Crime and Conspicuous Consumption.*

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Abstract

This paper develops an incomplete information model where individuals face a trade-off between status and security when deciding the optimal amount of conspicuous consumption. On the one hand, we assume that individuals derive utility from status, which is obtained by signaling wealth via the consumption of an observable good. On the other, increasing the consumption of observable goods also signals wealth to a criminal audience, thus increasing the chance of becoming targets of criminal activities. The paper proposes a new channel through which crime distorts consumption decisions that is different in nature from a channel where crime acts as a direct tax on observable and stealable consumption goods. Namely, we argue that individuals reduce their consumption of observable goods in the presence of crime not only because criminals may steal these goods, but because it reveals information that can potentially be used by criminals to target individuals' wealth. We test the predictions of our model using U.S. data, finding that crime has a negative and significant impact on conspicuous consumption and that this effect is not explained by the fact that some of these goods tend to be stolen by criminals. The negative impact of crime on observable consuption becomes even stronger once we correct for potential endogeneity problems. Finally, we show that this result is robust to different specifications and alternative measures of conspicuous consumption and crime.

Keywords: Crime, Conspicuous Consumption, Concerns for Status.

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"[whether or not I decide to rob a particular person] depends on what they got; like if they are wearing nice clothes, jewelry, and you know, that's basically it. You can look at a person and just tell if they've got money...." [quoted by Wright and Decker (1997)].

"Neither inflation nor unemployment. The most important concern for consumers in Rio de Janeiro... is violence." [Journal O Globo, Aug. 10, 2004. Cited by De Mello and Zillberman, 2008].

1 Introduction

As the quote above suggests, armed robbers rely on outward signs such as clothing, jewelry, and demeanor in order to judge how much cash people are likely to have. Anticipating this behavior, potential victims take into account the cost of this type of consumption that signals wealth to criminals, thus facing a trade-off between security and status when deciding the optimal amount of visible (conspicuous) consumption. More precisely, having higher levels of conspicuous consumption might give an individual higher social status by signaling a higher level of wealth to their peers, but at the same time, this revealed information about her wealth makes an individual a more attractive target of criminal activities.

In order to develop this idea formally we build an incomplete information model where individuals have concerns for status, defined here as others' beliefs about their wealth. The model is a two audience signaling model with a criminal audience and a status audience. Since wealth is private information, individuals signal their wealth by consuming more of an observable (conspicuous) good[1] (Ireland, 1994; Glazer and Konrad, 1996; Bagwell and Bernheim, 1996)[2]. However, signals are not only observed by peers from whom individuals obtain status but, also, by criminals seeking potential victims. Since devoting time to criminal activities is costly, criminals prefer to target individuals with higher wealth, who "offer" a higher rate of return to criminal activities[3]. Thus, the introduction of a criminal audience generates an incentive to hide wealth from peers that acts in the opposite direction from the motivation to "show off", present in models with concerns for status. Thus, when deciding the optimal consumption of observable goods, individuals trade-off the benefits from obtaining higher status with the expected cost of becoming targets of criminal activities. To the

[1] Conspicuous consumption (or "Veblen effects") exists when consumers are willing to pay a higher price for a functionally equivalent good (Bagwell and Bernheim, 1996).

[2] Other papers that incorporate concerns for status in economic models assume that status is given by the position of an individual in the distribution of conspicuous consumption across the reference group (Hopkins and Kornienko, 2004).

[3] See the extensive evidence in this respect cited in Wright and Decker (1997).

best of our knowledge, this channel trough which crime affects consumption decisions is new in the economics literature.

The main problem that we face when trying to test our proposed channel empirically is that its predictions are difficult to separate from those generated by a standard consumption model in which crime acts as a direct tax on observable and stealable goods, hence generating incentives to reduce their consumption. We will refer to this channel as the *direct substitution effect*. For example, individuals living in places with more larceny theft perceive a higher probability of getting their jewelry robbed. This is equivalent to an increase in the relative price of jewelry that leads individuals to consume less of it. Therefore, if places with higher property crime also exhibit lower amounts of conspicuous consumption, it could well be because some of these visible goods are targeted by crime and hence we observe a substitution towards safer types of goods. Whereas the direct substitution effect predicts that the consumption of observable and stealable goods decreases with crime, our proposed channel predicts a fall in consumption even for goods which are not (or cannot be) stolen, such as clothing, country clubs, beauty expenses, etc. More precisely, under our proposed channel individuals do not reduce the consumption of conspicuous goods because criminals may steal them, as in the direct substitution effect, but because it reveals information to criminals that can be used in order to target individuals' wealth.

In order to test the predictions of our model we use available data on consumption patterns for U.S. households from 1987 to 1999 and data on crime at the State level. We find strong empirical support for the mechanism proposed by the model. More precisely, we find a negative and significant effect of crime on the consumption of observable goods that are not (or cannot) directly be targeted by criminals. Furthermore, after solving the potential endogeneity problem of criminal activities, this relation becomes even stronger. Furthermore, we also show that the negative effect of criminal activities on the consumption of observable non stealable goods is robust to different specifications and alternative measures of conspicuous consumption and crime. We also show that crime reduces the consumption of goods which can be targeted or stolen by criminals, suggesting the substitution effect might be at work as well.

The contribution of this paper is twofold. First, it proposes and tests a channel, yet unexplored in the economics literature, through which crime distorts individuals' consumption decisions. Although the economic literature on the determinants of crime is quite large[4], to the best of our knowledge there are few contributions examining the effects of criminal ac-

[4]Since the seminal contribution of Becker (1968) there are several papers, both theoretical and empirical analyzing the determinants of crime. Among many others, see Ehrlich (1996), Freeman (1983, 1996), Levitt (1997), Glaeser and Sacerdote (1999), and Di Tella and Schargrodsky (2004).

tivities on individuals' behavior. Important exceptions are De Mello and Zilberman (2008), who find a robust positive impact of property crime on saving decisions using data for the State of Sao Paulo in Brazil. Also, using data for Colombia, Pshiva and Suarez (2006) find that kidnappings affect firms' investment decisions and Camacho and Rodriguez (2009) find that in those municipalities with higher attacks by either guerrilla or paramilitary groups there is a higher rate of firms' exit. Finally, Cullen and Levitt (1999) find that crime led to the depopulation of American cities. This paper contributes to this branch of the literature on the economics of crime by developing and testing a model where property crime affects individuals' consumption decisions. Second, the paper contributes to the growing literature that incorporates concerns for status in economic models[5]. One of the most salient results in this literature is that the incorporation of concerns for status in economic models leads to over investment in conspicuous consumption (Frank, 1999; Hopkins and Kornienko, 2004; Glazer and Konrad, 1996; Ireland, 1994)[6]. In this respect, this paper argues that criminal activities counteract this channel and, if crime is high enough, it may completely reverse it. That is, high enough levels of crime may lead to *under investment* in conspicuous goods.

The paper is divided in four sections, where this introduction is the first one. Section two describes in detail the model and its predictions. Section three presents the empirical evidence, and section four concludes.

2 The model

In order to formally develop the ideas described in the previous section, we develop an incomplete information model where individual have concerns for status. Since wealth is unobservable, individuals signal it by consuming an observable (conspicuous) good. We also introduce a *criminal audience,* modeled here as a unitary agent that decides how much time to allocate to expropriating individuals' wealth by using all the information at its disposal. Finally, we have a peer group, called the *status audience,* who "grants status" to individuals by forming beliefs about their wealth.

We assume that both the criminal and status audiences have exactly the same informa-

[5]See, among others, Cole et al. (1992); Frank (1999); Bagwell and Bernheim (1996); Rege (2008); Hopkins and Kornienko (2004). See Bastani (2007) for a thorough review of the literature on concerns for relative ranking in the economics literature.

[6]However, if there are complementary interactions between individuals, conspicuous consumption might be welfare enhancing, even when the costs of conspicuous consumption are taken into account, as they allow for a better (more efficient) matching between individuals in the marriage market or between firms and workers in the labor market (see, among others, Cole et al. (1992); Bagwell and Bernheim (1996); Rege (2008)).

tion, so that all information concealed by individuals to one of the audiences is also learned by the other. This assumption implies that individuals cannot direct their public observable signals in order to show wealth to the status audience while hiding it from the criminal audience. This assumption creates a direct trade-off between status and security when deciding the optimal amount of conspicuous consumption.

The timing of the model is as follows: Nature plays first, giving each individual a type consisting of her wealth, w, which is private information. Individuals observe their type and consume two goods, one observable good, z (called the conspicuous good), and one unobservable, y (called the numeraire good). Afterwards, the status audience observes the conspicuous consumption of all individuals and forms believes about their wealth. Finally, given the consumption of the observable good, the criminal audience decides the amount of effort allocated to expropriate both consumption goods based on their expected value, which must be equal to the individual's expected wealth. Notice that the criminal audience is indifferent between the goods it expropriates. Therefore we are assuming that both goods are equally stealable by criminals and therefore the presence of crime does not change their relative price. We make this assumption explicit in order to show that our mechanism is independent and different in nature from the substitution effect described in the introduction.

We now introduce in more detail the agents involved in the game, their objective functions and their strategies. We do it in the order in which they appear when solving the model by backward induction.

2.1 The criminal and status audiences

The criminal audience strategies are fully characterized by a function $t(\widehat{w})$, describing the level of effort allocated to expropriating an individual sending the signal z and whose expected wealth is $\widehat{w} = E(w|z)$. We assume that $t_{\widehat{w}} > 0$, so that the criminal audience allocates more expropriating effort to individuals who are expected to have higher wealth. Notice that the fact that t only depends on $\widehat{w}$ implies that the criminal audience is totally indifferent between expropriating the conspicuous or the numeraire good. In particular, the criminal audience only cares about the expected market value of the goods stolen, which is exactly equal to $\widehat{w}$[7].

We assume that the criminal audience has an expropriation technology given by a concave

[7] A more general version including substitution effects would be to let t depend on $z, \widehat{w}$ $(t(z, \widehat{w}))$. Thus, the assumptions about how much the criminal targets both goods become assumptions about the derivatives of this function. It could also be the case that the market value for stolen goods is less than its original value. Our model gives the same predictions if this value is proportional to the original one, even if it is less.

and smooth function $0 \leq a(t) \leq 1$, in which t is the amount of time invested in criminal activities. If the criminal audience expropriates both goods, z and $y = w - pz$, from a given individual at rates η_z, η_y respectively, and if the criminal audience has an opportunity cost of time normalized to 1, then its problem is given by

$$\max_t E[(z\eta_z + y\eta_y)a(t) - t] = \max(z(\eta_z - \eta_y) + \widehat{w}\eta_y)a(t) - t. \quad (1)$$

Since this function is concave, it has a unique maximum at $t(z, \widehat{w})$ satisfying

$$a'(t) = \frac{1}{z(\eta_z - \eta_y) + \widehat{w}\eta_y}. \quad (2)$$

If both goods are equally stealable, then $\eta_z = \eta_y = \eta > 0$. In this case t only depends on $\widehat{w}$, allowing us to uniquely define the function $t(\widehat{w})$ which is increasing in $\widehat{w}$ by the concavity of $a(t)$. We define $\gamma(\widehat{w})$ as the fraction of wealth not expropriated from an individual who is believed to have wealth $\widehat{w}$. Explicitly we have

$$\gamma(\widehat{w}) = 1 - \eta a(t\widehat{w}). \quad (3)$$

By the previous remarks, γ is a smooth function decreasing in $\widehat{w}$, so that individuals who are expected to be wealthier are expropriated a higher fraction of their wealth, as a simple version of the economic model of crime in Becker (1968) would predict. If expectations are rational, this assumption implies that richer individuals bear most of the burden of property crime. This implication has been documented for Latin American cities by Gaviria and Vélez (2001) and Gaviria and Pages (1999). However, Levitt (1999) finds that property crime victimization became increasingly concentrated on the poor between 1970 and 1994 and, by 1994, poor households were more likely to be victimized by property crime in the U.S. As noted by Levitt, this result seems to arise because individuals invest in private protection, and wealthier individuals invest more on it. This last point is important since we are not including private protection decisions in our model, and the fact that γ is a smooth function decreasing in $\widehat{w}$, rests upon this assumption. If individuals could invest in protection, their expenditures in this front cannot be ignored when computing the crime burden they face, as noted by Levitt (1999). Therefore, the fact that rich individuals face lower victimization does not mean they bear a lower crime burden, since they have to invest resources in order to lower their chances of becoming targets of crime. The crucial point for our model is that if criminals believe that an individual is wealthier, then this individual is going to loose utility, either because she is expropriated a larger fraction of her goods (as we are modeling it), or because she has to spend a larger fraction of her wealth in the protection of her property in order for it to not be stolen. In the latter case, the extra expenditures needed to avoid expropriation must be taken as a cost of signaling wealth to criminals (and, indeed, individuals must anticipate this extra protection costs when choosing their conspicuous consumption). A more general version of our model that incorporates private protection would yield the same results as long as the expectations of higher wealth by criminals would increase the burden of crime towards the individual (holding constant her expenditures on private protection). There are, of course, other possible situations. If, for example, private protection is not observable and it is though off as being positively correlated with wealth, then, under some circumstances, individuals may in fact choose to signal wealth to criminals in order to make them think they are well protected. In this case there would be no trade-off between status and security, but our model would still work with a function γ that may decrease from some point onward[8].

As it is usual in this literature, we assume that status is given by $S = \widehat{w}$. That is, status is given by others' beliefs about individuals' wealth. Here, $\widehat{w}$ is the individual's expected wealth given her conspicuous consumption. That is, $\widehat{w} = E(w|z)$. This assumption could be replaced by status being any smooth function of $\widehat{w}$ and all our results would still hold. We assume that the criminal and status audiences' beliefs are identical. This mutual consistency assumption implies that both audiences have the same information set. In other words, we assume that individuals cannot induce different beliefs on the two audiences by selectively concealing different information to each of them. Of course, this assumption may be relaxed because individuals may be able to discriminate between the receivers of their signals (for example, individuals can wear luxury jewelry at a private party but leave it at home when going out to downtown). As long as individuals cannot perfectly discriminate between the receivers of their signals we get a trade-off between security and status when deciding the optimal amount of conspicuous consumption.

