    | −0.03285<br>(0.05667)     | −0.03449<br>(0.05662)    | 0.0516<br>(0.007373)      | 0.0764<br>(0.0505)        | 0.07635<br>(0.05063)    |
| <i>house</i>                  | 0.3477*<br>(0.08394)     | 0.3764*<br>(0.08399)      | 0.3778*<br>(0.0828)      |                           |                           |                         |
| <i>place</i>                  | −0.1642*<br>(0.05939)    | −0.1404**<br>(0.06031)    | −0.141**<br>(0.06009)    |                           |                           |                         |
| <i>works</i>                  |                          |                           |                          | 0.2076*<br>(0.05294)      | 0.2013*<br>(0.05314)      | 0.1877*<br>(0.0533)     |
| <i>age</i> × <i>gender</i>    |                          |                           |                          | 0.00129<br>(0.003781)     | 0.001103<br>(0.003779)    | 0.001462<br>(0.003791)  |
| Constant                      | −1.5754*<br>(0.1208)     | −1.696*<br>(0.1255)       | −2.2809*<br>(0.2328)     | −1.01718*<br>(0.1042)     | −1.047*<br>(0.1045)       | −0.9436*<br>(0.1729)    |
| Risk is maximized at spending |                          | 1421                      |                          | 3421                      |                           |                         |
| Pseudo R <sup>2</sup>         | 0.0181                   | 0.0235                    | 0.0223                   | 0.0379                    | 0.0400                    | 0.0438                  |
| Wald test $\chi^2(8)$         | 41.68                    | 51.21                     | 49.08                    | 104.10                    | 113.52                    | 122.81                  |
| Number of observations        | 5076                     | 5076                      | 5076                     | 5581                      | 5581                      | 5581                    |

Notes: Standard errors in parentheses; the definitions of the variables are reported in Table 1; the results for the linear model for theft/robbery of persons are the same obtained by Scorzafave et al. (2011).

\* Significance at 1%.

\*\* Significance at 5%.

In addition, estimates obtained through two other specifications are reported: (a) without the quadratic term for spending, that is, assuming that the alleged effect of wealth is linear<sup>14</sup>; (b) using the logarithm of spending.

The results suggest that the positive effect of spending, the proxy for observed wealth, on victimization risk is independent from the specification that was used. It should be noticed that the change in how spending was controlled for did not lead to significant changes in the values and levels of statistical significance of the coefficients estimated for the other control variables. Moreover, the hypothesis of a positive, albeit not linear, relationship between wealth and risk of victimization is also supported when controlling by the variable ln(*spending*). The stability of the results provides strong evidence of their robustness.

Since the parabola is concave down, the function describing the estimated relationship between spending and victimization risk assumes a maximum value. Using the above-mentioned coefficients, it was estimated that the risk of becoming a victim of household theft/robbery in relation to spending reaches its peak at 1422 reals. And for theft/robbery of persons this peak was estimated at 3423 reals. These are values within the analysis interval.

Fig. 1 shows the estimated relationship between victimization risk and spending. This calculation was done considering only statistically significant coefficients, changing the value of the variable *spending* and keeping the other variables fixed at their sample mean values.

<sup>14</sup> Exclusion of the quadratic term implies using the same set of regressors used by Scorzafave et al. (2011) in the theft/robbery of persons model.

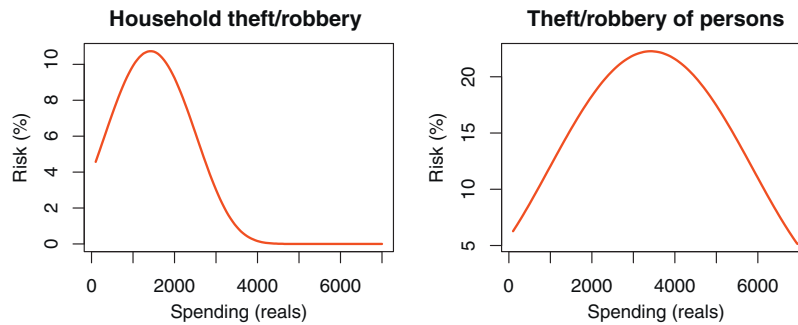


Fig. 1. Estimated relationship between spending (proxy for wealth observed by criminals) and the risk of property victimization (%).

Table 8

Frequency distribution of spending.

| Spending ranges (reals in 2003) | Frequency | Frequency % |
|---------------------------------|-----------|-------------|
| Less than 400                   | 4253      | 76.18       |
| 400–800                         | 835       | 14.96       |
| 800–1600                        | 237       | 4.25        |
| 1600 and above                  | 15        | 0.27        |
| Total                           | 5583      | 100.00      |

Note: All the observations of the two victimization surveys were used.

