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Underreporting of Property Crimes: An Empirical Economic Analysis

Frequência de denuncias de crimes contra a propriedade: uma análise econômica empírica

Marcelo Justus[1]
Unicamp

Luiz Guilherme Scorzafave[2]
USP

RESUMO

Indivíduos vitimados enfrentam o dilema de decidir se devem ou não denunciar o crime que sofreram. A pergunta é: será que vale a pena relatar o crime? A resposta pode ser indiretamente observado em pesquisas de vitimização. O objetivo deste trabalho é modelar o processo de tomada de decisão das vítimas de crimes contra a propriedade, aproximada por furto ou roubo de pessoas. Os dados individuais foram utilizada a partir de 3 e 8 pesquisas de vitimização realizadas na cidade de São Paulo. Nós estimamos um modelo probit bivariado com seleção da amostra. Conclui-se que a probabilidade de alguém denunciar um incidente aumenta no caso de um crime violento, e diminui com a frequência de vitimização repetida. Além disso, também é apresentada a hipótese de uma positiva, embora não linear, relação entre a riqueza e a probabilidade de denúncia.

Palavras-chave: crime, vitimização.
JEL: K42.

ABSTRACT

Victimized individuals face the dilemma of deciding whether or not to report the crime they suffered to law enforcement. The question is: does it pay to report crime? The answer can be indirectly observed in victimization surveys. The purpose of this paper is to model the decision-making process of victims of property crime, proxied by theft or robbery of persons. Individual data was used from 3 and 8 victimization surveys carried out in São Paulo city. We estimate a bivariate probit model with sample selection. We conclude that the probability of reporting an incident increases in the case of a violent crime and that it decreases with the frequency of repeated victimization. Moreover, the hypothesis of a positive, albeit not linear, relationship between wealth and reporting likelihood is also supported.

Keywords: underreporting, crime, victimization.
R: 15/8/14 **A**: 16/3/15 **P**: 30/3/15

[1] E-mail: marcejustus@gmail.com. The authors acknowledge Public Policy Center of Insper – Education and Research Institute – for financial support.
[2] E-mail: scorza@usp.br.

1. Introdução

Criminals act rationally when choosing their victims by assessing potential gains and their risk of being caught (Becker, 1968). The hypothesis of economic rationality has been supported in empirical studies, especially with regard to property crime. Some authors argue that a victim's decision after victimization (to report a crime or not) is also guided by their economic rationality (Myers, 1980; Goldberg and Nold, 1980; MacDonald, 2001; Allen, 2007; Santos and Kassouf, 2008). Thus, a question emerges: does it pay to report property crime? Sometimes it just doesn't pay to report victimization (Myers, 1980). Compared with the various economic studies about criminal behavior, the literature concerned with the causes of individual reporting behavior is very small (MacDonald, 2001). There are only two studies that empirically investigated the causes of underreporting of crimes in Brazil, namely, Santos and Kassouf (2008) and Madalozzo and Furtado (2011).

In this context, this study attempts to make empirical advances in the modeling of determinants of crime underreporting in Brazil. In sum, we intend to empirically model a victim's decision to report property crimes, proxied by theft or robbery cases and assuming that it is an economic choice. As opposed to the two above-mentioned studies, here the empirical modeling is done through a bivariate probit model with sample selection following Goldberg and Nold (1980) and MacDonald (2001).

In particular, in this study we investigate two factors which can influence the victims' decision-making process: a) individual's wealth, proxied by spending, and b) victims' confidence in law enforcement agencies and their tolerance regarding the number of crimes, proxied by frequency of repeated victimization in the last five years.

The wealth level can be associated with the decision to report in two ways. First, it determines personal assets. Considering that wealthier individuals suffer greater property losses when victimized, the expected benefit is greater for them than for less wealthy victims. Second, the opportunity cost of reporting tends to be higher for wealthier individuals. Therefore, the effect on the likelihood of reporting a crime can be ambiguous. For this reason, we intend to estimate the net effect of an individual's wealth on the probability of reporting a property crime.