2.2 Individuals' problem

Every individual has an exogenous determined level of weal, w, which is distributed across individuals according to the CDF $F(w)$ with support $[w_{min}, w_{max}]$ and density function $f(w)$. Since individuals decide first, they anticipate the subsequent reaction of the status and the criminal audiences and incorporate them in their reduced form problem. When an individual with wealth w signals z and both audiences expect her to have wealth $\widehat{w} = E(w|z)$,

[8] Mejía and Restrepo (2010) construct a model to understand private protection decisions in a private information context in which these decisions may carry information about the value of the goods being protected. Also, in future extensions of the model in this paper we let individuals differ in the extent to which they can protect themselves from criminal activities.

her reduced form utility function is given by:

$$V(w, \widehat{w}, z) = U(z\gamma(\widehat{w}), (w - pz)\gamma(\widehat{w})) + \lambda\widehat{w}. \tag{4}$$

The function U captures the private utility of consumption, which depends on the non expropriated goods. We let U be a smooth concave function with U_z, $U_y > 0$, and U_{zz}, $U_{yy} < 0$. Also, we assume that z is a normal good so that $U_{zy} - pU_{yy} > 0$. We denote by V_1, V_2 and V_3 the derivatives of V with respect to its arguments.

We make two assumptions about preferences and explicitly explain their consequences:

A1: The marginal rate of substitution U_z/U_y only depends on the ratio z/y, and not on γ, so that preferences are homothetic. We define $U_z/U_y = m\left(\frac{z}{w}\right)$.

We make this assumption in order to introduce crime in such a way that it does not affect consumption decisions by changing the marginal rate of substitution between the two goods. Since our objective is to propose a mechanism that is different in nature from the simple substitution effect, we impose this assumption in order to isolate our effect and show that it is totally independent from a substitution effect towards safer types of goods. However, this assumption about homothetic preferences is not necessary for our model to work, but in the absence of it we would have to note that changes in conspicuous consumption induced by crime would arise from both, the substitution effect and our proposed mechanism.

A2: We assume $U_y + zU_{zy} + yU_{yy} \leq 0$. This assumption about individual preferences implies that if two individuals with wealth w_1 and w_2 with the same amount of conspicuous consumption z are expropriated a fraction $1 - \gamma$ of all their goods, then they both loose utility, but the poorer individuals suffers the most.

Although not strictly necessary, this assumption is used in the proof of proposition 2 and it is also a condition that may be useful to prove the existence of a separating equilibrium. So, unlike assumption 1, this assumption plays a key role in the proofs of our results. In practice, if $U = f(S(z, y))$ with S being homogeneous of degree 1, then U satisfies our assumption A2 if $f''(x)x + f'(x) \leq 0$, that is, if f is "as concave" as logarithm. Thus, assumption A2 says that a poorer individual suffers more from the expropriation of a given fraction of her income than a rich individual does.

2.3 The complete information case

Under complete information $\widehat{w} = w$ and expectations are not affected by the consumption of z. Therefore, the optimal consumption $z(w)$ for an individual with wealth w is defined implicitly by the following tangency condition:

$$\frac{U_z(z(w)\gamma(w), (w - pz(w))\gamma(w))}{U_y(z(w)\gamma(w), (w - pz(w))\gamma(w))} = m\left(\frac{z(w)}{w}\right) = p, \tag{5}$$

Since preferences are homothetic, $z(w) = \alpha w$ with $0 < \alpha < 1$, and z is a normal good with income elasticity equal to 1.

In this case, consumption decisions are not affected by the extent of crime, since $z(w)$ does not depend on γ. This shows that under complete information, crime introduces no distortions on individuals' consumption decisions, just as we wanted by introducing assumption A1[9].

2.4 The incomplete information case: Separating equilibrium

In this case individuals' wealth is private information. In order to construct a separating equilibrium we must find a 1-1 function $\sigma : [w_{min}, w_{max}] \rightarrow \mathbb{R}$, describing the conspicuous consumption, $\sigma(w)$, of an individual with privately known wealth w. The function must be 1-1 because for every consumption level z, the audiences must be able to deduce the wealth of the individual sending that signal, a task that would be impossible if $\tau^{-1}(z)$ has several elements. Since the function is 1-1, equilibrium path beliefs must satisfy $\widehat{w} = E(w|\sigma(w) = z) = \sigma^{-1}(z)$. That is, both audiences can determine, without uncertainty, the wealth of an individual sending the signal z by applying the inverse function σ^{-1} to her signal. Notice that beliefs are only defined for $z \in \sigma([w_{min}, w_{max}])$, that is, "on the equilibrium path". Off equilibrium path beliefs must satisfy the intuitive criteria requirement (Cho and Kreps, 1987; Banks and Sobel, 1987), as is explained in the appendix.

From the reduced form utility function, we have that $V_2 = \lambda + \gamma'(\widehat{w})(zU_z + yU_y)$ captures the incentive to signal wealth. The sign of V_2 depends on the relative size of the concerns for status, captured by λ, and the extent of crime, captured by the negative term $\gamma'(\widehat{w})(zU_z + yU_y)$. Thus, as the level of property crime increases, the incentives to signal wealth diminishes. It could be the case that crime is so big relative to λ, that in fact $V_2 < 0$, and individuals face and incentive to hide their wealth. If, on the contrary, crime is small relative to λ, then $V_2 > 0$, and there is a positive incentive to signal wealth despite the fact that the signal increases property crime targeted towards the individual. It could also be the case that the sign of V_2 changes with w and z. However this situation could exhibit many equilibria and there is no easy characterization of a separating equilibria in this case.

Lemma 1 in the appendix shows that if V_2 is always greater than zero ($V_2 > 0$), then in any separating equilibrium the poorer individual will choose her complete information level of

[9] It is easy to show that if $\eta_y \neq \eta_z$, then the first order condition would depend of η_y and η_z. Therefore, crime would affect consumption decisions via the substitution effect. For example, if crime disproportionally targets conspicuous consumption, then individuals would do less of it because it implies a higher targeting by criminals, and also because this higher targeting would be associated to more expropriation of this goods, making the marginal utility per dollar invested in this goods fall relative to that of the numeraire.

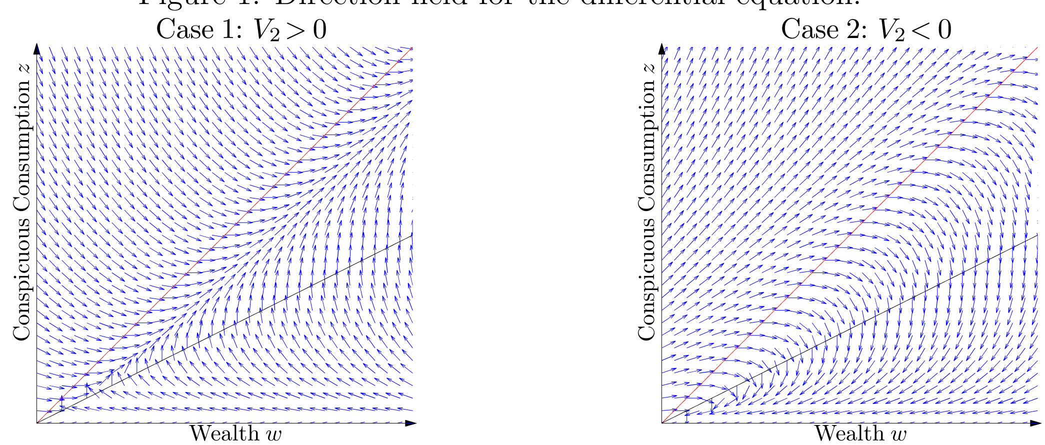
conspicuous consumption. The intuition behind this assertion is that since her type is going to be revealed in equilibrium, she strictly prefers to send her complete information signal. By doing so, both audiences cannot decrease her utility by changing their perception about her wealth, since w_{min} is a lower bound for $\widehat{w}$ on and off the equilibrium path. Therefore, this individual would be strictly better off by sending the signal $z(w_{min})$. In the same fashion, if $V_2 < 0$, then in any separating equilibrium the richer individual will choose her complete information level of conspicuous consumption, with the intuition being exactly analogous to the previous case.

Lemma 2 completely characterizes the unique separating equilibrium (if it exists) and provides the necessary and sufficient conditions for its existence when V_2 does not change sign and $V_{13} = \gamma^2(U_{zy} - pU_{yy}) > 0$ (which is always the case with homothetic preferences). The unique separating equilibrium (if it exists) must be the unique *increasing* solution to the following differential equation:

$$\sigma'(w) = \frac{\lambda + \gamma'(w)(zU_z + (w - p\sigma(w))U_y)}{\gamma(pU_y - U_z)}, \tag{6}$$

with the initial value condition $\sigma(w_{min}) = z(w_{min})$ if $V_2 > 0$ and $\sigma(w_{max}) = z(w_{max})$ if $V_2 > 0$. In order to make the notation more compact, we ignore the function's arguments, but we are assuming that all derivatives of U are evaluated at $(\sigma(w)\gamma(w), (w - p\sigma(w))\gamma(w))$. Notice that the numerator is exactly $V_2(w, w, \sigma(w))$ while the denominator is exactly $V_3(w, w, \sigma(w))$. The following figures show the direction field for this differential equation along with $z(w)$ (in black) and the upper bound for conspicuous consumption $z = w$ (in red). The left hand side panel shows the case where $V_2 > 0$ while the right hand side panel shows the case when $V_2 < 0$.

Figure 1: Direction field for the differential equation.



The idea behind the proof of lemma 2 is the following. If individuals only choose actions on the equilibrium path, then their problem is equivalent to choosing which type they want to mimic, since there is a bijection between types and equilibrium path signals. Therefore, an individual's problem may be stated as:

$$\max_{\widehat{w}\in[w_{min},w_{max}]} U(\sigma(\widehat{w})\gamma(\widehat{w}),(w-p\sigma(\widehat{w}))\gamma(\widehat{w}))+\lambda\widehat{w}. \tag{7}$$

Assuming that the problem is well defined and its maximum is characterized by its first order condition, it has a unique global maximum w^* satisfying the following first order condition:

$$\sigma'(w^*)\gamma(w^*)[U_z-pU_y]+\lambda+\gamma'(w^*)(\sigma(w^*)U_z+(w-p\sigma(w^*))U_y)=0. \tag{8}$$

Here, the arguments of the derivatives of U are $(\sigma(w^*)\gamma(w^*),(w-p\sigma(w^*))\gamma(w^*))$. The first term captures the change at the margin in the direct consumption utility from sending a particular signal, while the second and third terms capture the incentives to mimic other types. In particular, the second term captures the incentives to look wealthier in order to gain status, while the third term captures the cost associated with the potential risk of being targeted by criminals as a result of looking as a more attractive prey (e.g., wealthier).

The equilibrium must be *incentive compatible*, in the sense that every individual is worse off by mimicking other types, so that the equilibrium is indeed separating because individuals choose the signal corresponding to their type. This implies that $w^*=w$ for all $w\in[w_{min},w_{max}]$. Plugging $w^*=w$ into the first order condition 8 and isolating σ' we obtain the differential equation 6.

To guarantee that the first order condition actually characterizes a global maximum, and the separating equilibrium exists, we can follow different strategies. The most straightforward one is to follow Mailath (1987), who shows that the first order condition determining the differential equation gives a global maximum if we have the *single crossing condition* (SCC):

$$\sigma'\left[\gamma^2(U_{zz}-pU_{yy})-\frac{\gamma(U_z-pU_y)}{\lambda+\gamma'(\sigma U_z+(w-p\sigma)U_y)}\cdot\gamma'(U_y+\sigma\gamma U_{zy}+(w-p\sigma)\gamma U_{yy})\right]\geq 0, \tag{9}$$

for all w and $\widehat{w}$. Here γ and σ are evaluated at $\widehat{w}$, and the derivatives of U at $(\sigma(\widehat{w})\gamma(\widehat{w}),(w-p\sigma(\widehat{w}))\gamma(\widehat{w}))$. One easy way to guarantee the SCC is to assume $U_y+zU_{zy}+yU_{yy}\approx 0$, which implies $U_y+\sigma\gamma U_{zy}+(w-p\sigma)\gamma U_{yy}\approx 0$. In this case the term $\sigma'\gamma^2(U_{zz}-pU_{yy})$ dominates the other, and since $U_{zz}-pU_{yy}>0$, and $\sigma'>0$, because σ is increasing, we obtain the SCC. Thus, in this case there always exists a unique separating equilibrium given by the solution to the differential equation 6.

The last assumption is similar to A2, but says that crime, modeled here as the expropriation of equal fractions of both goods, hurts poor and rich individuals in approximately the same way. This could be the case because even though poorer individuals face a higher loss at the margin from loosing wealth or consumption, richer individuals loose a higher fraction of their wealth. The assumption would suggest that the magnitude of both effects is similar.

Intuitively, if $U_y+zU_{zy}+yU_{yy}$ is negative and large, poor individuals suffer a big deal from crime relative to rich individuals, so that they might end up pooling at the lowest possible consumption level, so a separating equilibrium may not arise in this case. Conversely, if $U_y+zU_{zy}+yU_{yy}$ is positive and large, richer individuals suffer a big deal from crime relative to poor individuals and they might end up pooling at the maximum level of conspicuous consumption. In fact, the SCC mainly rules out the possibility of individuals pooling at the maximum or minimum level of conspicuous consumption, or, in other words, rules out corner solutions to the individuals' maximization problem. The SCC also guarantees that the individual's problem has a unique critical point at $\widehat{w}=w$.

Another approach to guarantee that the first order condition for the individual's problem actually characterizes a maximum would be to prove that it gives a local maximum and then to show that the FOC only has one zero. This is precisely the approach followed by Glazer and Konrad (1995). It turns out that the condition for a local maximum at w is exactly

$$\sigma'\left[\gamma^2(U_{zz}-pU_{yy})-\frac{\gamma(U_z-pU_y)}{\lambda+\gamma'(\sigma U_z+(w-p\sigma)U_y)}\cdot\gamma'(U_y+\sigma\gamma U_{zy}+(w-p\sigma)\gamma U_{yy})\right]\geq 0, \tag{10}$$

with γ and σ evaluated at w, and the derivatives of U at $(\sigma(w)\gamma(w),(w-p\sigma(w))\gamma(w))$. In our case, this condition is satisfied because the term $\sigma'\gamma^2(U_{zz}-pU_{yy})$ is positive, and the last term can be written as $\frac{1}{\sigma'}\gamma'(U_y+\sigma\gamma U_{zy}+(w-p\sigma)\gamma U_{yy})$ which is positive by assumption A2. However, to complete this approach one ends up reaching the SCC because proving the FOC only has one solution requires to prove the monotonicity of $\frac{V_2}{V_3}$ as a function of w.

One particular case arises when there is no criminal audience and $\gamma=1$, we get $\gamma'=0$, so the SCC becomes $\sigma'(U_{zy}-pU_{yy})\geq 0$, and it is trivially satisfied. In this case, the increasing solution to the differential equation 6 is always a separating equilibrium.

Proposition 1 summarizes the main result of this section.

