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Economic Analysis of Theft Reporting: the Case of Mexico City

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Abstract

Theft is the major component of crime rates in Mexico City and its reporting remains low and stable even when the budget assigned to federal public security reached an increase of 202.23% in 2006-2010. We develop a utility maximization model that attempts to explain the incentives that individuals face when theft reporting and we empirically verify it. We empirically verify a direct relationship between theft reporting and the recovered proportion of what is robbed. Also, we find an inverse relationship between theft reporting and (i) its price, and (ii) theft itself.

JEL Classification: *K40; K42; K14.*
Keywords: *economic models of crime; theft; theft reporting.*

Resumen

El robo es el mayor componente de los índices de delincuencia en México y sus reportes se mantinen bajos y estables incluso cuando el presupuesto asignado a la seguridad pública federal alcanzó un incremento del 202.23% en el periodo 2006-2010. Se desarrolla un modelo de maximización de utilidad que intenta explicar los incentivos que enfrentan los individuos cuando se reporta el robo y probamos empíricamente las conclusiones. Empíricamente se verifica una relación directa entre el reporte del robo y la proporción recuperada de lo robado. También se encuentra una relación inversa entre el reporte de robo y (i) su precio, y (ii) el robo en sí mismo.

JEL Clasificación: *K40; K42; K14.*
Palabras clave: *modelos económicos de crimen; robo; reporte de robo.*

Introduction

Ciudad Juarez, located in the state of Chihuahua, Mexico, is known as one of the five most dangerous cities in the world because of its crime rates. Actually, it was declared "the most violent zone in the world outside of declared war zones" in 2010[1]. However, when revising the percentage of people who were victim of at least one criminal offense in Mexico, we find that Mexico City still has a higher rate than Chihuahua itself (see Table 1)[2].

TABLE 1. % OF VICTIMS OF AL LEAST ONE CRIMINAL OFFENSE IN MEXICO

ENTITY	2004	2007	2008
Federal District	**19**	**21**	**19**
Aguascalientes	**13**	**9**	**16**
Sonora	**14**	**11**	**15**
State of Mexico	**15**	**15**	**15**
Coahuila	**9**	**5**	**15**
Baca California	**10**	**13**	**15**
Chihuahua	**11**	**11**	**14**
Michoacan	**9**	**7**	**13**
Colima	**7**	**5**	**13**
Jalisco	**14**	**10**	**13**
Baja California Sur	**11**	**7**	**12**
Queretaro	**7**	**5**	**12**
Quintana Roo	**4**	**13**	**12**
Guanajuato	**8**	**12**	**11**
Nuevo Leon	**9**	**12**	**11**
Nayarit	**6**	**5**	**11**
Morelos	**12**	**10**	**10**
San Luis Potosi	**6**	**7**	**9**
Sinaloa	**14**	**5**	**8**
Puebla	**12**	**12**	**8**
Durango	**9**	**6**	**7**
Guerrero	**8**	**7**	**7**
Campeche	**11**	**7**	**6**
Tlaxcala	**7**	**7**	**6**
Zacatecas	**5**	**3**	**6**
Yucatan	**14**	**5**	**6**
Oaxaca	**8**	**5**	**5**

Source: ICESI (2009)

[1] Most Dangerous Cities (2010).

[2] Mexico City comprises the Federal District's 16 boroughs (delegaciones) and 33 municipalities that belong to the State of Mexico and are situated in the conurbation.

Actually, some other federal entities in Mexico have higher crime rates than Chihuahua for the very same years, as Table 1 shows. We may infer, then, that Mexican Public Security is a matter of academic interest. Furthermore, public security is a priority for the Mexican government[3]. In fact, between 2006 and 2010, the budget assigned to federal public security reached an increase of 202.23%, whereas the budget allocated to public security in each of the 32 federal states rose by 20% (see Table 2).

