Experimental studies on the psychology of property rights

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3. Theft and Piracy: Incentivized Experiments

3.1. Introduction

Consumers' lack of compliance with intellectual property rights is a contentious topic of debate among researchers, policy-makers, and managers (Mazar and Ariely 2006). Modern economies increasingly rely on intellectual property (IP) and there is evidence that the enforcement of IP rights stimulates economic growth (Gould and Gruben 1996). Notwithstanding enforcement efforts, there is broad evidence that the piracy of IP is still rampant. For example, the global software piracy rate increased from 38% in 2007 to 43% in 2013 (Business Software Alliance 2014).

To discourage piracy, organizations like the Recording Industry Association of America (RIAA) and the Motion Picture Association of America (MPAA) emphasize that piracy is a form of theft. Ubiquitous anti-piracy public service announcements aim to morally equate piracy with theft. In 2004 the MPAA initiated an advertisement campaign on many DVDs with the message that "downloading pirated films is stealing" and indistinguishable from stealing "a handbag," "a car" or "a mobile phone." However, studies suggest that piracy is far more prevalent than theft (e.g., Goodenough and Decker 2008).

Various explanations have been put forth to understand why people are more likely to commit piracy than theft. Economic incentives might explain the notable gap between the piracy rate and the theft rate. Arguably, weak deterrence makes piracy more attractive than theft (Becker 1968). However, economic deterrence alone might be

insufficient to explain unlawful behavior (Gneezy and Rustichini 2000). There is evidence that people are averse to committing theft, even if the probability of being caught is zero (Gächter and Riedl 2005; List 2007; Oxoby and Spraggon 2008). Furthermore, Green and Kugler (2010) find that most people consider theft significantly more blameworthy than piracy. Together these studies imply that there is a moral distinction between theft and piracy.

In this study, we propose that loss aversion might explain the moral distinction between theft and piracy. A number of studies argue that there is a link between theft aversion and loss aversion (Blumenthal 2010; Gintis 2007; Stake 2004). However, the standard interpretation of loss aversion considers only the losses and gains of the decision-maker, where losses weigh more than gain (Kahneman and Tversky 1979). Instead, we argue that extending loss aversion to take into account the gains and losses of others provides a novel theoretical framework to explain the moral distinction. We hypothesize that theft aversion depends on whether the resource is rivalrous in its use or not. Because IP is *non*-rivalrous, its use does not prevent others from using it as well. Both legal and illegal downloading does not result in copyright content owners losing their property. Therefore, the moral impediment to steal might not exist for IP, which explains why many consider piracy morally permissible (Nunes, Hsee, and Weber 2004).

The use of economic experiments to study piracy is scarce, if not nonexistent. Most studies on piracy either depend on non-incentivized survey responses or country-level data. In this study two framed economic experiments were conducted to study the moral distinction between theft and piracy. Although economic

experiments that elicit theft have been conducted before (e.g., List 2007; Oxoby and Spraggon 2008) the study of piracy in economic experiments is new.

3.2. Theoretical framework

3.2.1. The moral distinction between theft and piracy

The standard economic explanation of illegal behavior presupposes a self-regarding person who rationally considers, on the one hand, the value of an illegally obtained good and, on the other hand, the probability of getting caught and the penalty in case of getting caught (Becker 1968; Conner and Rumelt 1991). This amoral person would prefer to commit an illegal behavior if the expected utility of the good exceeds the expected cost of getting caught. Arguably, theft is rare because the probability of getting caught is high and the penalty for theft is universally stringent. In other words, there is a strong judicial deterrence against committing theft. In the case of piracy the incentives to prevent it differ. Technological innovations, such as peer-to-peer networking, have made it much easier to obtain and share intellectual property anonymously, which makes it difficult to catch violators of intellectual property laws. Furthermore, the judicial consequences of violating IP laws are often controversial, unclear or only weakly enforced (Marron and Steel 2000). These economic factors contribute to the attractiveness of committing piracy. Thus, from an economic point of view theft is less prevalent than piracy due to differences in the strength of deterrence.

Economic incentives alone might not explain why piracy is more prevalent than theft. Theft might still be a less attractive option than piracy even if the economic environment is kept the same. More precisely, moral considerations might inhibit illegal behavior even in the absence of any deterrence. For example, Green and Kugler (2010) show in a vignette study that pirating an electronic book is considered significantly less blameworthy than stealing a physical one. They note that the intuitive perception of IP rights differs distinctly from codified law while this does not seem to be the case for physical property. Due to this moral distinction, even if the economic incentives to steal and pirate were equal, it is likely that piracy would still be more prevalent than theft. However, no experimental study to date has explored this hypothesis in an incentivized environment.

3.2.2. Theft aversion

A number of economic experiments provide strong evidence that humans are theft averse even if stealing is monetarily optimal. Theft aversion can be defined as the aversion to deprive others of their property. This implies that people are inclined to respect property even if no legal mechanisms exist to enforce property-respecting behavior. For example, Levitt (2006) reports how in a natural field setting the sale of bagels and donuts can be sustainable with payment rates above 85% for many years without the requirement of any human oversight. Also, in settings in which the allocation of property rights is unclear, people are inclined to act on ownership information. Gächter and Riedl (2005) show, in a bargaining situation in which neither party has a strategic advantage, that participants are sensitive to claims of ownership in

favor of the claimants. Theoretical work that draws from evolutionary biology supports the possibility of theft aversion as a human predisposition (Eswaran and Neary 2014; Gintis 2007).

