Social Presence and Shopping Behavior: Evidence from Video Data

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1 Introduction

Even with the recent tremendous growth in e-commerce, consumers still purchase most products in the traditional retail shopping environment where they are surrounded by other shoppers and sales people. For example, in the second quarter of 2015, less than 7% of all retail sales occurred online in the U.S. [U.S. Department of Commerce, 2015]. Hence, brick-and-mortar retail stores remain the place for the usual "shopping experience" complete with customer service and interactions with other customers [Hu and Jasper, 2006].

While the basic traditional theories of economic behavior treat consumer choices as being unaffected by the social nature of human interactions, a well-established body of behavioral economics and marketing research examines how consumer behavior might be impacted by social characteristics of the environment. In particular, this literature investigates the impact of social interactions with peers, family members or sales people on consumer purchasing behavior [see, for example, Becker and Murphy, 2000], and establishes that the concepts of reciprocity, social norms and conformism, altruism and other behavioral constructs are important in explaining consumer choices. These behavioral mechanisms are likely to be at work (though to a lesser degree) even in social settings with complete strangers [Gui and Sugden, 2005, provide a detailed discussion]. To our knowledge, none of the existing studies have investigated whether social presence of strangers affects consumer behavior[1], which is the main focus of this paper.

There are at least two plausible reasons why social presence might affect consumer choices: status signaling and guilt reciprocity. Status signaling implies that consumers' purchasing decisions, in part, are influenced by the status that they want to convey to others with their purchases. Consumers have been shown to engage in status signaling with a variety of goods, including environmentally friendly goods [Griskevicius et al., 2010, Johansson-Stenman and Martinsson, 2006] or, pertinently to this paper, food items [Dubois et al., 2012, Dimara and Skuras, 2005]. Visibility is an important consideration in status signaling behavior and is likely to be affected by the number of people witnessing it. Status signaling is likely to be the strongest when other people are present, possibly leading consumers to either buy more expensive products, or to skip the purchase altogether to avoid a low-status signal. [Fremling

[1] Dahl et al. [2001] looked at how consumers feel when buying embarrassing products such as condoms in the presence of others, but did not look specifically at how the change in social presence affected consumer behavior.

and Posner, 1999].

Guilt reciprocity behavior, on the other hand, occurs when consumers experience a feeling of reciprocal responsibility towards the salesperson [Fehr and Gächter, 2000, Sugden, 1984, Rabin, 1993]. Dahl et al. [2005] find that consumers tend to have complex reactions to even the most fleeting social interactions in the store and often feel guilty when they fail to fulfill the norm of reciprocity and make a purchase. The mechanism of responsibility diffusion [Darley and Latane, 1968, Forsyth et al., 2002] is likely to reduce the feeling of guilt in presence of more customers. The effect of higher level of social presence is commonly seen in tipping behavior, for example Freeman et al. [1975] and Lynn [2006] suggest that the primary reason why large dining parties leave smaller percentage tips is the diffusion of shared responsibility that each group member has for tipping the server.

This paper examines whether and how the presence of other people in stores impacts consumers' shopping behavior. Specifically, we use a unique dataset of video surveillance combined with sales data from a small boutique wine store to investigate the effect of change in the level of social presence on customer behavior. We observe the entrance and exit times as well as various actions of individual customers in a store and determine whether there was an exogenous change in a social presence during each consumer's shopping trip. As some customers might self-select to enter an empty or a full store, or might be anchored to the level of social presence at the time of entry, consumer preferences might be endogenous to social presence. The choice of other shoppers to enter or leave the store, however, is exogenous to the decision of any customer to enter the store. In other words, the exogenous change in social presence status essentially gives us random assignment into a control and treatment groups. Customers from the control group do not experience a change in the level of social presence: those who come into an empty store have no other customers enter the store, while those who come into a full store do not end up shopping alone. Customers in the treatment group, on the other hand, experience a change in the level of social presence: those who enter an empty store have other shoppers come in, while customers who enter a full store end up shopping alone. Given the possible endogeneity concerns, we analyze consumers who enter the full and empty store separately. This two-by-two quasi-experimental design allows us to causally infer the effect of both a decrease and an increase in the level of social presence on shopping behavior. Furthermore, our unique data allows us to observe whether customers approached and investigated any wine on the central stand displaying only inexpensive wines,

as well as whether consumers kept and purchased any of the wines that they picked up to consider. These coded actions provide rich data for analyzing status signaling and guilt reciprocity behaviors.

Our main finding is that people have a significantly lower propensity to buy anything when other shoppers are present. This is consistent with both status signaling and guilt reciprocity behaviors. We also find that social presence has a different impact on the price of purchased bottles and total spending based on whether the customer entered an empty or full store. Specifically, for the customers who enter a full store, a higher level of social presence leads to a significant increase in the *mean price* of purchased bottles. On the other hand, for consumers who enter an empty store, a higher level of social presence decreased *total spending* on bottles bought. We develop a theoretical model that accommodates status signaling as well as guilt reciprocity behaviors and show that patterns observed in the data are consistent with our theoretical predictions.

This paper contributes to the behavioral economics and marketing literature by presenting robust empirical evidence that social characteristics of our environments affect our choices and should thus be taken into account when modeling consumer behavior. Specifically, this research contributes to the ongoing discussion on the social multiplier [Glaeser et al., 2003], a phenomenon of aggregate data not reflecting the relevant individual behavior and elasticities due to the presence of social interactions. Similarly, it highlights limitations of laboratory experiments that do not reflect realistic social environments. This is the first paper to our knowledge to present empirical field evidence of both behavior consistent with guilt reciprocity and status signaling. Finally, this paper provides insights about consumer behavior that are relevant for store managers.

We proceed with the paper by briefly summarizing the existing relevant research on status signaling and guilt reciprocity in section 2. We describe the data and provide descriptive statistics of interest in section 3. We develop a theoretical model and formulate relevant hypotheses in section 4. Section 5 discusses our estimation approach, and section 6 presents results. Finally, section 7 concludes.

2 Literature review

Two behavioral patterns most likely to influence consumer choices as the level of social presence changes are: (i) status signaling and (ii) anticipatory guilt and reciprocity towards the salesperson. Below we summarize the current research on both status signaling and guilt and reciprocity, discuss other research relevant for evaluating the effects of social presence on consumer behavior, and identify some gaps in the existing literature.

2.1 *Status Signaling*

Status signaling is a widely recognized behavioral pattern, first identified by Veblen [1899] through the concept of conspicuous consumption, where concern for social status drives consumption aimed at signaling the individual's wealth. Since then, evidence for status signaling behavior has been identified in a variety of environments, including markets for durables, food and clothing retail items [Basmann et al., 1988], luxury goods [Han et al., 2010], and even environmental goods [Griskevicius et al., 2010]. In addition to people engaging in status signaling behavior, it is now widely recognized that individuals often infer other people's social status and success from their possessions and signaling behavior [Richins, 1994, Burroughs et al., 1991].

Status signaling has important implications for many issues in economics, such as tax policy, growth models, environmental conservation, consumption and other areas [Corneo and Jeanne, 1997, Rege, 2008, Truyts, 2010, Kahneman et al., 1999, Brekke et al., 2003]. The question of how strongly consumer behavior is actually affected by status signaling can inform the decision to model or ignore it. The extent to which status signaling is observed remains a non-trivial issue as behaviors consistent with it could potentially be explained by other phenomena, and have different implications depending on how and who employs status signaling [e.g. Rucker and Galinsky, 2009, Brekke and Howarth, 2002].

Status signaling and conspicuous consumption are often used interchangeably, but status signaling need not be conspicuous. It has been identified in more short-term interactions or in purchases of food items [Dubois et al., 2012, Dimara and Skuras, 2005] that are much less conspicuous than durable goods. Finally, costly self-signaling can occur in the absence of any audience or observers [Johansson-Stenman and Martinsson, 2006].

