Strategic Obfuscation and Price Fairness*

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Abstract

Firms are increasingly using technology to enable targeted, or "personalized" pricing strategies. In settings where prices are transparent to all consumers, however, there is the potential that inter-personal price differences will be perceived as inherently unfair. In response, firms may strategically obfuscate their prices so that direct interpersonal comparisons are more difficult. In this article, we conduct an experimental analysis of strategic obfuscation in an environment in which price transparency varies exogenously and endogenously, and consumers are inherently inequity-averse. We find that obfuscating price information among buyers can be effective in alleviating peer-induced fairness concerns, and increase the likelihood that price offers are accepted. Sellers understand that buyers are inequity-averse, and that buyers are aware of the incentives present to obfuscate price offers. As a result, equilibrium prices are higher when a firm chooses to obfuscate prices, but they remain constrained by perceptions of distributional fairness between buyers and sellers.

Keywords: fairness, inequity aversion, price discrimination, retail pricing, experimental economics
JEL Codes: D43, L13, M31

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1 Introduction

Despite advances in technology that facilitate "personalized pricing," a seller’s ability to set prices according to each buyer’s willingness to pay (WTP) is constrained by perceptions that the price charged is inherently unfair (Garbarino and Lee 2003; Bolton, Warlop, and Alba 2003; Xia, Monroe, and Cox 2004). In order to ameliorate this perception, sellers can allow buyers to participate in the price-formation process (Haws and Bearden 2006; Sahay 2012; Richards, Liaukonyte, and Streletskaya 2015), frame price differences as something other than price discrimination (Kannan and Kopalle 2001; Darke and Dahl 2003; Weisstein, Monroe, and Kukar-Kinney 2013) or create perceptions that the buyer is receiving something additional for paying a higher price (Sahay 2012). In this study, we consider another potential means of overcoming perceptions of unfairness: Strategic obfuscation, or simply making it difficult for buyers to form expectations of what constitutes a fair price.

Strategic obfuscation commonly refers to sellers either increasing the complexity of the pricing structure (Muir, Seim, and Vitorino 2013), tailoring prices for specific individuals, or creating different versions of the same product with the express purpose of preventing price-comparison (Ellison and Ellison 2009). For example, the "Your Secret Price" function offered by Hotels.com to loyal customers is one means of creating personalized prices that others may not see, unless they happen to compare offline. Moreover, soft drink manufacturers offer dozens of variants of each sub-brand, often carried in slightly different multi-packs or container sizes specific to a single retailer. Without the ability to comparison shop, consumers pay more (Richards, et al. 2016). If obfuscation is effective at raising search costs, then it may also prevent buyers from comparing prices, and alleviate perceptions of price inequity. In this study, we examine the role of obfuscation in reducing interpersonal price-fairness concerns, and use a lab experiment to empirically determine the effect of obfuscation on perceived fairness, purchase intentions, and equilibrium prices between buyers and sellers.

Consider another prominent example. Perhaps no other pricing system in our economy is more opaque, or customized pricing more prevalent, than in the airline industry (McAfee and Te Velde 2006). A common adage holds that if a passenger were to ask everyone else in his or her row what they each paid for their seat, no two answers would likely be the same. Flyers do not complain much about differential pricing by airlines simply because they don’t ask what others paid – asking is simply not common in our society, and airlines know and exploit that fact. What if there was a price tag displayed prominently above each seat? Would airlines price differently? With full transparency, and inequity-averse buyers, we suspect they may.
Inequity aversion is likely to be an important reason why interpersonal price differences matter. Quite simply, economic agents, regardless of their role, are inherently averse to differential treatment, or outcomes (Hatfield, et al. 1978). For example, Fehr and Schmidt (1999) use the concept of inequity aversion in an economic setting to explain why public good contributions tend to be much larger in reality than predicted by theory. Retail transactions, however, do not involve public goods. Ho and Su (2009) and Ho, Su, and Wu (2014) refine the concept of inequity aversion in a way that is more appropriate for commercial transactions by considering both distributional fairness – or concerns regarding how the total surplus to a transaction are divided between the buyer and seller – and peer-induced fairness, which captures how buyers feel about paying prices that differ from other buyers. Ho, Su, and Wu (2014) are able to disentangle the distributional fairness and peer-induced fairness effects not only to understand how willing recipients are to accept differential prices, but how their expected responses condition sub-game perfect equilibrium prices. In their model, however, the mechanism by which the price signal is transmitted among buyers is obscured by some unspecified, exogenous event.

In reality, with inequity-averse buyers, the extent of price transparency is endogenous as sellers, in the wake of the ill-fated experiment by Amazon in 2000, fully understand how buyers feel and how they should respond optimally. Complete price transparency is likely to have a dramatic effect on the equilibrium distribution of prices. Individualized prices for prescription insurance (Frank and Newhouse 2008) or add-ons to relatively standard items (Ellison 2005) not only raise search costs as in Ellison and Ellison (2009), but they also obscure comparisons among peers who would otherwise be offended by paying more than their peers in the same situation. In this sense, sellers may use strategic obfuscation to avoid fairness-based barriers to individual pricing, without the need to negotiate prices. In this paper, we develop an empirical model that includes considerations of both distributional and peer-induced fairness on the buying-side, and endogenizes seller decisions regarding both the price to charge, and the decision to obfuscate. Ours differs from previous empirical models of inequity aversion and price fairness (Ho and Su 2009; Ho, Su, and Wu 2014) by isolating the effect of obfuscation as a means of overcoming consumer aversion, and how this may affect equilibrium pricing outcomes.

We test the predictions of our conceptual model of strategic obfuscation using a two-sided experiment in which subjects play the role of either a price-discriminating seller, or a utility-maximizing buyer. We use a laboratory environment because it provides the ability to separate consumer fair-

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1Strategic obfuscation is related to the framing argument of Weisstein, Monroe, and Kukar-Kinney (2013), as framing may be interpreted as obfuscation, but our model is more general, and focuses on the precise mechanism involved in reducing fairness concerns.
ness from other confounding effects (reciprocity, betrayal, altruism, etc.) present in transactional data. In particular, buyers decide whether or not to accept the price offer made by the seller while the level of interpersonal price transparency is varied both exogenously, and endogenously. We model exogenous price obfuscation by allowing subjects to have complete knowledge of what others pay, a fuzzy signal of what others paid, or no information at all. Endogenous price obfuscation is examined by allowing the seller to pay to obscure prices between buyers, so both the level of obfuscation and prices are endogenously determined. We use an incentive compatible design so that the participants’ actual monetary payment is directly proportional to the wealth they accumulated during the experiment.

We find that peer-induced fairness concerns are an important obstacle to charging personalized prices, but obfuscation can help sellers mitigate buyers’ aversion to inequity, even when they are aware that the supplier is doing so. When we allow for endogenous behavior by sellers, our core hypothesis is supported, namely that prices are higher when obfuscation is used in a strategic way. Although finding that limits to transparency can lead to higher prices is to be expected in a model of active consumer search, it is less obvious that equilibrium prices can rise even when buyers are aware of the incentives faced by sellers.

We contribute to both the conceptual and empirical literatures on price fairness by introducing obfuscation as a means by which sellers ameliorate buyers’ peer-induced concerns to implement a personalized pricing platforms. To this point, the literature on interpersonal perceptions of price fairness has taken price transparency as a given. However, in many settings sellers are able to utilize technologies that ensure prices are specifically targeted to individual buyers, or invest in product variants that make direct price comparisons more difficult. We explicitly consider the effect of these decisions on equilibrium prices. Further, while the mechanisms that underlie perceptions of price fairness are by now relatively well-understood (Xia, Monroe, and Cox 2004), there is little research on how these perceptions manifest in purchase decisions, or in optimal seller responses, despite evidence that equilibrium prices are likely to be fundamentally different if rational sellers take into account the fact that inequity-averse buyers may not purchase if they think they are being taken advantage of (Anderson and Simester 2008; Rotemberg 2011). Our findings on the decision to obfuscate add another level of realism to the conceptual fairness literature, and its practical importance. We also contribute to the empirical literature on price fairness. Our estimates of the importance of distributional and peer-induced fairness are obtained in an environment in which sellers can endogenously obfuscate prices. Estimating these effects together removes an important
element of bias that may have confounded previous estimates of the relative importance of each fairness concept in driving players’ fairness perceptions, and purchase decisions.