A common experimental setting to study social preferences, and more recently people's respect for property rights, is the Dictator Game (DG). In the DG two participants, a Dictator and a Receiver, are paired (Forsythe *et al*. 1994). The pair are usually endowed with an amount of money, usually $10. As the labels suggest, only the Dictator can decide how the wealth is divided. A perfectly self-regarding Dictator is predicted to appropriate the full endowment, thus leaving the Receiver with nothing. However, the observed average appropriation rate is around 70%, which is significantly lower than the predicted 100% (Engel 2011). This result is usually interpreted as evidence of the existence of altruistic preferences because Dictators are unable to gain materially from giving money to Receivers (Hoffman, McCabe and Smith 1996; Eckel and Grossman 1996). However, introducing property rights in the DG can alter the Dictators' behavior dramatically. Cherry, Frykblom and Shogren (2002) show that the appropriation rate in the DG can move close to 100% if Dictators are required to exert effort to earn the full endowment and anonymity is guaranteed. On the surface this result seems to support standard economic theory, which assumes perfectly self-regarding actors. Indeed, Cherry *et al*. (2002) argue that creating entitlements provides Dictators with a moral justification to 'appropriate' the full endowment. A more nuanced interpretation is that people are not predisposed to give money away to others with whom they are not familiar, especially if they consider the money to be theirs (Bardsley 2008).

Theft aversion can arise in situations in which Dictators are offered the opportunity to take money that is owned by the Receiver. In this case, standard theory predicts that Dictators will fully appropriate the endowment for themselves if Dictators are not punished for doing so. However, theft-averse Dictators are expected to leave the money to Receivers. List (2007) lets Receivers exert effort before playing the DG to make them earn the endowment that is controlled by the Dictator. In the treatment without an earned endowment, 44% of the Dictators appropriated the full amount. This number decreased to 19% in the treatment in which Receivers exerted effort to earn the endowment. This finding strongly supports the existence of theft aversion. Oxoby and Spraggon (2008) show that the effect is even more pronounced if Receivers' efficacy in an effort task determines the size of the endowment, which emphasizes the causal link between Receivers' actions and the endowment.

3.2.3. Second-Person Loss Aversion

We argue that theft aversion is a specific manifestation of loss aversion, which in turn can explain why theft aversion is unable to prevent piracy behavior. Loss aversion is a tendency in individual decision-making to weigh losses more than gains (Kahneman and Tversky 1979). Loss aversion is widely studied and has been used to explain a broad set of anomalies, such as the inclination to value owned goods more than if these were unowned, also known as the endowment effect (Knetsch 1989).

The effects of loss aversion are primarily studied in the context in which the decision-maker can only affect her own payoffs.

However, recent studies suggest that people also experience loss aversion if they decide for others (Andersson *et al.* 2015; Polman 2012). As a result, a distinction should be made between First-Person Loss Aversion (FPLA) and Second-Person Loss Aversion (SPLA). FPLA refers to the standard context of loss aversion in which an individual decides on possible outcomes for herself. SPLA extends FPLA in the sense that the focal person not only considers the consequences of her decision on her own outcome in terms of gains and losses but also on the outcome of others. Andersson *et al.* (2015) and Polman (2012) provide evidence of the existence of SPLA and both show that the losses of others weigh less than one's own losses.

SPLA might be able to explain the existence of theft aversion. Committing theft results in a gain for oneself *and, at the same time,* a loss to another person. If losses to others weigh more than gains for oneself then the behavioral prediction of SPLA is that decision-makers would refrain from theft. FPLA cannot explain theft aversion because it would only consider gains and losses to oneself. Indeed, a strict interpretation of FPLA would imply that theft is always the optimal decision if the probability of experiencing losses is zero. Thus, extending FPLA with SPLA would provide a tractable explanation of the existence of theft aversion. Interestingly, Nunes *et al.* (2004) also argue that loss aversion can explain why piracy is more prevalent than theft. However, they identify losses as incurring variable costs to produce the goods, which are lower for non-rivalrous goods.

3.2.4. Rivalry

We argue that SPLA mitigates the theft of physical goods but not piracy. In the case of theft of physical goods, the victim loses both the focal good and the opportunity to profit by selling the good. However, in the case of piracy, the victim only loses the opportunity to profit from the perpetrator, assuming that the perpetrator does not share the pirated good with others. Piracy does not deprive the victim of the good itself. The underlying reason for this distinction is the rivalrous nature of the good. Rivalry determines to what extent joint consumption is possible. This means that if a rivalrous good is in use, another person *cannot* use it too. The only way to make use of a rivalrous good without the owner's consent is by excluding the owner, which is one of the defining characteristics of theft. While intellectual property can be used without making it impossible for the owner to use it as well.