In most cases status signaling manifests through consumption of higher priced items,

or through higher than optimal consumption [Rege, 2008, Brekke and Howarth, 2002]. The theory of status signaling (for an in-depth discussion see Fremling and Posner, 1999) suggests that its effects are not limited to the purchase of more expensive goods. Specifically, individuals might avoid making a purchase or any decision that would send a low status signal to others. For example, consider a customer shopping for a bottle of wine who considers the status signal any particular bottle would send, the cost of status signaling, and his original willingness-to-pay (WTP) for the bottle. This consumer may actually decide to forgo the purchase altogether if the desired social status signal is deemed too costly.

The data on people foregoing the purchase is often missing, which might lead to underestimation of the actual extent of social status signaling. Additionally, a lot of the existing research on status signaling relies on self-reported attitudes or plans, which do not necessarily reflect subsequent actions.

This paper exploits data on customers who don't buy anything to examine the propensity to buy, which allows for a more complete investigation of status signaling. Prices of wines bought and the total spending in the store supplement the data on the propensity to buy and are used in this paper to further examine consumer behavior in the store.

Wine in itself is a peculiar consumer product. Consumers tend to use such extrinsic cues as prices when evaluating quality of wines [Lockshin and Timothy Rhodus, 1993], and reputation for quality, as well as expert ratings, often have a stronger influence on price and consumer preferences that the actual quality and taste characteristics [Cardebat and Figuet, 2004]. All in all, wine is a perfect product to examine the effect of status signaling, as it is commonly perceived as the preferred product of the affluent consumers [Bisson et al., 2002], and is commonly consumed by high income consumers [Blaylock and Blisard, 1993], and is thus likely to be a product used in status signaling behavior.

2.2 *Guilt and Reciprocity Paradigm*

Guilt is a form of emotional distress that usually stems from the belief that one has violated a personal or social norm [e.g. Lascu, 1991, Baumeister et al., 1994]. It is usually considered to be an adaptive function, acting as a behavioral interrupt and informing the consequent actions of the individual. The emotion of guilt in a consumption context has been linked to compulsive consumption and impulsive buying or returning of merchandise. More generally,

guilt is often used in advertising or in motivating pro-social behavior, especially in the public goods domain [Renner et al., 2013].

Reciprocity is a social norm that encourages individuals to pay back what others provided, often by focusing on what the person needs, rather than by matching the initial actions [Cialdini, 1980, Clark, 1986, Fehr and Gächter, 2000, Rabin, 1993]. Previous research has consistently shown that consumers value the social interactions with the salesperson [Hu and Jasper, 2006], and that consumers believe the act of purchase to be the expected normative outcome of an interaction with a salesperson. In this setting consumers violating the social reciprocal expectation of purchase will feel guilt, or anticipatory guilt when considering not buying anything. Using surveys administered after randomly assigned shopping tasks, Dahl et al., 2005 find that even short interactions with the salesperson lead to an increased experience of guilt when a purchase is not made, with participants planning to take that feeling into account during future visits to the store.

The above study has some limitations due to the self-reported nature of the emotions and planned future actions, the fact that shopping tasks were assigned, and not self-selected, the extremely low cost of the purchases made ($2 spending limit for items such as snacks or school supplies) and the student sample used . This study, on the other hand, uses field data from all customers entering a wine store, with no limit on spending and no experimental compulsion to buy anything. Also, Dahl et al., 2005 do not control for the presence of other people in the store, which limits our understanding of how social presence affects guilt and reciprocity behavior.We use video data to identify the change in the level of social presence to address that shortcoming.

Presence of other shoppers may be an important consideration in any research that examines social norms due to responsibility diffusion. When other people are present, the pressure of maintaining any particular reciprocal norm is not focused on one individual, but rather on all people present [Darley and Latane, 1968]. Therefore,the feeling of reciprocal responsibility diffuses proportionally to a group's size [Forsyth et al., 2002]. The reciprocal responsibility is widely observed in tipping, which is a common economic activity motivated by mostly by social norms [Conlin et al., 2003], where the size of tip is significantly impacted by the number of people present, i.e., the larger the group size, the smaller the percentage tip (Freeman et al. [1975]; see Lynn, 2006 for an extensive overview of tipping practices).

This leads us to expect responsibility diffusion to affect the extent to which consumers

feel guilt when they are not the only shoppers present, and thus are not the only people able to make the norm-driven purchase.

This paper addresses some of the shortcomings of the papers mentioned in this section. We expect both the guilt reciprocity and the status signaling to be present in our context, and in section 4 we develop a more formal model of consumer decision making.

3 Data and Descriptive Statistics

We use a combination of video surveillance data and sales data from a small boutique store specializing in small production estate-bottled wines and ciders for a period of 23 days in April-May 2014. The video data were collected using four different surveillance cameras covering the entire area of the store[2]. The surveillance video covered the whole area of the store, including the checkout counter, and provided the information on the time people entered and exited the store, and the various consumer actions at the store's displays and shelves. On the date and time stamps, present on all recorded files, seconds were used as the smallest unit of time. Seven research assistants were trained to code the surveillance data. A separate group of research assistants were asked to code a random sample (20% of the total footage) to cross-check the reliability of the original coders. In total, we analyzed 184 hours of the recorded footage. Coders were instructed to watch all video files without fast-forwarding, and to record the entry and exit time of each customer, customer's gender, whether or not the salesperson provided any assistance during shopping, and for those customers, who did buy something, the time they checked out at the counter. Coders also noted the number of times the person picked any bottle for close examination from the shelf or display, and whether the customer ended up purchasing the bottle she picked up. Additionally, the number of times a consumer approached a table that exclusively featured bottles priced under $15 (with a sign prominently displaying the price range) was recorded.

The sales data, obtained directly from the store owners, included item descriptions, prices, quantities purchased, tax and discount amounts, final total cost and the time and date of the purchase. The timestamps from the sales data provided additional reference points for

[2]Video surveillance in public is legal in New York State (the location of the studied boutique store) without explicit consent of people being observed as long as no audio data is recorded, and as long as the person surveyed does not have a reasonable expectation of privacy (Article 250, NY State Penal Law).

customers who made a purchase, and were used to match consumers in the video data to their expenditures For customers who did not make a purchase, the number of bottles is coded as zero.

3.1 *Quasi-experimental exogenous variation in number of people present in the store*

A common and important challenge for studies investigating the effects of social presence in the field is the problem of endogeneity. For example, a customer who is self aware might prefer to avoid any situation that leads him to, in his opinion, overspend, or to purchase unnecessary items. Similarly, consumers with specific preferences for the social aspects of shopping might prefer to come into a full or empty store. Finally, some consumers might be anchored to the social presence level in the store at the time of entry. This presents a serious endogeneity issue, since the preferences for social aspects of the shopping environment could potentially be correlated with the propensity to purchase anything and, for example, preferences for inexpensive or expensive wines. If customers do self-select the level of social presence at the time of entry, or become anchored to that level, then we can not compare the propensity to bu,y and the prices or total expenditures, of consumers who entered an empty or full store. On the other hand, for each customer, the decision of other people to come in or leave the store is exogenous to the his or her own decision to come in.

We utilize this exogenous variation in the level of social presence in the study design. Using the time stamps for the entry and exit of customers in the sample, we classify consumers into four groups, with two customer groups that do not experience a change in the level of social presence during their visit to the store, and two groups that do. Based on this classification, we define a control and treatment group for customers who come into an empty store:

1. There are no other people in the store at any point while the customer is in the store. In other words, the customer comes into an empty store, and leaves a still empty store. This is the control group, with customers who do not experience a change in the level of social presence.

2. There are no other shoppers when the customer enters the store, but there are other

shoppers present in the store when she leaves. This is the treatment group, in which consumers experience an increase in the level of social presence.