Considering that the previous victimizations are reported, victims are able to assess their satisfaction with the services provided by law enforcement agencies. The likelihood of reporting a recent victimization tends to be higher when the victim is satisfied with the performance of law enforcement agencies and lower otherwise. On the one hand, as the frequency of victimization increases, concerns over crime rates also tend to increase. It is therefore plausible that the likelihood of reporting increases with repeated victimizations. This happens, for example, when victims reach their limit of tolerance for repeated victimizations. In such cases, although they might not believe in the efficiency of law enforcement agencies, they will still seek their help. On the other hand, if the satisfaction with services provided by law enforcement agencies in previous victimizations was low, the likelihood of reporting a new victimization tends to be lower than in the previous situation. So, the other objective of this paper is estimate the net effect of number of previous victimizations on the probability of reporting a new property crime.

This paper is structured as follows: Section 2 presents the path observed throughout the process between victimization and eventual reporting of a crime, and consequences of underreporting; Section 3 provides a brief description of empirical modeling, and Section 4 describes the data utilized; Results are discussed in Section 5; Section 6 concludes the paper.

2. Origins and consequences of underreporting

Victimization surveys show that official crime figures based on police re- ports underestimate the true number of crimes. The recorded crime rate is below the actual crime rate, i.e., underreporting of crimes (henceforth only underreporting) prevails, leading to mismeasurement of crime indicators. Many experts, especially criminologists and sociologists, refer to this underreporting rate as the "dark figure".

Figure 1 shows the path observed throughout the process between victimization and eventual reporting of a crime.

The volume of crime is divided into exposed and hidden crimes. Corruption is a good example of a hidden crime. It is possible for hidden crimes to be unveiled during police investigations of other crimes. Unfortunately, some of them are not registered in a formal police report, especially in societies marked by a high level of corruption. This aspect is the main source of crime underreporting.

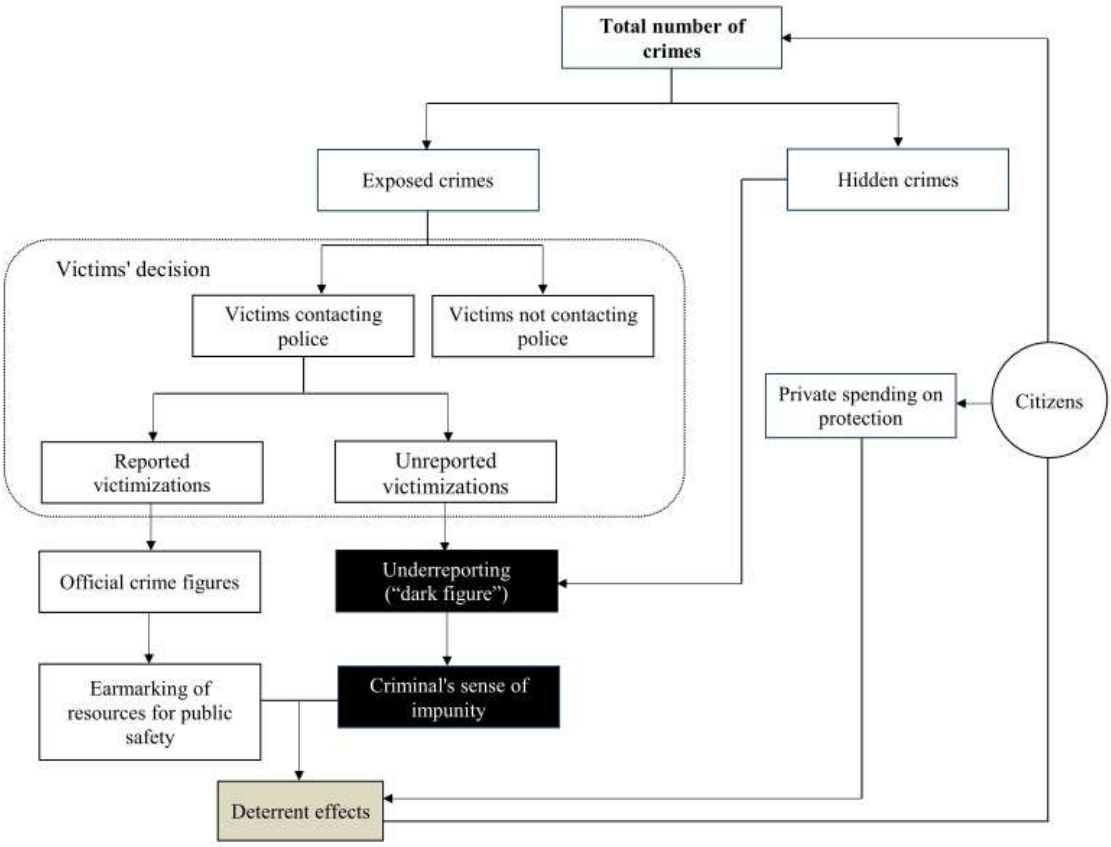
Exposed criminality is composed of crimes directly detected by police and crimes in which the victims know they have been victimized. After being victimized, they have to decide whether they should go to a police station to report the crime or not. Unfortunately, many victims choose not to report. There are also victims who give up the idea of recording a crime after contacting law enforcement. Unreported crimes are thus another source of crime underreporting.