Stake (2004) and Goodenough and Decker (2008) argue that our sense for property has evolved to coordinate the distribution of resources efficiently and to avoid conflicts that might harm the proliferation of the species. However, such conflicts could only arise in goods that are rivalrous (Maynard Smith and Price 1973). Even though theft and piracy both result in losses to the victim, the losses are qualitatively distinct, which explains why SPLA is able to mitigate theft but not piracy. Brenner *et al.* (2007) make a distinction between valence losses and possessive losses. A valence loss can be defined as any negative change with respect to a reference point. For example, losing the opportunity to profit is a valence loss. A possessive loss is defined as losing possession of a good, such as in the case of theft. Brenner *et al.* (2007) and

Morewedge *et al.* (2009) show that decision-makers are more sensitive to possessive losses than valence losses. Considering that SPLA is an extension of loss aversion, it can be hypothesized that SPLA is more likely to mitigate theft than piracy.

3.2.5. Two framed incentivized experiments

In Study 1, two participants are paired to create a setting in which the participants can potentially exchange a single good. The good can be purchased or appropriated without the owner's consent. In the rivalrous treatment the good can be stolen and in the non-rivalrous treatment the good can be pirated. The difference between the two treatments is a difference in framing while the incentive structure between the two treatments is identical. Study 2 extends Study 1. In this study, we develop a game design based on a Dictator Game with multiple goods. Dictators are able to appropriate up to 10 goods. We also provide an incentive to Receivers to elicit their beliefs about the Dictator's behavior.

3.3. Study 1: Exchange Game

3.3.1. Sample

Participants ($N = 1026$) were recruited from the online labor market Amazon Mechanical Turk (AMT). The use of online labor markets for economic experiments is now widely recognized as a viable alternative to laboratory experiments (Horton, Rand and Zeckhauser 2011). The main advantages of using an online labor market for experiments are: 1) access to a large population, 2) monetary incentives can depend on the choices that participants

make during the experiment, and 3) anonymity is inherently insured (Charness, Gneezy and Kuhn 2013). Horton *et al*. (2011) replicated well-known experimental games such as the prisoner's dilemma with outcomes that conform to earlier results obtained by laboratory experiments. Amir, Rand, and Gal (2012) show that using small stakes on AMT results in behavior that is consistent with behavior observed in offline laboratory experiments. Potential participants were unable to view the content of the experiment unless they agreed to participate. Participants who viewed the content could not re-enter the experiment, irrespective of whether they had completed the experiment. Participants received a fixed participation fee of \$0.25 if they completed the experiment and received more depending on the decisions made during the experiment. Participants were required to correctly answer questions about the consequences of each decision to receive a payoff.

3.3.2. Experimental Design

Two participants, a Seller and a Buyer, are paired. The Seller is endowed with a good. In the rivalrous treatment (T1) this is visualized as a physical chip and in the non-rivalrous treatment (T2) this is visualized as an intangible character. The Buyer values the good at $v_b = \$0.50$, and the Buyer is endowed with a budget, $b_b = \$0.50$. The Buyer is given the possibility to do nothing, to buy the good for a fixed price, $p = \$0.25$ or to appropriate. In the rivalrous treatment appropriation means to take the good without purchase (theft) while in the non-rivalrous treatment this means to copy the character without purchase (piracy). Note that the non-rivalrous treatment is comparable to the situation in which digital

tokens can be bought to be able to continue playing a game on a mobile phone. A prominent example of such a game is Candy Crush (www.candycrushsaga.com). These tokens have no intrinsic value to the publisher (in the experiment, the Seller) but do have a positive value to the gamer (in the experiment, the Buyer). The publisher is able to make money by selling these tokens at very low marginal costs.

In Table 3.1 an overview is provided of how each decision affects the monetary value of the Seller's and Buyer's possession and efficiency. It is noteworthy that the efficiency for each decision does not change across treatments. Thus, the Exchange Game effectively renders the distinction between rivalrous and non-rivalrous goods to solely a difference in framing, which is necessary to test our hypothesis based on SPLA. We also measured perceived ownership to investigate whether rivalry indeed leads to different perceptions of losses. Specifically, participants indicated who they thought was the owner of the good *after* a decision had been made. We predict that in the rivalrous treatment that Buyers are more likely to consider the good theirs in case of purchase or appropriation compared to Buyers in the non-rivalrous treatment.

Table 3.1: ***Monetary value of possessions depending on the Buyer's decision***

Buyer's decision	*Seller*	*Buyer*	*Efficiency*
Do nothing	$v_s = \$0.00$	$b = \$0.50$	\$0.50
Purchase	$p = \$0.25$	$b - p + v_b = \$0.75$	\$1.00
Appropriate	$v_s = \$0.00$	$b + v_b = \$1.00$	\$1.00

Notes. The second and third columns show respectively how much the Seller and Buyer receive depending on the Buyer's decision in the first column. Appropriation in the rivalrous treatment (T1) means that the Buyer chose to take the chip without purchase (theft) while in the non-rivalrous treatment (T2) this means that the Buyer chose to copy the character without purchase (piracy). Efficiency is defined as the sum of the Seller's and Buyer's monetary value of their possessions.