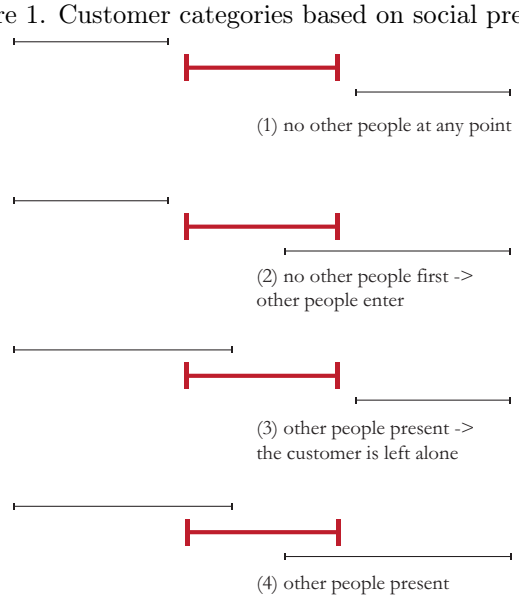
Similarly, the control and treatment groups are defined for customers who enter a full[3] store.

1. There are other shoppers in the store both at the time of entry and exit. This is the control group, where customers not experiencing a change in the level of social presence.

2. There are other people present when the customer enters the store, but no other customers when she leaves. This is the treatment group, with customers experiencing a decrease in the level of social presence.

Using the timestamps, we calculate the length of the visit to the store. Figure 1 presents generalized timeframes for the four customer groups outlined above

Figure 1. Customer categories based on social presence



We use this quasi-experimental exogenous variation to see how the change in the number of people present in the store affects customers' propensity to purchase as well as the price of their selected bottles. It is important to note that among customers who enter an empty

[3]In this paper we use a word "full store" to denote a situation where there is at least one other customer present, other than the customer in question.

store, we see the effect an increase in the level of social presence has on consumer choices, while the control and treament groups for shoppers who come into a full store provide information on the effects of a decrease in the level of social presence. Using the Kolmogorov-Smirnov tests, we compare the distributions of time of entry for consumers in the control and treatment groups for customers who enter a full or empty store, and find them not to be significantly different from each other. This confirms that this change in social level presence can be treated as exogenous. The same test is used to compare the distribution of entry times between customers entering a full or an empty store in general, and they are also found to not be significantly different from each other.

Descriptive statistics

Over the course of the 23-day period, we observe 1,093 individual shoppers. Twice during the analyzed period the store held wine-tastings from 5 to 9 pm. We drop all observation of people shopping during the wine tasting, as the number of people in the store and the shopping behavior are likely to be influenced by the tasting and the promotional activities. After dropping these observations, a total of 982 individuals remain in our sample. Descriptive statistics for each of the four customer groups are presented in table 2.

In the entire sample, 49% of customers make a purchase, most buying 1 or 2 bottles. The average price of the bottle is $18.66 (standard deviation of $12.11), and the cheapest bottle available in the store costs $6.80. The average visit is around 6 minutes, however, customers who buy anything on average spend significantly more time in the store.

The proportion of female and male customers is about equal for all four customer groups, with the exception of the treatment group for customers who came into an empty store, which has more men, though the difference is not statistically significant compared to the other groups. Approximately 12% more customers receive manager's assistance when level of social presence is higher, a difference significant at the 5% level. This is reasonable as more people in the store makes it more difficult for a salesperson to help every customer.

Table 1. Descriptive statistics, full sample

Variables of interest:	
% of people buying	0.494 (0.500)
Average price of bottle, if bought	18.665 (12.132)
Average number of bottles, if bought	1.872 (1.641)
Total cost, if bought	34.271 (33.330)
% people assisted	0.338 (0.473)
Time spent in the store, minutes	6.061 (5.016)
Female	0.495 (0.500)
N	983

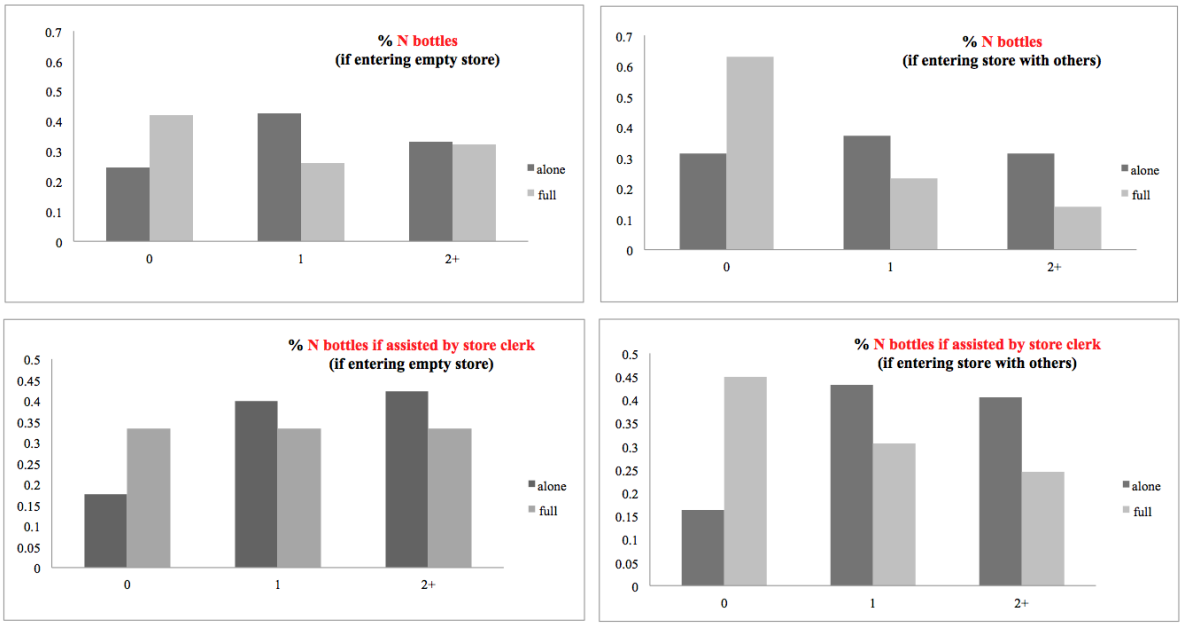
For the four customer groups, the most striking difference by far lies in the proportion of people making purchases: in general, a lower level of social presence increases the proportion of customers making a purchase. The mean prices of bottles bought varies approximately between \$17.20 and \$19.50 in the four customer groups, and figures 3 and 4 illustrate the mean price and total spending differences in more detail.

Table 2. Descriptive statistics, four customer groups

Come in the store when it is:	Variables of interest:	*Leave the store when it is:* **empty**	*Leave the store when it is:* **full**
empty		Control	Treatment
	% of people buying	0.755 (0.431)	0.580 (497)
	Average price of bottle, if bought	19.516 (14.476)	17.185 (6.591)
	Average number of bottles, if bought	2.014 (1.811)	1.915 (1.365)
	Total cost, if bought	37.486 (38.046)	31.198 (20.830)
	% people assisted	0.433 (0.497)	0.407 (0.494)
	Time spent in the store, minutes	5.48 (5.29)	7.73 (8.88)
	Female	0.464 (0.500)	0.346 (0.479)
	N	196	81