Proposition 1: In the unique separating equilibrium (if it exists), the strategies must solve the differential equation 6. If crime is high enough relative to concerns for status, then $V_2=\lambda+\gamma'(zU_z+yU_y)<0$ *and individuals underinvest in the conspicuous good relative to the complete information case with a criminal audience. Conversely, if crime is low enough relative to the concerns for status, then* $V_2=\lambda+\gamma'(zU_z+yU_y)>0$ *and individuals overinvest in the conspicuous good relative to the complete information case with a criminal audience. Existence requires the SCC. In particular, if* $U_y+\sigma\gamma U_{zy}+(w-p\sigma)\gamma U_{yy}\approx 0$*, then a separating equilibrium exists.*

Proposition 1 is a straightforward consequence of lemmas 1 and 2, whose proofs and full statements can be found in the appendix and the previous discussion about the SCC. It turns out that σ is increasing because of the initial value condition and the fact that $U_{zy} - pU_{yy} > 0$, so wealthier individuals are able to send higher signals. Since σ is increasing, the differential equation implies that $V_2 = \lambda + \gamma'(zU_z + yU_y)$ and $-V_3 = \gamma(pU_y - U_z)$ have the same sign. If $V_2 > 0$ and individuals want to look wealthier, then $\gamma(pU_y - U_z) > 0$ and

$$m\left(\frac{\sigma(w)}{w}\right) < p, \tag{11}$$

so $\sigma(w) > z(w)$. That is, individuals overinvest in the conspicuous good. The intuition behind this result is that we have the poorer individual exactly at $z(w_{min})$. From there on, every individual pushes her consumption up (from their optimal consumption levels) in order to differentiate from the individuals right below her and look richer. We end up with all individuals overinvesting in the observable good. If, on the contrary, $V_2 < 0$ and crime is so high that individuals actually want to hide their wealth, then $\gamma(pU_y - U_z) < 0$ and

$$m\left(\frac{\sigma(w)}{w}\right) > p, \tag{12}$$

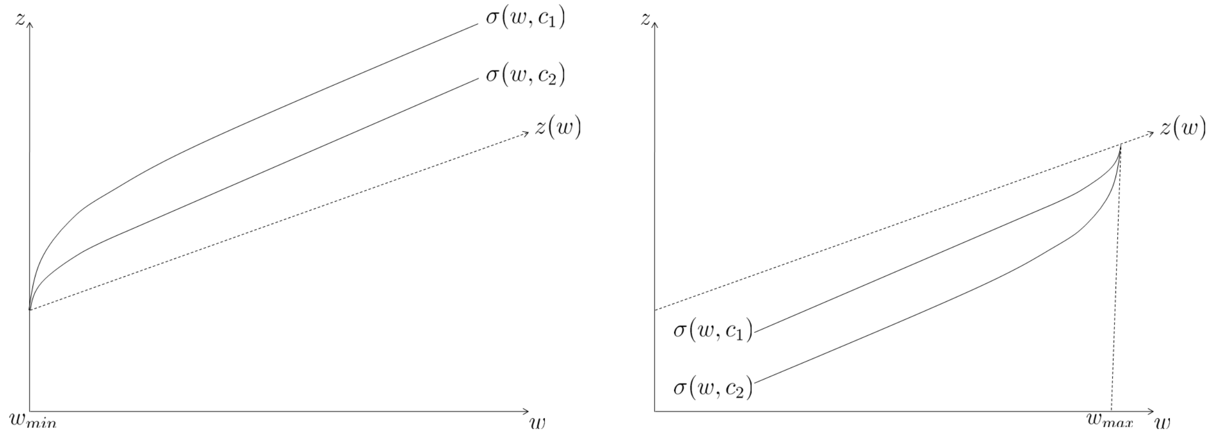
so $\sigma(w) < z(w)$. That is, individuals underinvest in the conspicuous good. The intuition behind this result is that we have the richer individual exactly at $z(w_{max})$. From there on, every individual pushes her consumption down (from their optimal consumption levels) in order to differentiate from the individuals right above them and look poorer. We end up with all individuals underinvesting in the observable. The overinvesting or underinvesting decreases welfare because if individuals could agree to consume $z(w)$, then they would end up with the same status, same crime targeted towards them, and more direct utility from consumption.

One special case that arises in this setting is when the level of crime is such that $\gamma'(zU_z + yU_y) = \lambda$. In this case, crime acts exactly as a pigouvian tax on conspicuous consumption correcting the externality generated by the incentives to differentiate from others. In this special case, $\sigma(w) = z(w)$.

Thus far we have introduced crime without a measure of its intensity. Let c measure the crime level and assume that the non expropriated wealth depends on $\widehat{w}$ and the crime level c, so that an individual whose expected wealth is $\widehat{w}$, is not expropriated a fraction $\gamma(\widehat{w}, c)$ of her goods. We assume $\frac{\partial \gamma}{\partial c} < 0$, so crime increases expropriation and $\frac{\partial(\gamma'/\gamma)}{\partial c} < 0$ so $\frac{\gamma'}{\gamma}$ decreases with c (it becomes more negative), and crime is more responsive to signals. Proposition 2 describes the main comparative statics result of our model.

Proposition 2: Let $\sigma(w, c)$ be the unique separating equilibrium when the crime level is c. Then, for any $w \in (w_{min}, w_{max})$, conspicuous consumption for an individual with wealth w is strictly decreasing in c.

Figure 2: Proposition 2. Crime and conspicuous consumption.



Proposition 2 also follows directly from lemma 3 in the appendix and the following considerations about the effects of crime on the slope of σ (given by $-V_2/V_3$). When $V_2 > 0$, by lemma 3 it is enough to show that $-V_2/V_3$ decreases with crime in order to show that the unique separating equilibrium for a crime level c, $\sigma(w, c)$ decreases with the level of crime. If we rewrite the differential equation as

$$\sigma' = \frac{\lambda}{\gamma U_y \cdot (p - m(\sigma(w)/w))} + \frac{\gamma'}{\gamma}\left(\frac{\sigma(w)m(\sigma(w)/w) + w - p\sigma(w)}{p - m(\sigma(w)/w)}\right), \tag{13}$$

then, differentiating the right hand side with respect to c and holding w and σ constant, we obtain the following expression for the first term:

$$-\frac{\lambda}{(\gamma U_y)^2 \cdot (p - m(\sigma(w)/w))}\frac{\partial \gamma}{\partial c}(U_y + \sigma\gamma U_{zy} + (w - p\sigma)\gamma U_{yy}) < 0. \tag{14}$$

Here we use the fact that $U_y + \sigma\gamma U_{zy} + (w - p\sigma)\gamma U_{yy} < 0$ by assumption A2. For the second term we obtain the following expression:

$$\frac{\partial(\gamma'/\gamma)}{\partial c}\left(\frac{\sigma(w)m(\sigma(w)/w) + w - p\sigma(w)}{p - m(\sigma(w)/w)}\right) < 0. \tag{15}$$

Which proves that $-V_2/V_3$ decreases with crime, and therefore, conspicuous consumption decreases with crime by lemma 3A. In a completely analogous way, and using lemma 3B, we also find that conspicuous consumption decreases with crime when $V_2 < 0$, by showing that $-V_2/V_3$ increases with crime in this case. Figure 2 summarizes proposition 2. The left hand side panel shows how conspicuous consumption varies with crime when $V_2 > 0$, while the right hand side panel shows how conspicuous consumption varies with crime when $V_2 < 0$. In both cases we have $c_1 < c_2$.

Intuitively, crime decreases the incentives to signal wealth by making it more costly, since it is more likely that a criminal sees the signal and responds to it. Therefore, individuals trade-off security and status when deciding whether to reveal information about their wealth via the consumption of observable goods. Proposition 2 shows that the solution to this trade-off becomes more tilted towards not showing wealth in high crime environments.

3 Empirical evidence

3.1 Data

In order to test the predictions of the model, we use the data from Charles et al. (2009) on consumption expenditures by different categories at the household level. This data set contains the 1986-2002 CEX family-level extracts made available by the NBER and collected by the United States Department of Labor. The CEX is an ongoing rotating panel in which a random sample of U.S. households are interviewed up to 5 times each, at three month intervals. For every household interviewed we have its State of residence; year of interview; consumption expenditures aggregated to the categories proposed by Harris and Sabelhaus (2000); demographic characteristics; household composition; education level for each member; and some income measures. A complete description of this dataset can be found in Harris and Sabelhaus (2000) and Charles et al. (2009).

Regarding crime variables, we use available information at the State level about crime rates, with crime divided into several categories including homicide, murder, rape, violent assault, robbery, larceny theft, burglary, and car theft. This data comes from the FBI uniform crime reporting system (UCR) and is taken from John Lott's data set[10]. This data set contains information for all States between the years 1977 through 1999. We use the average of robberies, burglaries and larceny thefts in order to construct a measure of the property crime rate (per 100,000 inhabitants), and match each household to the property crime rate in its State of residence during the year it was surveyed. Although the FBI defines property crime as larceny theft, burglary and car theft, we also include robbery, defined as the use of force or threat against a victim in order to expropriate her property. Since our model deals with criminals making inferences about individuals' wealth (which they can steal but do not observe), we exclude car theft from our property crime measure in the baseline specifications, since this type of crime targets a very specific and observable good whose value can be easily estimated without the need of specific signals. In other words, car theft does not fit the mechanism proposed in the model since, intuitively, criminals just have to look for the right car to steal, and doing so does not require information that they cannot directly observe. On the other hand, a burglar or a robber does not observe the value of the

[10]This dataset is downloadable from http://www.johnlott.org/.

objects he could potentially steal from a victim, and thus he has to make an inference about it by observing other victim characteristics or signals such as their conspicuous consumption. We also include the homicide rate and the arrest rate for burglaries, which we will use as instrumental variables for the crime rate in our IV approach described below.

Given our focus on the relationship between crime and conspicuous consumption, we divide different consumption goods along two dimensions for our empirical analysis: *visibility* and the degree to which they are stealable ("*stealability*"). Visible goods are those which can easily be observed by others without the need of having several interactions in order to notice them. Thus, visible goods are perfect candidates for signals of individuals' wealth. On the other hand, stealable goods are those which can be targeted by robbery, larceny theft or burglary. Table 1 shows our division of Harris and Sabelhaus (2000) original consumption categories into the five consumption measures used in this paper: Visible and non stealable (VN); Stealable (S); not visible and non stealable (NN); car expenditures; and housing expenditures[11]. Rather than just guessing which goods are visible, we use surveys conducted by Charles et al. (2009) and Heffetz (2009) about the visibility of different consumption categories and their expected income elasticity. We code durable recreation goods (such as televisions and other electronic devices), furniture, and jewelry as stealable, or at least potentially stealable since thefts, burglars and robbers seem to have a marked preference for cash, following the annual FBI crime reports and the ethnographic evidence in Wright and Decker (1996) and Wright and Decker (1997). Appendix B discusses both surveys and explains the criteria used to define our consumption categories We assign house rents and the rent equivalent of a house to a different category called "Housing expenditures", because this is a large investment whose logic differs from the one outlined in our model. We also leave all car related expenses in a different category called "Car expenditures", since, as explained before, we do not want to capture the relation between car theft and expenditures on cars in our empirical models[12].

In order to control for some factors varying over time and across States, we match each household to a series of State level controls for the year the household was surveyed. These controls include mean income and standard deviation of income for the household head's

[11]Stealable goods are not divided in visible or non visible since all of them were told to be very visible in one of the surveys we used to construct this categories. The details can be found at appendix B.

[12]Cars appear to be highly visible in both surveys and since they are not directly target by the types of crime in our property crime measure it could be considered as a visible non stealable good. However, although cars are not directly targeted by property crime as we defined it, most car accessories are. Also, car theft is highly correlated with our property crime measure and including it as a visible non stealable good may create a trivial association between property crime and visible non stealable consumption, an association that is not driven by the mechanism proposed in our model.

reference group from Charles et al. (2009) (defined by race and sex); the Gini coefficient; the poverty rate; population and population density; and the percentage of males within some age and race brackets. All of these controls are important since they may be related to crime and conspicuous consumption, and omitting them might create a spurious relationship between our variables of interest.

We follow Charles et al. (2009) and use the average consumption expenditure for each of our categories over the periods that a household was surveyed. Although some households are not surveyed five times, we still use the average over the times that they were interviewed[13]. Hence, the unit of analysis is the average quarterly expenditure in a consumption category over the period that the household is in the sample[14]. We restrict our sample to household heads between 18 and 59 years old and we exclude households reporting 0 consumption in the aggregate expenditure categories that we use in this paper. Our main sample contains 41,152 households in almost all States for the years between 1986 and 1998. We do not use the CEX observations for 1999-2002 because we do not have the corresponding State-level controls and crime variables for this period.

Table 2 presents the descriptive statistics for the main variables described above. As shown in this table, housing expenditures represent about 27% of households' total expenditures, suggesting that, indeed, housing is an expenditure whose logic is beyond the scope of our model and corroborating our decision of leaving it aside of the proposed classification.

3.2 Empirical strategy

The main prediction of our model is that crime affects conspicuous consumption and that this effect should not only be observed for visible and stealable goods (S), as the direct substitution effect predicts, but also for visible and non stealable goods (VN), since the consumption of these goods reveals information to criminals about individuals' wealth, thus inducing the latter to do less of it as crime increases. We work with the following baseline

[13] Although the reasons why some households leave the panel might be related to crime (for example if they migrate), our results are robust to using only households for which all five surveys were completed. Including households that left the panel could in fact bias our results against us, since they might keep a high level of conspicuous consumption despite a high crime level, because they expect to move to another city (perhaps with less crime) soon.

[14] We do not exploit the panel structure of the original CEX data since we do not have the corresponding state controls and crime variables varying at a quarterly frequency. Moreover, it is highly unlikely that households adjust their consumption during a year and that crime variables have enough variation in a year to identify the effect of crime on consumption from changes in consumption within a household in a given year.

specification:

$$\ln VN_{i,t,s} = \beta_o + \beta_1 \ln PC_{s,t} + \beta_2 \ln W_{i,s,t} + \Phi Z_{i,s,t} + \gamma X_{s,t} + \varepsilon_{i,s,t}, \tag{16}$$

where $VN_{i,s,t}$ is the level of visible and non stealable consumption expenditures for household i, in State s, and year t (the year the household was interviewed). $PC_{s,t}$ is the property crime rate in State s and year t; $W_{i,s,t}$ is household i's permanent income at time t; $Z_{i,s,t}$ is a set of household controls; $X_{s,t}$ is a set of controls at the State level; $\varepsilon_{i,s,t}$ denotes the error term[15]; finally, in all specifications we also include State and year fixed effects. In this specification β_1 is our parameter of interest and we want to interpret it as the causal effect of crime on conspicuous consumption due to its visibility.