Official crime figures can be used to earmark resources for public safety. When this is done, the allocation process is inefficient due to underreporting. For any policy adopted to fight crime, spending will be lower than what is actually required to reduce crime levels. Furthermore, the geographical allocation of resources will not be optimized because the percentage of crimes registered in a formal police report can vary between different areas. Hence, the inefficient allocation of public resources is the first economic consequence of underreporting.

Early interruption of effective public security policies is another negative consequence of underreporting. Policymakers should know that an effective policy has two effects in the short run: a decrease in the actual number of crimes and an increase in crime reporting. The probability of crime reporting tends to be higher according to the extent to which a victim believes in the efficiency of public security institutions. On the one hand, a reduction is observed in recorded crimes because crime events are decreasing. On the other hand, recorded crime increases due to a reduction in underreporting. Therefore, in the short run, the result of implementing an effective policy is uncertain if observed through the lens of official crime statistics, i.e., using the recorded crime rate. It is plausible that an increase in official crime statistics will be observed, rather than any expected reduction. However, continuing to apply the policy will lead to a reversal of that fact in the long run[3]. Unfortunately, public security policies that apparently failed to yield positive results in the short run are rarely continued by law enforcement agencies. This is the second harmful consequence of underreporting.

[3] This fact was observed in the city of Sao Paulo in recent years (see Santos and Kassouf, 2012).

Figure 1: Official crime statistics and underreporting of crime



The third negative consequence of underreporting is its impact on criminal behavior. The deterrent effect plays an important role in an individual's decision to engage in criminal activity. This decision is partially determined by the probability of failure in crime (Becker, 1968). Both hardened criminals and potential criminals, even if unconsciously, take into account the probability of failure if they choose to commit a crime. Criminals consider a conditional probability: that of being reported by victims (see Goldberg and Nold, 1980), that of being wanted by the police after being reported, that of being captured after being found, that of being arrested after being captured, that of being judged after being arrested, that of being convicted after being judged, and that of being imprisoned if convicted. They also consider the severity of the penalties or fines involved if convicted. We conclude that the probability of failure in crime is conditional on the sequence of random events that only occur if the victims report their victimization. This information is necessary for law enforcement to take action. As a result, the act of not reporting contributes to criminal activity. The greater the certainty that victims won't report a crime, the lower the probability of failure measured by criminals.

3. Empirical Modelling

Victims who make the reporting decision must weigh the expected utility from reporting, that is probabilistic by definition, against the stochastic utility from not reporting (Allen, 2007). Although some victimized individuals, especially those to whom the incident was an

extremely disturbing experience, may not foresee any benefits from reporting, others may carefully balance the outcomes of their decisions based on a cost-benefit analysis (Myers, 1980).