The remainder of the paper is organized as follows. In the next section, we provide some background on the concepts of obfuscation and fairness, and use this conceptual framework to develop hypotheses regarding the ability of firms to mitigate adverse perceptions of price unfairness by limiting price transparency. We describe the experiments used to test these hypotheses in the third section, and summarize some of our preliminary findings. Our econometric approach to testing the hypotheses more formally is developed in a fourth section, while a fifth presents the estimation results and draws some implications for our primary findings on the value of strategic obfuscation.

2 Conceptual Background

2.1 Obfuscation

Ignorance as a source of market power has been well understood since Scitovsky (1950). If firms are able to make price-comparison difficult or costly, they will be more likely to sell to buyers unwilling to search for the true price. However, our notion of strategic obfuscation is different. In the extant literature, there are two types of obfuscation: (1) adding attributes to obscure the true nature of the product (Ellison 2005; Gabaix and Laibson 2006; Ellison and Ellison 2009; Kalayci and Potters 2011), or (2) making the pricing structure itself sufficiently complex that buyers have difficulty determining the true price (Carlin 2009; Wilson 2010; Wilson and Waddams-Price 2010; Chioveanu and Zhou 2013; Muir, Seim, and Vitorino 2013). If interpersonal price comparisons do indeed represent a significant barrier to a firm’s ability to price discriminate, then reducing price transparency represents another potential source of market power. While our concept of obfuscation is clearly related to the others, there are important differences.

Much of what we know about strategic obfuscation is based on settings in which firms are able to vary the attributes of their product such that direct price comparisons are difficult, or at least more costly (Ellison 2005; Gabaix and Laibson 2006). If firms have the ability to "add-on" features that raise the final price, but are not necessarily advertised, they can use these to price discriminate in a competitive environment (Ellison 2005). Add-ons give rise to an adverse selection effect: The additional profits due to add-ons are not bid away because prices are pushed sufficiently far apart that the firm attracts a large number of "cheapskates" to the base product,

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2 Ellison and Wolitzky (2012) describe a more general form of obfuscation that can include both attribute and pricing obfuscation as special cases. They show that it is individually-rational for firms to obfuscate in a competitive model of costly search and oligopolistic rivalry.

3 "Versioning" is a type of obfuscation through attribute variation in which the intent is to induce consumers to self-select into higher or lower-priced variants where the difference is unrelated to cost (Varian 1997).
and sufficient others willing to buy the add-on so that profits are sustainable in a competitive equilibrium. However, competitors should still be able to reveal the nature of these add-ons and remove any profit opportunities. Nonetheless, Gabaix and Laibson (2006) show that when the market consists of a substantial number of naive buyers who are unaware of the add-on premium, add-ons can proliferate in equilibrium. Essentially, add-ons are a form of strategic obfuscation as they are intended to raise the effective price of an item without affecting the "shelf price" or the price that buyers initially see when searching across products. Because adding features to mass-produced buyer products is often not possible, these models describe a special case that is not typical of most retail markets. Moreover, empirically, strategic obfuscation through attribute complexity is difficult to identify independent from mere differentiation (Kalayci and Potters 2011). Therefore, we focus on obfuscation through price transparency.

Prices are not transparent in many important markets. For example, Carlin (2009) studies price dispersion in financial markets. Using an oligopoly search model, he shows that prices rise in the complexity of the price structure, and interprets complexity as strategic obfuscation. Somewhat counter-intuitively, he shows that as the number of firms grows, then the market does not necessarily become more competitive as the degree of complexity increases, and hence obfuscation, rises accordingly. The reason is straightforward: as more firms enter, each firm receives a smaller share of expert buyers. Therefore, their best response is to increase the level of complexity in order to increase rents from uninformed buyers when they do not "win" the expert buyers. Since each firm has the same incentive to do so, the fraction of informed buyers falls as firms enter – complexity tends to reduce competition more generally. Firms actively manage the level of obfuscation as the proportion of uninformed buyers is endogenously determined by the complexity choices made by the firms. Further emphasizing the strategic nature of obfuscation, Wilson (2010) describes a theoretical model in which firms are asymmetric, and use obfuscation in order to separate themselves from other firms, which he terms "prominent" firms, that choose to remain easily searchable and transparent. Agents with positive time costs first search the rival (prominent firm), which raises its price, and softens competition for the customers that choose to search beyond the most immediately transparent firm. The prominent firm has no incentive to obfuscate because doing so reduces profits to both firms, so the profits due to obfuscation are not bid away in a Nash equilibrium. However, equilibrium prices are lower with obfuscation in his model, so he describes a different outcome than we have in mind here.

Others predict that complex pricing structures can lead to higher equilibrium prices. In fact, how prices are framed can affect complexity (Spiegler 2006; Piccione and Spiegler 2012; Chioveanu
and Zhou 2013), where price framing refers to how prices are presented to the buyer. Namely, prices and quantities may be stated in units of measure that make it difficult to compare across products – interest rates quoted in various time units, or nutritional content of food products being specified in various units of weight or volume. Chioveanu and Zhou (2013) find that, in equilibrium, firms randomize their choice of price frame in order to reduce the elasticity of demand, and sustain positive profits. Firms choose both frame differentiation, and frame complexity, so there is 2 separate dimensions as to how obfuscation enters the model. Similarly, using the bounded-rationality assumption of Spiegler (2006), Piccione and Spiegler (2012) argue that when firms compete in prices and complexity, prices will not fall to the competitive level, even when the products are homogenous. The same holds true in a service context as Muir, Seim, and Vitorino (2013) find empirical evidence that more complex pricing structures are responsible for higher search costs, greater price differences among suppliers, and higher markups. Obfuscation in services such as this is common, but it is difficult to disentangle what is horizontal differentiation from complexity in pricing schedules.4

Clear separation between complexity and differentiation is perhaps best achieved in the lab. For example, Kalayci and Potters (2011) induce subjects’ preferences for an hypothetical good, so are able to hold willingness-to-pay constant while varying the complexity of the pricing terms. Complexity is still described in terms of the number of attributes their subjects must consider in comparing products, but attributes do not affect utility. Allowing complexity to vary randomly over a series of product choices is another alternative (Sitzia and Zizzo 2009). Using this approach, Sitzia and Zizzo (2009) attempt to disentangle subjects’ aversion to complexity from their sense of being exploited, and find no evidence of complexity aversion, and only weak evidence in support of their exploitation hypothesis. We also model obfuscation in a lab environment, but avoid confounding attribute and price complexity by offering subjects fuzzy signals defined over prices only, with no variation in product attributes.

Nonetheless, these experiments do contribute to a growing body of literature that examines whether there is empirical support for strategic obfuscation – a literature that also includes investigation using secondary data (Ellison and Ellison 2009; Wilson and Waddams-Price 2010). Other than Sitzia and Zizzo (2009), the evidence shows that strategic obfuscation is an empirical regularity in many real-world markets, whether online or offline. However, there is no empirical research that considers the role that pricing complexity plays in obscuring interpersonal comparisons that we describe. This is perhaps surprising given the prominence of price-fairness research both in mar-

4Piccione and Spiegler (2012) argue that their approach provides a new interpretation of differentiation that admits perceptual differentiation through framing complexity.
keting and economics, and with the increased focus on social interaction and economic outcomes in
general (Amaldoss and Jain 2005a, b; Brock and Durlauf 2007; Godes and Mayzlin 2009). In this
paper, we synthesize these two literatures to arrive at a more general model for how interpersonal
equity can affect firms’ ability to price discriminate.