The first problem when estimating model 16 directly by OLS is that, as noticed by Charles et al. (2009), the CEX income measure does not perform well, mainly because this survey is designed to measure consumption expenditures and not income. It is important to control for income since visible goods tend to have an income elasticity greater than 1 (e.g. they are luxury goods), and if there is a correlation between crime and income, ignoring this control would cause our estimate to capture this correlation, biasing our results in favor of our hypothesis. Therefore, we will use total consumption as a proxy for permanent income in our empirical specification and estimate equation 16 using total expenditures instead of income[16]. However, total consumption is endogenous in this model because all consumption categories are simultaneously determined, and therefore the OLS coefficient would be biased. More problematic for our purposes is that total consumption could be a bad proxy for permanent income in this regression because the relation between present consumption and permanent income could be affected by crime. This could be the case if people save more when facing a higher crime rate, as suggested by De Mello and Zilberman (2008). Having a bad proxy could also bias our coefficient of interest. To address this issue we present all our estimations with two different specifications: first we show the OLS estimates, and second we show results in which we follow Charles et al. (2009) and instrument total consumption using the poorly measured income data, household head's occupation, industry and educational level. The last strategy solves the bad proxy problem because it "cleans" non structural determinants of consumption. However, this strategy does not necessarily imply that the coefficient of permanent income is consistently estimated, since these instruments need not be exogenous (for an explanation of how to solve the bad proxy problem see Appendix C)[17].

[15]The error term could be correlated for households in the same state or have a different variation for some of the states. Therefore we use clustering by state in all our regressions.

[16]The use of total expenditures as a proxy for permanent income is motivated by the fact that in life cycle models, consumption is directly proportional to permanent income.

[17]We also exclude total consumption from the right hand side in the robustness checks. All of our results

The second and more troubling problem for the consistent estimation of the β_1 is the potential endogeneity of crime in the model specified in 16. Property crime could be endogenous in this regression because of simultaneity, since, conspicuous consumption could induce higher levels of property crime since there are more stealable goods, and more people revealing information to criminals. In other words, more visible (stealable or non stealable) consumption might induce criminals to undertake more crimes against property, which would bias our coefficient of interest upward. There could also be measurement error in the crime variable, which would more likely attenuate our results. Both arguments imply that the OLS estimate of β_1 is larger than its true value. Thus, if the OLS coefficient turns out to be negative, most likely, the real coefficient would be even more negative, and we would be underestimating the negative impact of crime on visible, non stealable consumption.

In order to solve this potential endogeneity problem we instrument the property crime rate using the homicide rate and burglary-related police arrests. Intuitively, we need an instrument that is correlated with property crime but that does not affect conspicuous consumption directly. Homicide rates are related to violent crime and more violent crime could increase property crime by increasing the pool of potential criminals or by congesting the judicial system. On the other hand, violent crime does not affect consumption decisions although it could affect inter temporal consumption decisions by changing the discount rate, thus it satisfies the exclusion restriction. Finally, burglary-related police arrests are related to property crime because a higher arrest rate dissuades potential criminals, and most likely, arrest rates are only related to household consumption decisions trough the property crime level. In all our estimations of model 16, we show the OLS and IV results.

3.3 Results

Table 3 shows 8 different estimations of model 16. Columns 1 and 2 present the results of the estimations by OLS. The first column includes state level controls an the second column adds household level controls. Both are estimated with time and state fixed effects. Columns 3 and 4 have the same specification as the two previous ones but with our measure of property crime instrumented. Columns 5 and 6 have the same specification as columns 1 and 2 but with total consumption instrumented using a vector of potential determinants of permanent income and the poorly measured income in the CEX data. Finally, in columns 7 and 8 both property crime and total consumption are simultaneously instrumented. All columns have standard errors estimated with clustering by state. Crime appears to have a negative and significant impact on non stealable conspicuous consumption in all specifications. When

still hold under this alternative specification.

property crime is not instrumented the estimates suggest that a 10% increase in our property crime measure decreases non stealable conspicuous consumption by about 1.2% and this effect is significant at the 1% confidence level, except in one specification in which it is significant at the 5% confidence level. When we instrument the property crime rate the point estimate becomes more negative, suggesting the presence of an upward bias in our OLS estimates, as suggested by our discussion above. The IV estimates suggest a 10% increase in our property crime measure decreases non stealable conspicuous consumption by about 2.4% in most specifications and 1.66% in the most demanding one, with the effect being significant at the 1% confidence level except in the last specification in which the effect is significant at the 5% level.

Permanent income has a significant and positive effect on non stealable conspicuous consumption. In particular, we find a 10% increase in permanent income is associated with a 11.7% increase in non stealable conspicuous consumption when the permanent income proxy is not instrumented, and 16.1% when it is. Both estimates suggest that goods coded as visible and non stealable are luxury goods since they have an income elasticity greater than 1, which shows that indeed the consumption of these goods is a very reliable signal of wealth. However, this result requires a caveat, since this coefficient is consistently estimated only when the instruments are exogenous. As mentioned before, we do not require this exogeneity to consistently estimate β_1 (and solve the bad proxy problem), but we do if we want to estimate β_2.

Although the previous estimates suggest a negative impact of crime on the level of non stealable conspicuous consumption, as our model predicts, there could also be alternative mechanisms explaining this relation that may be different from the one proposed in our model. There are several alternatives: Crime may cause a general fall in consumption because potential victims increase precautionary savings (see De Mello and Zilberman (2008)) or because firms increase prices to cover losses created by criminal activities. Therefore, our estimate could be capturing a general fall in consumption. It could also be the case that households increase their expenses on protection when facing higher crime rates, thus tightening their budget constraint. In particular, households could increase their expenses on categories such as housing, since they would be more willing to pay higher rents to avoid areas with high levels of crime, or they would make extra expenditures on security[18]. Our model could also be capturing the tightening of the budget constraint due to increasing victims' precaution (see Levitt (1999)). In order to isolate our proposed mechanism from this

[18] On the other hand it is possible that the urban flight caused by crime Cullen and Levitt (1999) reduces housing prices and rents, and consequently, expenditures on housing. This would bias our coefficient upwards since the budget constraint implies more expenditures on goods other than housing.

alternatives we estimate the following specification:

$$\ln\left(\frac{VN_{i,t,s}}{N_{i,t,s}}\right) = \beta_o + \beta_1 \ln PC_{s,t} + \beta_2 \ln W_{i,s,t} + \Phi Z_{i,s,t} + \gamma X_{s,t} + \varepsilon_{i,s,t}, \qquad (17)$$

where all variables have the same notation as in model 16. It should be noted that alternative channels suggesting a tightening of the budget constraint or a general fall in expenditures cannot predict visible non stealable consumption falling more than non stealable consumption with higher crime rates, since these channels suggest that crime should affect both categories in the same way. Therefore, a negative estimate for β_1 in equation 17 implies that property crime decreases visible non stealable conspicuous consumption more than it decreases non stealable consumption. Since visible non stealable conspicuous consumption differs from all non stealable goods because it is observable, a negative estimate would suggest that crime must have a negative impact on visible non stealable conspicuous consumption precisely because of its observability. The estimation of the model in equation 17 offers yet another advantage in identifying the effect of crime on conspicuous consumption trough our proposed mechanism: by considering only N (non stealable consumption) in the denominator of the dependent variable (omitting stealable goods and car related expenditures), we are removing a potential bias against our results created by the decrease in stealable consumption due to higher property crime, which implies a substitution towards non stealable goods and an increase in these goods through the budget constraint.

Table 4 shows 8 different estimations of the specification in equation 17. Columns 1 and 2 show the OLS estimations. The first one includes state level controls an the second one adds household controls (both are estimated with time and state fixed effects). Columns 3 and 4 have the same specification as the two previous ones but with property crime instrumented. Columns 5 and 6 have the same specification as columns 1 and 2 but with total consumption instrumented. Finally, in columns 7 and 8 both property crime and total consumption are instrumented. All columns have standard errors estimated with clustering by state. Crime appears to have a negative and significant impact on the ratio of visible non stealable consumption to non stealable consumption in all specifications. When property crime is not instrumented the estimates suggest that a 10% increase in our property crime measure decreases the ratio between visible non stealable to non stealable consumption by about 1.27%, and this effect is significant at the 1% confidence level in all specifications. When we instrument our measure of property crime the point estimate becomes more negative, suggesting the presence of an upward bias in our OLS estimates as suggested by our previous discussion. The IV estimates indicate that a 10% increase in our property crime measure decreases the ratio between visible non stealable to non stealable consumption by 1.79%, with the effect being significant at the 1% confidence level.

One potential source of criticism to the way we are interpreting the estimates of model 17 is that visible non stealable goods could also differ from non stealable goods because they have strong complementarities with stealable goods (including car related expenses). As an example, take the expenditures on jewelry (stealable) and country clubs (visible and non stealable). If the marginal utility of going to a country club is increasing in the jewels women wear, then using less jewels because they can be stolen would imply expending less in country clubs, not because the country club signals wealth and this information could attract criminals as proposed by our mechanism, but because crime "taxes" a complementary good. Therefore, if visible non stealable goods are more complementary to stealable goods than the average non stealable good, we could be exaggerating the negative impact of crime on visible non stealable consumption. To address this concern we directly control for the level of consumption in stealable goods and cars (whose consumption also falls with property crime and could also be complementary to visible non stealable goods) in on the right hand side of the model in equation 17[19]. The results of this strategy are shown in table 5, which are the same regressions as those presented in table 4, but including expenditures in cars and stealable consumption as control variables. Consistent with the intuition just described, when the coefficient of stealable consumption and cars is positive, indicating stronger complementarities between this types of goods and stealable non visible goods, the coefficient of property crime becomes less negative but remains significant in all specifications. On the other hand, when the coefficient of stealable consumption and cars is negative, the opposite happens and the effect of crime actually becomes more negative. The fact that the coefficient of stealable consumption and car expenditures changes sign from those specifications in which total consumption is instrumented and those in which it is not is not an issue, since in fact this variable is endogenous in this regression and it is itself affected by crime, making the estimation of its coefficient inconsistent. However, in all cases we can be sure that the true effect of crime on the ratio between visible non stealable and stealable goods is between that estimated in table 4 and the one estimated in table 5 (See Appendix C for an explanation).

4 Robustness Checks

In order to establish the robustness of our results we conduct several checks. First we explore different specifications of the basic model in equation 16. Table 6 shows that our results hold

[19]We obtain the same results if we separately control for car expenditures and stealable consumption. Due to space limitations those results are not presented here, but they are available from the authors upon request.

if we directly control for household savings, housing expenditures and stealable consumption instead of modifying the dependent variable. The specifications in this table are the same as in table 3 but including these additional controls.

Our results are also robust to a different treatment of permanent income. Table 7 shows that our results hold if we remove total consumption as a control when estimating the specification in model 17. The first four columns are the same specifications showed in the first four columns of table 4, while the last four columns include stealable consumption and car expenditures as controls in the previous specifications. Table 8 shows that our results also hold if we use the CEX income measure as a proxy of permanent income rather than total consumption. The columns show the same specifications as in table 7 but including the log of quarterly income as an explanatory variable. The permanent income coefficient changes in size but remains positive and significant while the property crime coefficient is unaffected.

Table 9 shows the results of estimating model 17 by slightly changing the way we defined our consumption categories. Every pair of columns includes estimations of this model under a different division of Harris and Sabelhaus (2000) consumption categories across our five subcategories. These alternative divisions are obtained by changing the way we coded some of the original categories. For each new division, the first column estimates model 17 without instrumenting total consumption whereas in the second one we instrument it. Both estimations have the property crime measure instrumented. These tables indicate that our results are not sensible to the way we aggregate different consumption goods.

Tables 10, 11, 12 and 13 show our estimations of model 17 for each consumption category coded as visible non stealable. The results in these tables show that the negative impact of crime appears in all of these categories except health and beauty expenses, for which we estimate a positive but insignificant effect of crime. One possible explanation for the absence of a negative impact on this category is that these expenditures are not very visible (specially those on health) or are not used by criminals as a signal of wealth. In fact, the estimated income elasticity for this category is smaller than one and also the expected income elasticity in the Charles et al. (2009) survey for this category is significantly lower than that of other categories coded as visible.

Table 14 shows the results of estimating model 17 with different measures of property crime. We use as alternative measures the robbery rate alone, the burglary rate alone, and the average of these two rates. For each property crime measure we show three different estimations of model 17. The first column is estimated by OLS with a full set of controls, the second one instruments crime and the third one instruments both crime and total consumption. This table shows that our results hold under different definitions of the property crime measure.

Our result also hold under different sub samples. In tables 15 and 16 we break the sample into two periods (1986-1990 and 1991-1999) and break the sample according to household age, sex and race. All the results presented in these tables are obtained following the IV approach. The results presented in these tables suggest that there is a negative impact of crime on visible non stealable consumption before 1990 and after 1990. This effect is bigger before 1990 but becomes more significant after 1990. There is also a negative effect for white and nonwhites households (defined by the household head race). The effect is more negative for nonwhites presumably because they tend to live in areas with a higher crime rate[20]. There is a negative effect for both men or women, although the effect is stronger and more significant for households headed by males. This result is hard to rationalize because one would expect woman to bear a higher crime burden since they are potentially more vulnerable to crime. However, it is possible that women perceive that they will still be targeted despite their visible consumption levels. Thus, the effect of reducing conspicuous consumption on the probability of being victimized is small at the margin for women. Finally, there is a negative impact of crime on visible non stealable consumption for both younger or older households, although the effect is larger and more significant for younger households. Again, this could be explained because older household heads perceive they would still be targeted by criminals despite their visible consumption levels, since they are potentially more vulnerable to a crime attempt[21].

Finally, table 17 shows a falsification test where we estimate model 16 using the log of non visible non stealable consumption ($ln\ (NN)$) as the dependent variable. There is no significant impact of crime, suggesting that indeed the channel trough which crime affects visible non stealable consumption has to do with its visibility. Also, table 18 estimates model 17 using S (stealable goods) instead of N (non stealable goods), in order to test if the predictions of the direct substitution effect are also present in the data. As expected, there is a negative impact of crime on stealable consumption and the size of the crime coefficient is much larger than those estimated for only visible non stealable consumption. This results suggests that besides the visibility of stealable goods, the direct substitution effect might as well be at work.

[20]Another potential explanation is that nonwhites have a reference group in which the lowest income person is poorer than in the whites' reference group (see Charles et al. (2009) for a similar reasoning). Since the effect of crime "accumulates" through the consumption of poorer individuals who try to differentiate from the poorest one, the effect is amplified for nonwhites.

[21]There is extensive ethnographic evidence in Wright and Decker (1997) suggesting armed robbers prefer victims who are white, female and older.