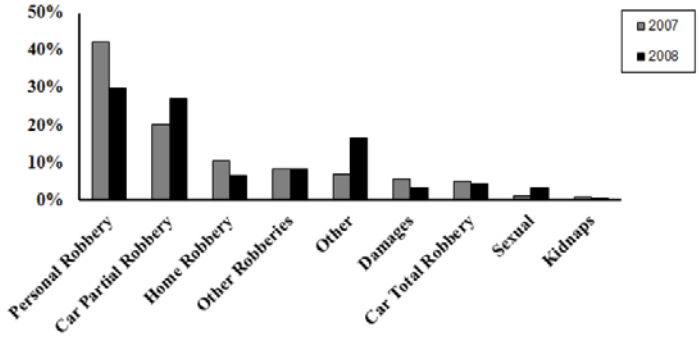
TABLE 2. BUDGET ALLOCATION 2006-2010 (IN JUNE PESOS)

[1]	[2]	[3]	[4]	[5]	[6]	[7]
YEAR	HIGER EDUCATION	% CHANCE	LOCAL PUBLIC SECURITY	% CHANCE	FEDERAL PUBLIC SECURITY	% CHANCE
2006	$ 7,423,572,175.80		$ 5,786,348,799.74		$ 10,732 ,982 ,661.65	
2007	$ 9,152,509,333.89	23.3%	$ 5,576,717,849.07	-3.6%	$ 15,240 ,815 ,931.67	42.0%
2008	$ 6,785,569,837.25	-25.9%	$ 6,281,965,595.35	12.6%	$ 20,637 ,955 ,833.63	35.4%
2009	$ 7,164,038,725.00	5.6%	$ 6,991,988,578.11	11.3%	$ 33,274 ,658 ,509.78	61.2%
2010	$ 9,401,067,273.00	31.2%	$ 6,916,800,000.00	-1.1%	$ 32,437 ,772 ,662.00	-2.5%

Source: Mexican Congress Data (2006-2010)

Despite this important budgetary increase, very few academic studies focus on this topic. As a matter of fact, the few studies on public security that are carried out in Mexico focus on issues related to drug-trafficking and crime (for instance, Shelley (2001) and Guerrero-Gutiérrez (2010)), when, according to the Instituto Ciudadano de Estudios sobre la Inseguridad (ICESI) (Citizens' Institute for Crime Studies), 83.7% of criminal offenses in Mexico are of local jurisdiction (i.e., not connected to the types of crime most often reviewed in the literature). According to this same institute, 87% of the local jurisdiction crimes are theft.

FIGURE 1. CRIME DISTRIBUTION IN MEXICO

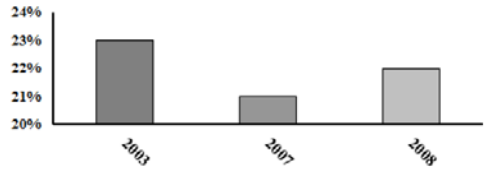


[3] Currently, security and the rule of law comprise the first section, out of five, of the National Development Plan (2007-2012), the document that outlines the government strategy for each presidential period.

Source: ICESI (2009)

Given these, studying theft in Mexico City may be academically relevant. Theft represents 87% of the 83.7% of criminal offenses in Mexico. Furthermore, even when the Mexican government spends more in crime-related policies than in higher education, for example, the theft reporting rates seem to be stable and low over the time (see Figure 2). Clearly, it is very diffcult for the government to reduce crime if households do not report it.

FIGURE 2. THEFT REPORTING IN MEXICO



Source: ICESI (2009)

Hence, it is important to investigate the incentives that lead households to theft reporting in Mexico City. In this paper we do so theoretically and empirically. We empirically verify a direct relationship between theft reporting and the recovered proportion of what is robbed. Also, we find an inverse relationship between theft reporting and 1) its price, and 2) theft reporting. To do so, we use a database spanned by a victimization survey especially carried on to measure crime determinants in Mexico City. The rest of the paper is structured as follows. Section 1 reviews the literature. Section 2 outlines a utility maximizing problem of theft reporting, while Section 3 develops its empirical application. Section 4 gives final comments.

Literature Review

The invention of economics does not respond to the need of evaluating agents' behavior in criminal contexts, since traditionally, it is a science that studies interactions and incentive systems within markets for goods and services. Therefore, an individual selected at random from a relatively educated population would think that economics has little capability to put forward and predict criminal activities.

The study of markets undertaken by economics is based on rationality assumptions. However, criminal acts such as physical assault, theft and kidnapping are not usually associated with rational choice analysis because they are said to be coercive, emotion-driven or passiondriven. At first glance, it seems impossible to associate criminal behaviors with any type of rational

choice or cost-benefit analysis. Nonetheless, from Becker's (1968) theoretical work onwards, economics and crime are studied jointly -in research classified as belonging to the economics of crime.