An economic or utilitarian model of reporting behavior by a rational victim was proposed by Myers (1980). This theoretical model is simple but useful for the discussion carried out in this study. In sum, it is a simple theoretical model about a victim's decision-making process.

A population is defined for individuals, Ω^j, who have been victims of an offense j. This population is divided between those who report the crime, and those who do not report it, Ω_{nr}. It is assumed that the individual's decision to report victimization is guided by his or her desire to maximize the utility associated with belonging to the first or second group. Considering that x is a vector of characteristics of the victim and the offense, the expected utility of reporting the crime is $U_r = f(x) + \varepsilon_r$, and the utility of not reporting it is $U_{nr} = f(x) + \varepsilon_{nr}$; where ε refers to identically and independently distributed random errors.

Although the utility from reporting is a non-observed variable, we can figure out the victims' decision using a database of victimization surveys. It is assumed that $U_r \geq U_{nr}$ when the victim decided not to report the crime, and $U_r < U_{nr}$ otherwise. Let $reporting$ be equal to 1 if the victim reported a given crime and 0 if he or she did not report it. In short, $Prob(reporting = 1|x) = Prob(U_{nr} - U_r \leq 0|x)$.

The percentage of total reported crimes (actual crime) varies widely across different types of crimes (Soares, 2004). Individual reporting inclination, for instance, is greater in theft or robbery involving vehicles and smaller in cases of rape, assault, extortion, kidnapping, etc.

The victims' decision process is based on a cost-benefit analysis related to reporting a crime. The main direct cost derived from reporting a crime is the time lost in the reporting process. Time is the opportunity cost of reporting. Unfortunately, reporting an incident can be time-consuming. It also involves other minor costs, such as with bus tickets, fuel, fear of revenge from the criminal concerned, and so on.

Victims evaluate the expected benefits of their reporting decisions based on a subjective measure of the probability of recovering their losses and/or of the criminal being actually punished. When losses are unrecoverable, the expected benefit is solely derived from the desire to know that the criminal was actually punished. The higher the violence used in a crime, the higher the desire to make sure that the criminals involved are punished. The higher the confidence in public security institutions, especially in the police, the higher the expected benefit from reporting an incident.

In short, the subjective measurement of costs and expected benefits from reporting is conditional on the type of crime, the victims' characteristics, the victim's degree of confidence in public safety institutions, property loss
degree of violence used by criminals, and fear of revenge from criminals.

The empirical modeling is made through the bivariate probit model[4] with sample selection. In the literature on underreporting, Goldberg and Nold (1980) and MacDonald (2001) were the only authors who considered this possibility.

Let $reporting$ and $victim$ be crime reporting and victimization, respec- tively. A bivariate probit model with sample selection (de Ven and Praag, 1981) assumes that there is an underlying relationship (latent equation) $_i$

[4] For a straightforward introduction to binary choice models, we suggest Cameron and Trivedi (2005).

$$\mathtt{reporting}_i^* = \mathbf{x}_i\boldsymbol{\beta} + \varepsilon_i, \tag{1}$$

such that we observe only the binary outcome (probit equation)

$$\mathtt{reporting}_i^{\text{probit}} = (\mathtt{reporting}_i^* > 0). \tag{2}$$

The response variable, however, is not always observed. Rather, the response variable for observation i is observed if (selection equation).

$$\mathtt{victim}_i^{\text{selection}} = (\mathbf{z}_i\gamma + \eta_i > 0), \tag{3}$$

where $\varepsilon_i \sim N(0,1)$, $\eta_i \sim N(0,1)$ and $\text{corr}(\varepsilon_i, \eta_i) = \rho$.

Recognizing the potential limitations of a utilitarian model of reporting behavior shown, it is notwithstanding helpful to specify and estimate such a model because victims may still act as if they were rationally balancing the cost and benefit of reporting a crime.