5 Concluding remarks

This paper proposed and empirically tested a new channel through which criminal activities affect individual behavior. In particular, we develop the idea that individuals face a trade-off between status and security when making (observable) consumption decisions. On the one hand, by choosing a higher level of conspicuous consumption, individuals signal higher wealth to their peers and may enjoy higher social status. On the other, signaling higher wealth via more conspicuous consumption also makes an individual a more attractive target of criminal activities. Thus, when making observable consumption decisions, individuals trade-off status and security concerns. This channel is different in nature from the one where crime directly increases the cost of observable consumption. More precisely, the proposed channel argues that crime affects consumption decisions not because consumption can be directly targeted by criminal activities, but because the level of (observable) consumption reveals information about individual's wealth that criminals may actually use to target their potential victims.

We use individual level data for U.S. households in order to test the main prediction of the model. We find robust empirical evidence in favor of the channel proposed in this paper through which crime affects consumption decisions. In particular, we find a negative and significant impact of property crime on the level of expenditures on visible (stealable and non stealable) consumption goods.

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Table 1: Consumption categories.

Our spending category	Harris and Sabelhaus (2000) categories
Stealable consumption (S)[a]	Recreation and sports durables (063)
	Jewelry (031)
	Furnishing (036)
Visible Non stealable consumption (VN)	Beauty, parlors and health clubs (033)
	Food in restaurants (024)
	Clothes and tailors (029, 030)
	Recreational services (064)
Non Visible Non stealable consumption (NN)	Tobacco and Alcohol (026, 027, 028)
	Rent of other lodging (035)
	House maintenance (038, 039, 040, 041, 042)
	Health (044, 045, 046, 047, 048, 049, 051)
	Business services (050)
	Transportation (other than car) (058, 059)
	Airfare tickets (060)
	Books and publications (061, 062)
	Education (066, 067, 068)
	Food Home and Work (023, 025)
	Gambling (065)
	Charity (069)
Car Expenditures	Cars (052, 053, 054, 055, 056, 057)
Housing Expenditures	Home Rent (034)
	Rent Equivalent of Owned house (075)
	Servants and house services (043)

Notes: Numbers in parentheses refer to Harris and Sabelhaus (2000) original consumption categories in the CEX family extracts. Toiletry (032) and Household supplies (037) are missing in our data.

[a] The goods coded as stealable turned out to be very visible according to the survey by Heffetz (2009). Therefore, we do not divide stealable goods in visible or non visible sub categories.

Table 2: Descriptive statistics for main variables.

	Mean	Std. Dev.
Visible and Non Stealable consumption	1446.493	(1313.988)
	13.1%	
Non Visible and Non Stealable consumption	3569.161	(2402.809)
	35.4%	
Stealable consumption	645.106	(1266.938)
	5.2%	
Expenditures on cars	2468.875	(3143.036)
Cars share	19.5%	
Expenditures on housing	2695.151	(1727.57)
	26.9%	
Total Consumption	10824.786	(6961.105)
Robbery rate	237.112	(130.503)
Burglary rate	1138.012	(379.364)
Larceny theft rate	3088.216	(714.858
Property crime rate	1487.78	(359.876)
Homicide rate	8.896	(4.307)
Arrest rate for burglaries	12.308	(4.136)

Notes: For each consumption category its average quarterly expenditure is reported in 2005 dollars and its share of total consumption is reported below it. The construction of all expenditure categories is explained in appendix B. The data used to construct expenditure measures comes from the NBER CEX family level extracts. Crime rates are taken from the FBI Uniform Crime Reporting System (UCR) and the rates in the table are per 100.000 people.

Table 3: Estimates of the effects of crime in Visible Non stealable (VN) consumption.

	OLS		Instrumenting Crime[a]		Instrumenting Consumption[b]		Instrumenting Crime and consumption[a,b]	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Property crime	-0.137***	-0.127***	-0.262***	-0.235***	-0.141***	-0.116**	-0.247***	-0.166**
	(0.037)	(0.038)	(0.073)	(0.071)	(0.042)	(0.049)	(0.074)	(0.073)
Total consumption	1.088***	1.176***	1.088***	1.176***	1.350***	1.609***	1.350***	1.609***
	(0.013)	(0.014)	(0.013)	(0.014)	(0.022)	(0.019)	(0.022)	(0.019)
R-squared	0.593	0.605	0.593	0.605	0.564	0.550	0.564	0.550
Observations	38349	38349	38349	38349	38349	38349	38349	38349
Year and state effects	*Y*	*Y*	*Y*	*Y*	*Y*	*Y*	*Y*	*Y*
State level controls[c]	*Y*	*Y*	*Y*	*Y*	*Y*	*Y*	*Y*	*Y*
Household controls[d]	*N*	*Y*	*N*	*Y*	*N*	*Y*	*N*	*Y*

Notes: Data are from the NBER CEX extracts for the years 1986-1998. The table reports the coefficient of Property Crime in a regression of log Visible Non stealable consumption ($\log(VN)$) on the log of Property Crime and the other indicated controls. Robust standard errors with clustering by state are shown in parentheses. For the reported coefficients, those with *** are significant at the 1% level; those with ** are significant at the 5% level and those with * are significant at the 10% level.

[a] Property crime is instrumented using the log of the homicide rate and the log of the arrest rate for burglaries.

[b] Total consumption is instrumented using the log of the CEX income measure, a dummy for households reporting zero income, occupation and industry dummies related to the household head employment and household head education.

[c] State level controls include regional dummies, dummies for urban areas, density, population, demographic composition, gini, poverty rate, mean income, mean income by race and sex, deviation for income by race and sex.

[d] Household controls include age, sex, marital status and race of the household head, household size and number of adults living in the household.

Table 4: Estimates of the effects of crime in the ratio VN/N.

	OLS		Instrumenting Crime[a]		Instrumenting Consumption[b]		Instrumenting Crime and consumption[a,b]	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Property crime	-0.145***	-0.134***	-0.268***	-0.222***	-0.148***	-0.127***	-0.261***	-0.179***
	(0.038)	(0.033)	(0.063)	(0.059)	(0.037)	(0.036)	(0.063)	(0.060)
Total consumption	0.231***	0.385***	0.231***	0.385***	0.441***	0.687***	0.441***	0.687***
	(0.013)	(0.009)	(0.013)	(0.009)	(0.023)	(0.018)	(0.023)	(0.018)
R-squared	0.102	0.198	0.102	0.198	0.047	0.120	0.046	0.120
Observations	38349	38349	38349	38349	38349	38349	38349	38349
Year and state effects	*Y*	*Y*	*Y*	*Y*	*Y*	*Y*	*Y*	*Y*
State level controls[c]	*Y*	*Y*	*Y*	*Y*	*Y*	*Y*	*Y*	*Y*
Household controls[d]	*N*	*Y*	*N*	*Y*	*N*	*Y*	*N*	*Y*

Notes: Data are from the NBER CEX extracts for the years 1986-1998. The table reports the coefficient of Property Crime in a regression of the log of Visible Non stealable consumption share of the total Non stealable consumption ($\log(VN/N)$) on the log of Property Crime and the other indicated controls. Robust standard errors with clustering by state are shown in parentheses. For the reported coefficients, those with *** are significant at the 1% level; those with ** are significant at the 5% level and those with * are significant at the 10% level.

[a] Property crime is instrumented using the log of the homicide rate and the log of the arrest rate for burglaries.

[b] Total consumption is instrumented using the log of the CEX income measure, a dummy for households reporting zero income, occupation and industry dummies related to the household head employment and household head education.

[c] State level controls include regional dummies, dummies for urban areas, density, population, demographic composition, gini, poverty rate, mean income, mean income by race and sex, deviation for income by race and sex.

[d] Household controls include age, sex, marital status and race of the household head, household size and number of adults living in the household.

Table 5: Estimates of the effects of crime in the ratio VN/N.

	OLS		Instrumenting Crime[a]		Instrumenting Consumption[b]		Instrumenting Crime and consumption[a,b]	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Property crime	-0.136***	-0.128***	-0.250***	-0.212***	-0.151***	-0.138***	-0.276***	-0.209***
	(0.039)	(0.035)	(0.062)	(0.058)	(0.037)	(0.035)	(0.063)	(0.063)
Total consumption	0.064***	0.270***	0.064***	0.270***	0.455***	0.803***	0.455***	0.803***
	(0.019)	(0.012)	(0.019)	(0.012)	(0.034)	(0.032)	(0.035)	(0.032)
Stealable consumption and cars	0.099***	0.065***	0.099***	0.065***	-0.046***	-0.106***	-0.046***	-0.106***
	(0.008)	(0.005)	(0.008)	(0.005)	(0.011)	(0.014)	(0.011)	(0.014)
R-squared	0.124	0.207	0.123	0.206	0.051	0.101	0.051	0.101
Observations	38349	38349	38349	38349	38349	38349	38349	38349
Year and state effects	*Y*	*Y*	*Y*	*Y*	*Y*	*Y*	*Y*	*Y*
State level controls[c]	*Y*	*Y*	*Y*	*Y*	*Y*	*Y*	*Y*	*Y*
Household controls[d]	*N*	*Y*	*N*	*Y*	*N*	*Y*	*N*	*Y*

Notes: Data are from the NBER CEX extracts for the years 1986-1998. The table reports the coefficient of Property Crime in a regression of the log of Visible Non stealable consumption share of the total Non stelable consumption ($\log(VN/N)$) on the log of Property Crime and the other indicated controls. Robust standard errors with clustering by state are shown in parentheses. For the reported coefficients, those with *** are significant at the 1% level; those with ** are significant at the 5% level and those with * are significant at the 10% level.

[a] Property crime is instrumented using the log of the homicide rate and the log of the arrest rate for burglaries.

[b] Total consumption is instrumented using the log of the CEX income measure, a dummy for households reporting zero income, occupation and industry dummies related to the household head employment and household head education.

[c] State level controls include regional dummies, dummies for urban areas, density, population, demographic composition, gini, poverty rate, mean income, mean income by race and sex, deviation for income by race and sex.

[d] Household controls include age, sex, marital status and race of the household head, household size and number of adults living in the household.

Table 6: RC1: Estimates of the effects of crime in Visible Non stealable (VN) consumption.

	OLS		Instrumenting Crime[a]		Instrumenting Consumption[b]		Instrumenting Crime and consumption[a,b]	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Property crime	-0.124***	-0.118***	-0.230***	-0.214***	-0.082*	-0.072	-0.217**	-0.165**
	(0.035)	(0.035)	(0.070)	(0.067)	(0.043)	(0.046)	(0.086)	(0.080)
Total consumption	1.451***	1.562***	1.451***	1.562***	2.689***	3.014***	2.689***	3.014***
	(0.015)	(0.016)	(0.015)	(0.016)	(0.080)	(0.093)	(0.080)	(0.093)
Stealable consumption and cars	-0.124***	-0.144***	-0.124***	-0.144***	-0.481***	-0.537***	-0.481***	-0.537***
	(0.009)	(0.011)	(0.008)	(0.011)	(0.038)	(0.046)	(0.038)	(0.046)
Housing expenditures	-0.195***	-0.183***	-0.194***	-0.183***	-0.618***	-0.615***	-0.618***	-0.615***
	(0.015)	(0.014)	(0.015)	(0.014)	(0.031)	(0.031)	(0.031)	(0.031)
Household savings	0.000***	0.000***	0.000***	0.000***	-0.000***	-0.000***	-0.000***	-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
R-squared	0.612	0.624	0.612	0.624	0.467	0.450	0.467	0.450
Observations	38349	38349	38349	38349	38349	38349	38349	38349
Year and state effects	*Y*	*Y*	*Y*	*Y*	*Y*	*Y*	*Y*	*Y*
State level controls[c]	*Y*	*Y*	*Y*	*Y*	*Y*	*Y*	*Y*	*Y*
Household controls[d]	*N*	*Y*	*N*	*Y*	*N*	*Y*	*N*	*Y*

Notes: Data are from the NBER CEX extracts for the years 1986-1998. The table reports the coefficient of Property Crime in a regression of the log of Visible Non stealable consumption ($\log(VN)$) on the log of Property Crime and the other indicated controls. Robust standard errors with clustering by state are shown in parentheses. For the reported coefficients, those with *** are significant at the 1% level; those with ** are significant at the 5% level and those with * are significant at the 10% level.

[a] Property crime is instrumented using the log of the homicide rate and the log of the arrest rate for burglaries.

[b] Total consumption is instrumented using the log of the CEX income measure, a dummy for households reporting zero income, occupation and industry dummies related to the household head employment and household head education.

[c] State level controls include regional dummies, dummies for urban areas, density, population, demographic composition, gini, poverty rate, mean income, mean income by race and sex, deviation for income by race and sex.

[d] Household controls include age, sex, marital status and race of the household head, household size and number of adults living in the household.

Table 7: RC2: Estimates of the effects of crime in the ratio VN/N.

	OLS		Instrumenting Crime[a]		OLS		Instrumenting Crime[a]	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Property crime	-0.142***	-0.144***	-0.286***	-0.284***	-0.134***	-0.123***	-0.248***	-0.218***
	(0.042)	(0.039)	(0.071)	(0.068)	(0.039)	(0.038)	(0.063)	(0.061)
Stealable consumption and cars					0.123***	0.152***	0.123***	0.152***
					(0.005)	(0.005)	(0.005)	(0.005)
R-squared	0.035	0.071	0.035	0.071	0.122	0.180	0.121	0.179
Observations	38349	38349	38349	38349	38349	38349	38349	38349
Year and state effects	*Y*	*Y*	*Y*	*Y*	*Y*	*Y*	*Y*	*Y*
State level controls[c]	*Y*	*Y*	*Y*	*Y*	*Y*	*Y*	*Y*	*Y*
Household controls[d]	*N*	*Y*	*N*	*Y*	*N*	*Y*	*N*	*Y*

Notes: Data are from the NBER CEX extracts for the years 1986-1998. The table reports the coefficient of Property Crime in a regression of the log of Visible Non stealable consumption share of the total Non stelable consumption ($\log(VN/N)$) on the log of Property Crime and the other indicated controls. Robust standard errors with clustering by state are shown in parentheses. For the reported coefficients, those with *** are significant at the 1% level; those with ** are significant at the 5% level and those with * are significant at the 10% level.

[a] Property crime is instrumented using the log of the homicide rate and the log of the arrest rate for burglaries.

[c] State level controls include regional dummies, dummies for urban areas, density, population, demographic composition, gini, poverty rate, mean income, mean income by race and sex, deviation for income by race and sex.

[d] Household controls include age, sex, marital status and race of the household head, household size and number of adults living in the household.

Table 8: RC3: Estimates of the effects of crime in the ratio VN/N.