The first theoretical studies on economics of crime date from 1968. Likewise, the publishing dates of the first empirical studies on this topic dates back to the decade of the seventies. Subsequently, it can be corroborated that this literature experienced exponential growth in the decade of the nineties with studies on the police, imprisonment, death penalty, etc. Ever since, the theoretical structure put forward by economics is used successfully to characterize diverse criminal phenomena. According to Levitt and Miles (2006), this type of analysis:

(a) Makes emphasis on the incentives that determine individuals' behavior, be they criminals, victims or those responsible for law enforcement, (b) employs econometric techniques that seek to differentiate between correlation and causality in non-experimental contexts, (c) focuses on broad public policy design, rather than on the specific evaluation of small interventions, (d) uses cost-benefit analysis as the measure to evaluate public policies.

In the academic literature, Ehlrich (1975), David (1982), Dilulio & Piehl (1991), Cameron (1994), Dezhbakhsh (2003), and Donohue and Wolfers (2006) study death penalty in the United States in each of the previously mentioned ways. Katz (2003) does a study with the characteristics described under (a) on the incentives that the conditions in prisons in the United States generate among the inmates. Likewise, Levitt (1996 and 1997) does research with characteristics (a) and (b) on the effects of the number of inmates in prisons, and the effect of the number of police officers on crime rates, respectively, focusing in the case of the United States.

Also, Marvel & Moody (1996) reviews the literature on the economics of crime and analyzes the econometric methods generally used. Shepherd (2004) studies crimes of passion with the characteristics mentioned under (a). The present study belongs to the descriptions outlined in (a) and (b).

When carrying out this type of research, empirical studies show that rational choice theories which form the basis of modern economics can be extended to the study of crime. The economic analysis of crime focuses on broad public policy implications and underestimates the evaluation of specific interventions in isolated contexts. In general, economics aims for studies which are representative of the aggregate population.

Studies in economics of crime have this same characteristic: they approximate individual behavior through instruments that aggregate the population and thus, they establish comparisons among populations, geographic districts or judicial districts. Moreover, they analyze the structure of behaviors, incentives, benefits and costs characteristic of each participant in an interaction referred to as crime (e.g. theft, kidnapping, rape, etc.) on the basis of economic theory. Hence, the breadth in public policy implications

that the economic analysis of crime seeks has its roots in the understanding of general human behavior, not certain individuals' behavior under specific circumstances. The present study does not attempt to be an exception. However, it does so in a thus far unexplored context: theft reporting in a developing country.

Model

This section presents a utility maximization model to illustrate problem that a representative household faces when deciding to report a theft. The predictions found here are tested in Section 4.

We suppose that a utility maximizing household decides its theft report level, d, and its consumption goods level, x. Initially, one may think of d as a discrete choice variable; however, we claim that the household may decide how much theft reporting to consume. The reason is the following: the process of theft reporting is not only a single one of reporting or not, but one of following the report until some judicial decision is taken about it. Therefore, we model d as a continuous variable. Then, the household solves the following problem.

$$\max_{\mathrm{x,d}}\{\alpha \mathrm{U}(\mathrm{x},\mathrm{d}) + (1-\alpha)\mathrm{U}(\mathrm{x},0)\}$$

s.a.

$$\alpha(\mathrm{p_x x} + \mathrm{p_d d}) + (1-\alpha)\mathrm{p_x x} = \alpha(\mathrm{I} - \mathrm{L} + \theta \mathrm{L}) + (1-\alpha)\mathrm{I}$$

where $\mathrm{U}(\cdot)$ is a Bernoulli utility function over the two goods that we consider and $\mathrm{p_x}$ and $\mathrm{p_d}$ are their corresponding prices; I is the household's income, L is the value of the lost due to the theft, θ is the recovered proportion of what is robbed and α is the probability of suffering a theft.

Let us consider interior solutions in order to shorten notation and understand the basics of the model. In order to this, we make some usual assumptions about the Bernoulli utility functions:

$$\mathrm{U_i}(\mathrm{x},\mathrm{d}) := \frac{\partial \mathrm{U}(\mathrm{x},\mathrm{d})}{\partial \mathrm{i}} > 0 \qquad (1)$$

$$\mathrm{U_{ii}}(\mathrm{x},\mathrm{d}) := \frac{\partial \mathrm{U}(\mathrm{x},\mathrm{d})}{\partial \mathrm{i}^2} < 0 \qquad (2)$$

For $\mathrm{i} = \mathrm{x},\mathrm{d}$.[4]

[4] Also, we assume

$$\frac{\partial^2 \mathrm{U}(\mathrm{x},\mathrm{d})}{\partial \mathrm{i}\,\partial \mathrm{j}} > 0$$

for $\mathrm{i} = \mathrm{x},\mathrm{d}$.