2.2 Fairness

Identifying the effect of obfuscation as a barrier to price discrimination means controlling for how
buyers regard the fairness of retail prices. Indeed, perhaps due to its fundamental importance to
the viability of any pricing system, price fairness has assumed a prominent place in both economics
(Rotemberg 2011) and marketing research (Xia, Monroe, and Cox 2004). This literature reveals a
number of factors that determine how price-fairness perceptions are formed: buyers’ perceptions
of seller’s cost (Kahneman, Knetsch, and Thaler 1986a, Vaidyanathan and Aggarwal 2003; Darke
and Dahl 2003; Bolton, Warlop and Alba 2003; Bolton and Alba 2006), buyers’ previous experience
with the product or seller (Darke and Dahl 2003; Bolton, Warlop and Alba 2003; Shehryar and
Hunt 2005; Rondan-Cataluna and Martin-Ruiz 2011), cultural differences among buyers (Bolton
et al. 2010), competitor prices (Bolton, Warlop and Alba 2003), loyalty to the retailer (Martin,
Ponder, and Lueg 2009), the procedures used to set prices (Maxwell 2002; Xia, Monroe, and Cox
2004; Shehryar and Hunt 2005; Kukar-Kinney, Xia, and Monroe 2007; Tsai and Lee 2007), the
motives inferred for setting prices (Campbell 2007), any perceived violation of social norms in price
setting (Garbarino and Maxwell 2010; Maxwell and Garbarino 2010), and interpersonal differences
in prices (Ordóñez, Connolly, and Coughlan 2000; Darke and Dahl 2003; Haws and Bearden 2006;
Anderson and Simester 2008; Ashworth and McShane 2012). Although each of these factors is
clearly important in forming impressions of price fairness, we focus on interpersonal comparisons
as price transparency is one of the key defining features of discriminatory pricing in modern, multi-
channel, social, and mobile platforms.

Retail prices can evoke feelings of unfairness among buyers for a number of reasons. Kahneman,
Knetsch, and Thaler (1986a, b) argue that buyers are motivated by a sense of dual entitlement. Their
theory maintains that buyers’ perceptions of price fairness are governed by the notion that firms
are expected to earn a reference level of profit, and buyers expect to pay a reference price. If buyers
believe that a price increase is driven by higher demand – a snowstorm raising the demand for
shovels – then the price is more likely to be viewed as unfair than if it were driven by higher costs
of selling shovels. While interpersonal notions of equity are implicit in the reference price in dual
entitlement theory, equity theory (Adams 1965; Bagozzi 1975; Oliver and Swan 1989) makes such
comparisons explicit as a basis for evaluating the fairness of a price. According to equity theory, the perception of a deal is guided by the reasoning that “...exchanges tend to be perceived as fair when the ratio of costs and benefits is the same for all participants...” (Darke and Dahl 2003; Xia, Kukar-Kinney, and Monroe 2010). While this interpretation of equity theory relies on outcomes, or distributive justice, prices that are set according to rules that are deemed to be unfair are regarded as violations of procedural justice (Thibault and Walker 1975; Martin, Ponder, and Lueg 2009). Maxwell (2002), for example, finds that buyers will regard prices as more fair, and more willing to purchase from one seller relative to another, if they are aware of the rules used to set prices. Procedural justice, however, is often judged specific to an industry or market as perceptions of justice are made relative to social norms that have evolved differently from one context to the next (Xia, Monroe, and Cox 2004; Maxwell and Garbarino 2010).

Social norm theory explains why airline passengers do not appear to mind paying different prices from peers for nearly identical seats, while Amazon was forced to abandon their attempt to price DVDs the same way in 2000 (Garbarino and Maxwell 2010). Regardless of social norms, buyers are more likely to be satisfied with the price they paid if they feel they received a "good deal" (Darke and Dahl 2003). Transaction utility theory (Thaler 1985) maintains that buyers obtain some benefit simply from the perception that they paid less than their reference price – and reference prices can be established through interpersonal comparisons. In the context of discriminatory pricing, each of these theories would predict that price transparency – knowledge of what others paid – can lead to perceptions of inequity through any one of a number of mechanisms. In this research, we examine the implications of peer-induced fairness concerns on market outcomes, and consider how obfuscation can support a system of discriminatory pricing.

Central to any model of price fairness is the notion that buyers, either explicitly or implicitly, have some sort of reference price they use to assess whether or not a price is fair. Quite simply, fairness is not an absolute concept. Buyers form benchmarks, or reference prices, in a number of ways: By recalling previous transactions, observing competitor prices, from an understanding of seller costs, or by observing the prices paid by other shoppers (Briesch et al. 1997). Indeed, for products that are purchased infrequently, are sufficiently unique that there are no real competitors, or if the costs of production cannot plausibly be known, prices paid by others is a logical benchmark for evaluating how fair a retail price is (Vaidyanathan and Aggarwal 2003; Haws and Bearden 2006; Anderson and Simester 2008). Furthermore, Amaldoss and Jain (2008, 2010) show that the presence of reference effects can motivate firms to add costly features which provide limited benefit to consumers and induce product proliferation. In the reference price literature, however, benchmarks
are likely to be uncertain as buyers do not have perfect knowledge regarding what others paid, or even what they paid in the past (Terui and Dehana 2006; Koszegi and Rabin 2006). Therefore, in this research we simulate both the notion of a reference price, and the uncertainty buyers have over what their reference price should be, by presenting them with either exact information of what others paid (Weisstein, Monroe, and Kukar-Kinney 2013, for example), or a range in which the other's price falls into. By examining behavior under varying levels of transparency, we are able to isolate the effect of obscuring others’ prices on purchase behavior.

Obfuscation is likely to be important in an online environment as discriminatory pricing through internet-based retail platforms invites buyers to compare the price they paid with others. Interpersonal differences in price are likely to be among the more salient drivers of fairness perceptions online as discriminatory pricing relies on interpersonal differences in WTP in order to extract the most surplus from the market (Gelbrich 2011). Providing context for interpersonal comparisons is critical in establishing expectations that a system of pricing will yield outcomes that are, while not always similar among buyers, at least acceptable (Ordóñez, Connolly, and Coughlan 2000; Darke and Dahl 2003; Anderson and Simester 2008; Ashworth and McShane 2012). Perceptions of unfairness, however, do not necessarily mean that a system of discriminatory pricing is inherently untenable. Weisstein, Monroe, and Kukar-Kinney (2013), for example, show that framing prices in terms of "dollars off" or "% off" can reduce the perception that the price gap between one buyer and another is unfair, and can improve the level of trust in the vendor. On the other hand, Piccione and Spiegler (2012) also show that framing can be an effective means of obfuscation. In this study, we do not consider framing per se, but our method of inducing complexity is sufficiently general to admit framing as a special case of price-obfuscation.

Few studies link perceptions of price fairness to choice or market demand. Connecting fairness perceptions and demand is critical to understand whether a discriminatory pricing regime will succeed or fail. Among those who do consider this question, Anderson and Simester (2008) use a large-scale, choice-based, field experiment to study the question of why retailers do not offer premium prices for larger-size clothing, even when they typically pay wholesale premiums for plus sizes. They find that buyers of sizes that marginally qualify as "large" perceive premiums as unfair, and are less likely to buy as a result. Anderson and Simester (2010) find that customers react by making fewer subsequent purchases if they buy a product and later observe the same retailer selling it for less, attributing this effect to buyer antagonism. Losing some customers, however, does not necessarily mean that discriminatory pricing is suboptimal as Courty and Paglier (2010) find that price variation in response to temporal changes in demand at an internet cafe may antagonize
customers, but, in fact, increases net demand as the elasticity of demand is inversely related to its level. If perceptions of price fairness affect demand, then rational sellers should respond accordingly. Rotemberg (2011), for example, argues that optimal pricing is constrained by considerations of fairness. Therefore, we incorporate both perceptions of fairness, and endogenous pricing, in our strategic obfuscation experiment.

3 Experiment Design and Procedure

To our knowledge, no previous study focuses on how a seller’s strategic obfuscation decision effects buyers’ perceptions of price fairness and their subsequent purchase decision. Ho, Su, and Wu (2014) study how distributional and peer-induced fairness interact and influence economic outcomes in a supply chain. When both types of fairness concerns are present they find that peer-induced fairness concerns are more salient than distributional fairness concerns. However, they do not account for different peer-induced fairness responses from advantaged (low price) versus disadvantaged (high price) subjects, nor allow for the possibility that sellers may choose to obfuscate prices. Our experiment uses an interactive trading environment to observe buyers’ fairness perceptions and the effect strategic obfuscation has on equilibrium prices.

The market experiment consists of subjects who play the role of either a seller, who sets prices for a fictitious good, and in some cases, makes an obfuscation decision, as well as buyers who decide whether to accept the price offer or not. Participants are randomly assigned to these roles at the beginning of the experiment and interact with each other over several periods in a two-sided, incentive-compatible environment. In particular, a single seller is randomly and anonymously matched every period with 2 different buyers using networked computers. The random matching allows for the possibility that the same buyer-seller match occurs, however, anonymity is imposed so participants are not aware who they are matched with in any period. This anonymous matching is used to eliminate collusion, reciprocity, reputation effects, and other dynamic strategic behavior (Ho, Su, and Wu 2014; Yuan, Gomez, and Rao 2013; Lim and Ho 2007; and Amaldoss, and Rapoport 2005). Each period, therefore, represents a one-shot game with the decisions made in a single period independent from all the others.