	OLS		Instrumenting Crime[a]		OLS		Instrumenting Crime[a]	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Property crime	-0.138***	-0.137***	-0.274***	-0.266***	-0.133***	-0.120***	-0.247***	-0.210***
	(0.042)	(0.039)	(0.070)	(0.067)	(0.039)	(0.038)	(0.063)	(0.061)
Household income	0.008***	0.011***	0.008***	0.011***	0.001	0.005***	0.001	0.005***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Stealable consumption and cars					0.122***	0.149***	0.122***	0.149***
					(0.005)	(0.005)	(0.005)	(0.005)
R-squared	0.040	0.080	0.040	0.079	0.122	0.182	0.122	0.181
Observations	38349	38349	38349	38349	38349	38349	38349	38349
Year and state effects	*Y*	*Y*	*Y*	*Y*	*Y*	*Y*	*Y*	*Y*
State level controls[c]	*Y*	*Y*	*Y*	*Y*	*Y*	*Y*	*Y*	*Y*
Household controls[d]	*N*	*Y*	*N*	*Y*	*N*	*Y*	*N*	*Y*

Notes: Data are from the NBER CEX extracts for the years 1986-1998. The table reports the coefficient of Property Crime in a regression of the log of Visible Non stealable consumption share of the total Non stelable consumption ($\log(VN/N)$) on the log of Property Crime and the other indicated controls. Robust standard errors with clustering by state are shown in parentheses. For the reported coefficients, those with *** are significant at the 1% level; those with ** are significant at the 5% level and those with * are significant at the 10% level.

[a] Property crime is instrumented using the log of the homicide rate and the log of the arrest rate for burglaries.

[c] State level controls include regional dummies, dummies for urban areas, density, population, demographic composition, gini, poverty rate, mean income, mean income by race and sex, deviation for income by race and sex.

[d] Household controls include age, sex, marital status and race of the household head, household size and number of adults living in the household.

Table 9: RC4: IV[a,b] Estimates of the effects of crime in the ratio VN/N modifying VN

	Removing Tailors		Removing Food out		Removing Health and beauty		Removing Rec. services	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Property crime	-0.178***	-0.207***	-0.250***	-0.295***	-0.225***	-0.254***	-0.196***	-0.231***
	(0.066)	(0.067)	(0.080)	(0.087)	(0.071)	(0.075)	(0.069)	(0.068)
Total consumption	0.721***	0.826***	0.920***	1.166***	0.724***	0.844***	0.729***	0.849***
	(0.017)	(0.031)	(0.018)	(0.040)	(0.020)	(0.035)	(0.024)	(0.037)
Stealable consumption and cars		-0.102***		-0.189***		-0.109***		-0.116***
		(0.014)		(0.020)		(0.015)		(0.014)
R-squared	0.128	0.112	0.070	0.032	0.134	0.117	0.095	0.083
Observations	38307	38307	38117	38117	38322	38322	38282	38282
Year and state effects	Y	Y	Y	Y	Y	Y	Y	Y
State level controls[c]	Y	Y	Y	Y	Y	Y	Y	Y
Household controls[d]	Y	Y	Y	Y	Y	Y	Y	Y

Notes: Data are from the NBER CEX extracts for the years 1986-1998. The table reports the coefficient of Property Crime in a regression of the log of Visible Non stealable consumption share of the total Non stelable consumption ($\log(VN/N)$) on the log of Property Crime and the other indicated controls. Robust standard errors with clustering by state are shown in parentheses. For the reported coefficients, those with *** are significant at the 1% level; those with ** are significant at the 5% level and those with * are significant at the 10% level.

[a] Property crime is instrumented using the log of the homicide rate and the log of the arrest rate for burglaries.

[b] Total consumption is instrumented using the log of the CEX income measure, a dummy for households reporting zero income, occupation and industry dummies related to the household head employment and household head education.

[c] State level controls include regional dummies, dummies for urban areas, density, population, demographic composition, gini, poverty rate, mean income, mean income by race and sex, deviation for income by race and sex.

[d] Household controls include age, sex, marital status and race of the household head, household size and number of adults living in the household.

Table 10: Estimates of the effects of crime in the ratio Clothing and tailors/N.

	Instrumenting Crime[a]		Instrumenting Crime and consumption[a,b]		Instrumenting Crime[a]		Instrumenting Crime and consumption[a,b]	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Property crime	-0.788***	-0.770***	-0.769***	-0.688***	-0.810***	-0.787***	-0.822***	-0.772***
	(0.235)	(0.240)	(0.230)	(0.235)	(0.236)	(0.239)	(0.234)	(0.235)
Total consumption	1.357***	1.369***	1.569***	1.882***	1.580***	1.573***	1.978***	2.403***
	(0.019)	(0.021)	(0.031)	(0.040)	(0.035)	(0.038)	(0.075)	(0.092)
Stealable consumption and cars					-0.132***	-0.115***	-0.279***	-0.381***
					(0.018)	(0.019)	(0.036)	(0.043)
R-squared	0.277	0.303	0.270	0.279	0.281	0.306	0.273	0.279
Observations	37624	37624	37624	37624	37624	37624	37624	37624
Year and state effects	*Y*	*Y*	*Y*	*Y*	*Y*	*Y*	*Y*	*Y*
State level controls[c]	*Y*	*Y*	*Y*	*Y*	*Y*	*Y*	*Y*	*Y*
Household controls[d]	*N*	*Y*	*N*	*Y*	*N*	*Y*	*N*	*Y*

Notes: Data are from the NBER CEX extracts for the years 1986-1998. The table reports the coefficient of Property Crime in a regression of the log of Visible Non stealable consumption share of the total Non stelable consumption ($\log(VN/N)$) on the log of Property Crime and the other indicated controls. Robust standard errors with clustering by state are shown in parentheses. For the reported coefficients, those with *** are significant at the 1% level; those with ** are significant at the 5% level and those with * are significant at the 10% level.

[a] Property crime is instrumented using the log of the homicide rate and the log of the arrest rate for burglaries.

[b] Total consumption is instrumented using the log of the CEX income measure, a dummy for households reporting zero income, occupation and industry dummies related to the household head employment and household head education.

[c] State level controls include regional dummies, dummies for urban areas, density, population, demographic composition, gini, poverty rate, mean income, mean income by race and sex, deviation for income by race and sex.

[d] Household controls include age, sex, marital status and race of the household head, household size and number of adults living in the household.

Table 11: Estimates of the effects of crime in the ratio Recreational services/N.

	Instrumenting Crime[a]		Instrumenting Crime and consumption[a,b]		Instrumenting Crime[a]		Instrumenting Crime and consumption[a,b]	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Property crime	-0.320***	-0.270**	-0.305**	-0.200*	-0.279**	-0.244**	-0.346***	-0.260**
	(0.116)	(0.115)	(0.119)	(0.120)	(0.116)	(0.114)	(0.115)	(0.118)
Total consumption	0.351***	0.535***	0.695***	0.997***	0.108***	0.351***	0.832***	1.214***
	(0.018)	(0.021)	(0.031)	(0.034)	(0.020)	(0.023)	(0.045)	(0.066)
Stealable consumption and cars					0.147***	0.106***	-0.126***	-0.175***
					(0.010)	(0.012)	(0.022)	(0.033)
R-squared	0.127	0.176	0.085	0.126	0.139	0.183	0.070	0.106
Observations	36275	36275	36275	36275	36275	36275	36275	36275
Year and state effects	*Y*	*Y*	*Y*	*Y*	*Y*	*Y*	*Y*	*Y*
State level controls[c]	*Y*	*Y*	*Y*	*Y*	*Y*	*Y*	*Y*	*Y*
Household controls[d]	*N*	*Y*	*N*	*Y*	*N*	*Y*	*N*	*Y*

Notes: Data are from the NBER CEX extracts for the years 1986-1998. The table reports the coefficient of Property Crime in a regression of the log of Visible Non stealable consumption share of the total Non stelable consumption ($\log(VN/N)$) on the log of Property Crime and the other indicated controls. Robust standard errors with clustering by state are shown in parentheses. For the reported coefficients, those with *** are significant at the 1% level; those with ** are significant at the 5% level and those with * are significant at the 10% level.

[a] Property crime is instrumented using the log of the homicide rate and the log of the arrest rate for burglaries.

[b] Total consumption is instrumented using the log of the CEX income measure, a dummy for households reporting zero income, occupation and industry dummies related to the household head employment and household head education.

[c] State level controls include regional dummies, dummies for urban areas, density, population, demographic composition, gini, poverty rate, mean income, mean income by race and sex, deviation for income by race and sex.

[d] Household controls include age, sex, marital status and race of the household head, household size and number of adults living in the household.

Table 12: Estimates of the effects of crime in the ratio Food out/N.

	Instrumenting Crime[a]		Instrumenting Crime and consumption[a,b]		Instrumenting Crime[a]		Instrumenting Crime and consumption[a,b]	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Property crime	-0.423***	-0.359***	-0.408***	-0.305***	-0.402***	-0.350***	-0.429***	-0.342***
	(0.110)	(0.097)	(0.115)	(0.102)	(0.109)	(0.095)	(0.115)	(0.105)
Total consumption	0.267***	0.495***	0.603***	0.898***	0.026	0.362***	0.608***	1.016***
	(0.017)	(0.012)	(0.038)	(0.027)	(0.028)	(0.020)	(0.061)	(0.040)
Stealable consumption and cars					0.146***	0.077***	-0.073***	-0.135***
					(0.013)	(0.009)	(0.020)	(0.016)
R-squared	0.100	0.212	0.050	0.163	0.116	0.216	0.058	0.160
Observations	36849	36849	36849	36849	36849	36849	36849	36849
Year and state effects	*Y*	*Y*	*Y*	*Y*	*Y*	*Y*	*Y*	*Y*
State level controls[c]	*Y*	*Y*	*Y*	*Y*	*Y*	*Y*	*Y*	*Y*
Household controls[d]	*N*	*Y*	*N*	*Y*	*N*	*Y*	*N*	*Y*

Notes: Data are from the NBER CEX extracts for the years 1986-1998. The table reports the coefficient of Property Crime in a regression of the log of Visible Non stealable consumption share of the total Non stelable consumption ($\log(VN/N)$) on the log of Property Crime and the other indicated controls. Robust standard errors with clustering by state are shown in parentheses. For the reported coefficients, those with *** are significant at the 1% level; those with ** are significant at the 5% level and those with * are significant at the 10% level.

[a] Property crime is instrumented using the log of the homicide rate and the log of the arrest rate for burglaries.

[b] Total consumption is instrumented using the log of the CEX income measure, a dummy for households reporting zero income, occupation and industry dummies related to the household head employment and household head education.

[c] State level controls include regional dummies, dummies for urban areas, density, population, demographic composition, gini, poverty rate, mean income, mean income by race and sex, deviation for income by race and sex.

[d] Household controls include age, sex, marital status and race of the household head, household size and number of adults living in the household.

Table 13: Estimates of the effects of crime in the ratio Beauty, parlors and health clubs/N.

	Instrumenting Crime[a]		Instrumenting Crime and consumption[a,b]		Instrumenting Crime[a]		Instrumenting Crime and consumption[a,b]	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Property crime	0.190	0.166	0.199	0.235	0.215	0.183	0.176	0.189
	(0.152)	(0.150)	(0.155)	(0.162)	(0.158)	(0.155)	(0.149)	(0.150)
Total consumption	0.056***	0.097***	0.289***	0.487***	-0.118***	-0.061**	0.323***	0.630***
	(0.016)	(0.016)	(0.028)	(0.039)	(0.028)	(0.025)	(0.051)	(0.065)
Stealable consumption and cars					0.105***	0.091***	-0.060***	-0.134***
					(0.013)	(0.013)	(0.018)	(0.022)
R-squared	0.040	0.074	0.016	0.029	0.047	0.080	0.016	0.019
Observations	33558	33558	33558	33558	33558	33558	33558	33558
Year and state effects	*Y*	*Y*	*Y*	*Y*	*Y*	*Y*	*Y*	*Y*
State level controls[c]	*Y*	*Y*	*Y*	*Y*	*Y*	*Y*	*Y*	*Y*
Household controls[d]	*N*	*Y*	*N*	*Y*	*N*	*Y*	*N*	*Y*

Notes: Data are from the NBER CEX extracts for the years 1986-1998. The table reports the coefficient of Property Crime in a regression of the log of Visible Non stealable consumption share of the total Non stelable consumption ($\log(VN/N)$) on the log of Property Crime and the other indicated controls. Robust standard errors with clustering by state are shown in parentheses. For the reported coefficients, those with *** are significant at the 1% level; those with ** are significant at the 5% level and those with * are significant at the 10% level.

[a] Property crime is instrumented using the log of the homicide rate and the log of the arrest rate for burglaries.

[b] Total consumption is instrumented using the log of the CEX income measure, a dummy for households reporting zero income, occupation and industry dummies related to the household head employment and household head education.

[c] State level controls include regional dummies, dummies for urban areas, density, population, demographic composition, gini, poverty rate, mean income, mean income by race and sex, deviation for income by race and sex.

[d] Household controls include age, sex, marital status and race of the household head, household size and number of adults living in the household.

Table 14: RC5: Estimates of the effects of crime in the ratio VN/N modifying crime measure.

	Defining crime as robberies			Defining crime as burglaries			Defining crime as the average between robberies and burglaries		
		IV[a,b]			IV[a,b]			IV[a,b]	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Property crime	-0.072***	-0.091***	-0.107***	-0.121***	-0.146***	-0.168***	-0.121***	-0.133***	-0.153***
	(0.021)	(0.030)	(0.031)	(0.023)	(0.048)	(0.049)	(0.021)	(0.043)	(0.044)
Total consumption	0.385***	0.687***	0.802***	0.385***	0.687***	0.803***	0.385***	0.687***	0.803***
	(0.009)	(0.018)	(0.032)	(0.009)	(0.018)	(0.032)	(0.009)	(0.018)	(0.032)
Stealable consumption and cars			-0.106***			-0.106***			-0.106***
			(0.014)			(0.014)			(0.014)
R-squared	0.198	0.120	0.101	0.198	0.120	0.101	0.198	0.120	0.101
Observations	38349	38349	38349	38349	38349	38349	38349	38349	38349
Year and state effects	*Y*	*Y*	*Y*	*Y*	*Y*	*Y*	*Y*	*Y*	*Y*
State level controls[c]	*Y*	*Y*	*Y*	*Y*	*Y*	*Y*	*Y*	*Y*	*Y*
Household controls[d]	*Y*	*Y*	*Y*	*Y*	*Y*	*Y*	*Y*	*Y*	*Y*

Notes: Data are from the NBER CEX extracts for the years 1986-1998. The table reports the coefficient of Property Crime in a regression of the log of Visible Non stealable consumption share of the total Non stelable consumption ($\log(VN/N)$) on the log of Property Crime and the other indicated controls. Robust standard errors with clustering by state are shown in parentheses. For the reported coefficients, those with *** are significant at the 1% level; those with ** are significant at the 5% level and those with * are significant at the 10% level.

[a] Property crime is instrumented using the log of the homicide rate and the log of the arrest rate for burglaries.