Conditions (1) and (2) imply that the first order conditions are necessary and sufficient to find the optimal and interior household consumption of x and d. The first order conditions describe the solution through equations (3) and (4)

$$g_1(\cdot) := \frac{\alpha U_x(x,d) + (1-\alpha)U_x(x,0)}{p_x} - \frac{U_d(x,d)}{p_d} = 0 \qquad (3)$$

$$g_2(\cdot) := p_x x + \alpha p_d d - I + \alpha L - \alpha\theta L = 0. \qquad (4)$$

In this context, one may want to know how the household's decision changes when the theft reporting incentives change; i.e., what happens with the optimal levels of x and x when p_d, θ, L or α changes.

By the implicit function theorem,

$$\begin{pmatrix} \frac{\partial x}{\partial f} \\ \frac{\partial d}{\partial f} \end{pmatrix} = -\begin{bmatrix} \frac{\partial g_1(\cdot)}{\partial x} & \frac{\partial g_1(\cdot)}{\partial d} \\ \frac{\partial g_2(\cdot)}{\partial x} & \frac{\partial g_2(\cdot)}{\partial d} \end{bmatrix}^{-1} \begin{pmatrix} \frac{\partial g_1(\cdot)}{\partial f} \\ \frac{\partial g_2(\cdot)}{\partial f} \end{pmatrix}$$

for $f = p_d, \theta, \alpha$. Define

$$D = (\alpha p_d)^2 U_{xx}(x,d) + \alpha {p_d}^2 (1-\alpha) U_{xx}(x,0) - 2\alpha p_x p_d U_{xd}(x,d) - p_x p_d (1-\alpha) U_{xd}(x,0) + {p_x}^2 U_{dd}(x,d).$$

After solving for each of the parameters listed above, we find that

$$\frac{\partial d}{\partial \theta} = \frac{\alpha L p_d}{|D|}\left\{-\alpha U_{xx}(x,d) - (1-\alpha)U_{xx}(x,0) + \frac{p_x}{p_d}U_{xd}(x,d)\right\} > 0 \qquad (5)$$

$$\frac{\partial d}{\partial p_d} = \frac{1}{|D|}\{-p_x[\alpha U_x(x,d) + (1-\alpha)U_x(x,0)] + \alpha^2 p_d d U_{xx}(x,d) + \alpha(1-\alpha)p_d d U_{xx}(x,d) - \alpha p_x d U_{xd}(x,d)\} < 0$$

which means that a) an increase in the recovered proportion of what is robbed gives incentives households to increase their theft reporting level; and b) the substitution effect is bigger than the income effect and a rise in the

Note that this condition implies a certain complementarity between the two goods. This means that having more of one good gives a higher utility when consuming the other good, which is the standard assumption for consumption goods.

price of d has a negative impact in this choice variable. With respect to the remaining parameters, we could not sign the partial effects. Then, the direction of

$$\frac{\partial d}{\partial \alpha} = \frac{1}{|D|}\left\{ \begin{array}{c} p_x p_d [U_x(x,0) - U_x(x,d)] \\ +[p_d d + L(1-\theta)][\alpha p_d U_{xx}(x,d) + (1-\alpha) p_d U_{xx}(x,0) - p_x U_{xd}(x,d)] \end{array} \right\} \quad (6)$$

remains as an empirical question. In Section 3 we explain how we corroborate this empirically.

Empirical Evidence

Data

In order to answer the empirical questions that come from the model we develop in the last section we use the database spanned by the Encuesta sobre victimización y Eficacia Institucional (Envei) (Survey on victimization and institutional efficacy) conducted by the *Centro de Investigación y Docencia Económicas (CIDE)* (Center for Research and Teaching in Economics) carried on during 2007.

The Envei 2007 was conducted in the metropolitan area known as Mexico City. This is part of the *Programa de Seguridad Pública y Estado de Derecho (PESED)* (Public Security and Rule of Law Program) undertaken by the Law Faculty at CIDE. The sampling scheme used to carry out this survey was stratified in two stages. However, based upon certain population indices, weights were established for each unit of analysis, making it possible to treat the sample as representative of Mexico City's population.