The design includes three exogenous treatments where price transparency is fixed, and two endogenous treatments that provide sellers the opportunity to decide whether or not to obfuscate prices. Table 1 summarizes the five treatments. Under the exogenous treatments the price ob-

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5Participant interaction was facilitated using the ztree software which is the Zurich Toolbox for Readymade Economic Experiments (Fischbacher 2007).
fuscation is: none (a buyer observes his own, and his peer’s price offer), full obfuscation (a buyer only observes his own price offer), and partial obfuscation (a buyer observes a randomly generated price range around his peer’s price offer\(^6\)). We endogenize the price obfuscation decision in separate treatments. In both treatments, if the seller does not pay the obfuscation cost the 2 buyers she is paired with have complete price transparency. Alternatively, the seller can choose to pay the added cost so the prices are fully obscured in treatment 4, or partially obfuscated in treatment 5 (analogous to the partial obfuscation used in treatment 3). Buyers are aware of the obfuscation decision made by the sellers. Together, the treatments are designed to elicit information on sellers’ wealth allocation, and observe buying behavior under different price obfuscation scenarios. This will allow us to disentangle buyer’s distributional and peer-induced fairness responses as well as observe whether buyers’ reactions differ based on being in the advantageous or disadvantageous position.

Table 1: Summary of Experiment Treatment Design.

<table>
<thead>
<tr>
<th>Exogenous Obfuscation</th>
<th>Treatment 1</th>
<th>Treatment 2</th>
<th>Treatment 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peer Price Obfuscation:</td>
<td>Full</td>
<td>None</td>
<td>Partial</td>
</tr>
<tr>
<td>Endogenous Obfuscation</td>
<td>Treatment 4</td>
<td>Treatment 5</td>
<td></td>
</tr>
<tr>
<td>If paid</td>
<td>Full</td>
<td>None</td>
<td>Partial</td>
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<tr>
<td>If not paid</td>
<td>None</td>
<td>None</td>
<td>Partial</td>
</tr>
</tbody>
</table>

In each period, a seller sets two separate prices based on 2 different, random WTP draws from a uniform distribution with a minimum of $50\text{EC}$ (experiment credits) to $150\text{EC}$. To avoid buyers making judgements about the likelihood they received the lower WTP relative to their peer, participants were not informed of the upper limit of WTP. A buyer observes his own WTP for that period, and the price the seller offers. Depending on the treatment a buyer may or may not observe information about the prices offered to the other buyer. Each buyer then decides whether or not to accept the price. If the offer is rejected, both the seller and buyer earn nothing. If the offer is accepted, the buyer obtains the difference between his WTP and the price, while the seller keeps an amount equal to the price minus a fixed cost of $50\text{EC}$. All subjects are aware of the seller’s cost, so the amount of profit retained by the sellers is known. Once all buyers make their decision, a surplus / profit screen shows the amount each subject earns, and the accumulated earnings. This procedure, and its relationship to the treatment summary provided in table 1, is summarized in

\(^6\)The randomly generated price range is created by drawing 2 random values from a uniform distribution: One draw is added to the other buyer’s price, and one subtracted from it. In this way, the other buyer’s price has an equal chance of being anywhere within the observed range. This serves as a "fuzzy price signal".
In order to motivate the participants to make thoughtful, realistic decisions during the experiment, an incentive-compatible design is used. Prior to starting we explained that subjects could earn an additional $0 - $10 based on their total profit / surplus at the end of the experiment (see Appendix A for additional details).\(^7\)

Figure 1: Summary of Treatment Process and Design

We recruited 228 subjects (~ 47 for each treatment) from a large Eastern University in the United States. Each of the 5 treatments were conducted in two sessions with ~ 20 periods per session for a total of 3,498 observed transactions. Of the subjects assigned to the seller role, nearly 50% had retail work experience. After the instructions were given, we conducted 2 practice rounds to familiarize participants with their role and the process. Prior to starting, subjects were asked privately (i.e. on their computer screen) if they understood, and encouraged to ask any remaining

\(^7\)Subjects were paid $20 for their participation in experiment, which was the minimum we could pay based on the experimental lab’s guidelines.
questions. All participants indicated that they did in fact understand. We feel confident that the participants recruited to take part in the study understood the experiment and made decisions consistent with a manager facing this same simplified market scenario. For approximately 60 minutes, subjects traded for as many periods as possible. In order to avoid end-game behaviors, subjects were informed that the experiment would last for approximately 60 minutes, but did not know which period was the last until it was already over (Yuan, Gomez, and Rao 2013; Zwick and Chen 1999). This approach is preferable to a known fixed number of periods because it allows for the maximum number possible within the 60 minute time frame, and does not require that the last period be discarded.

In summary, when fairness concerns are present they reduce a buyer’s utility and require the seller to compensate through lower prices, or offering more surplus. If obfuscation is effective at reducing fairness concerns then we will observe higher equilibrium prices as a result. In treatment 1 buyers only observe their own price so distributional fairness is present, but peer-induced fairness concerns will not play a role in the price offer’s acceptance. Equilibrium prices in treatment 1, therefore, should be higher than treatment 2 since it has complete price transparency so both distributional and peer-induced fairness concerns are present. Buyers’ peer-induced fairness reaction when a fuzzy price signal is observed in treatment 3 is an empirical question. Finally, in treatments 4 and 5, the seller has the option to obfuscate prices which allows her mitigate the two buyers’ peer-induced fairness concern. However, buyers are aware of the decision made by the seller and understand her incentive to obfuscate so their distributional fairness concerns may change as a result. By varying the degree of price obfuscation across treatments, our experiment is able to disentangle the effects of distributional fairness, peer-induced fairness, and obfuscation on equilibrium prices. Because the net effect depends on the relative importance of each form of fairness, the resolution is an empirical question, answerable only by controlling appropriately for all other, potentially confounding, influences.

4 Empirical Model of Peer-Induced Fairness

In this section, we describe the empirical model used to test for the relative importance of distributional and peer-induced fairness. Our model is similar to Ho and Su (2009), but we allow for strategic obfuscation, thereby endogenizing both the pricing and obfuscation decisions made by the seller. In addition, the model disaggregates peer-induced fairness concerns based on whether the buyer experiences advantageous inequity (receives a lower price quote), or disadvantageous inequity (receives a higher price offer) following Fehr and Schmidt (1999).
The nature of the game played between sellers and buyers is relatively simple: In the first stage, a seller observes her two buyers’ WTP and sets the prices (and decides on an obfuscation strategy in treatments 4 and 5). In the second stage, buyers observe their offers (and perhaps the other buyer’s price), and make a decision to accept or reject the transaction. The markets clear, and equilibrium profits and surplus are realized. We describe the model by backward induction, from the buyers’ decisions back to the seller’s. We begin by describing the empirical model we use to estimate buyer behavior, and follow with the seller model.

4.1 Buyer-Response Model

Buyer utility is formed conditional on the first-stage decision made by the seller. In the second stage, buyers decide whether or not to make a purchase decision given the seller’s price offer. Within the experiment a buyer’s utility will depend on the difference between his WTP for the item and the price offered, or the amount of buyer surplus ($CS_j$). Utility also depends on the buyer’s intrinsic concern for the total profit retained by the seller ($DS_j$), as well as the prices quoted to other buyers in either an advantageous inequality ($AI$) or disadvantageous inequality ($DI$) state. In our setting, the utility for buyer $j$ is given by:

$$U_j = \begin{cases} \beta_0 + \sum_T \left\{ \alpha_T CS_{jT} + \delta_T DS_{jT} + \rho_{AI,T} AI_{jT} + \rho_{DI,T} DI_{jT} + \eta_T OB_{iT} \right\} + \varepsilon_j & \text{if accept} \\ 0 & \text{if reject} \end{cases}$$

All of the parameters in equation (1) are allowed to vary by treatment, $T$, except the constant, $\beta_0$, which is fixed across all treatments. For ease of exposition we suppress the treatment subscript, $T$, hereafter. Buyer surplus is measured by: $CS_j = W_j - p_j$, where $W_j$ is the exogenously-determined WTP, and $p_j$ is the seller’s price offer to individual $j$.\(^8\)

The remaining variables in the consumer utility function capture subjects’ response to concerns regarding distributional fairness, or peer-induced fairness.\(^9\) Specifically, the total profit retained by the seller is defined as $DS_j = \pi^{seller} - CS_j$, or the difference between the payoffs the seller retains and the buyer receives (Ho and Su 2009).\(^10\) If $DS_j > 0$ the seller keeps a larger portion of the total available wealth than is offered to the buyer. As $DS_j$ rises the price offered to the buyer is more distributionally unfair. The seller’s exogenous cost of selling, $c$, is fixed at $50EC$, or the lower limit of the WTP distribution. With this definition, the coefficient on $DS_j$ is given by $\delta$, which

\(^8\) At the end of the experiment the buyers are compensated in real dollars based on their total accumulation of buyer surplus.