3.3.3. Results

FINDING 1.1 *Piracy rate is higher than the theft rate.*

The distribution of decisions in the rivalrous treatment is marginally significantly different from the distribution of decisions in the non-rivalrous treatment ($\chi^2(2) = 4.57$, $p = 0.10$). To be able to determine whether piracy is more likely to occur, we define the theft and piracy rate as the percentage of Buyers who choose to steal and pirate respectively. The percentage of Buyers who neither stole nor purchased is not significantly different between the two treatments (Fisher's exact, $p = 0.37$, two-tailed). The theft rate is 45.6% while the piracy rate at 53.3% is 16.9% higher, which is significantly higher (Fisher's exact, $p = 0.05$, one-tailed). This result supports the hypothesis that theft is less attractive than piracy due to an aversion to causing a possessive loss.

FINDING 1.2 *Ownership is more likely perceived to be shared in case of piracy.*

After the Buyer had made a decision, participants were asked to indicate who they consider to be the owner of the good to study how rivalry affects perceptions of losses. For this analysis we focus on Buyers who chose either to purchase or to appropriate and indicated either that they considered the good theirs or shared after making a decision. An overwhelming majority of Buyers fell within this group (81.9%).

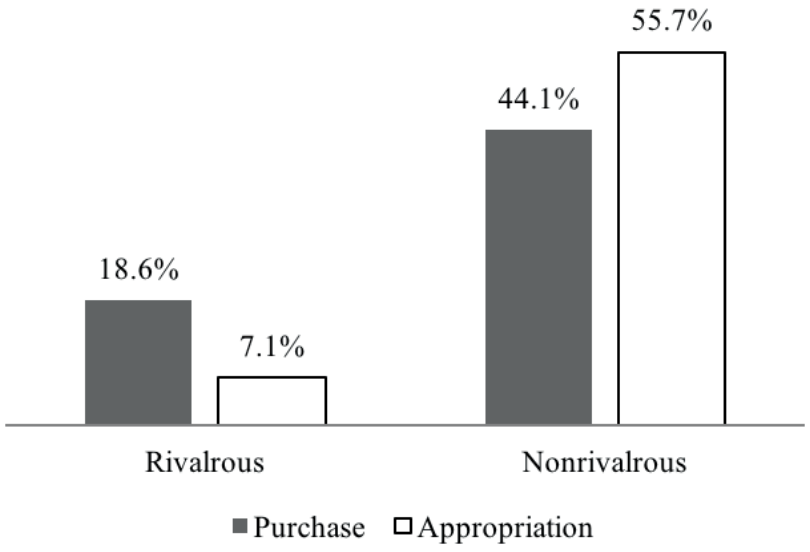
Buyers in the non-rivalrous treatment were significantly more likely to indicate that post hoc ownership is shared compared to Buyers in the rivalrous treatment (Non-rivalrous: 50.4%, Rivalrous: 12.8%; Fisher's exact, $p < 0.01$). This supports the prediction that purchasing or appropriating in the rivalrous treatment results in the perception that ownership shifted from Seller to Buyer, while in the non-rivalrous treatment this is less likely the case. In fact, Buyers in the non-rivalrous treatment are more likely to perceive that the good is shared between themselves and the Seller (Figure 3.1).

FINDING 1.3 *Piracy is associated with the perception that ownership is shared*

We also studied whether the act of appropriating can affect perceptions of ownership. Interestingly, Figure 3.1 suggests that theft increases the likelihood that Buyers consider the good to be theirs while piracy increases the likelihood that Buyers consider the good to be shared. A logistic regression confirms that an interaction effect exists between the appropriation and perceptions of

ownership (Table 3.2). Specifically, Buyers are more likely to believe that the Seller is not the owner anymore if the good is rivalrous, especially if it was stolen. In the non-rivalrous treatment, however, Buyers are significantly more likely to believe that ownership is shared with the Seller and this likelihood is even significantly higher in case of piracy. A possible explanation is that Buyers who pirated were beforehand not convinced that the Seller was the owner. However, it is also possible that Buyers who pirated rationalize their action by convincing themselves or the experimenter that the Seller was not the owner to begin with.

Figure 3.1: ***Perceived shared ownership***



Notes. $N = 420$. Only Buyers that claimed sole or shared ownership after purchase or appropriation were included in this analysis. The percentages represent the relative number of Buyers who indicated that ownership is shared with the Seller after purchase or appropriation.

Table 3.2: ***Determinants of perceived ownership after making a decision***

Independent variables		
Non-rivalrous	1.24 (0.33)	***
Appropriation	-1.09 (0.47)	**
Non-rivalrous × appropriation	1.56 (0.54)	***
(1 = Piracy)		
Constant	-1.48 (0.26)	***
Wald χ^2 (df)	80.70 (3)	***
Log pseudo-likelihood	-225.58	
Nagelkerke's R^2	.24	
N	420	

Notes. Logistic regression. The dependent variable is 1 if the Buyer indicated after making a decision that ownership is shared and is 0 if the Buyer indicated that she is the sole owner. Buyers who chose to do nothing were excluded as there is no transfer of possession in these cases.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

3.4. Study 2: Dictator Game

3.4.1. Experimental Design

The previous study involved a single good per pair and the pricing across treatments was fixed (p = \$0.25). To consider a more realistic setting, Study 2 extends the number of available tokens to 10. This renders Study 2 to the Dictator Game. The pair is endowed with a fixed amount of money. The Dictator (Buyer) decides how

the endowment is divided. The Receiver (Seller) has no say and leaves with whichever amount, if anything, the Dictator allocates to her.