Unfortunately, based on the spending frequency distribution reported in Table 8, it can be concluded that only a small portion of citizens in the sample is in the descending part of these estimated curves. Specifically, only 3.2% of the surveyed households spent more than 1422 reals and only 0.3% of them spent more than 3423 reals.

Table 9 shows the percentage marginal effects derived from changes in the values of the regressors of the model with the quadratic specification for spending, as evaluated at their means.

Regarding the determinants of the individual becoming a victim of household theft/robbery, it was also concluded that: (a) living in a house increases the risk of victimization by about 3.9 (pp) as compared to living in an apartment or gated community; (b) the risk of victimization is approximately 1.7 pp lower for individuals living in slums, near slums, or near projects as compared to those living in areas with slums nearby; and (c) the risk of victimization decreases by about 0.1 pp for each additional year of age.

These results are consistent with those observed by Madalozzo and Furtado (2011) for the same type of crime, differing only in the magnitude of the estimated marginal effects. Considering individuals residing in slums as the control category, these authors arrived at the conclusion that living outside a slum (near a slum or far from a slum) increases the risk of having one's home stolen/robbed by approximately 2.7 pp; living in a house increases the risk of victimization by about 1.6 pp as compared to living in an apartment or house in a gated community; the risk decreases by circa 0.2 pp for each additional year over the average age of the members of the household. Peixoto et al. (2011) also found a positive and statistically significant effect of the type of residence (house) and age on the likelihood of becoming a victim of household theft/robbery. He reached the conclusion that living in a house increases the risk of victimization and that older individuals are less likely to be victimized as compared to younger ones. Gomes (2011) also concludes that living in a house increases the risk of becoming a victim of household theft/robbery and that if the residence is located in a slum, near a slum or in a project, the risk of becoming a victim of this type of crime is lower as compared to living farther from slums. In Scorzafave et al. (2011) significant negative and positive effects were found for the age of the household head and type of residence, respectively.

With few exceptions, living in slums, near slums or in projects is a sign of low household wealth. According to the principle of economic rationality, criminals choose households where there is more wealth to be stolen. In other words, criminals expect to have greater gains for each crime committed in more affluent areas of the city. Based on a preliminary analysis of the data made in Section 4, we suspected that this relationship was possible, considering that the percentage of victims of this crime was much higher in the group of individuals living in areas with slums nearby.

Table 9  
Percentage marginal effects by type of theft/robbery (quadratic specification).

| Variable                     | Household | Persons   |
|------------------------------|-----------|-----------|
| <i>spending</i>              | 0.00881   | 0.00678   |
| <i>spending</i> <sup>2</sup> | −3.10e−06 | −9.91e−07 |
| <i>house</i>                 | 3.8765    |           |
| <i>place</i>                 | −1.6685   |           |
| <i>works</i>                 |           | 2.8616    |
| <i>age</i>                   | −0.09389  | −0.2373   |

Notes: Only the marginal effects of variables with statistically significant coefficients have been reported (see Table 7).

Therefore, the negative sign for the variable *place* corresponds to the expected effect of the location on the risk of household theft/robbery. However, once observed wealth is controlled for through spending, the risk of victimization should be greater in areas with slums nearby. This indicates that observed wealth might not have been appropriately controlled for. It should be considered that controls are almost invariably imperfect.

Another expected result, mainly based on common sense, is that the risk of household theft/robbery is lower for apartments or houses in gated communities than in ordinary houses. It is known that stealing or robbing goods from a house is easier than committing such crimes in apartments or gated communities. Therefore, this is seen as further indirect evidence that criminals act rationally when choosing their victims by assessing potential gains and their risk of being caught.

For theft/robbery of persons, the results are that the risk of victimization is 2.9 pp higher for individuals engaged in work outside their home as compared to those who are not. The estimates indicate that each additional year of age reduces the risk of becoming a victim of crimes of this nature by about 0.2 pp. All these results and also the non-significant coefficients observed for the other variables in the model are consistent, including in terms of the marginal effect's magnitude, with the results observed in [Scorzafave et al. \(2011\)](#), even though no quadratic term for spending was included.

It is seen as plausible that the effect of age on the risk of victimization is greater for theft/robbery of persons than for household theft/robbery. Overall, younger individuals are more exposed to the risk of theft/robbery of persons than older ones. It should be noted as well that older individuals tend to adopt an even more cautious behavior after being victimized in any way. It is also true that younger individuals are much more exposed to criminals than older ones because they go out more often to places and at times where the likelihood of criminals being caught in a criminal act is lower.

It was expected that the risk of victimization for theft/robbery of persons would be higher for individuals who work outside their home. This is so because such crimes are usually committed in public places where more individuals usually work outside their home, such as, for example, in shopping streets and centers. Also in this case, empirical evidence corroborates what was found in the preliminary analyses. In that section, it was seen that the percentage of victimized individuals is much higher in the group of individuals who worked outside their home.