We believe that victims are more likely to make a rational choice for property crimes than for crimes against persons. Thus, our empirical modeling will be performed for property crime reporting (proxied by theft/robbery of persons).The surveyed individuals were asked whether they *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 (one-year period)*.

It is assumed that crime reporting is an economic decision. This choice is captured by the dummy variable `reporting`, which is equal to 1 if this is so and 0 if not.

We think that wealth is a determinant factor for the victim's decision. The spending incurred by victims is a proxy to their wealth. We opted for a spending measure rather than for one related to income in order to reduce response bias. The spending variable is defined as the logarithm for total monthly per capita household spending (hereinafter just spending) as measured in real 2003 figures, (in Reais, the Brazilian currency)[5].

In Eq. (2) age, gender, ethnicity, economic activity, number of repeated victimization, if the criminal used a weapon of any kind, and time effect were controlled for. The three last controls are not applied in Eq.(3). For the model to be well identified, this equation should have at least one control variable that is not applied in the first equation. We used the same set of regressors used by Santos and Kassouf (2013) in the theft/robbery victimization model. Education level and marital status are controls used only in the selection equation.

[5] The figures for 2008 were deflated using the National Consumer Price Index.

4. Data and preliminary analysis

The data set used to estimate the model is a pooled cross section sample of two victimization surveys conducted in São Paulo city in 2003 and 2008 by the Future Brazil Institute[6] and the company Ipsos Public Affairs.

The observations were filtered to derive appropriate samples for the estimates. First, victims who had their personal documents stolen were excluded. This filter was necessary because when victims lose their personal documents in a victimization incident, their choice is almost always that of reporting the crime. Second, we excluded thirteen observations because they are panel data. This filter was applied to reduce imprecision in the estimates. After filtering and considering losses due to missing data, our pooled sample consisted of 4885 individuals (187 victimized and 4698 non-victimized individuals) aged between 16 and 70 years old.

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

Table 1: Definition, mean and standard derivation of the variables used in the probit equation

Variable	Definition	Mean	Std. Dev.
`reporting`	1 if theft/robbery was reported and 0 otherwise.	0.2620	0.4409
`spending`	Total monthly per capita household spending, in *Reais* (the Brazilian currency) in 2003.	451.25	504.68
`age`	Age in years.		
	`16−24`	0.3689	0.4838
	`25−35`	0.3369	0.4739
	`36−50`	0.2192	0.4148
	`51−70`	0.3743	0.4852
`man`	1 if man and 0 if woman.	0.5454	0.4993
`white or yellow`	1 if white or yellow (Asian) and 0 otherwise.	0.6150	0.4879
`active`	1 if part of the economically active population and 0 otherwise.	0.7647	0.4253
`repeat victimizations`	number of previous victimizations.	0.4225	0.9322
`year`	1 if the observation is from the 2008 survey and 0 if it is from the 2003 one.	0.3743	0.4852

Note: Sample size is 187.

The reporting rate is a remarkably low in the sample: only 26% of victimized individuals decided to report.

Table 2 shows the frequency of conditional reporting in the categories of qualitative control variables. Women reported more than men and the reporting rate is higher when a weapon is used in the crime. However, the reporting rate in any category never exceeds 32%.

[6] As of February 2009, all the activities carried out by this institute were transferred to the Public Policy Center, which was incorporated into Insper – Education and Research Institute.

Table 2: Frequency of reporting conditional on the categories of the qualitative control variables

Variable	Category	reporting	
		0	1
man	0	68.63	31.37
	1	80.00	20.00
white or yellow	0	69.44	30.56
	1	76.52	23.48
age	16−24	68.12	31.88
	25−35	80.95	19.05
	36−50	70.73	29.27
	51−70	78.57	21.43
active	0	77.27	22.73
	1	72.73	27.27
weapon	0	83.82	16.18
	1	68.07	31.93
year	0	74.36	25.64
	1	72.86	27.14

Note: Precise definitions of variables are given in Table 1.

The mean of the quantitative control variables conditional on reporting is given in Table 3. Spending is higher in the group of victims who reported their last victimization to the police, and the number of repeated victimizations is higher among those who do not report.