Because of the way in which the Envei 2007 presents the data, the units of analysis considered in this study are Mexico City's households. Consequently, all the data and results that appear in this study are at the household level. For example, in Table 3 the variable theft shows whether any member of the household suffered at least one in 2007. The reasoning is similar for the remaining variables.

TABLE 3. SUMMARY STATISTICS

VARIABLES		MEAN	S.D
Awareness of authorities		**.8189**	**.6964**
Answers the survey correctly		**.7268**	**.4458**
Files a report		**.1322**	**.3394**
Education	No schooling	**.1373**	**.3443**
	Elementary	**.1977**	**.4950**
	Secondary	**.5385**	**.6844**
	Higher	**.1306**	**.4012**
Income	income<3 min. wages	**.6530**	**.7241**
	3 min. wages < income < 10 min. wages	**.3256**	**.7240**
	income > 10 min. wages	**.0214**	**.1671**
Locality	State of Mexico	**.4993**	**.6681**
	Federal District	**.5007**	**.6681**
Theft	Auto Theft	**.0115**	**.1145**
	burglary	**.0266**	**.1884**
	Personal Theft	**.1220**	**.3712**
Household Size		**2.8628**	**.7718**
Average commute size	time < 30 minutes	**.2579**	**.6941**
	30 minutes < time < 90 minutes	**.4369**	**.6545**
	time > 90 minutes	**.3052**	**.5659**
Type of transportation	Public	**.3158**	**.6042**
	Private	**.6842**	**.6042**

Source: Envei 2007.

The initial sample size was 1486 observations. The descriptive statistic of the variable “reporting" is conditional on theft taking place. Likewise, the descriptive statistic of “income" is conditional on the survey being answered correctly. The Servicio de Administración Tributaria (Tax Administration Service) (2010) reports, for 2007, a minimum wage of $50.57 pesos per day (in pesos of June 2002).

The variables that show the number of people and number of women per household are continuous. The variable “locality" is dichotomous: it equals 1 when the home is in the State of Mexico, and 0 when it is in the Federal District. The variable private transportation is dichotomous: equal to 1 when the average transportation of the household is private; equal to 0 when the average transportation is public. The variable “commute time" is dichotomous and has the three levels observed in Table 2, all representing the average time that the household's members spend transporting themselves.

The variable “education" is dichotomous and has the three levels seen in Table 2; it refers to the head of the household's educational attainment. The variable “income" is treated in the same way as “education". The variables derived from the types of theft are dichotomous and equal to 1 if a member is a victim of any type of theft -note that they are exclusive and not

in levels. Finally, note that the three dependent variables are dichotomous and equal to 1 if their occurrence is positive.

Estimation

In order to measure theft reporting, the naive approach will be to estimate a model that considers a dichotomous dependent variable (i.e. Probit or Logit). However, according to Heckman (1979) this will not imply, in general, unbiased results. Specifically, if theft and theft reporting equations are correlated, Sartori (2003) explains that the bias appears because of two reasons: 1) individual observations that have higher propensity to suffer a theft are more likely to report a theft so one may observe a sample that has a non-random characteristic; 2) individual observations with low propensity to suffer a theft actually report it. This happens because they have high values on some unmeasured variables captured in the stochastic term of the equation that characterizes theft.

Hence, whether or not the independent variables in the theft reporting equation are uncorrelated with the stochastic term of the equation that characterizes theft in the overall population, the two variables are correlated in the selected sample. If the stochastic variables lead to a higher propensity to theft reporting, then we will have a bias in our estimation of the effect of the independent variables on it.

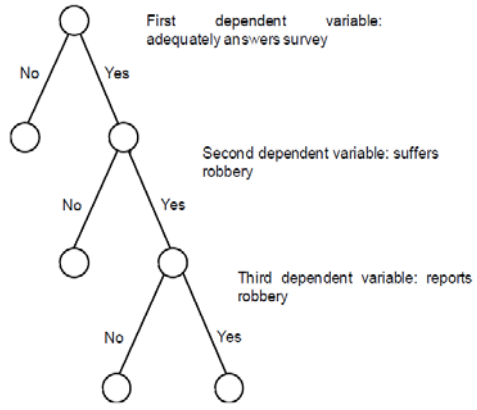
We find that in our database 27% of the individual observations fail to adequately answer the victimization survey5. This is a case where non-random loss of information may occur in the potential independent variables. For example, it may happen that the individuals that constitute the studied sample decide not to provide information about socioeconomic variables. It is incorrect to assume, a priori, that this is a random decision. Therefore, the adequate answering of the survey must be considered as one of the phenomena that characterizes the individuals.