The variant of the Dictator Game that is employed in this study differs from the standard Dictator Game in four respects. The first difference is that the endowment consists of a combination of money and tokens instead of money alone. The second difference is that depending on the treatment tokens can either be taken (rivalrous) or copied (non-rivalrous). Similar to Study 1, the verb 'to appropriate' refers to both taking and copying tokens. The third difference in the framing in all treatments is that the tokens are initially in possession of the Receiver while the money is in possession of the Dictator. The fourth difference is that Dictators are required to purchase tokens that are not appropriated. Despite the above differences, Dictators are faced with a payoff scheme that is the same as in the standard Dictator Game. Thus, a self-regarding Dictator is expected to appropriate all tokens.

Dictators start with a budget of \$0.50, which allows them to purchase tokens. Receivers are endowed with 10 tokens without a budget. For Receivers, the value of a token is \$0.00 while for Dictators it is \$0.05. Dictators are asked to decide how many tokens should be purchased and appropriated. The combined sum of tokens purchased and appropriated is always 10. The price of a token is randomly drawn from the set \$0.00, \$0.01, \$0.02, \$0.03, \$0.04, and \$0.05. The minimum and maximum prices constitute interesting corner cases. If the price is \$0.00 Dictators are monetarily indifferent between purchasing and appropriating. Only at this price a self-regarding Dictator is indifferent between all

possible decisions. The other extreme is when the price is $0.05. In this case Dictators do not monetarily gain from purchasing tokens because the value of a token to Dictators is $0.05 as well.

Piracy is operationalized as the number of tokens copied without purchase in the non-rivalrous treatment and theft is operationalized as the number of tokens taken without purchase in the rivalrous treatment. More generally, the appropriation rate (*d*) is defined as the number of tokens copied or taken without purchase. Also note that the monetary payoff does not depend on whether the tokens are rivalrous (Table 3.3). Thus, as in Study 1, the difference between the rivalrous and non-rivalrous treatment is only a difference in framing. Participants were recruited from AMT (N = 1,202). Both Receivers and Dictators were required to correctly answer a question about their understanding of the experiment in order to receive a payoff. To elicit Receivers' beliefs about what Dictators will do, Receivers were eligible to earn $0.10 if they were able to predict the exact appropriation rate of the paired Dictator.

We hypothesize, based on SPLA, that in the rivalrous treatment the appropriation rate is lower than in the non-rivalrous treatment. We also predict that in both treatments a higher price results in a higher appropriation rate. Although it is evident that a higher price provides Dictators with a stronger monetary incentive to appropriate, a higher price also implies that Receivers' economic losses are higher as well. Thus, at a high price Receivers lose in terms of opportunity costs than at a low price. But considering that this loss is not a possessive loss, SPLA is not expected to prevent Dictators from taking this into account, which also known as 'opportunity cost neglect' (Frederick *et al.* 2009).

Our last hypothesis focuses on Receivers' beliefs about what they think Dictators will do. Studies show that people have difficulties when considering the effects of loss aversion on the decision-making of others (Faro and Rottenstreich 2006; Loewenstein and Adler 1995; Van Boven, Dunning and Loewenstein 2000). Considering that SPLA is an extension of loss aversion, it is expected that Receivers will fail to take into account the effect of SPLA in the form of theft aversion. Specifically, we hypothesize that Receivers expect a higher theft rate than the actual theft rate.

Table 3.3: ***Final distribution of tokens and payoffs Dictators and Receivers***

	Tokens in possession		
	Rivalrous	*Non-rivalrous*	*Payoff*
Receiver	0	10	$(10 - d) \times p$
Dictator	10	10	$\$1.00 - (10 - d) \times p$

Notes. In the rivalrous treatment Dictators always obtain all tokens from the partnered Receiver. In the non-rivalrous treatment Dictators are only able to copy and, thus, both Dictators and Receivers are left with 10 tokens each. Receivers' payoff depends on how many tokens are appropriated (d) and the price charged for each token (p). As Dictators always end up with 10 tokens their payoff is \$1.00 (= budget + value of 10 tokens) minus the price paid for purchased tokens $(10 - d) \times p$.