Table 3: Mean of the quantitative control variables conditional on reporting

Variable	reporting	
	1	0
spending	530.29	423.19
repeat victimization	0.2857	0.4710

Note: Precise definitions of variables are given in Table 1.

The statistical analyses presented in this section cannot support any assumptions regarding causality. However, in connection with previous literature, they can shape expectations about the signs of coefficients in the model estimated in this empirical exercise.

On the one hand, we expect to find that the likelihood of reporting a recent victimization is higher when the victim is rich and falls as the frequency of victimization increases. We also expect to find that the likelihood of reporting is lower when the victim is a man and higher in cases involving a weapon. In the next section, we present our arguments for this expectation along with empirical results. On the other hand, there is not a clear relationship between the victim's age and the likelihood of reporting a re- cent victimization, as well as between the victim's economic status and the likelihood of reporting a recent victimization.

5. Results and discussion

Table 4 shows the selectivity-corrected probit estimates of the probability of reporting a theft/robbery incident.

Null hypothesis $H_0: \rho = 0$ of the Wald test is rejected at a 1% significance level. When $\rho = 0$, standard probit techniques applied to the first equation yield biased results. Fortunately, the probit model with sample selection provides consistent and asymptotically efficient estimates for the coefficients. The sample selection was also diagnosed in MacDonald (2001).

The wealth level, proxied by spending, can be associated with the decision to report in two ways. First, it determines personal assets. Considering that wealthier individuals suffer greater property losses when victimized, the expected benefit is greater for them than for less wealthy victims. Second, the opportunity cost of reporting tends to be higher for wealthier individuals.

The results suggest that spending, the proxy for wealth level, has an ambiguous effect on the reporting likelihood. Moreover, we observed a positive non-linear relationship between spending and reporting likelihood. This result is suggestive that the cost of reporting can increase more with wealth than the expected benefit of reporting. This indicates, for instance, that for the same property loss due to an incident it is plausible that for less wealthy victims the expected benefit will be greater than the cost of reporting. The other way around is also plausible.

In general, victimization surveys show that robbery underreporting is lower than theft underreporting. Thefts are carried out without violence, since there is no contact between the criminal and the victim. Because of this, we used the variable `weapon` of any kind to control for violence committed by criminals. Violent crimes can cause severe emotional disorders. This variable is also used to control for crime type, i.e., to distinguish between theft and robbery. Moreover, the weapon used by a criminal can be positively associated with physical damage to the victims. Accordingly, given the cost, gun use implies a greater expected benefit from reporting a crime.

We control for the victims' confidence in law enforcement agencies and their tolerance regarding the number of crimes by the frequency of repeated victimization. When previous victimizations are reported, victims are able to assess their satisfaction with the services provided by law enforcement agencies. We believe that the likelihood of reporting a recent victimization is higher when the victim is satisfied with the performance of law enforcement, and lower otherwise. As the frequency of victimization increases, concerns with crime level also tend to increase. Therefore, it is plausible that the probability of reporting increases with repeated victimizations. This happens, for example, when victims reach their tolerance limit for repeated victimizations. In such cases, although they might not believe in the efficiency of law enforcement

agencies, they will still seek their help. Our results indicate that the probability of a theft/robbery being reported is lower if the individual has been the victim of others crimes, considering all types of crime occurred during the period covered by the surveys (one-year period).