This situation may be illustrated as follows. Let us suppose certain individual observations fail to adequately answer the survey from which theft and its reporting will be studied. It is then necessary to use a tool that studies the three phenomena that take place jointly. This is because, in general, it is not true that the decision of answering the survey adequately or not is independent from, for example, the decision to report a crime or not. For example, it may happen that the individual observations that do not report theft are not interested in providing information regarding the crimes suffered, or that they fear reprisals for doing so. This might carry a social cost, for example, the absence of information to prosecute crimes.

[5] The adequate answering of the survey refers to the case where the relevant information that characterizes the equations to be estimated is actually observed by the researcher.

Furthermore, it can create a positive correlation between reporting theft and answering the survey adequately.

DIAGRAM 1. THEFT REPORTING IN MEXICO



Hence, estimating a pair of equations with dependent variables such as theft and reporting is not, a priori, enough to know the variables that impact these two acts. A third equation is needed to solve the attrition problem stemming from the collection of the data. Consequently, it is necessary to consider a trivariate model, since the correlations between the correct answering of the survey, the theft and the reporting may be statistically different from zero.
The model discussed is illustrated in Diagram 1. It is important to note that the order set forth in Diagram 1 is not the one in which the events took place, but that in which the data are presented. That is, when carrying out the study, the data for the variable theft are obtained if the survey is answered correctly. Subsequently, the data for the reporting are collected if a theft was suffered. Actually, this is the very reason why the double sample selection appears.

TABLE 4. DISTRIBUTION OF THE DEPENDENT VARIABLES

EDEQUATE ANSWER OF THE SURVEY				
Yes		No		Total
# of observations	% of observations	# of observations	% of observations	# of observations
1080	72.68%	406	27.32%	1486
EDEQUATE ANSWER OF THE SURVEY AND SUFFERS A THEFT				
# of observations	% of observations	# of observations	% of observations	# of observations
347	32.13%	733	67.87%	1080
EDEQUATE ANSWER OF THE SURVEY, SUFFERS A THEFT, REPORTS THEFT				
# of observations	% of observations	# of observations	% of observations	# of observations
43	12.39%	304	87.61%	347

Source: Envei 2007.

The statistical magnitude of the correlation coefficients makes it possible to know what the correct characterization of the phenomena is. For example, if the correlations between the first and second, and the first and third dependent variables are statistically equal to zero, the estimation by a Bivariate Probit with Sample Selection is correct.

TABLE 5. JOINT STATISTICAL TEST ON THE CORRELATION COEFFICIENTS OF THE TPDSS

$\hat{\rho}_{12}$	-.4436
$\hat{\rho}_{13}$	.2231
$\hat{\rho}_{23}$	.0723
$\chi^2(3)$	8052.30
p-value	.0000

Observing Table 4, one realizes that the correlation coefficients are significant; hence, in order to obtain robust results we must estimate a model as the one illustrated in Diagram 1. We run our estimations based on Carreon-Rodriguez and Garcia-Menendez (2011), which theoretically develop the Trivariate Probit Model that helps to answer our empirical question since they consider the double sample selection problem.

The results summarized in Table 5 show that the correct estimations is the one of the Trivariate Model with Double Sample Selection (TPDSS). Table 6, then, present the marginal effects for the univariate, the bivariate and the trivariate models. For obvious reasons, we use the result from the last exercise for our results interpretation. The first column shows the most naive approach, where a model that considers theft reporting and ignores the other two dependent variables is estimated. The second column shows the

estimation of the Bivariate Probit with Sample Selection (BPSS) that ignores attrition. The third column presents the estimation of the TPDSS.