3.4.2. Results

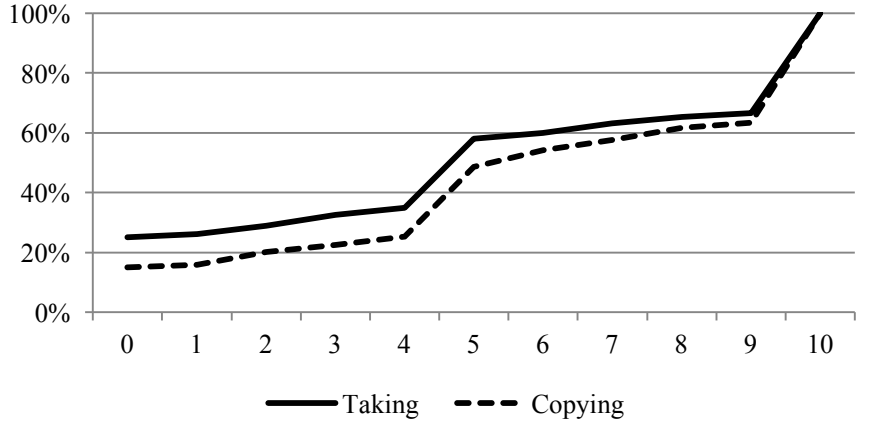
Table 3.4: ***Overview***

	Price range					
	All		< $0.03		≥ $0.03	
Dictator	*N*	Mean (SD)	*N*	Mean (SD)	*N*	Mean (SD)
Appropriation (*d*)						
Rivalrous (theft)	317	5.39 (3.96)	154	4.98 (3.88)	163	5.78 (4.01)
Non-rivalrous (piracy)	284	6.15 (3.62)	124	5.30 (3.70)	160	6.82 (3.42)
Combined	601	5.75 (3.82)	278	5.12 (3.80)	323	6.29 (3.76)
Receiver						
Expected appropriation (d)						
Rivalrous (theft)	317	6.48 (3.51)	154	6.22 (3.66)	163	6.71 (3.36)
Non-rivalrous (piracy)	284	6.47 (3.31)	124	6.31 (3.35)	160	6.60 (3.29)
Combined	601	6.47 (3.42)	278	6.26 (3.52)	323	6.66 (3.32)

FINDING 2.1 *Piracy is more prevalent than theft*

Dictators appropriated, on average, 5.75 tokens (SD = 3.82) (Table 3.4). Dictators appropriated significantly more tokens in the non-rivalrous treatment (6.15) than in the rivalrous treatment (5.39) (Mann-Whitney $U = 40140$, $p = 0.02$, two-tailed). The difference is especially striking if a distinction is made between Dictators who appropriated nothing ($d = 0$) and Dictators who appropriated a positive number of tokens ($d > 0$) (Figure 3.2). In the rivalrous treatment 25.2% of the Dictators appropriated nothing and in the non-rivalrous this is only 15.1%, which is significantly lower (Fisher's exact, $p < 0.01$, one-tailed).

Figure 3.2: ***Cumulative distribution of Dictators' appropriation***

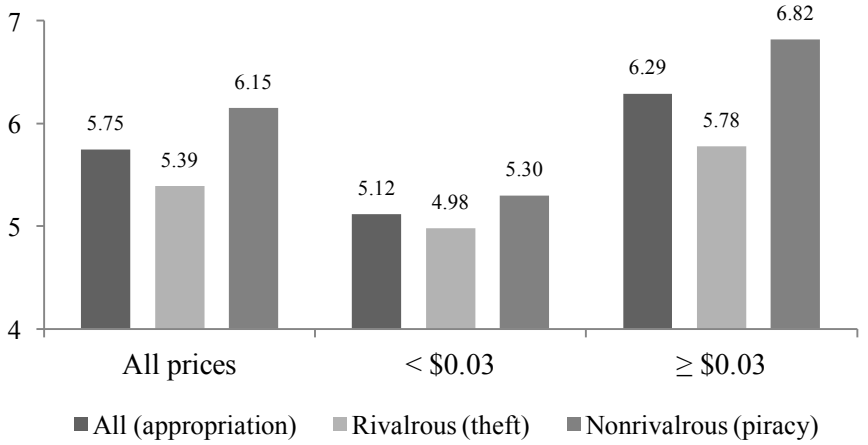


Notes. $N = 601$. Lines represent the cumulative distribution of the Dictators' appropriation rate for the rivalrous (taking) and non-rivalrous treatment (copying). The horizontal axis represents appropriation where 0 stands for nothing stolen or pirated and 10 stands for everything stolen or pirated.

FINDING 2.2 *Price increases appropriation rate*

The appropriation rate seems to increase with a higher price (Figure 3.3). Dictators who are faced with a price of \$0.00 appropriated, on average, 4.34 tokens while Dictators who could purchase at \$0.50 appropriated, on average, 6.41 tokens (Mann-Whitney $U = 2792.5$, $p < 0.01$, two-tailed). In an OLS regression it is estimated that the impact of price on the appropriation rate is, on average, 0.359 tokens more appropriated for every dollar cent increase in price ($F(1) = 14.8$, $p < 0.001$). This coefficient is higher in the rivalrous treatment ($B = 0.253$, $p = 0.06$) but lower in the non-rivalrous treatment ($B = 0.477$, $p < 0.01$). Indeed, in the treatments with a price equal to or lower than \$0.02, there is no significant difference between average theft (4.98) and piracy (5.30) (Mann-Whitney $U = 9045$, $p = 0.43$, two-tailed). While in treatments with a price equal to or higher than \$0.03, average piracy (6.82) is significantly higher than average theft (5.78) (Mann-Whitney $U = 11265$, $p = 0.03$, two-tailed). This result suggests that the magnitude of piracy depends more on how high the price is than it does for theft. In sum, a higher price provides a stronger monetary incentive, which leads to a higher appropriation rate. However, in the rivalrous treatment this effect seems to be mitigated by SPLA. As a result, the difference in the appropriation rate between piracy and theft is largest at a high price.