It should be noted that, regardless of the type of theft/robbery, no statistically significant effects were detected for the gender, color, and time variables. Such evidence of insignificance corroborates the little or almost no difference observed in the percentage of individuals victimized conditional on the categories of these variables. However, with regard to the gender of an individual, our expectations, based on common sense, that women are easier victims of theft/robbery of persons were not corroborated. For theft/robbery of persons also, the hypothesis of null effect of the variable for the interaction between gender and age that was not expected initially either cannot be rejected (Table 8).

Regarding the household theft/robbery, the non-significance of the coefficients of the dummy variables for gender, color, and time had already been observed in the estimations made by [Madalozzo and Furtado \(2011\)](#). [Peixoto et al. \(2011\)](#) also found a non-significant effect for color and time, but he observed a significant effect for gender. In the various models estimated by [Gomes \(2011\)](#), the coefficient of the dummy variable for time was statistically significant in two only, in which an effort was made to control for an assumed spatial correlation between the households. In [Scorzafave et al. \(2011\)](#), the coefficient estimated for the dummy variable for time was significant at conventional levels of significance, but its magnitude is negligible. In this study, it was seen that gender is not a determinant of victimization risk and that the coefficient estimated for the dummy variable for Race was only statistically significant at 10% level.

## 6. Concluding remarks

This study was guided by the hypothesis that wealth influences the risk of an individual becoming a victim of property crimes through two elements: economic attractiveness and protection capacity. In particular, we tested the hypothesis that the observed relationship between wealth (approximated by spending) and the risk of property victimization is positive, albeit nonlinear. This hypothesis was not rejected for the two types of crimes analyzed here: household theft/robbery and theft/robbery of persons.

It can be indirectly inferred that non-rejection of the hypothesis investigated in this study indicates that the decision to commit a crime is guided by economic rationality, as suggested by the economic theory on the causes of criminal behavior. According to this theory, criminals assess their expected return before committing a crime, subjectively computing potential gains and the likelihood of being caught.

The evidence on the nonlinear effect of spending on victimization risk strongly suggests that the economic status of a family is a determinant not only of gains from crime, but also of its capacity to protect itself from crime.

According to the rational choice theory, there is a clear positive relationship between gains from crime and the number of criminal occurrences, a hypothesis that has been tested empirically using the per capita household income as proxy variable (Mendonça et al., 2002; Santos and Kassouf, 2007; Santos, 2009, and many others). It has often been argued that this variable is associated with both expected gains from and the opportunity cost of crime and, in addition, according to Sjoquist (1973), income incorporates the opportunity cost if the criminal is punished with imprisonment. However, the first effect has prevailed in empirical analyses to such an extent that, in most cases, a positive effect of income on crime has been diagnosed. But the evidence found in this study suggests that it might be more appropriate to control for a possible nonlinear effect of income on crime rates. In other words, based on the findings of this study, we suggest that a quadratic term for the variable that measures household income should be included in the calculations. We believe that this should be done because it determines both expected gains from crime and spending contributing to prevent crime. Due to the lack of appropriate data, private investment to deter crime is not controlled for in the estimations of models in which the crime rate is used as dependent variable. Therefore, including a quadratic term for the variable intended to control for expected gains from crime can be a good alternative to indirectly control for private efforts to deter criminal behavior.

As for public policies designed to reduce crime levels, we believe, on the one hand, that measures adopted by the State should focus on factors that increase the opportunity cost of crime, discouraging more individuals from becoming criminals and recidivism. On the other hand, it is imperative to increase the likelihood of failure for hardened criminals in committing crimes. This can be done through public security policies designed to increase the efficiency of public security institutions. It is also necessary to put measures in place to reduce underreporting of crimes, as knowing the actual crime rate is crucial for the competent authorities to make informed decisions on earmarking resources for public safety. Finally, if this is not done, society will bear the burden of preventing victimizations by adopting an increasingly cautious behavior and spending part of its wealth on its safety, which is constitutionally a duty of the State.