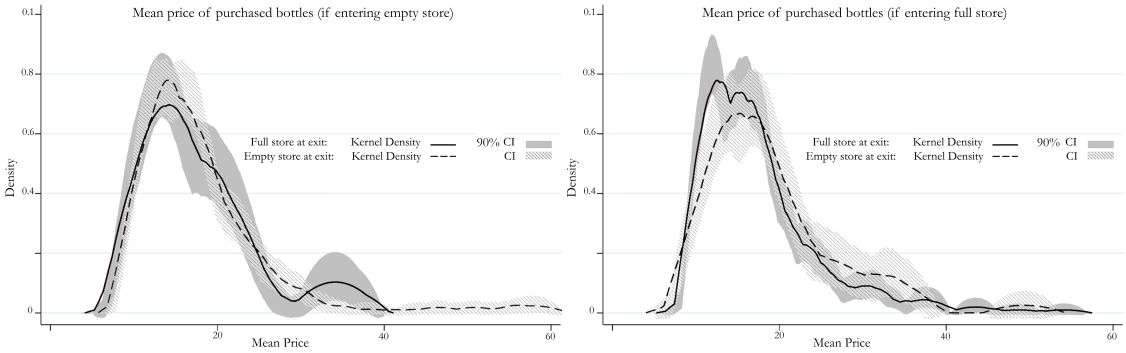
Come in the store when it is:		**empty**	**full**
full		Treatment	Control
	% of people buying	0.685 (0.467)	0.373 (0.484)
	Average price of bottle, if bought	18.507 (7.616)	18.461 (12.341)
	Average number of bottles, if bought	1.820 (1.365)	1.787 (1.644)
	Total cost, if bought	35.814 (36.564)	32.421 (31.200)
	% people assisted	0.416 (0.496)	0.2285 (0.452)
	Time spent in the store, minutes	7.24 (5.93)	5.86 (3.90)
	Female	0.438 (0.499)	0.533 (0.499)
	N	89	617

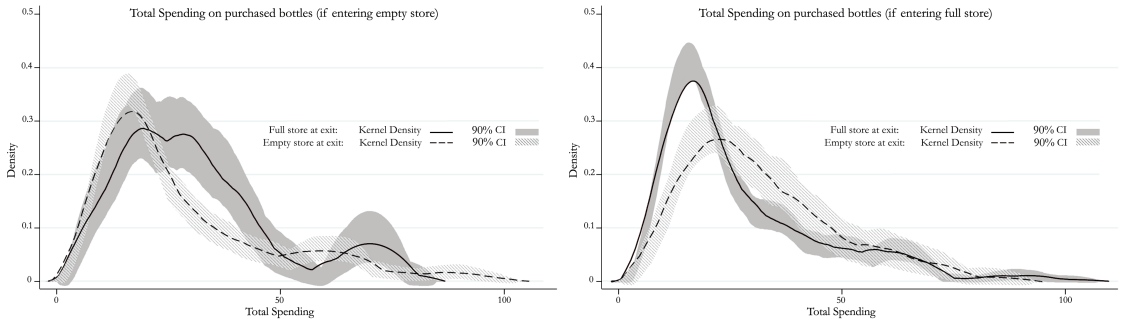
Figure 3. # of bottles bought



Higher level of social presence seems to have the same impact on the propensity to buy whether people entered the full or empty store. Customers in lower social presence level are approximately twice as likely to leave without buying anything for both customer groups. Over 60% of those who enter a full store do not make a purchase if always around other shoppers. A similar pattern of changes in propensity to buy is seen for the subset of people who receive some assistance from the sales manager.

Figure 4. Mean price and total spending per group, kernel density and 95% confidence interval estimates





On the other hand, higher level of social presence has a different impact on customers who enter an empty store, and those who enter a full store. Figure 4 provides the estimated kernel densities with the corresponding 90% confidence intervals for both the mean price and total spending for the four customer groups. Lower social presence level leads to a more dispersed mean price distribution among people who entered an empty store, but to a less dispersed distribution for those who entered a full store. The differences in total spending in the store appear stronger and follow the same pattern as the changes in the mean price. It is important to note that these densities do not control for any fixed effects or differences between the four groups.

This provides us with some preliminary evidence that the level of social presence has some correlation with the observed consumer behavior, and also that the presence level in the store at the time of entry is correlated with customer behavior as well. It is possible that people self-select to enter an empty or full store, or that social presence at the time of entry affects customer's behavior for the duration of the visit.

4 Theoretical Model and Hypotheses

In this section we develop a simple theoretical model that allows social presence to affect not only the propensity to buy, but also the average price and total expenditure at the store. We use the existing research [please see Rege, 2008, Truyts, 2010, Dahl et al., 2005, among others] on status signaling and guilt reciprocity behavior to guide the development of our model. We do not impose any restrictive assumptions on the model and let the data guide our estimation results.The theory model in this section can be used to deepen our understanding of the impact of other shoppers on one's behavior; however, given the complex nature of the relationship between social presence and purchasing decisions, the exact effects of guilt

reciprocity and status signaling might be difficult to disentangle.

We modify a standard utility model to allow for both the signaling and the guilt reciprocity effects. The consumer's maximization problem, when deciding whether to purchase bottle i, is in choosing whether to make the purchase given the price p_i and other characteristics of the bottle and environment, or skip it. It can be formalized as follows:

$$\begin{aligned} \max[\quad & \underbrace{u(x_i, h)}_{consumption\,utility} + \underbrace{g(n, v)}_{signal\,multiplier} \underbrace{s(p_i)}_{signal\,utility} + \\ & + \underbrace{f(n)}_{reciprocity\,multiplier} \underbrace{R(h)}_{reciprocal\,utility} - p_i,\ 0] \end{aligned} \tag{1}$$

where $u(x_i, h)$ is the customer's derived consumption utility for bottle i that depends on characteristics x_i of the bottle and help h received from the salesperson; $s(p_i)$ is the signaling utility of bottle i; given its price p_i; $g(n, v)$ is the modulator of the signaling effect, amplifying or decreasing the importance of signaling given the visibility of the signal v and the number of people present n; $R(h)$ is the reciprocity utility that depends on the level of assistance from the salesperson, h; and $f(n)$ regulates the effect of the reciprocity utility given the level of social presence (n) in the store.

Assuming $B = 1$ if $\max[V, 0] = V$, and $B = 0$ if $\max[V, 0] = 0$, then probability of purchase $\text{Prob}(B = 1)$ increases as $[u(x_i, h) + g(n, v)s(p_i) + f(n)R(h) - p_i]$ increases. This allows us to interpret the changes in propensity to buy bottle i on average as a result of the changes in the level of social presence in the store.

The actual number of people present in the store might fluctuate during anyone's shopping trip. More people can come in at any time, a couple of customers might leave and then new customers still could come in moments later. While those changes might have some effect on consumer behavior they would be very hard to identify because of their transient nature. Observing a categorical switch from being surrounded by other shoppers to being alone and vice versa allows us to cleanly identify the general effect of change in social presence but doesn't identify smaller marginal effect of one more person in the store[4]. Thus we observe

[4]We do estimate the model with the change between the maximum and the minimum number of present present as the treatment variable and obtain similar results. However, we don't believe using these data on number of people present at various time points during a customer's visit to the store is justified, as multiple

two general levels of n on our sample for both customers who entered a full and an empty store, n_{lower} and n_{higher}. Among customers who enter an empty store, the control group has the lower level of social presence n_{lower}, while the treatment group has a higher level of social presence due to customers coming in n_{higher}. For customers who come into a full store, the control group has a higher level of social presence n_{higher}, and the treatment group has a lower level of social presence n_{lower}, as other customers leave. This is summarized in table 3.

Table 3. Discrete variation on levels of social presence.

		Group 1	Group 2
		Come in:	
		alone	**full**
leave:	**alone**	$n_{low\ 1}$	$n_{low\ 2}$
	full	$n_{high\ 1}$	$n_{high\ 2}$

With the general framework of customer utility defined, we proceed to discuss the individual components of interest.

4.1 *Signaling Utility Component*

To properly define the signaling component of customer utility, we need to allow for both positive and negative signaling utility. The utility of signaling is positive when the actual price of the bottle is equal or above the price customer believes will send a higher signal about her social status, given the bottle's characteristics. Assume each consumer has a bottle specific monetary-equivalent valuation for each bottle i, γ_1, that he believes will signal his social status perfectly. To signal a higher social status the price of the bottle needs to be $\gamma_i + \alpha_i$, where α_i would be the monetary valuation of the signaling above one's and could be equal to zero, when the customer just wants to signal his own social status (instead of signaling a higher one)[5]. The consumer signaling utility is the result of the comparison of

changes within the visit, sometimes of different directionality, occur.