\(^9\) Demographic information was collected from the participants but did not have a statistically significant effect on the buyers’ decision to accept the price offer.

\(^10\) Seller profit, $\pi^{seller}$, is the difference between prices paid by the buyer and cost, $c$, if the buyer accepts the price offer.
captures the importance of distributional fairness to the buyer when deciding whether or not to accept the price offer, all else constant. Because the seller determines the allocation of wealth, her share is expected to always be positive, so the marginal utility associated with $DS_j$ is negative ($\delta < 0$) if buyers are concerned about distributional fairness.

We measure buyers’ peer-induced fairness concern by defining advantageous inequity as the absolute value of the difference between the price a buyer is asked to pay and what the other buyer’s offer is, or: $AI_j = \max(- (p_j - p_{-j}), 0)$ if $j = L$ (i.e. the buyer received the lower price offer), and disadvantageous inequity is: $DI_j = \max(0, p_j - p_{-j})$ if $j = H$ (i.e. the buyer received the higher price offer). In equation (1) the parameter $\rho_{DI}$ represents the marginal (dis)utility associated with disadvantageous inequity, and $\rho_{AI}$ the marginal (dis)utility from advantageous inequity. By estimating separate parameters for advantageous and disadvantageous buyers, we test Fehr and Schmidt’s (1999) hypothesis that concern for peer-induced fairness differs across buyers (i.e. $\rho_{DI} \neq \rho_{AI}$).

In treatments 4 and 5, sellers have the option of obfuscating prices. In the absence of obfuscation buyers observe both their own price, $p_j$, and the price of the other buyer, $p_{-j}$. However, buyers are aware of seller $i$’s obfuscation decision, or lack thereof, so a binary variable, $OB_i$, is included whose parameter captures buyers’ average response to the seller’s obfuscation decision. Namely, if $\eta_T < 0$ the seller’s decision to obfuscate the prices decreases the likelihood the buyer accepts the price offer, all else constant. When prices are obfuscated, buyers do not see the other’s price, so $\rho_{AI} = \rho_{DI} = 0$. Removing the possibility of peer-induced fairness concerns across treatments, therefore, helps identify the effect of pricing asymmetry on buyer behavior.

Recognizing that buyers may have heterogenous preferences and fairness concerns, we allow all the parameters in equation (1) to vary randomly over subjects. Each parameter is assumed to follow a normal distribution, where the mean of each parameter is interpreted as the average response across buyers, while the standard deviation captures the degree of response-heterogeneity. Assuming that the stochastic demand component, $\varepsilon_j$, is Type I Extreme Value distributed, the demand model in equations (1) is estimated as a random coefficient logit model using simulated maximum likelihood with 500 Halton draws.

### 4.2 Seller-Decision Model

Next, we estimate a model describing the sellers’ behavior, both with respect to the offered price and the decision to obfuscate, which captures their equilibrium response to expectations regarding
buyer behavior. In the first decision-stage, sellers choose a price conditional on the exogenously-drawn buyers’ WTP, $W_j$, and, in treatments 4 and 5, whether or not to obfuscate.

The equilibrium pricing decisions for the exogenous and endogenous-obfuscation treatments are written as:

$$p_{ijT} = \gamma_0 + \sum_T \left\{ \gamma_{1T}W_{jT} + \gamma_{2T} (W_{jT}D_{L,T}) \right\} + \epsilon_j \quad \text{if } T = 1, 2, \text{ or } 3;$$

$$p_{ijT} = \gamma_0 + \sum_T \left\{ \gamma_{1T}^{OB}W_{jT}^{OB} + \gamma_{2T}^{OB} (W_{jT}D_{L,T}^{OB}) \right\} + \gamma_{3T}^{OB} (W_{jT}D_{L,T} (1 - OB_i)) + \epsilon_j \quad \text{if } T = 4, \text{ or } 5;$$

where $p_{ijT}$ is the price the $i^{th}$ seller quoted the $j^{th}$ buyer in treatment $T$.\(^\text{11}\) We allow the parameters in equation (2) to vary by treatment, while the constant term, $\gamma_0$, is fixed across treatments. The treatment subscript is suppressed hereafter. Each seller is paired with 2 buyers who have separate randomly drawn WTPs. We expect equilibrium prices to depend on the value of the random WTP draw for each buyer, $W_j$, and whether the seller is setting the price for the advantageous, or lower WTP buyer. Because the seller faces two buyers, each potentially able to see the price offered to the other, the seller has to anticipate that the buyers will respond differently depending on whether they perceive themselves to be disadvantaged. In the pricing model, the dummy variable $D_L = 1$ if the buyer received a lower WTP relative to the other buyer. We expect $\gamma_{2T} > 0$ because sellers are more likely to offer the buyer with the lower WTP a smaller surplus relative to the buyer with the higher WTP. For example, if $\gamma_1$ were estimated to be 0.50 then sellers request a price that represents 50% of WTP, on average, while if $\gamma_2$ was estimated to be 0.10, sellers request the advantaged buyers pay 10% more than the disadvantaged buyers, on average.

In treatments 4 and 5 the seller has the option of paying a randomly-generated obfuscation cost in order to reduce, or eliminate, price transparency. We model the obfuscation decision as:

$$OB_i = \phi_0 + \sum_T \left\{ \phi_{1T} (W_{HT} + W_{LT}) + \phi_{2T} (W_{HT} - W_{LT}) + \phi_{3T} g_T \right\} + \zeta_i;$$

where $OB_i$ captures the seller’s binary obfuscation decision as before, $W_H + W_L$ is the total revenue the seller will obtain if both pricing offers are accepted, $W_H - W_L$ captures the difference between the two buyers’ WTP draws, and $g$ is the randomly generated cost of obfuscation. We expect the likelihood of obfuscation to rise in the total amount of revenue in the transaction, $W_H + W_L$, and in the difference in WTP between the buyers, $W_H - W_L$. The difference in WTP measures the

\(^{11}\)To avoid any possible sample selection bias we use all the pricing observations set by the sellers, whether or not the price was accepted. The prices represent true-faith offers that the sellers expect will be accepted as they cannot perfectly anticipate the buyers’ reaction, a priori. We estimated the pricing equation conditional on only accepted prices and found the results were similar to those discussed below.
potential severity of a peer-induced fairness response so the greater the difference in WTP, the higher the potential value from obfuscation. We allow the parameters in (3) to vary by treatment, while the constant term, $\phi_0$, is fixed across treatments. We control for the endogeneity of $OB_i$ in the pricing equation using a control function approach (Garen 1984; Wooldridge 2010 ch. 6), where the instruments in the control-function regression include all of the exogenous variables in equation (3) and residuals of the first stage are used as controls in the second stage.

It is important to re-iterate that our approach explicitly endogenizes seller behavior. Although our buyer model provides important insights regarding the effect of differential pricing on advantageous and disadvantageous inequity, and how both affect purchase behavior, the complete story describes how sellers respond in deciding whether or not to obfuscate, and the equilibrium prices they offer the buyers.