## References

- Beato, F.C., Peixoto, B.T., Andrade, M.V., 2004. *Crime oportunidade e vitimização*. *Revista Brasileira de Ciências Sociais* 19 (55), 73–89.
- Becker, G.S., 1968. *Crime and punishment: an economic approach*. *The Journal of Political Economy* 76 (2), 169–217.
- Cameron, A.C., Trivedi, P.K., 2005, July. *Microeconometrics: Methods and Applications*, 1st edition. Cambridge University Press, New York.
- Cameron, A.C., Trivedi, P.K., 2009, March. *Microeconometrics Using Stata*, 2nd edition. Stata Press, College Station.
- Carneiro, L.P., 2000. *Violent Crime in Latin America Cities: Rio de Janeiro and São Paulo*. Research Report. USP, São Paulo, pp. 129.
- Carvalho, J.R., Lavor, S.C., 2008. *Repeat criminal victimization and income inequality in Brazil*. *Economia (Selecta)* 9 (4), 87–110.
- Cerqueira, D., Lobão, W., 2004. *Determinantes da criminalidade: Arcabouços teóricos e resultados empíricos*. *Dados – Revista de Ciências Sociais* 47 (2), 233–269.
- Cohen, L.E., Kluegel, J.R., Land, K.C., 1981. *Social inequality and predatory criminal victimization: an exposition and test of a formal theory*. *American Sociological Review* 46 (5), 505–524.
- Ehrlich, I., 1967. *The Supply of Illegitimate Activities*. Columbia University, New York (unpublished manuscript).
- Ehrlich, I., 1973. *Participation in illegitimate activities: a theoretical and empirical investigation*. *The Journal of Political Economy* 81 (3), 526–536.
- Fleisher, B.M., 1963. *The effect of unemployment on juvenile delinquency*. *The American Economic Review* 71 (6), 543–555.
- Fleisher, B.M., 1966. *The effect of income on delinquency*. *The American Economic Review* 61 (1), 118–137.
- Gaviria, A., Pagés, C., 2002. *Patterns of crime victimization in Latin American cities*. *Journal of Development Economics* 67, 181–203.



- Gomes, F.A.R., 2011. *Vitimização por roubo e furto em São Paulo: qual é a importância da dimensão espacial?* Research Report. CPP-INSPER, São Paulo, pp. 76.
- Gomes, F.A.R., Paz, L.S., 2008. *The determinants of criminal victimization in São Paulo State – Brazil*. *Brazilian Review of Econometrics* 28 (2), 217–238.
- Hindelang, M.J., Gottfredson, M.R., Garofalo, J., 1978. *Victims of Personal Crime: An Empirical Foundation for a Theory of Personal Victimization*. Ballinger Publishing Company, Cambridge.
- Levitt, S.D., 1999. *The changing relationship between income and crime victimization*. *Economic Policy Review* (September), 87–98.
- Madalozzo, R., Furtado, G.M., 2011. *Um estudo sobre vitimização para a cidade de São Paulo*. *Revista de Economia Política* 31 (1), 160–180.
- Meier, R.F., Miethe, T.D., 1993. *Understanding theories of criminal victimization*. *Crime and Justice* 17, 459–499.
- Mendonça, M.J.C., Loureiro, P.R.A., Sachsida, A., 2002. *Uma análise empírica a partir dos dados do Presídio da Papuda*. *Estudos Econômicos* 32 (4), 621–641.
- Miethe, T.D., McDowall, D., 1993. *Contextual effects in models of criminal victimization*. *Social Forces* 71 (3), 741–759.
- Peixoto, B., Souza, L.G., Lima, R.S., 2011. *Uma análise sistêmica: vitimização e políticas de segurança em São Paulo*. Tech. Rep. Centro de Políticas Públicas do Instituto de Pesquisa e Ensino (CPP-Insper), São Paulo.
- Santos, M.J., 2009. *Dinâmica temporal da criminalidade: mais evidências sobre o “efeito inércia” nas taxas de crimes letais nos estados brasileiros*. *Economia* 10 (1), 169–194.
- Santos, M.J., Kassouf, A.L., 2007. *Uma investigação econômica da influência do mercado de drogas ilícitas sobre a criminalidade brasileira*. *Economia* 8 (2), 187–210.
- Santos, M.J., Kassouf, A.L., 2008. *Existe explicação econômica para o sub-registro de crimes contra a propriedade?* *Economia Aplicada* 12, 5–27.
- Scorzafave, L.G., Santos, M.J., Kassouf, A.L., 2011. *Determinantes da vitimização e do sub-registro de crimes na cidade de São Paulo*. Tech. rep. Centro de Políticas Públicas do Instituto de Pesquisa e Ensino (CPP-Insper), São Paulo.
- Sjoquist, D.L., 1973. *Property crime and economic behavior: some empirical results*. *The American Economic Review* 63 (3), 439–446.
- Smigel-Leibowitz, A., 1965. *Does Crime Pay? An Economic Analysis*. Columbia University, New York, Ph.D. Thesis, Master's Thesis.
- Sparks, R.F., 1981. *Multiple victimization: evidence theory and future research*. *Journal of Criminal Law and Criminology* 72 (Summer (2)), 762–778.
- Witte, A.D., 1980. *Estimating the economic model of crime with individual data*. *The Quarterly Journal of Economics* 94 (1), 57–84.
- Ybarra, L.M.R., Lohr, S.L., 2002. *Estimates of repeat victimization using the national crime victimization survey*. *Journal of Quantitative Criminology* 18 (1), 1–21.