[b] Total consumption is instrumented using the log of the CEX income measure, a dummy for households reporting zero income, occupation and industry dummies related to the household head employment and household head education.

[c] State level controls include regional dummies, dummies for urban areas, density, population, demographic composition, gini, poverty rate, mean income, mean income by race and sex, deviation for income by race and sex.

[d] Household controls include age, sex, marital status and race of the household head, household size and number of adults living in the household.

Table 15: RC6: IV[a,b] Estimates of the effects of crime in the ratio VN/N for different sub samples

	Using years 1986-1990		Using years 1991-1998		Nonwhite households heads		White household heads	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Property crime	-0.651*	-0.607*	-0.179***	-0.209***	-0.307**	-0.312**	-0.131**	-0.167***
	(0.342)	(0.333)	(0.060)	(0.063)	(0.138)	(0.136)	(0.058)	(0.065)
Total consumption	0.719***	0.871***	0.687***	0.803***	0.661***	0.727***	0.690***	0.825***
	(0.025)	(0.045)	(0.018)	(0.032)	(0.019)	(0.034)	(0.022)	(0.040)
Stealable consumption and cars		-0.127***		-0.106***		-0.048***		-0.134***
		(0.017)		(0.014)		(0.013)		(0.016)
R-squared	0.133	0.106	0.120	0.101	0.148	0.135	0.100	0.083
Observations	13951	13951	38349	38349	8518	8518	29831	29831
Year and state effects	*Y*	*Y*	*Y*	*Y*	*Y*	*Y*	*Y*	*Y*
State level controls[c]	*Y*	*Y*	*Y*	*Y*	*Y*	*Y*	*Y*	*Y*
Household controls[d]	*Y*	*Y*	*Y*	*Y*	*Y*	*Y*	*Y*	*Y*

Notes: Data are from the NBER CEX extracts for the years 1986-1998. The table reports the coefficient of Property Crime in a regression of the log of Visible Non stealable consumption share of the total Non stelable consumption ($\log(VN/N)$) on the log of Property Crime and the other indicated controls. Robust standard errors with clustering by state are shown in parentheses. For the reported coefficients, those with *** are significant at the 1% level; those with ** are significant at the 5% level and those with * are significant at the 10% level.

[a] Property crime is instrumented using the log of the homicide rate and the log of the arrest rate for burglaries.

[b] Total consumption is instrumented using the log of the CEX income measure, a dummy for households reporting zero income, occupation and industry dummies related to the household head employment and household head education.

[c] State level controls include regional dummies, dummies for urban areas, density, population, demographic composition, gini, poverty rate, mean income, mean income by race and sex, deviation for income by race and sex.

[d] Household controls include age, sex, marital status and race of the household head, household size and number of adults living in the household.

Table 16: RC6: IV[a,b] Estimates of the effects of crime in the ratio VN/N for different sub samples

	Male household head		Female household head		Household head age $\geq$ 40		Household head age $\leq$ 39	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Property crime	-0.307***	-0.330***	-0.109**	-0.145**	-0.093	-0.124*	-0.246**	-0.272***
	(0.090)	(0.092)	(0.055)	(0.059)	(0.070)	(0.068)	(0.100)	(0.105)
Total consumption	0.724***	0.847***	0.655***	0.784***	0.701***	0.748***	0.644***	0.795***
	(0.028)	(0.052)	(0.015)	(0.028)	(0.021)	(0.031)	(0.021)	(0.045)
Stealable consumption and cars		-0.096***		-0.117***		-0.074***		-0.114***
		(0.018)		(0.014)		(0.011)		(0.019)
R-squared	0.124	0.096	0.129	0.109	0.168	0.170	0.101	0.064
Observations	13666	13666	24683	24683	17024	17024	21325	21325
Year and state effects	Y	Y	Y	Y	Y	Y	Y	Y
State level controls[c]	Y	Y	Y	Y	Y	Y	Y	Y
Household controls[d]	Y	Y	Y	Y	Y	Y	Y	Y

Notes: Data are from the NBER CEX extracts for the years 1986-1998. The table reports the coefficient of Property Crime in a regression of the log of Visible Non stealable consumption share of the total Non stelable consumption ($\log(VN/N)$) on the log of Property Crime and the other indicated controls. Robust standard errors with clustering by state are shown in parentheses. For the reported coefficients, those with *** are significant at the 1% level; those with ** are significant at the 5% level and those with * are significant at the 10% level.

[a] Property crime is instrumented using the log of the homicide rate and the log of the arrest rate for burglaries.

[b] Total consumption is instrumented using the log of the CEX income measure, a dummy for households reporting zero income, occupation and industry dummies related to the household head employment and household head education.

[c] State level controls include regional dummies, dummies for urban areas, density, population, demographic composition, gini, poverty rate, mean income, mean income by race and sex, deviation for income by race and sex.

[d] Household controls include age, sex, marital status and race of the household head, household size and number of adults living in the household.

Table 17: Falsification test: Estimates of the effects of crime in Non visible Non stealable (NN) consumption.

	OLS		Instrumenting Crime[a]		Instrumenting Consumption[b]		Instrumenting Crime and consumption[a,b]	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Property crime	0.052	0.049	0.097*	0.064	0.052	0.051	0.103**	0.076
	(0.045)	(0.037)	(0.051)	(0.048)	(0.045)	(0.038)	(0.050)	(0.047)
Total consumption	0.801***	0.674***	0.801***	0.674***	0.792***	0.721***	0.792***	0.721***
	(0.009)	(0.011)	(0.009)	(0.011)	(0.012)	(0.009)	(0.012)	(0.009)
R-squared	0.683	0.737	0.683	0.737	0.683	0.735	0.683	0.735
Observations	38349	38349	38349	38349	38349	38349	38349	38349
Year and state effects	*Y*	*Y*	*Y*	*Y*	*Y*	*Y*	*Y*	*Y*
State level controls[c]	*Y*	*Y*	*Y*	*Y*	*Y*	*Y*	*Y*	*Y*
Household controls[d]	*N*	*Y*	*N*	*Y*	*N*	*Y*	*N*	*Y*

Notes: Data are from the NBER CEX extracts for the years 1986-1998. The table reports the coefficient of Property Crime in a regression of log Non visible Non stealable consumption ($\log(NN)$) on the log of Property Crime and the other indicated controls. Robust standard errors with clustering by state are shown in parentheses. For the reported coefficients, those with *** are significant at the 1% level; those with ** are significant at the 5% level and those with * are significant at the 10% level.

[a] Property crime is instrumented using the log of the homicide rate and the log of the arrest rate for burglaries.

[b] Total consumption is instrumented using the log of the CEX income measure, a dummy for households reporting zero income, occupation and industry dummies related to the household head employment and household head education.

[c] State level controls include regional dummies, dummies for urban areas, density, population, demographic composition, gini, poverty rate, mean income, mean income by race and sex, deviation for income by race and sex.

[d] Household controls include age, sex, marital status and race of the household head, household size and number of adults living in the household.

Table 18: Estimates of the effects of crime in the ratio S/N.

	OLS		Instrumenting Crime[a]		Instrumenting Consumption[b]		Instrumenting Crime and consumption[a,b]	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Property crime	-0.299***	-0.279**	-0.490**	-0.419**	-0.302***	-0.275***	-0.485**	-0.395**
	(0.103)	(0.105)	(0.196)	(0.199)	(0.100)	(0.104)	(0.192)	(0.197)
Total consumption	0.599***	0.767***	0.599***	0.767***	0.814***	0.962***	0.814***	0.962***
	(0.014)	(0.018)	(0.014)	(0.018)	(0.031)	(0.041)	(0.031)	(0.041)
R-squared	0.107	0.139	0.107	0.139	0.097	0.134	0.097	0.134
Observations	35183	35183	35183	35183	35183	35183	35183	35183
Year and state effects	*Y*	*Y*	*Y*	*Y*	*Y*	*Y*	*Y*	*Y*
State level controls[c]	*Y*	*Y*	*Y*	*Y*	*Y*	*Y*	*Y*	*Y*
Household controls[d]	*N*	*Y*	*N*	*Y*	*N*	*Y*	*N*	*Y*

Notes: Data are from the NBER CEX extracts for the years 1986-1998. The table reports the coefficient of Property Crime in a regression of the log of Stealable consumption over the total Non stealable consumption ($\log(S/N)$) on the log of Property Crime and the other indicated controls. Robust standard errors with clustering by state are shown in parentheses. For the reported coefficients, those with *** are significant at the 1% level; those with ** are significant at the 5% level and those with * are significant at the 10% level.

[a] Property crime is instrumented using the log of the homicide rate and the log of the arrest rate for burglaries.

[b] Total consumption is instrumented using the log of the CEX income measure, a dummy for households reporting zero income, occupation and industry dummies related to the household head employment and household head education.

[c] State level controls include regional dummies, dummies for urban areas, density, population, demographic composition, gini, poverty rate, mean income, mean income by race and sex, deviation for income by race and sex.

[d] Household controls include age, sex, marital status and race of the household head, household size and number of adults living in the household.

Appendix A: Model proofs and lemmas

Lemma 1: Assume V_2 is nonzero and never changes sign. Let σ be a separating equilibrium. If $V_2 > 0$ then $\sigma(w_{min}) = z(w_{min})$. If $V_2 < 0$ then $\sigma(w_{max}) = z(w_{max})$. That is, the initial value condition is always satisfied.

Proof:

Case 1: $V_2 > 0$. Suppose by way of contradiction that $\sigma(w_{min}) \neq z(w_{min})$. Then

$$V(w_{min}, w_{min}, \sigma(w_{min})) < V(w_{min}, w_{min}, z(w_{min})) \leq V(w_{min}, \widehat{w}, z(w_{min})), \tag{A1}$$

for all expected $\widehat{w}$. The first inequality occurs since $z(w)$ maximizes $V(w, w, z)$ by definition. The second inequality occurs because $V_2 > 0$, and $\widehat{w} \geq w_{min}$ for every expected wealth because every $\widehat{w}$ must be a convex combination of those $w \in [w_{min}, w_{max}]$. Since this inequality holds for all possible beliefs $\widehat{w}$, it holds in particular for ANY in or off equilibrium path beliefs attached to the signal $z(w_{min})$. Thus, the individuals with w_{min} strictly prefer to signal $z(w_{min})$, contradicting the fact that $\sigma(w_{min}$ was a best response.

Case 2: $V_2 < 0$. Suppose by way of contradiction that $\sigma(w_{max}) \neq z(w_{max})$. Then

$$V(w_{max}, w_{max}, \sigma(w_{max})) < V(w_{max}, w_{max}, z(w_{max})) \leq V(w_{max}, \widehat{w}, z(w_{max})), \tag{A2}$$

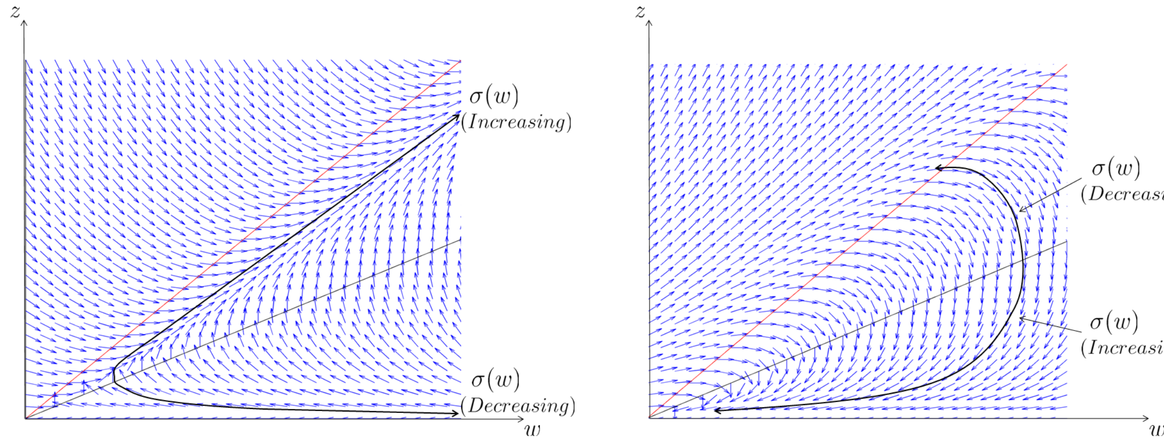
for all expected $\widehat{w}$. The first inequality occurs since $z(w)$ maximizes $V(w, w, z)$ by definition. The second inequality occurs because $V_2 < 0$, and $\widehat{w} \leq w_{max}$ for every expected wealth because every $\widehat{w}$ must be a convex combination of those $w \in [w_{min}, w_{max}]$. Since this inequality holds for all possible beliefs $\widehat{w}$, it holds in particular for ANY in or off equilibrium path beliefs attached to the signal $z(w_{max})$. Thus, the individuals with w_{max} strictly prefer to signal $z(w_{max})$, contradicting the fact that $\sigma(w_{max}$ was a best response.

Lemma 2: Assume V_2 is nonzero and never changes sign. Then σ is the unique separating equilibrium of our game if and only if: i. It is the unique INCREASING solution to the boundary value problem given by the differential equation DE in equation 6 and the initial value condition. ii. It satisfies the single crossing condition, which is equivalent to $V_{13}V_2 - V_3V_{12}$ having the same sign as V_2 for all $(\widehat{w}, z)$ in the graph of σ.

Proof: This lemma is implied by theorems 2 and 3 in Mailath (1987). Conditions (1),(3), (4) and (5) in Mailath theorems are satisfied when U is C^2 and strictly convex as we assumed was the case. Also condition (2) is satisfied when V_2 is nonzero and never changes sign.

We also have the initial value condition, which is condition (6) in Mailath (1987). These six conditions together imply by theorem 2 that every separating equilibrium must be monotonic and differentiable, solve the boundary problem given by the differential equation 6, and σ' must have the same sign as V_{13}, which in our case, makes every separating equilibrium increasing since $V_{13} = \gamma^2(U_{zy} - pU_{yy}) \geq 0$ because z is a normal good.

Figure A1: Lemma 2. Solutions to the differential equation.



The corollary to theorem 2 is that the separating equilibrium is unique (if it exists) because the boundary problem with the condition $\sigma' > 0$ has a unique solution if $|V_2(w, w, z)|$ is bounded. In our model $V_2 = \lambda + \gamma'(zU_z + yU_y)$ is bounded because it is a continuous function in a compact set. This is true because we assumed U and γ were smooth functions, and because the set of all possible equilibrium signals is bounded by the convexity of U. Figure A1 shows the direction field for the differential equation. It shows that the boundary problem always have an increasing and a decreasing solution. The condition $\sigma' > 0$ rules out the decreasing solution and implies the unicity of the separating equilibrium.