5 Experiment Results

5.1 Descriptive Statistics

We begin by presenting some summary observations from the experimental data, and then move to the econometric estimates. Tables 2 and 3 provide the descriptive statistics from the experiment across the different treatments, which are summarized in table 1. When sellers know the buyers’ WTP, they are able to increase profits by price discriminating. However, when prices are transparent, sellers tend to offer less buyer surplus, $W_j - p_j$, to the low price buyers (advantaged buyers), and made substantially higher profit as a result. Sellers understood that these buyers would be more likely to accept their offer relative to the disadvantaged buyers, so saw no need to offer more surplus. This finding suggests that sellers not only had separate pricing strategies for the advantaged buyers compared to the disadvantaged buyers, but that transparency led sellers to compensate high-price buyers by offering them more of the total surplus. Consistent with Muir, Seim, and Vitorino (2013) our results show a wider variation in price charged across high versus low price buyers, $p_H - p_L$, when there is no price transparency compared to perfect price transparency.

Summary observations of seller behavior also support the maintained hypothesis that strategic obfuscation may be profit-enhancing. In the first three treatments, we exogenously vary the level of obfuscation. In reality, firms often have the ability to invest in obfuscation, either through making the structure of prices more complex, or adding slightly-different versions to the product line (Ellison and Wolitzky 2012). We capture this behavior in treatments 4 and 5. The obfuscation-cost
distribution was defined such that it is optimal to obfuscate about half of the time.\textsuperscript{12} Table 3 shows that when sellers can obfuscate, the average price charged was raised and the buyer surplus offered was diminished (i.e. treatments 2 v. 4, and treatments 3 v. 5). Finding larger equilibrium prices under obfuscation provides evidence that it is profit enhancing. In fact, if the cost of obfuscating is added back to the sellers’ profit in treatments 4 and 5, the average earnings are higher compared to the same treatment under exogenous obfuscation. The summary statistics in table 3 suggest that buyers are more likely to make a purchase when the prices are obfuscated even though they knew the seller had intentionally, and strategically, reduced the price transparency. Overall, tables 2 and 3 provides model-free evidence in favor of our main hypothesis, but summary statistics alone cannot confirm that obfuscation increases prices in general without controlling for other, potentially confounding factors. Therefore, we present estimates of the buyer-choice and seller-decision models in the following subsections.

5.2 Econometric Estimates of Buyer Model

Recall that the dependent variable in the buyer model is a binary accept-or-no-accept variable. Our estimates of the random coefficient logit model used to describe the buyers’ purchase decisions are provided in table 4. As a model of buyer choice, our estimates show how they respond to sellers’ pricing and strategic obfuscation decisions, and the degree to which their distributional and peer-induced fairness concerns affect the transaction. Further, by combining data from exogenous and endogenous obfuscation treatments, our findings show how sellers’ expectations of buyer response affect the equilibrium price and obfuscation outcomes. By separating out the treatment effects from other confounding factors, we are able to cleanly identify the effects of buyer surplus ($CS$), distributional fairness ($DS$), advantageous inequity ($AI$), disadvantageous inequity ($DI$), and strategic obfuscation ($OB$) on buyer acceptance.

Distributional fairness is likely to be important to buyers if they think the pricing mechanism is inherently unfair, regardless of the prices offered to others. In fact, we find that distributional fairness ($\delta_T$) has a statistically-significant, negative effect on the likelihood of accepting an offer, although the monetary impact is small. Namely, for every $10 difference between seller and buyer payoffs, the probability that a buyer accepts the offered price decreases by $0.7 – 1.6\%$, depending on

\textsuperscript{12}Optimization was determined by simulating the seller’s optimal pricing and obfuscation decision based on the maximum expected profit conditional on the buyer’s demand function. The solution to each simulated seller-buyer interaction was determined numerically as there is no analytical closed form result.
the treatment. As expected, buyers are most sensitive to distributional unfairness when prices are fully obfuscated. In this case, buyers do not know what others are asked to pay, so their concern with the pricing mechanism is concentrated on their relationship with the sellers. When buyers think they are being treated unfairly, but have no evidence to blame other buyers, the seller is targeted. This finding is purely a behavioral phenomenon as buyers’ real monetary compensation depended on the total surplus accumulated. The concern with how much the seller retains was a purely intrinsic cost the buyers imposed on their decision. Nevertheless, our estimates are consistent with Ho and Su (2009) and suggest that buyer surplus has a much larger impact compared to distributional fairness on the likelihood of acceptance.

Next, we test whether buyers respond differently depending on whether they were given the higher or lower price offer, relative to their peers. Consistent with Richards, Liaukonyte, and Streletskaya (2015), but in contrast to Fehr, and Schmidt (1999), our results show that perceptions of both advantageous and disadvantageous inequity are important determinants of buyers’ acceptance decisions. The results show that under both the no price obfuscation, and partial price obfuscation treatments, advantageous inequality buyers are more likely to purchase ($\rho_{AI,2} > 0$, and $\rho_{AI,3} > 0$). Consistent with transaction utility theory (Thaler 1985), the perception of receiving the better deal relative to a peer provides an intrinsic utility. This, in turn, allows the seller to offer a smaller surplus and retain a larger profit, regardless of whether it was known with certainty (treatment 2), or uncertainty (treatment 3). In contrast to Ho and Su (2009) our results suggest that a buyer’s peer-induced fairness response depends on whether he received a higher, or lower relative price offer.

Peer-induced fairness concerns reduce disadvantaged buyers’ utility, ($\rho_{DI,2} < 0$), which decreases the likelihood a price offer is accepted when peers’ prices are transparent. The results in table 4 show that, for a $10 difference in the prices, the probability of acceptance for a disadvantaged buyer falls 1.1%. This finding explains our summary statistics observation that sellers appear to provide a larger surplus to disadvantaged buyers in order to compensate for quoting them the higher price. In contrast, the high price buyers in the partial obfuscation treatment have considerably less concern about peer-induced fairness compared to the no obfuscation treatment ($\rho_{DI,3} \simeq 0$). Consistent with Van den Steen (2004), these estimates, in conjunction with the added profit sellers made in treatment 3, lend evidence that suggests when a buyer observes a randomly drawn price range for his peer’s price offer, as opposed to the exact price (treatment 2), the buyer is overly optimistic.

13 In treatment 3 the high and low price buyers were separated based on whether their own price offer was above (high) or below (low) the midpoint of the observed price range.
about the probability he receives the better deal.\textsuperscript{14} If more than half of the buyers perceive that they are in the advantageous position then sellers can charge increasingly higher prices since peer-induced fairness is not a significant concern. Taken together, when the exact prices others paid is known, sellers have to offer a larger surplus to the disadvantaged buyers, but can capitalize on buyers’ misconception that they obtained the better deal when prices are obfuscated.

A seller’s decision to obfuscate has a significant effect on the likelihood a price offer is accepted. In treatments 4 and 5 sellers had the option of paying a randomly-generated cost to either fully (\( \eta_4 \)), or partially (\( \eta_5 \)), obfuscate prices. On average, when sellers ensure that buyers cannot see what their peers paid, the likelihood of acceptance rises by 0.53\%, even though the buyer is fully aware of the seller’s decision (\( \eta_4 > 0 \)). Because the effect of partial obfuscation is not statistically different from zero, we conclude that sellers are better off when prices are obfuscated, even if paying a reasonable cost to do so, because individuals’ awareness of obfuscation is not a detriment to purchase and peer-induced fairness concerns are significant for disadvantaged buyers.

5.3 Econometric Estimates of the Seller Model

The buyer response model findings suggest that sellers may have an opportunity to profitably-obfuscate prices among buyers, but whether they do depends on the empirical strength of their response to buyers’ aversion to inequity. We address this question by estimating formal models of the sellers’ pricing and obfuscation decisions given in equations (2) and (3), respectively. The estimated parameters provide insight into how the sellers change their pricing behavior based on the different WTPs they observed, while controlling for potentially confounding factors.

We first consider the decision to obfuscate provided in equation (3). In this model, our maintained hypothesis is that sellers will be more likely to obfuscate the greater the total potential surplus in the transaction, \( W_H + W_L \), and the larger is the difference in WTP between the two buyers, \( W_H - W_L \). The estimates in table 5 support these hypotheses, both when the outcome is to fully obfuscate (treatment 4), or to partially obfuscate (treatment 5) prices.\textsuperscript{15} In particular, each additional $10EC of potential total surplus, \( W_H + W_L \), is associated with a 2.5\% increase in the probability of obfuscating when prices are completely obscured (treatment 4), and a 1.7\% probability increase when prices were partially obfuscated (treatment 5).

The results in table 5 also suggest that the marginal effect of the difference in WTP, \( W_H - W_L \), is at least 4 times larger than the effect of total surplus (13\% in treatment 4, and 6.6\%)

\textsuperscript{14}This has also been referred to as the self-serving bias (Miller and Ross 1975).