[5]This assumes status signaling is exhibited through spending more, not less money for the majority of shoppers, following the existing research on social signaling

$\gamma_i + \alpha_i$ with the price of the bottle p_i, which are weighted the two according to the consumer's signaling function. The signaling utility's absolute effect is amplified by the number of people (n) present in the store: the more people are around, the stronger the effect of signaling[6]:

$$\frac{\partial g(n, v)}{\partial n} > 0 \tag{2}$$

Using discrete coding for the level of social presence, it can be expressed as

$$g(n_{higher}, v) - g(n_{lower}, v) > 0 \tag{3}$$

Note, that it is consistent with our model to choose to send a negative signal and still maximize the utility. This might happen in the situations when the individual is placing a lot more weight on the price than on the status signaling component of the utility function. In addition to social presence affecting the extent of signaling, it is also modulated by the visibility of the purchase. The visibility of the purchase can be endogenously set by the customer - the customer can choose an item the price of which is more visible to other shoppers. In our model, higher visibility increases the magnitude of the signaling effect, which in turn can be both positive and negative:

$$\frac{\partial g(n, v)}{\partial v} > 0 \tag{4}$$

4.2 *Guilt Reciprocity Utility Component*

Guilt reciprocity is also allowed to be impacted by the number of people present *(n)*. The responsibility diffusion effect decreases the guilt reciprocity as fthe level of social presence is higher:

$$\frac{\partial f(n)}{n} < 0 \tag{5}$$

As we look at discrete change in n, equation (5) is effectively is equivalent to

$$f(n_{high}) - f(n_{low}) < 0 \tag{6}$$

[6]The above assumption follows existing research, but is not enforced in the estimation. It is only used to define the expected effect of the changes in social presence on consumer behavior.

Following Dahl et al. 2005 results, the guilt reciprocity component depends on the level of assistance, h, received by the customer. Higher level of assistance increases guilt reciprocity behavior:

$$\frac{\partial R(h)}{h} > 0 \tag{7}$$

In our dataset, the level of assistance is identified through a dummy variable equal to one when the salesperson provided any assistance before the purchase. Equation (7) can be expressed as

$$R(h = 1) - R(h = 0) > 0 \tag{8}$$

Receiving help from the manager also impacts the search costs of the customer through consumption utility $u(x_i, h)$ - by making it easier or harder to identify the real characteristics of the wine. We allow it to be negative, in case some consumers are discomfited or confused by higher or lower levels of assistance. The effect of change in the level of assistance is ambiguous as h enters the maximization problem through both its impact on guilt, and the more traditional effect of assistance in limiting search/cognitive costs: $\frac{\partial R}{\partial h} > 0$, but sign of $\frac{\partial c}{\partial h}$ is ambiguous. The guilt effects of assistance would be moderated by the number of people present, while the matching cognitive load effect of being assisted should not be affected by the number of people present in the store. This distinction allows us to test for the presence of guilt reciprocity in our data.

4.3. Propensity to Buy as a Function of Signal Visibility, and Manager's Assistance

In our model, the propensity to buy any given bottle depends on whether the customer believes the purchase of the bottle sends a positive or a negative signal, as described above.

When the signal is positive, the effect of an increase in the social presence on purchase probability is ambiguous, as social signaling effect would positively impact the propensity to buy, while the guilt reciprocity effect would decrease due to responsibility diffusion. When the signaling effect is dominant over the effect of guilt/reciprocity the probability of buying any given bottle increases, and vice versa.

A negative status signal wil have an unambiguously negative effect on propensity to buy

as the level of social presence increases:

$$\begin{array}{c}[u(x_i,h)+g(n_{high},v)s(p_i)+f(n_{high})R(h)-p_i]- \\ -[u(x_i,h)+g(n_{low},v)s(p_i)+f(n_{low})R(h)-p_i]\end{array} < 0 \tag{9}$$

The overall effect of signaling would depend on the distributions of social signaling valuation for all customers, and distribution of prices p_i of wines available in the store. On the one end of the extreme, if most bottles that customers can afford are considered to send a negative signal about their social status, we would expect customers to have a lower propensity to buy when surrounded by more people. This can be intuitively interpreted as people avoiding a negative signal by avoiding the purchase, or by responsibility diffusion preventing the customer from feeling guilty when no purchase is made. On the other side of the extreme, when most bottles of the desired social status are affordable, people will be more likely to buy the bottles and they might be of a higher price on average under the status signaling. Guilt reciprocity is still going to lead to a decreased propensity to buy in higher social presence environments.

Depending on whether the customer thinks a particular bottle or behavior sends a positive or negative signal, she can adjust the visibility of this signal. When a bottle sends a positive signal about one's social status, the customer would increase the visibility of the bottles price, and vice versa. In our study a centrally located table clearly labeled as "Wines under \$10 and \$15" serves as good proxy for how consumers might choose to modify the price visibility while shopping. Bottles available on that table are significantly cheaper than the wines bought elsewhere in the store. Approaching this table is a visible, and, likely can be interpreted as a negative status signal for most customers in the store.

Salesperson's assistance is another component that might have an ambiguous effect on consumer behavior, as it enters both the consumption utility, and the guilt reciprocity utility. The sales clerk's assistance would increase the propensity to buy through an increase in guilt reciprocity when no one else is present. On the other hand, consumers might have differing preferences on the level of assistance in general. For some, assistance will minimize search costs and increase propensity to buy, for others assistance might have negative utility and do the opposite.

Finally, we assume $f(n)$ and $g(n,v)$ to be different for people depending on their reference point or inherent preferences. In other words, we expect that either people who enter a store

to have inherently different preferences or customers' behavior is primed and anchored by the level of social presence in the store at time of entry. All things equal, we might expect a customer who entered the store in presence of other people to be more aware of them, and thus more prone to status signaling, while people who stepped into the store that was empty except for the sales clerk would be more prone to exhibit guilt reciprocity behavior. We do not parameterize this expected difference in the behavior in our model, but rather expect to see some differences in the incidence and levels of signaling and guilt/reciprocity for the two groups depending on whether they self-selected to enter the full or empty store.

Hypotheses

Following the theoretical model detailed above and the existing research and data available from this study, the following hypotheses about the impact of social presence on consumer shopping and purchasing behavior emerge:

H1: Social presence affects consumer behavior through changes in the propensity to buy, bottle price, and total spending. The expected impacts will differ based on the relative strength of guilt reciprocity and status signaling effects.

We expect customers experiencing guilt reciprocity to have an increased propensity to buy items when alone with the salesperson (responsibility diffusion effect). Under status signaling, on the other hand, in a higher level of social presence we might see an increase *or* a decrease in the propensity to buy, and an increase in price of items bought in the store. It is important to note that it is impossible to distinguish the effects of guilt and status signaling empirically just by looking at the propensity to purchase, as status signaling and guilt reciprocity effects would could coincide when most wines are easily affordable. Additionally, we expect that either people who enter a store have inherently different preferences or customers' behavior is primed and anchored by the level of social presence in the store at time of entry:

H2: The level of social presence at the time of entry affects customer behavior.

This could be true either because the level of social presence in the store at the time of entry is endogenous to consumer preferences, or because it anchors customers to a particular state of social presence and primes them to pay more attention to (or to be more susceptible to) either guilt reciprocity or status signaling. Finally, a decrease in the level of social presence might have a different effect from an increase in it.

To provide a way to differentiate between status signaling and guilt reciprocity behavior, we develop supplemental hypotheses presented below.

Consumers engaged in status signaling are likely to choose to avoid visible signals which might suggest their consideration of or preference for inexpensive wines:

H3: Customers modify the visibility of their signaling behavior when the level of social presence changes. If status signaling is a factor in purchasing behavior then, everything else constant, the number of approaches to the *"Wines under $10 and $15"* table will be lower when the level of social presence is higher. This would suggest an avoidance of sending a low-status signal.