Figure 3.3: ***Mean appropriation rate per price range***



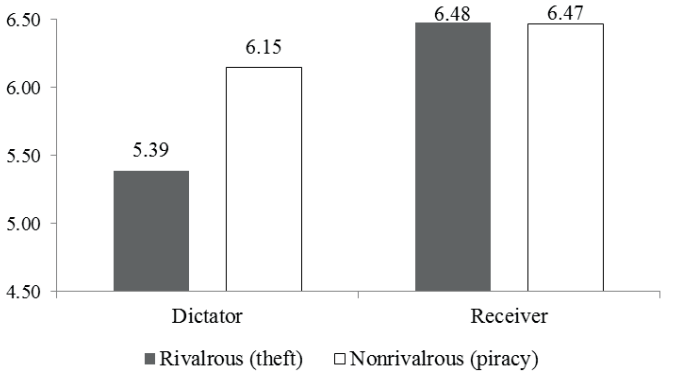
Notes. N = 601. Bars represent the mean Dictators' appropriation, theft, and piracy rate for each price.

FINDING 2.3 *Receivers believe that piracy is as prevalent as theft*

Receivers' beliefs about what their respective Dictator will do were elicited by providing a monetary incentive for correctly predicting her decision. Twenty-six percent of the Receivers predicted the Dictator's exact appropriation rate, which is significantly higher than the likelihood of picking a random prediction (Random choice: 1/11, Binomial test, $p < 0.01$, one-tailed). The correct prediction rate did not differ significantly between the rivalrous and non-rivalrous treatment (Fisher's exact, $p = 0.194$, two-tailed). A logistic regression shows that the token price did not significantly affect the likelihood of a correct prediction ($B = -0.17$, $p = 0.76$). In general, Receivers expected an average appropriation rate of 6.47

tokens while the actual appropriation rate of 5.75 tokens is significantly lower (Mann-Whitney $U = 163052.5$, $p < 0.01$, two-tailed). This result indicates that Receivers seem to overestimate the appropriation rate. If the analysis is restricted to the non-rivalrous treatment only, no significant difference between the predicted (6.47) and actual (6.15) appropriation rate is found (Mann-Whitney $U = 38950.5$, $p = 0.46$, two-tailed). Receivers' overestimation of Dictators' appropriation rate seems primarily to stem from the rivalrous treatment (Figure 3.4). Receivers in this treatment expected, on average, an appropriation rate of 6.48 while the actual rate is 5.39, which is significantly lower (Mann-Whitney $U = 42692.5$, $p < 0.01$, two-tailed). These results indicate that, on average, Receivers held correct beliefs about the extent to which Dictators would commit piracy but incorrect beliefs about the extent of theft. Less theft was committed than Receivers predicted. As hypothesized, a possible explanation is that participants fail to take into account the existence of SPLA and, as a result, overestimate the degree of theft.

Figure 3.4: ***Mean actual and expected appropriation rate***



Notes. $N = 1{,}202$. Bars represent the mean appropriation rate for Dictators (left) and the mean expected appropriation rate by Receivers (right).

3.5. Discussion

This study aims to investigate why piracy is arguably more prevalent than theft, even if economic incentives are kept constant. Earlier studies suggest that economic incentives alone are unable to explain the discrepancy (Nunes *et al.* 2004) but lack theoretical underpinning and empirical evidence. Our study reports on two framed incentivized experiments that explore to what extent theft aversion can be explained by SPLA. We argue that theft aversion affects decision-making if the potential victim loses possession of a rivalrous good. To our knowledge this study is the first to consider theft and piracy alongside each other in an economic experiment while earlier studies focused on either theft (e.g., Oxoby and Spraggon 2008) or piracy (e.g., Buchanan and Wilson 2014) separately. Two economic experiments were conducted to explore to what extent our proposed extension of loss aversion can explain the moral distinction. In both experiments we implement a novel payoff scheme that renders the difference between theft and piracy to solely a difference in framing. This allows for a clean comparison of piracy and theft.

We identify four specific contributions of this study. First, this study provides theoretical underpinning as to why a specific form of loss aversion may explain a phenomenon that cannot be explained by economic incentives alone. Our experiments provide evidence in support of the hypothesis that the likelihood of appropriation depends on whether the focal good is rivalrous. This

implies that piracy is more likely to occur than theft even if the economic incentives between the two types of goods are kept constant. Earlier studies on theft aversion focused primarily on the possible appropriation of rivalrous goods (e.g., List 2007; Gächter and Riedl 2005). We contribute to the literature on theft aversion by showing that the aversion is only triggered if the focal good is rivalrous. We provide a novel explanation of this effect by extending loss aversion to SPLA to take into account losses caused to others.