TABLE 6. MARGINAL EFFECTS ESTIMATIONS FOR THEFT REPORT EQUATION

		[1]	[2]	[3]
Locality (=1 if State of Mexico)		-.1451 [.0842]	-.0617 [.0356]	.0224 [.0316]
# People/Household		.0315 [.0326]	.0069 [.0112]	.0365 [.07557]
% of Women/ Household		.0014 [.0023]	.0017 [.0009]	.0954 [7.4971]
Awareness of authorities		-.0626 [.1190]	-.0001 [.0439]	.0321 [.5731]
Education	Elementary	-.1478 [.1038]	-.0585 [.0609]	.0000 [.0021]
	Secondary	.0378 [.1347]	.0126 [.0592]	-.0176 [1.3729]
	Higher	-.1257 [.1307]	-.0275 [.0717]	.0000 [.0158]
	Auto Theft	.7968 [.0414]	.8418 [.0613]	.1499 [.0318]
	Burglary	.3324 [.1585]	.2253 [.0913]	.1371 [.0550]
	Personal theft	.1573 [.0795]	.0924 [.0355]	-.0108 [.0049]
Pseudo R^2		.8471	.8328	.5230
N		242	994	1486

Note: standard errors in brackets.

Results

The variables that quantify theft monetarily are significant for its reporting (car theft, personal theft and burglary). Furthermore, it is important to point out that the probability that a household victim of car theft files a report for crime is 14.9 percent higher than the probability that a household with the same characteristics that is not a car theft victim. This may be because the recovered proportion of the robbed object, which appears in the model as θ, is high when reporting a car because of automobile insurance: for an insurance company to cover the theft of a car, the offense must be reported.

It is important to highlight that this empirical finding ratifies one of the conclusions of the theoretical model that we present in Section 3. When the recovered proportion what is robbed increases then theft reporting itself increases. Hence, we empirically verify that

$$\frac{\partial \mathrm{d}}{\partial \theta} > 0.$$

It may then be concluded that the agents are guided by different incentives when reporting the theft. Therefore, social programs that increase θ may be undertaken. For example, if θ is an increasing function of the judicial system efficiency or transaction costs, then the government may take into account that in order to incentive theft reporting costs may go down and efficiency most go up.

The same marginal effects let us infer that, when the value of the robbed object is higher, the probability of theft reporting increases. Actually, we notice that the marginal effects on theft reporting are decreasingly sorted for auto theft, burglary and personal theft victims. Commonly, we will expect that the first kind of theft will have the highest value and the last one the lowest. As expected, when the households perceive a big loss when they suffer a theft, they have more incentives to theft report because the potential recover is bigger, i.e.
θL is bigger.

Households whose members' average commute time is between 30 and 90 minutes a day, and more than 90 minutes raise their probability of reporting a crime by 3.3 and 3.8 percentage points respectively, compared to those whose commute is less than 30 minutes. This may mean that spending more time commuting increases the possibility of filing a report due to lower transaction costs (it means time that would be spent away from home anyway).

This may complete the question that we asked in Section 4 and that remained as an empirical question: what happens with theft reporting as its price goes down? Here, commute time may be considered as a proxy of theft reporting prices. Then, we see that, in this case, the substitution effect is bigger than the income effect. Therefore, if theft reporting prices go down then theft reporting increases. According to our estimations,

$$\frac{\partial \mathrm{d}}{\partial \mathrm{p_d}} < 0.$$

This is important when creating public policies, since it highlights that the agents take into account the price that filing a report entails. Hence, if the government wishes to increase the crime reporting rate, it must put into practice public policies that reduce the price of reporting criminal offenses, e.g., increasing the number of public prosecutor's offices, reducing the time to _file a report, etc.

Finally, in order to answer if a higher probability of suffering a theft implies a higher level of theft reporting we use one of the results that Table 5 summarizes. From the estimationsof the TPDSS model we find the correlation between theft and theft reporting. Since the coefficient is negative and we

estimate a probabilistic model, we find that when the probability of suffering a theft goes up the probability of theft reporting goes down. Then,

$$\frac{\partial \mathrm{d}}{\partial \alpha} < 0.$$

This may mean that, when households suffer theft, their incentives to report decrease -for instance, this may be due to a perception of impunity when obbed or not enough confidence in the judicial system to assume the commuting costs of theft reporting. Hence, the government may enforce the rule of law and the efficiency of the judicial system in order to give households the incentives to report theft.

Conclusions

In this paper, we stress out the academic importance of studying theft reporting in Mexico City. We do so by developing a utility maximization problem which seems to adequately fit our database. Our empirical strategy addresses some sample selection and attrition problems. We corroborate one of the model's insights, that the level of theft reporting increases when the recovered proportion of what is robbed goes up. Then, we find out that theft reporting is decreasing in the price of doing so and in the probability of suffering a theft. We believe that our results may guide public policy makers, since our paper is the first to study theft and theft reporting in a developing country, it develops an economic analysis based on a theoretical model, and it manages some data imperfections.

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