Customers engaged in guilt reciprocity behavior are less likely to put down a bottle they expressed an interest in if the sales clerk assisted them. Intuitively, we would expect people to feel guiltier if they gave the clerk any indication that they were considering buying a bottle; that feeling would be exacerbated if they were assisted by the clerk and had a chance to build mutual rapport. This is particularly important as Dahl et al. [2005] suggest the guilt is stronger when consumers believe they could conceivably make the purchase.

H4: The effect of assistance is modified by the social presence level in case of guilt reciprocity behavior. In other words, under guilt reciprocity behavior, consumers shopping in a store with a lower level of social presence are more likely to keep a bottle they picked up to consider if receiving any assistance.

5 Estimation approach

In our data set, we observe both people making a purchase and deciding to not buy anything. This kind of observed behavior calls for a corner solution model to estimate the changes both at the intensive (mean price and total spending[7]) and extensive (propensity to buy) margins. We expect that some common unobserved factors affect both the purchase and the amount decisions, which is why we use the Exponential Type II Tobit (ET2T) model [Wooldridge, 2010] which allows for conditional correlation between the two stages. This model is very similar to the Heckman two-step approach (Heckit Heckman, 1979), but the dependent variable is log-transformed. We use data on consumers who left without buying anything to correct for the selection bias among customers who end up buying something and so are

[7]The model was estimated with the price of the most expensive bottle, to the same results.

our only source of information on price and total spending. We specify the following model, estimated separately for customers who enter a full and an empty store:

$$\begin{cases} y_i = s_i \cdot w_i^* \\ w_i^* = \exp(\beta_0 + D\beta_D + x_{i1}'\beta_1 + u_i) \\ s_i = 1,\ if\ \delta_0 + D\delta_D + x_{i2}'\delta_2 > -v_i \end{cases} \tag{10}$$

where w^* is the observed continuous variable of interest (in this case, mean price or total spending), s is a binary indicator equal to one when a customer made a purchase, D is the treatment dummy variable equal to 1 when the level of social presence is higher, x_1 is the vector of independent variables that affect the continuous variable of interest, and x_2 is the set of independent variables that affects the probability of purchasing .

Correlation between s_i and w_i^* is modeled through correlation between the error terms, where

$$(u, v) \sim N_2(0, \Sigma) \tag{11}$$

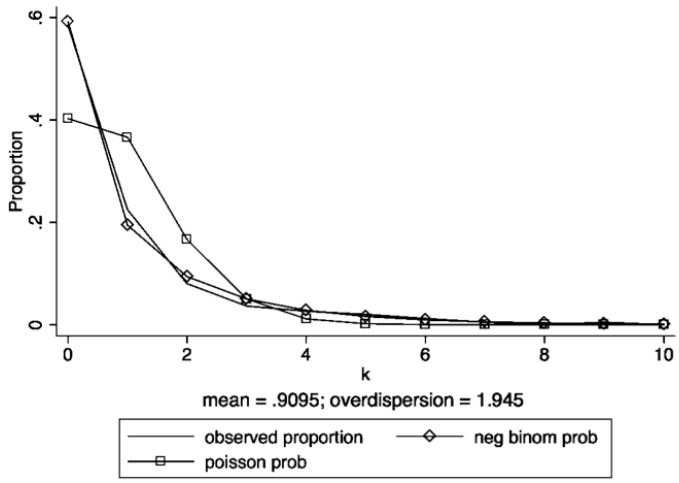
with

$$\Sigma = \begin{bmatrix} \sigma^2 & \rho\sigma \\ \rho\sigma & 1 \end{bmatrix} \tag{12}$$

The model in (8) is estimated in two stages: first, a Probit model is used to estimate the probability of purchase, and then OLS is used to estimate the effect of people and other observed characteristics on the natural logarithm of the mean price and total cost for customers who made a purchase.

In the ET2T models $x_1$and x_2 can contain the same set of variables, but generally the performance of a model improves with exclusion restrictions, making the estimates more precise. The exclusion criteria that we utilize in this model is related to sales clerk assistance. We include a dummy variable for manager's assistance in the x_2; however we exclude this in x_1 and instead we include a dummy variable equal to one when the customer ends up buying a bottle recommended to her by the manager. Being assisted by the manager is likely to impact one's propensity to buy; however, the price is more likely to be affected if one follows the manager's advice.

Figure 5. # of approaches to "cheap" display table; Poisson and Negative Binomial Distribution



To investigate the third hypothesis, we use the information about the number of approaches a customer makes to the table display with inexpensive wine to estimate the effect of social presence on signal visibility. We adopt a negative binomial regression. This type of regression is specifically developed for dealing with count data, and fits the distribution of the dependent variable very well (see figure 5 for comparison between the actual distribution of count of approaches to the table, a Poisson and a negative binomial distribution). As a result, our model can be specified as:

$$\begin{cases} \text{Prob}(N = n_i|z_i) = \frac{\Gamma(\theta+n_1)}{\Gamma(n_i+1)\Gamma(\theta)} r_i^{n_i}(1-r_i)^{\theta} \\ \lambda_i = \exp(\gamma_0 + D\gamma_D + x_i\gamma_1 + \ln E_i + \varepsilon_i) \\ r_i = {}^{\lambda_i}/_{(\theta+\lambda_i)} \end{cases} \tag{13}$$

In the estimated equation, the dummy variable $D = 1$ when the level of social presence is higher n_{high}, and x_i are the characteristics of the wine and the environment. The parameters are estimated by forming the log-likelihood conditional onε_i and estimating using Maximum Likelihood.

The fourth hypothesis is estimated through a separate Probit model assessing the probability of keeping any bottle a customer picked up to consider.

All models are estimated separately for the two exogenous variation groups: people who come into an empty store, and people who come into a full store. As we are interested in the effect of the number of people present in the store, we are also forced to consider the effects of

potential crowding. Being in a full or crowded room could affect consumer behavior through limiting easy access to wine displays, discourage purchases through a longer register line, and otherwise affect customers behavior. Because of this we also run the above models for the less crowded sub-sample of observations, discussed in more detail in the Results section.

6 Results

Hypothesis 1: Social presence affects consumer behavior through changes in the propensity to buy, mean price, and total spending

To investigate this, we estimate the ET2T model for the two groups using the exogenous variation of other people exiting or entering the store. We compare people who enter a full store, and leave a full store, to people who enter a full store and leave an empty store. Similarly, for people who enter an empty store, we compare customers who spend their whole time in the store alone, to people who end up shopping with others. The estimation results for the main ET2T model for the two groups of interest are presented in table 4.

Table 4. Mean price and total cost, ET2T

	Second Stage (mean price and total cost)				First Stage (propensity to buy), margins	
	Come in alone		*Come in full store*		*Come in alone*	*Come in full store*
dependent variable	ln(mean price)	ln(total cost)	ln(mean price)	ln(total cost)	Purchase = 1	Purchase = 1
Explanatory variables:						
T (more people)	-0.092	-0.249*	0.140~	0.147	-0.122**	-0.243***
	(0.085)	(0.135)	(0.088)	(0.140)	(0.059)	(0.051)
female	-0.106	-0.151	-0.053	-0.142*	0.090*	-0.002
	(0.069)	(0.104)	(0.049)	(0.079)	(0.058)	(0.034)
manager's assistance	-	-	-		0.083	0.215***
					(0.058)	(0.044)
manager's choice of bottle	0.109*	0.377***	0.107~	0.132	-	-
	(0.064)	(0.100)	(0.067)	(0.112)		
Controls:	day, time of day, female-assistance interaction, length of visit to the store					
	-0.160	0.230	-0.380**	-0.471*		
Inverse mills (lambda)	(0.304)	(0.472)	(0.158)	(0.256)		

The change in the shopping behavior with the change in social presence is observed for both groups. Moreover, the change is consistent across the two groups. If more people are present, customers were less likely to purchase anything. Among people who enter an empty store, those who continue without other shoppers present have a 12% higher probability of

buying anything, significant at the 5% level. People who enter a full store are 24% less likely to buy anything when the level of social presence is higher.