Second, our findings show that rivalry and appropriation can affect perceived ownership. In the first experiment Buyers are more likely to consider a rivalrous good theirs, irrespective of whether the good was purchased or appropriated, compared to Buyers in the non-rivalrous treatment. This result provides empirical support for the assumption that the transfer of rivalrous goods, whether voluntarily or involuntarily, is perceived as a possessive loss. We also find that this effect is more pronounced among Buyers who appropriated. The link between rivalry and possessive losses in the context of loss aversion is unexplored. Our study of this link contributes to the literature on loss aversion that stresses the importance of possessive losses (Brenner *et al.* 2007; Dommer and Swaminathan 2013; Morewedge *et al*. 2009).

Third, we find that increasing prices results in a higher theft and piracy rate. A prominent moral argument against piracy is that piracy inflicts economic losses. In the DG experiment potential economic losses were equal to prices. At the same time, higher prices provide a stronger incentive to appropriate. Considering that an economic loss is not a possessive loss, we observe that the net

effect of higher prices is a higher appropriation rate. A possible explanation is that cognitively it is more difficult to imagine the gravity of an economic loss due its abstract nature, while possessive losses are material. This would be in line with earlier studies that show that decision-makers often fail to take into account similar abstract considerations such as opportunity costs (Frederick *et al.* 2009; Spiller 2011).

Fourth, we show that the inability to anticipate loss aversion extends to SPLA. Earlier studies demonstrated that people are unable to anticipate FPLA in the decision-making by others (Loewenstein and Adler 1995; Van Boven *et al.* 2000). We find that people are also unable to anticipate that others are averse to stealing. This implies that SPLA does not differ from FPLA in this respect and supports the theory that theft aversion is a manifestation of loss aversion. In a managerial setting, this insight can explain why firms marvel over why consumers are reluctant to pay for non-rivalrous goods. As a result, decision-makers should be aware that mitigating piracy requires stronger economic incentives than lowering the likelihood of theft.

More generally, our study contributes to research on loss aversion by extending it to the moral domain. Research on loss aversion has primarily focused on how loses affect the decision-maker. Our study shows that taking into account the losses of others provides a new avenue of research. Further investigations of SPLA might reveal how other types of illegal behavior besides theft and piracy can be explained as well. For example, fare dodging is illegal because it constitutes a refusal to pay for used services such as public transportation. Nevertheless, fare dodging is relatively

common and is often perceived as a minor offence (Groot and Van Den Brink 2010). Similar to piracy, fare dodging does not deprive the victim of any possessions, which prevents SPLA from acting as a moral deterrence.

Our explanation of the prevalence of piracy behavior based on SPLA has clear policy implications. Efforts to convince consumers that piracy is morally equivalent to theft seem futile if SPLA is cognitively hardwired, like FPLA (Tom *et al.* 2007). These efforts constitute a burden on firms and consumers. IP publishers spend time and money on public service announcements, which is unnecessary if such messages are ineffective. Furthermore, consumers are often required to watch or listen to these public service announcements, which increases the time cost of consumption of these media. A more effective communication strategy is probably to emphasize the economic loss that results from piracy. Furthermore, the findings of this study suggest that piracy needs a stronger deterrence than theft. Because piracy lacks the moral deterrence that seems to exist for theft, policy-makers who aim to impede piracy are advised to implement measures that sufficiently deter piracy by adopting a psychological framework that takes into account SPLA.

3.6. Appendix: Experimental Instructions Exchange Game

This is an experiment in decision-making. Your participation is anonymous. In this experiment you will be asked to make a decision and to respond to a number of questions.
Another worker was asked to participate in this experiment as well. This worker received one chip, which is presented below. You receive a budget of $0.50.

The monetary value of this chip for you is $0.50 and for the other worker this is $0.00. The other worker is willing to sell the chip for $0.25. Momentarily, the monetary value of your possessions is $0.50 (the budget) and for the other worker this is $0.00 (the chip). This does not change if you choose to do nothing.

If you purchase the chip, the monetary value of your possessions becomes $0.75 because this is equal to the budget - the paid price + the chip, and for the other worker this becomes $0.25 because this is equal to the paid price - the chip. If you [take/copy] the chip without purchase, the monetary value of your possessions becomes $1.00 because this is equal to the budget + the chip, and for the other worker this becomes $0.00 because this is equal to the chip - the chip.

3.7. Appendix: Experimental Instructions Dictator Game

For this experiment you're matched with another worker. One of you gets the role of X and the other gets the role of Y. This is determined randomly. Y produced ten identical tokens and X receives a budget of $0.50. The value of a single token for X is $0.05 and for Y this is $0.00. X is the only person who can decide. Y cannot decide. Y can earn money by selling tokens. The price of a single token is $[price].

For each token X has to decide whether to purchase it or to [take/copy] it. Y [won't have the token anymore/will still have a copy] of the token if it is purchased or [taken/copied]. Your role is revealed on the next page. At the end of the experiment, the possessions of each person are exchanged for money and granted as a bonus.

Examples
If X decides to purchase all tokens: X will receive $[0.50 – (price×10)] (budget left) + $0.50 (value tokens) = $[1– (price×10)] and Y receives $[price×10] (sales).

If X decides to copy all tokens: X will receive $0.50 (budget left) + $0.50 (value tokens) = $1.00 and Y receives $0.00 (value tokens).