\textsuperscript{15}The parameter estimates are only applicable to Treatments 4 and 5 because these were the endogenous obfuscation Treatments wherein a seller made the obfuscation decision.
in treatment 5). This finding implies that sellers in our experiment respond rationally to the
economic incentives they face – the expected benefit of obfuscation increases as the value of price
discrimination increases, or when perceptions of peer related price unfairness threaten an offer’s
acceptance. Sellers, therefore, are more likely to obfuscate when presented with the "guarantee"
that price discrimination across buyers will not be revealed. Somewhat surprisingly, the cost of
obfuscation is only significant when presented with the option to fully-obfuscate (it was marginally
significant at the 11% significance level for partial obfuscate). This result reinforces the importance
of the promise that price-discrimination will be effective through complete obfuscation.

Next, we consider the pricing decision estimates in table 6a. In interpreting these parameters,
it is important to keep in mind that the estimates represent equilibrium price responses. That is,
the estimates describe sellers’ profit-maximizing responses to their expectations as to how buyers
will react in each case, including the buyers’ response to the sellers’ obfuscation decision. In this
model, the marginal effect of WTP on price depends not only on the absolute level of $W_j$ but also
on whether the buyer received the lower WTP and will presumably be in the advantageous position
when prices are set, denoted with $D_L = 1$. Thus, the marginal effect of WTP on price is $\gamma_1 + \gamma_2$
for advantageous buyers, and $\gamma_1$ for disadvantageous individuals. The estimates reported in table
6a largely support our primary hypothesis, namely that equilibrium prices are higher when sellers
obfuscate compared to buyers observing their peer’s price offer.

In the exogenous obfuscation treatments 1 - 3, the marginal effect of obfuscation on prices is
straightforward: for both the full and partial obfuscation treatments, sellers set higher prices for
a given WTP compared to prices being fully transparent ($\gamma_{11} > \gamma_{12}$ and $\gamma_{13} > \gamma_{12}$). The effect
is not as clear when the decision to obfuscate is endogenous. Comparing the four parameters
estimated for treatments 4 and 5 (No Obfuscation versus Full or Partial Obfuscation) reveals no
clear pattern upon first inspection. However, the estimated $\gamma_1$ parameters in the endogenous
obfuscation treatments are interpreted as the pricing rule the seller uses, or how equilibrium prices
vary with WTP. As table 6b illustrates, the median observed price under full or partial obfuscation is
fully $10EC$ higher than under no obfuscation ($90$ versus $80$ in both treatments). This suggests
that the implied marginal effects are considerably higher under some form of obfuscation. In
particular, obfuscating the buyers’ peers’ prices in treatments 4 and 5 added fully $12.21EC$ and
$6.36EC$, respectively, to the sellers’ profit on average. Therefore, these estimates provide evidence
that sellers understand the value of obfuscation and use it successfully to enhance profit.
The results in table 6a also show that, as expected, the sellers set similar prices for both high and low price buyers in treatment 1, \((\gamma_{21} \approx 0)\), because prices were fully obfuscated so buyers did not know whether they received the higher or lower WTP. We find a similar result in treatment 3 which is not surprising given buyers’ propensity to overestimate the likelihood they received the lower price from the seller (Van den Steen 2004). Sellers, therefore, charge both groups a higher price and command a larger profit by capitalizing on this bias. Finally, in the no obfuscation environment (treatment 2) the seller exhibits individualized pricing across the low and high WTP buyers. Specifically, she sets prices at around 67% of WTP for the disadvantaged buyer, but asks an additional 5.4% from the buyer with the lower WTP, on average. As a result, in the absence of obfuscation the seller has to account for both distributional and peer-induced fairness by decreasing the price dispersion offered to the two buyers, but commands a larger profit from those with the lower WTP.

6 Conclusion and Discussion

In this study we empirically determine how buyers respond to sellers strategically obfuscating price information while taking into account interpersonal price-comparisons and the perception of price fairness. According to Turow, Feldman, and Meltzer (2005), some "...64% of American adults who have used the internet recently do not know it is legal for an online store to charge different people different prices at the same time of day..." (p. 3) and yet a strong majority believe that it should be illegal. Moreover, fully 91% of respondents disagree with the statement "...It’s OK if the supermarket I use charges different people different prices for the same products during the same hour..." (p. 22) so clearly there is both a lack of knowledge regarding the nature of personalized pricing and aversion to different prices being charged across buyers.

We frame our analysis in terms of a conceptual model of inequity aversion, and examine how different obfuscation events affect the perception of price fairness, and purchase probability. We test the obfuscation theory (Carlin 2009; Wilson 2010; Wilson and Waddams-Price 2010; Chioveanu and Zhou 2013; Muir, Seim, and Vitorino 2013), and its effectiveness, using a two-sided experiment in which a seller is randomly matched with 2 buyers and sets a price for each based on their individual willingness to pay. This allows sellers and buyers to face a number of incentive-compatible pricing or purchase situations that vary based on price transparency and the seller’s ability to obfuscate peer price information. By comparing purchase behavior across treatments we examine the importance
of fairness perceptions on the purchase decision, and determine how buyers respond to sellers knowingly obfuscating the knowledge of their peers’ price offer.

The findings suggest that obfuscating price information increases the likelihood that higher price offers are accepted. We find that under both, exogenous and endogenous obfuscation equilibrium prices and profits are higher. However, the pricing power under obfuscation is somewhat constrained by perceptions of distributinal fairness between buyers and sellers, especially in situations where prices are fully obfuscated. In this case, buyers do not know what others are asked to pay, so their concern is concentrated on their relationship with the seller. Furthermore, our results imply that a buyer’s knowledge of having received a better offer increases the likelihood that he accepts the offer, and allows the seller to retain a greater profit. In other words, sellers are able to price discriminate the lower priced consumer more effectively and at the same time reduce the difference in prices offered to the buyers. In addition, when prices are less-than-transparent, buyers are more likely to be overly optimistic about the probability they received the lower price. Taken together, our findings suggest that price-discrimination, or personalized pricing regimes are likely to be more successful if sellers choose to obfuscate prices, whether by increasing the complexity of their pricing practices, or by changing the nature of the product or service customer-by-customer, so prices are not easily compared across buyers.

Firms are increasingly collecting and analyzing individual customer data that facilitates their ability to determine each buyer’s willingness to pay not only for goods, but also the value buyers place on the attributes of the items and potential add-on products. However, a company’s ability to charge individual buyers different prices based on his willingness to pay has been constrained by perceptions that the price charged is inherently unfair. Our results show that obfuscation provides a mechanism to successfully overcome these fairness concerns.

Our findings have a number of implications for managerial practice in a range of settings. First, in online environments, where price discrimination is likely to be both more profitable and technologically-feasible, price transparency will likely become a thing of the past as sellers realize the value in keeping "firewalls" around their one-on-one deals with individual customers. Second, the practice of price discrimination, and obfuscation, is also likely to become more prominent in the public policy conversation as buyers begin to realize that they are paying more for relatively-common items than they probably need to be. Third, greater complexity, both in product attributes and pricing structures, will become the rule for selling when prices are potentially-transparent. Easily sold as providing value through "customization" to fit specific needs, complexity and obfuscation are two sides of the same coin.
References