Additionally, customers who enter an empty store spend approximately 22% less it total when the level of social presence is higher, significant at the 10% level. Among these customers the mean price of a bought bottle does not significantly change when more people are present. The opposite is true for customers who entered a full store. The mean price for these customers is 15% higher when more people are present (marginally significant at the 15% level); while the total spending on the bottles remained statistically the same.

As we are interested in the effects of social presence, we might be concerned about crowding affecting access to bottles. We ran the above model for people who have at most three other people present at any point during shopping, which leaves us with a sample of 536 customers. The results remain very similar, and we present them in table 5.

Table 5. Mean price and total cost, ET2T, 3 people maximum

	Second Stage (mean price and total cost)				First Stage (propensity to buy), margins	
	Come in alone		*Come in full store*		*Come in alone*	*Come in full store*
dependent variable	ln(mean price)	ln(total cost)	ln(mean price)	ln(total cost)	Purchase = 1	Purchase = 1
Explanatory variables:						
T (more people)	-0.086 (0.088)	-0.331** (0.138)	0.243** (0.118)	0.116 (0.158)	-0.123** (0.061)	-0.224*** (0.056)
female	-0.108 (0.075)	-0.136 (0.104)	-0.056 (0.065)	-0.141* (0.090)	0.105* (0.058)	-0.039 (0.039)
manager's assistance	-	-	-	-	0.069 (0.059)	0.182*** (0.051)
manager's choice of bottle	0.107* (0.064)	0.410*** (0.100)	0.096 (0.082)	0.132 (0.112)	-	-
Controls:	day, time of day, female-assistance interaction, length of visit to the store					
Inverse mills (lambda)	-0.155 (0.306)	0.342 (0.479)	-0.508** (0.230)	-0.367 (0.323)		

If anything the results are even stronger and more significant. Looking at this subsample allows us to exclude the effects of the store being too crowded limiting access to the bottles or creating a long line at the check-out conter, for example. As the level of social presence is higher, the propensity to buy is lower by 12% for people who enter an empty store, or 22% for those who enter a full store. Social presence affects customer's behavior differently on the intensive margin depending on the state of the store at entry. When the level of social presence is higher, people entering a full store spend approximately 27% more on a single

bottle, significant at a 5% level. People who enter the store alone, on the other hand, spend 28% less in total on wine purchased.

Both status signaling and guilt reciprocity can explain the changes in the propensity to buy. The differences in the pattern of change on the intensive margin (the mean price and total spending) is an interesting result indicating some differences in behavior between the groups, that might stem from the different behavioral mechanism guiding customers' behavior.

If the difference between the two groups purchasing behavior was just driven by inherent differences of the groups and self-selection, say, a preference for being surrounded by people, a higher level of social presence would be unlikely to have the same directional impact for both groups. In our sample both customers who enter a full or an empty store experience similar changes in the propensity to buy.

Following the results of table 4 and 5, we are able to reject the null in favor of H1.

Hypothesis 2: Social presence level at the time of entry affects customer's behavior

While we do see significantly different behavior reflected in the descriptive statistics for people and in the asymmetrical results of the main model presented in tables 5 and 6, we now explicitly check for it using a ET2T model for level of social presence at time of entry, where D is now a dummy variable equal to 1 when customer enters a full store. Assuming social presence at the time of entry or preferences for social presence indeed affects one's shopping behavior, we would expect to see the differences in the propensity to purchase, mean price, and total cost of items bought remain in the model controlling for the observable customer and shopping characteristics we have. This model is just to confirm there are any differences to suggest different behavior for people who enter a full or empty store. The results are presented in table 6.

Table 6. Level of social presence at time of entry, ET2T

	Second Stage, All		*Second Stage, Uncrowded*		*First Stage, All*	*First Stage, Uncrowded*
dependent variable	ln(mean price)	ln(total cost)	ln(mean price)	ln(total cost)	Purchase = 1, margins	
Explanatory variables:						
T (more people)	0.178**	0.033	0.228**	0.048	-0.250***	-0.263***
	(0.075)	(0.110)	(0.107)	(0.140)	(0.032)	(0.033)
female	-0.088**	-0.164***	-0.10**	0.080	0.017	-0.006
	(0.040)	(0.059)	(0.049)	(0.118)	(0.106)	(0.042)
manager's assistance	-	-	-		0.205***	0.156***
					(0.034)	(0.038)
manager's choice of bottle	0.079	0.247***	0.744	0.545	-	-
	(0.051)	(0.082)	(0.060)	(0.147)		
Controls:	day, time of day, female-assistance interaction, length of visit to the store					
Inverse mills (lambda)	-0.425***	-0.318	-0.554***	-0.328*		
	(0.148)	(0.225)	(0.213)	(0.289)		

We provide the average marginal effects for the first stage estimates of all ET2T models for the sake of easier discussion. People who enter a full store spend 18% more on an average bottle, and ware 25% less likely to make a purchase overall in the store, both of which are statistically significant at the 5% significance level. Total cost of items bought is not significantly different between the two groups. However, customers entering a non-empty store are significantly at the 1% level less likely to buy anything, an estimated 25% decrease on average. Women, on average, spend 9% less on any bottle, and 17% less in total. Manager's assistance significantly at the 1% significance level increased customer's propensity to buy, and buying any of the bottles recommended by the manager significantly affected customer's total costs, with an estimated increase of 28%. The same results stand for the less crowded sample, also provided in table 6.

We also see that the manager's assistance coefficients are significant in the first stage estimates. First, manager's help increases the probability of purchase for both groups. It is quite interesting to compare the estimated effects of change in social presence, estimated in *H1*, to the impacts of manager's assistance: they are approximately equal for those who entered an empty store, but the social presence effect is significantly different and stronger than the assistance effect for those who came into a full store.

Buying wine picked out or suggested by the manager, on average, increases the mean price of the bottle by around 12% significant at the 10% level for people who entered an empty store, and by 11% (marginally significant at the 15% level) for people who entered a full store. It also significantly (at the 10% level) increases total spending by 28% among

people who entered an empty store.

Hypothesis 3: Consumers endogenously change the visibility of signaling as social presence changes

We expect to observe some other evidence for the signaling behavior than the change in propensity to buy. The store layout included a centrally placed table with two highly visible signs on it indicating the table carries the selection of more affordable wines under $15. Approaching this table would send a clear single about the customer looking for wines specifically under the $15 mark, which is significantly below the average price of bottle bought in the store (between $17 and $19 for different customer groups). Moreover, as all bottles presented on the table are also available at other shelves in the store, the table is just a conveniently presented combination of cheaper wines, and avoiding it would not limit one's choice, but will make the information about the price range of the bottles you are buying less salient to other shoppers.

For each customer, we count the number of time she approached the table, and estimate the effect of change in the level of social presence on number of times the table was approached, using the length of the shopping trip as the exposure variable[8]. We use the negative binomial distribution, with results presented in table 7, for both the full sample, and the less crowded subsample.

We find more evidence for the asymmetrical behavior between people who entered the store when it was empty versus when it was full. For customers who enter an empty store, higher level of social presence does not significantly impact the number of times they would approach the cheaper selection table. However, if the customers enter the store with other shoppers present, they approach the "cheap table" significantly fewer times when the level of social presence is higher. This holds for both the full and the less crowded subsample; moreover, the subsample's results are more significant and of a larger magnitude for customers who enter a the full store. The pseudo R^2 is also higher for the subsample for both consumer groups, suggesting that removing observations from a more crowded store leads to a better fit of the model.