Table 4: Theft/robbery reporting probit equations with and without correcting for sample selection bias

Probit equation: `reporting`	Without correction	With correction
`constant`	−2.171*	−3.866*
	(0.734)	(0.357)
`ln(spending)`	0.244***	0.282*
	(0.128)	(0.0615)
`weapon`	0.511**	0.289**
	(0.244)	(0.123)
`man`	0.132	0.0430
	(0.229)	(0.120)
`age`		
25−35	−0.549**	−0.412*
	(0.266)	(0.131)
36−50	−0.191	−0.389*
	(0.275)	(0.136)
51−70	−0.544	−0.744*
	(0.424)	(0.220)
`white or yellow`	−0.250	−0.112
	(0.219)	(0.120)
`active`	0.159	0.0977
	(0.254)	(0.125)
`repeat victimization`	−0.224**	−0.106***
	(0.109)	(0.0555)
`year`	0.193	0.203***
	(0.222)	(0.116)
Selection equation: `victim`		
`constant`		−2.191*
`man`		−0.414**
`age`		−0.0261*
`age x man`		0.0119*
`white or yellow`		0.0206
`works`		0.0562
`ln(spending)`		0.226*
`year`		0.0725
Wald test of indep. eqns $\chi(1)$ Statistics [p−value]		12.78 [0.0004]
Pseudo R^2	0.0875	
Number of observations	187	4885
Censored observations		4698
Uncensored observations		187

Notes: Robust standard errors are between parentheses; Robust standard errors for the selected equation estimates are available upon request; *, ** and *** denote significance at 1%, 5% and 10%, respectively; The basic characteristics are women for gender, aged between 16 and 24 for years of age, black, mulatto or indigenous for ethnicity, and 2003 survey for year; Precise definitions for the variables are given in Table 1.

The victim's age was controlled for by age brackets rather than by years of age because we suspected that there are differences in the cost-benefit analysis between age ranges. The cost of reporting a crime, especially the opportunity cost of this time-consuming process, is smaller for young and elderly individuals than for middle-aged ones (Goldberg and Nold, 1980; Craig,

1987). However, the property losses derived from crime tend to be smaller for young and elderly victims (Craig, 1987). Our estimates support these assumptions. The causal relationship between age and reporting likelihood found in our paper supports these thoughts. As compared with the group of victims aged 16-24, the probability of reporting is smaller if the victim is between 25-35 or 53-70 years old, and higher for victims aged between 36-50 years old.

Obviously, the results of this study are not directly comparable to those of other studies due to differences in the methodology, data set, crime types analyzed and empirical model specification. Nevertheless, recognizing this limitation, some comparisons are still possible.

We found evidence in favor of the hypothesis of a positive, albeit not linear, relationship between wealth (proxied by spending) and reporting likelihood. In MacDonald (2001) the income or spending of the victim was not controlled for; Allen (2007) did control for family income and did not find any linear effect on the probability of reporting a rape; Myers (1980), controlling for the percentage of high-income families, found a negative effect of this variable on the reporting likelihood. According to our results, ethnicity or gender does not appear to explain any variation in reporting probability across victims. Santos and Kassouf (2008), MacDonald (2001), and Madalozzo and Furtado (2011) have detected a gender effect. In their first study, the authors concluded that the likelihood of a robbery (of any kind) being reported is greater if the victim is male. The opposite was observed in others studies cited for reporting a burglary and theft/robbery of vehicle, respectively. It must be considered that in this last study the authors did not exclude observations regarding insured victims. In Santos and Kassouf (2008), no causal effect of ethnicity on the reporting likelihood was observed. Myers (1980) and MacDonald (2001) observed inconclusive results, since the effect of ethnicity appears to depend on the type of crime.

Concerning the age effect, we observed that this effect (either positive or negative) depends on the age range. Our results indicate that compared to victims aged 16-24 years old, those aged 25-35 or 51-70 are less likely to report. However, victims aged 36-50 are more likely to report as compared to the omitted category. Our results corroborate those obtained by Santos and Kassouf (2008) and Goldberg and Nold (1980). The results of these studies also suggest that there is a non-linear relationship between age and reporting likelihood.

Considering that wealth was proxied by spending and controlled for by the logarithm for spending rather than by income brackets, our evidence that wealth has a non-linear effect on the reporting likelihood is in tune with the findings of Goldberg and Nold (1980) and Santos and Kassouf (2008). We emphasize that wealth was proxied by spending and controlled for by the logarithm for spending rather than by income brackets.