Theorem 3 guarantees that the increasing solution to the boundary problem is indeed a separating equilibrium if and only if it satisfies the SCC. The SCC guarantees incentive compatibility in the sense that every individual is in fact maximizing his utility by revealing his type and choosing his expected signal. These observations imply that if it exists, the unique separating equilibrium of our game must satisfy all properties stated in lemma 2.

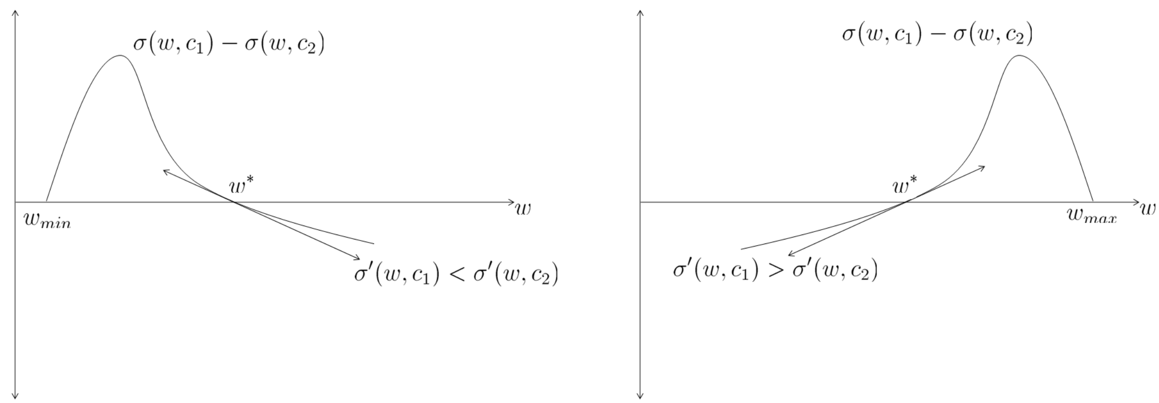
Finally, to guarantee the stability of this equilibrium we need only to define off equilibrium path beliefs sustaining it. The most intuitive option is to define $\widehat{w} = w_{max}$ for $z > \sigma(w_{max})$ and $\widehat{w} = w_{min}$ for $z < \sigma(w_{min})$.

Lemma 3: (A) Consider the differential equation $\sigma'(w, c) = -\frac{V_2(w,w,\sigma(w),c)}{V_3(w,w,\sigma(w),c)}$ *in* $[w_{min}, w_{max}]$ *with initial value condition* $\sigma(w_{min}, c) = z(w_{min})$*. If* $\frac{\partial V_2/V_3}{\partial c} > 0$ *then any continuous solution* $\sigma(w, c)$ *satisfies* $\frac{\partial \sigma}{\partial c} < 0$*. (B) Consider the differential equation* $\sigma'(w, c) = -\frac{V_2(w,w,\sigma(w),c)}{V_3(w,w,\sigma(w),c)}$ *in* $[w_{min}, w_{max}]$ *with initial value condition* $\sigma(w_{max}, c) = z(w_{max})$*. If* $\frac{\partial V_2/V_3}{\partial c} < 0$ *then any continuous solution* $\sigma(w, c)$ *satisfies* $\frac{\partial \sigma}{\partial c} < 0$*.*

Proof:

(A) We proceed by contradiction. Define $\Delta(w) = \sigma(w, c_1) - \sigma(w, c_2)$, with $c_1 < c_2$. Then

Figure A2: Lemma 3.



$\Delta(w_{min}) = 0$ and Δ satisfies that if $\Delta(w^*) = 0$, then $\Delta'(w^*) > 0$. This is because

$$\begin{aligned}
\Delta'(w^*) &= \sigma'(w^*, c_1) - \sigma'(w^*, c_2) && \text{(A3)}\\
&= -\frac{V_2(w^*, w^*, \sigma(w^*, c_1), c_1)}{V_3(w^*, w^*, \sigma(w^*, c_1), c_1)} + \frac{V_2(w^*, w^*, \sigma(w^*, c_2), c_2)}{V_3(w^*, w^*, \sigma(w^*, c_2), c_2)} && \text{(A4)}\\
&= \frac{V_2(w^*, w^*, z, c_2)}{V_3(w^*, w^*, z, c_2)} - \frac{V_2(w^*, w^*, z, c_1)}{V_3(w^*, w^*, z, c_1)} && \text{(A5)}\\
&> 0. && \text{(A6)}
\end{aligned}$$

The last step follows from the fact that V_3/V_2 is assumed to be an increasing function of c. Here $z = \sigma(w^*, c_1) = \sigma(w^*, c_2)$. Now, since $\Delta(w_{min}) = 0$, we have $\Delta'(w) > 0$ for w close to w_{min}.

Suppose by way of contradiction that $\Delta(w) \leq 0$ for some $w > w_{min}$. By the mid value theorem there must be a point w^* such that $\Delta(w^*) = 0$. If we take the smallest such w^* (it exists since it is a closed and bounded set), then we get that for $w \in (w_{min}, w^*)$, $\Delta(w) > 0$. By approximating $\Delta(w)$ with $w \in (w^* - \epsilon, w^*)$ with a Taylor expansion we obtain

$$0 < \Delta(w) \approx \Delta(w^*) + (w - w^*)\Delta'(w^*) < 0. \tag{A7}$$

A contradiction. This contradiction implies there cannot exist a $w \in (w_min, w_{max}]$ such that $\Delta(w) \leq 0$, so $\Delta(w) > 0$ for all $w > w_{min}$ and $\sigma(w, c_1) > \sigma(w, c_2)$, which implies $\frac{\partial \sigma}{\partial c} < 0$. Figure A2 left panel shows graphically what is happening. If $\Delta(w^*) = 0$ for the first time then we must have $\Delta'(w^*) \leq 0$, a contradiction.

(B) Again, we proceed by contradiction. Define $\Delta(w) = \sigma(w, c_1) - \sigma(w, c_2)$, with $c_1 < c_2$.

Then $\Delta(w_{max}) = 0$ and Δ satisfies that if $\Delta(w^*) = 0$, then $\Delta'(w^*) < 0$. This is because

$$\begin{aligned}
\Delta'(w^*) &= \sigma'(w^*, c_1) - \sigma'(w^*, c_2) && \text{(A8)} \\
&= -\frac{V_2(w^*, w^*, \sigma(w^*, c_1), c_1)}{V_3(w^*, w^*, \sigma(w^*, c_1), c_1)} + \frac{V_2(w^*, w^*, \sigma(w^*, c_2), c_2)}{V_3(w^*, w^*, \sigma(w^*, c_2), c_2)} && \text{(A9)} \\
&= \frac{V_2(w^*, w^*, z, c_2)}{V_3(w^*, w^*, z, c_2)} - \frac{V_2(w^*, w^*, z, c_1)}{V_3(w^*, w^*, z, c_1)} && \text{(A10)} \\
&< 0. && \text{(A11)}
\end{aligned}$$

The last step follows from the fact that V_3/V_2 is assumed to be a decreasing function of c. Here $z = \sigma(w^*, c_1) = \sigma(w^*, c_2)$. Now, since $\Delta(w_{max}) = 0$, we have $\Delta'(w) < 0$ for w close to w_{max}.

Suppose by way of contradiction that $\Delta(w) \leq 0$ for some $w < w_{max}$. By the mid value theorem there must be a point w^* such that $\Delta(w^*) = 0$. If we take the biggest such w^* (it exists since it is a closed and bounded set), then we get that for $w \in (w^*, w_{max})$, $\Delta(w) > 0$. By approximating $\Delta(w)$ with $w \in (w^*, w^* + \epsilon)$ with a Taylor expansion we obtain

$$0 < \Delta(w) \approx \Delta(w^*) + (w - w^*)\Delta'(w^*) < 0. \tag{A12}$$

A contradiction. This contradiction implies there cannot exist a $w \in [w_min, w_{max})$ such that $\Delta(w) \leq 0$, so $\Delta(w) > 0$ for all $w < w_{max}$ and $\sigma(w, c_1) > \sigma(w, c_2)$, which implies $\frac{\partial \sigma}{\partial c} < 0$. Figure A2 right panel shows graphically what is happening. If $\Delta(w^*) = 0$ for the last time then we must have $\Delta'(w^*) \geq 0$, a contradiction.

Appendix B: Consumption categories

In order to code the consumption categories as visible we use two surveys shown in table A1. First we use Charles et al. (2009) survey posted in their online appendix. This survey includes a visibility index and a perceived income elasticity index for the consumption categories in their paper. We also use the survey made by Heffetz (2009) about the visibility of this consumption categories which includes a visibility index (Vindex) for each category. Both surveys have Harris and Sabelhaus (2000) categories aggregated into particular categories but Heffetz (2009) survey is more disaggregated. We define visible goods as those having a high visibility index in both surveys relying in Heffetz (2009) when the surveys show different results. We also require visible goods to have a high estimated income elasticity or a high expected income elasticity to guarantee these goods are actually interpreted as signals of wealth. We estimate the income elasticity for each consumption category with the model

$$\ln cat_i = \beta_0 + \beta_1 \ln totexp_i + \varepsilon_i \tag{A13}$$

in which cat_i are the total expenditures in any given consumption category. We instrument $totexp_i$ with the CEX income measure and a vector of occupation and industry of employment for the household head following Charles et al. (2009).

We code recreational durables, furnishing and jewelry as stealable goods following the ethnographical evidence in Wright and Decker (1996) and Wright and Decker (1997). Although we classify them as stealable criminals repeatedly mention in their interviews a strong preference for cash over all these goods.

Table A1: Consumption categories, visibility and stealable goods

	Harris and Sabelhaus (2000) categories		Charles et al. (2009) categories			Heffetz (2009) categories	
	Number	Income elasticity	Category	Visibility	Perceived Income elasticity	Category	Vindex
Visible Non stealable (VN) Consumption	Clothing and shoes (29)	1.415	Clothing	0.64	0.57	Clo and Und	0.71
	Food off-premise (23)	1.495	Food away from home	0.24	0.47	FdO	0.62
	Barbershops, Beauty Parlors, Health Clubs (33)	0.926	Personal Care	0.31	0.35	Brb	0.6
	Other recreation services (64)	1.516	Entertainment Services	0.12	0.5	Ot2	0.58
	Clothing services (30)	0.659	Clothing	0.64	0.57	Lry	0.34
Stealable (S) Consumption	Furniture and durable household equipment (36)	1.518	Household furnishing	0.09	0.37	Fur	0.68
	Jewelry and Watches (31)	1.183	Jewelry	0.67	0.52	Jwl	0.67
	Recreation and sports equipment (63)	1.365	Entertainment Durables	0.17	0.53	Ot1	0.66
Non visible Non stealable (NN) Consumption	Tobacco products (26)	0.152	Tobacco	0.4	0.16	Cig	0.76
	Alcohol on-premise (28)	0.458	Alcohol	0.35	0.07	AlH	0.61
	Alcohol off-premise (23)	0.72	Alcohol	0.35	0.07	AlO	0.6
	Magazines, Newspapers, Other nondurable toys, etc. (62)	1.267	Entertainment Services	0.12	0.5	Bks	0.57
	Books and maps (61)	0.833	Entertainment Services	0.12	0.5	Bks	0.57
	Nursery, Elementary, and Secondary education (67)	1.059	Education	0.15	0.3	Edu	0.56
	Other education services (68)	0.836	Education	0.15	0.3	Edu	0.56
	Higher education (66)	0.396	Education	0.15	0.3	Edu	0.56
	Food on.premise (24)	0.558	Food			FdH	0.51
	Other rented lodging (35)	1.326	Other			Htl	0.46
	Airline fares (60)	0.901	Entertainment Services	0.12	0.5	Air	0.46
	Taxicab, railways, bus, and other travel expenses (59)	0.639	Other transportation	0.05	0.08	Bus	0.45
	Mass transit systems (58)	-0.246	Other transportation	0.05	0.08	Bus	0.45
	Telephone and Telegraph (42)	0.642	Household Utilities	0.06	0.05	Tel and Cel	0.38
	Physicians, dentists, other medical professionals (46)	0.867	Health	0.02	0.07	Med	0.36
	Ophthalmic products and orthopedic appliances (45)	0.37	Health	0.02	0.07	Med	0.36
	Health insurance (49)	0.251	Health	0.02	0.07	Med	0.36
	Hospitals (47)	0.121	Health	0.02	0.07	Med	0.36
	Nursing homes (48)	0.0286	Health	0.02	0.07	Med	0.36
	Drug preparations (44)	-0.152	Health	0.02	0.07	Med	0.36
	Religious and welfare activities (69)	1.156	Other	0.04	0.18	Cha	0.34
	Electricity (38)	0.556	Household Utilities	0.06	0.05	Utl	0.31
	Water and other sanitary services (40)	0.442	Household Utilities	0.06	0.05	Utl	0.31
	Gas (39)	0.413	Household Utilities	0.06	0.05	Utl	0.31
	Fuel oil and coal (41)	-0.5	Household Utilities	0.06	0.05	Utl	0.31
	Business services (50)	1.061	Other			Fee	0.26
	Expense of handling life insurance (51)	0.956	Other			LIn	0.16
	Pari-mutuel net receipts (65)	0.161	Other				
	Food furnished employees (25)	-0.215	Food				
Housing expenditures	Rent (34) and Rental equivalence of owned home (75)	0.779	Housing	0.37	0.47	Hom	0.5
	Domestic service, other household operation (43)	1.319	Other			HIn	0.17
Car expenditures	New and used motor vehicles (52)	1.153	Vehicle (limited)	0.49	0.44	Car	0.73
	Interest paid by consumers-Vehicles (71)	0.68	Vehicle (expanded)	0.03	0.07	Car	0.73
	Tires, Tubes, Accessories, and other parts (53)	0.597	Vehicle (expanded)	0.03	0.07	Car	0.73
	Repair, greasing, washing, parking, storage, rental (54)	1.353	Vehicle (expanded)	0.03	0.07	CMn	0.42
	Gasoline and oil (55)	0.898	Other transportation	0.05	0.08	Gas	0.39
	Auto insurance (57)	0.696	Other transportation	0.05	0.08	CIn	0.23
	Bridge, tunnel, ferry, and road tolls (56)	0.324	Other transportation	0.05	0.08		

Notes: Income elasticity estimated by a regression of the form $\ln cat_i = \beta_0 + \beta_1 \ln totexp_i + \varepsilon_i$ instrumenting $\ln totexp$ with the CEX income and occupation measures (see Charles et al., 2009) Here cat_i is the quarterly expenditure of household i in any given category and $totexp$ are its total quarterly expenditures. Numbers in parentheses refer to Harris and Sabelhaus (2000) original consumption categories in the CEX family extracts. Toiletry (032) and Household supplies (037) are missing in our data.

Appendix C: The bad proxy problem