[8]We ran a simple Poisson regression with very similar results, but slightly lower significance level. The negative binomial distribution is a better for for the data – see figure 5. This is also supported by the goodness of fit test in the Poisson regression (the Lagrange multiplier test), and the likelihood ration test suggests the over-dispersion in the data makes Poisson regression not appropriate.

Table 7. Approaches to the "selection under $15" table, negative binomial regression

	Come in alone		Come in full store	
dependent variable	# of approaches to the "selection under $15" table		# of approaches to the "selection under $15" table	
	full sample	under 3 people present	full sample	under 3 people present
Explanatory variables:				
T (more people)	-0.063	0.073	-0.375**	-0.542***
	(0.266)	(0.271)	(0.171)	(0.187)
female	-0.591*	0.590*	0.116	0.070
	(0.319)	(0.321)	(0.147)	(0.172)
manager's assistance	-0.512	-0.542	-0.261	-0.239
	(0.333)	(0.339)	(0.189)	(0.227)
Controls:	day, time of day, female-assistance interaction, length of visit to the store (exposure variable)			
Pseudo R2	0.0778	0.0810	0.0363	0.0434

We reject the null for people who entered a full store, but are unable to reject for people who entered an empty store. In general, for people who entered a full store the pattern of behavior fits within the status-signaling framework. Specifically, we observe that people are less likely to buy anything, but the mean price of purchased bottles is higher, on average, when more people are present.

Hypothesis 4: The effects of sales clerk assistance depends on the social presence level under the effects of guilt reciprocity

Finally, we check for evidence of guilt reciprocity behavior by looking at how the number of bottles customers expressed interest in changes depending on the level of social presence in the store, along with the probability of buying any of these bottles. Previous research indicates that customers feel guiltier when they believe they have the choice to make a purchase, and when the level of interaction with the salesperson is higher. Picking up a bottle is an indication of consumers considering a choice of whether to buy or not to buy a specific bottle. Controlling for the number of picks, we examine whether receiving assistance, having more people around and, most importantly, the interaction of those two variables of interest has any impact on consumer behavior. The effect of assistance on propensity to buy on its own is not enough to confirm the presence of guilt reciprocity behavior, as assistance can also reduce search costs. We run the above model for both the full and the less crowded sample, and present the results in table 8. As marginal effects of the interaction are not

extremely useful for interpretation as interaction coefficient requires simultaneous changes in two variables, we just provide the coefficients estimates.

Table 8. Probability of keeping a picked up bottle

dependent variable	Come in alone		Come in full store	
	% of keeping a picked bottle			
	full sample	under 3 people present	full sample	under 3 people present
Explanatory variables:				
T (more people)	-0.264~	-0.291~	-0.540***	-0.474***
	(0.179)	(0.202)	(0.149)	(0.165)
manager's assistance	-0.088	-0.103	0.022	0.058
	(0.133)	(0.135)	(0.188)	(0.207)
T - assistance interaction	-0.497***	-0.557***	-0.188	-0.131
	(0.176)	(0.179)	(0.154)	(0.176)
female	-0.235*	-0.188~	0.015	-0.092
	(0.123)	(0.127)	(0.079)	(0.093)
Controls:	day, time of day, length of visit to the store, number of picks			
Pseudo R2	0.1615	0.1647	0.1061	0.1108

The interaction between the level of social presence and assistance from the salesperson is significant at the 1% level for people who enter an empty store, allowing for the separate effect of social presence and managers assistance. It is, however, not significant for people who entered a full store. The results hold for both the full and the less crowded subsamples.

We reject the null for people who entered an empty store, but are unable to for shoppers who came into a full store. Overall, this suggests presence of guilt reciprocity behavior among customers who enter an empty store, but not a full one.

7 Discussion and Concluding Remarks

Using a series of models we estimate the impact of social presence on consumer behavior. Propensity to buy universally and significantly decreases when the level of social presence is higher. In terms of mean price of purchased bottles and of the total spending, customers behave differently based on whether they entered a full or an empty store: the former buy more expensive wines when the level of social presence is higher, and the latter spend less in total. These results, and all results presented in the paper, hold for both the full sample, which includes times when up to eleven people where present in the store at the same time,

and for the less crowded sample, when at most three other customers where in the store at any time during one's shopping.

It is possible that the two groups were anchored to the social presence at the store at the time they enter: in this case, customers entering an empty store might be less aware of people coming in and mostly think about the presence of the manager, which would be more conducive for guilt reciprocity behavior rather than signaling. On the other hand, customers entering a full store are from the onset surrounded by other shoppers, an environment that could potentially prime them for status signaling behavior.

We examine customers' shopping behavior in further detail by considering other support for both signaling and reciprocity behavior. We use the number of times a customer approaches the table of wines clearly labeled as "wines under $10 and $15" to consider whether customers approach it less frequently when more people are present in order to minimize the visibility of their interest in cheaper wines. The fact that all bottles from this table are also available on the other shelves in the store and that the average price for all comparison groups is significantly above $15, made this wine display the perfect spot to examine how consumers modify the visibility of their signaling. We see customers who entered a full store approaching the table significantly fewer times when the level of social presence is higher. We do not find support for status signaling for customers who enter an empty store.

We proceed with examining the guilt reciprocity behavior by seeing how the probability of keeping any bottle the customer expressed an interest in changes with both the number of people present, and the level of assistance provided by the manager. Using the video surveillance data we record all instances of shoppers actually picking up any bottle, for example to examine the label or price more closely, and whether the customer ended up keeping the bottle or not. Controlling for the total number of times the customer picked something up, we see that people who enter an empty store are significantly more likely to keep the bottle provided they received assistance from the sales clerk and there were no other shoppers present. This is independent of the direct impact of being assisted or surrounded by fewer people in the store. This result is consistent with responsibility diffusion lessening the feelings of guilt when more people are present, and the level of assistance playing a strong role in generating the original feelings of guilt. Interestingly, this result does not hold for people who entered a full store – their probability of keeping anything does not depend on the interaction of the number of people present and the level of assistance.

Together, the main results from the Exponential Type II model, on both the extensive and intensive margin, and the auxiliary analysis of other evidence for status signaling and guilt reciprocity suggest people who enter an empty store are more sensitive to the presence of the sales person and thus prone to guilt reciprocity behavior, while customers entering a full store are more prone to status signaling . The intriguing asymmetry we observe could be explained by customers with different preferences over social presence electing to enter either full or empty stores. This is not very likely, as it assumes customers know before entering whether the store is empty or full, and are able to base their decision to shop or not to shop based on this. Alternatively, customers could be primed by the presence of others in the store at the time of entry to be either more sensitive to their interactions with the salesperson or their signaling towards other customers. Given the importance of reference points and priming for a variety of consumer behavior, that seems like a viable explanation.

This research is both useful for the practical purposes of store and retail managers, and for expanding our understanding of how social interactions or just visible presence of other people affects economic behavior. The latter contributes to the ongoing discussion on whether aggregate data can be used to make individual behavior inferences, especially when no information about the level of social presence is available, or whether individual behavior obtained in socially isolated environments such as economic lab experiments reliably translates into aggregate level inferences [Glaeser et al., 2003].

Finally, while we do observe stark differences in consumer behavior depending on the level of social presence, the field nature of the data carries inherent complications as many influences are competing motivations are present among consumers at the same time. To further examine the behavioral mechanisms behind the effects of social presence on purchasing decisions, field data needs to be supplemented with controlled lab and field studies that could isolate the priming, status signaling, responsibility diffusion, and guilt reciprocity impacts on consumer behavior. This paper is the first to our knowledge to examine the effects of social presence on consumer behavior using quasi-experimental exogenous variation in the field and is just a step towards identifying the impacts. While we provide and examine the support for two behavioral mechanisms behind the impact of social presence, the limitations of field data do not allow us to isolate those effects separately or to precisely estimate their relative impact. Those challenges provide ample room for further research on the issue.

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