Finally, we performed an additional exercise to investigate whether there is any indication of spurious regression for theft/robbery. We estimated a model for the reporting of assault and battery incidents. The specification includes marital status and whether there was any serious injury rather than the use of a weapon of any kind in order to control for violence. We believe that the hypothesis that the victim's decision is guided by economic rationality is more plausible for property crimes than for crimes against persons. In this sense, for instance, there are no reasons to expect a significant effect of spending on the probability of reporting an incident. Table 5 shows the results:

Table 5: Assault and battery reporting probit equations with and without correcting for sample selection bias

Probit equation: `reporting`	Without correction	With correction
`constant`	−1.027	−2.113*
	(0.727)	(0.599)
`ln(spending)`	−0.147	−0.0862
	(0.139)	(0.113)
`serious injury`	0.955*	0.657
	(0.268)	(0.452)
`marital status`	0.804*	0.356
	(0.244)	(0.397)
`man`	−0.228	−0.236
	(0.255)	(0.201)
`age`		
`25−35`	−0.158	−0.233
	(0.273)	(0.197)
`36−50`	−0.0377	−0.273
	(0.320)	(0.276)
`51−70`	0.641	−0.0203
	(0.455)	(0.604)
`white or yellow`	0.0612	−0.0242
	(0.246)	(0.191)
`active`	0.611***	0.465
	(0.349)	(0.357)
`repeat victimization`	0.00840	−0.00147
	(0.0343)	(0.0270)
`year`	0.134	−0.0362
	(0.253)	(0.237)
Selection equation: `victim`		
`constant`		−0.874*
`spouse`		−0.288*
`years of schooling`		−0.00863
`man`		−0.385***
`age`		−0.0223*
`age x man`		0.00881
`white or yellow`		−0.0555
`works`		0.0141
`ln(spending)`		0.0355
`year`		−0.179**
Wald test of indep. eqns $\chi(1)$ Statistics [p−value]		0.83 [0.3613]
Pseudo R^2	0.1516	
Number of observations	193	4969
Censored observations		4786
Uncensored observations		183

Notes: Robust standard errors are between parentheses; Robust standard errors for the selected equation estimates are available upon request; *, ** and *** denote significance at 1%, 5% and 10%, respectively; The basic characteristics are women for gender, aged between 16 and 24 for years of age, black, mulatto or indigenous for ethnicity, and 2003 survey for year; Precise definitions for the variables are given in Table 1.

Notice that only the new control variables included in this model were significant, and that the null hypothesis H_0:$\rho = 0$ of the Wald test cannot be rejected. The results of the single probit model show that the probability is greater if the injury is classified as serious and when the victim has a spouse. In short, the other explanatory variables are not statistically significant at the usual levels, reinforcing previous evidence about reporting of property crime. The non-significant variables support more the rational choice hypothesis for property crimes.

6. Concluding remarks

In this study we attempted to make empirical advances in the modeling of determinants of property crime underreporting in Brazil. We provide more evidence of the determinants of property crime reporting and, consequently, of its underreporting. The data set allowed us to analyze the reporting decision for a given crime type where rational economic behavior is more plausible.

We conclude that the probability of reporting an incident increases in the case of a violent crime and that it decreases with the frequency of repeated victimization. Moreover, the hypothesis of a positive, albeit not linear, relationship between wealth and reporting likelihood is also supported.

A victimized individual possesses a piece of public information: the crime incident. Knowing the actual number of crimes is very important for the police to take action and for developing effective public safety policies. We argue that crime reporting is a necessary condition for criminals to be punished. Appropriate punishment implies a deterrent effect on future criminal behavior (Becker, 1968). Moreover, the reporting likelihood observed by criminals is a victim-specific deterrent variable (Goldberg and Nold, 1980).

In this context, media campaigns designed to encourage the reporting of victimizations can be effective for reducing crime. Reporting can also be encouraged by reducing the time spent in the reporting procedure and, hence, the cost of reporting. Finally, the negative effect of repeated victimization on the probability of reporting indicates that if the crime rate decreases, the underreporting rate will also drop

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