Table 2: Summary Statistics of Exogenous Obfuscation Treatments

<table>
<thead>
<tr>
<th></th>
<th>Treatment 1</th>
<th>Treatment 2</th>
<th>Treatment 3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Full Obfuscation</td>
<td>No Obfuscation</td>
<td>Partial Obfuscation</td>
</tr>
<tr>
<td>Profit¹</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Seller - High Price</td>
<td>48.11 (28.38)</td>
<td>48.80 (31.09)</td>
<td>50.07 (31.22)</td>
</tr>
<tr>
<td>Seller - Low Price</td>
<td>50.52 (29.68)</td>
<td>52.42 (32.66)</td>
<td>57.89 (37.73)</td>
</tr>
<tr>
<td>Buyer - High Price</td>
<td>20.14 (13.56)</td>
<td>22.46 (16.72)</td>
<td>17.77 (13.83)</td>
</tr>
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<td>Buyer - Low Price</td>
<td>11.42 (9.48)</td>
<td>10.76 (11.13)</td>
<td>8.48 (8.49)</td>
</tr>
<tr>
<td>Pr[Trans. Accepted]</td>
<td>0.8095</td>
<td>0.8264</td>
<td>0.8281</td>
</tr>
<tr>
<td>High Price (p_H)²</td>
<td>92.29 (17.08)</td>
<td>89.53 (18.06)</td>
<td>95.09 (19.13)</td>
</tr>
<tr>
<td>Low Price (p_L)</td>
<td>70.41 (16.04)</td>
<td>74.64 (18.00)</td>
<td>73.30 (19.86)</td>
</tr>
<tr>
<td>Buyer Surplus (W_H - p_H)³</td>
<td>23.49 (10.48)</td>
<td>25.58 (14.58)</td>
<td>20.32 (12.00)</td>
</tr>
<tr>
<td>Buyer Surplus (W_L - p_L)⁴</td>
<td>13.21 (8.91)</td>
<td>12.05 (10.45)</td>
<td>9.52 (7.88)</td>
</tr>
<tr>
<td>p_H - p_L⁵</td>
<td>22.82 (15.03)</td>
<td>19.40 (15.17)</td>
<td>24.40 (18.18)</td>
</tr>
<tr>
<td>Number of Periods Completed</td>
<td>357</td>
<td>432</td>
<td>384</td>
</tr>
</tbody>
</table>

The buyers’ willingness to pay randomly drawn from Uniform[50,150].

¹ Mean (standard deviation) of the average profit made each period.
² Proportion of transactions that were accepted by the buyers.
³ Mean (standard deviation) of the price the seller requested.
⁴ Mean (standard deviation) of the buyer surplus the sellers offered.
⁵ Mean (standard deviation) of the absolute difference between prices offered to buyer 1 vs. 2.
Table 3: Summary Statistics of Endogenous Obfuscation Treatments

<table>
<thead>
<tr>
<th>Obfuscation Level→</th>
<th>Treatment 4</th>
<th>Treatment 5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pay to Obfuscate?</td>
<td>Pay to Obfuscate?</td>
</tr>
<tr>
<td></td>
<td>Yes:</td>
<td>No:</td>
</tr>
<tr>
<td></td>
<td>Full</td>
<td>None</td>
</tr>
<tr>
<td>Profit$^1$</td>
<td>Seller - High Price</td>
<td>44.77 (28.67)</td>
</tr>
<tr>
<td></td>
<td>Seller - Low Price</td>
<td>57.78 (35.39)</td>
</tr>
<tr>
<td></td>
<td>Buyer - High Price</td>
<td>20.05 (12.34)</td>
</tr>
<tr>
<td></td>
<td>Buyer - Low Price</td>
<td>9.80 (7.23)</td>
</tr>
<tr>
<td>Pr[Trans. Accepted - $p_H]^2$</td>
<td>0.8182</td>
<td>0.8031</td>
</tr>
<tr>
<td>Pr[Trans. Accepted - $p_L]$</td>
<td>0.8611</td>
<td>0.8535</td>
</tr>
<tr>
<td>High Price ($p_H)^3$</td>
<td>100.24 (14.95)</td>
<td>93.78 (19.42)</td>
</tr>
<tr>
<td>Low Price ($p_L$)</td>
<td>74.14 (20.58)</td>
<td>71.93 (18.83)</td>
</tr>
<tr>
<td>Buyer Surplus ($W_H - p_H)^4$</td>
<td>11.53 (9.89)</td>
<td>18.93 (10.86)</td>
</tr>
<tr>
<td>Buyer Surplus ($W_L - p_L$)</td>
<td>10.40 (6.66)</td>
<td>22.77 (9.32)</td>
</tr>
<tr>
<td>$p_H - p_L^5$</td>
<td>33.78 (16.68)</td>
<td>20.98 (14.00)</td>
</tr>
<tr>
<td>Obfuscation Cost Incurred$^6$</td>
<td>10.18 (2.66)</td>
<td>-</td>
</tr>
<tr>
<td>Proportion of Obf. Trans.$^7$</td>
<td>0.5519</td>
<td>-</td>
</tr>
<tr>
<td>Number of Periods Completed</td>
<td>270</td>
<td>-</td>
</tr>
</tbody>
</table>

$^1$ The buyers’ willingness to pay randomly drawn from Uniform[50,150].
$^2$ Mean (standard deviation) of the average profit made each period.
$^3$ Proportion of transactions that were accepted by the buyers.
$^4$ Mean (standard deviation) of the price the retailer requested.
$^5$ Mean (standard deviation) of the buyer surplus the sellers offered.
$^6$ Mean (standard deviation) of the absolute difference between prices offered to buyer 1 versus 2.
$^7$ Mean (standard deviation) of the obfuscation cost the sellers incurred.

Proportion of transaction wherein the seller obscured the prices from the consumers.
### Table 4: Random Coefficient Demand Model Results

<table>
<thead>
<tr>
<th></th>
<th>Random Coef.</th>
<th>Marginal Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Logit Model</td>
<td>S.E.</td>
</tr>
<tr>
<td></td>
<td>Coefficient</td>
<td>S.E.</td>
</tr>
</tbody>
</table>

**Effects of Buyer Surplus ($CS_{jT}$):**

- $CS_{j1}$ - Full Obfuscation: $\alpha_1 = 0.2409^* (0.0212), 0.599%^*$
- $CS_{j2}$ - No Obfuscation: $\alpha_2 = 0.2485^* (0.0193), 0.618%^*$
- $CS_{j3}$ - Partial Obfuscation: $\alpha_3 = 0.1954^* (0.0174), 0.486%^*$

**Effects of Distributional Fairness ($DS_{jT}$):**

- $DS_{j1}$ - Full Obfuscation: $\delta_1 = -0.0666^* (0.0073), -0.165%^*$
- $DS_{j2}$ - No Obfuscation: $\delta_2 = -0.0468^* (0.0045), -0.116%^*$
- $DS_{j3}$ - Partial Obfuscation: $\delta_3 = -0.0261^* (0.0044), -0.065%^*$

**Effects of Advantageous Inequity ($AI_{jT}$):**

- $AI_{j2}$ - No Obfuscation: $\rho_{AI_{j2}} = 0.0096 (0.0053), 0.024%^*$
- $AI_{j3}$ - Partial Obfuscation: $\rho_{AI_{j3}} = 0.0094 (0.0046), 0.023%^*$

**Effects of Disadvantageous Inequity ($DI_{jT}$):**

- $DI_{j2}$ - No Obfuscation: $\rho_{DI_{j2}} = -0.0444 (0.0650), -0.110%^*$
- $DI_{j3}$ - Partial Obfuscation: $\rho_{DI_{j3}} = -0.0098 (0.0650), -0.002%$

**Effects of seller’s Price Obfuscation Decision ($OB_{iT}$):**

- $OB_{i4}$ - No Obf. $\rightarrow$ Full: $\eta_4 = 0.5372^* (0.2417), 0.874%^*$
- $OB_{i5}$ - No Obf. $\rightarrow$ Partial: $\eta_5 = -0.3798 (0.2149), -0.583%$

Log-Likelihood: $-1121.93$

*Indicates significance at the 5% level. The Constant and the standard deviation of the random parameters are omitted. The dependent variable: buyer’s binary decision to accept seller’s price offer. The observations from treatments 4 and 5 are combined with the respective 1-3 treatment observations based on the seller’s obfuscation decision (see bottom of Figure 1).

### Table 5: Obfuscation Decision Model Results.

<table>
<thead>
<tr>
<th>Obfuscation →</th>
<th>Point Estimates</th>
<th>Marginal Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Treatment 4</td>
<td>Treatment 5</td>
</tr>
<tr>
<td>$W_H + W_L$</td>
<td>$\phi_1 = 0.0068^* (0.0017)$</td>
<td>0.0045$^* (0.0017)$</td>
</tr>
<tr>
<td>$W_H - W_L$</td>
<td>$\phi_2 = 0.0335^* (0.0039)$</td>
<td>0.0186$^* (0.0030)$</td>
</tr>
<tr>
<td>Obfuscation cost ($g$)</td>
<td>$\phi_3 = -0.0667^* (0.0304)$</td>
<td>-0.0369 (0.0248)</td>
</tr>
</tbody>
</table>

Observations: 576
Log Likelihood: -310.98

*Indicates significance at the 5% level. The Constant is omitted. Standard error of the parameter estimates are in parentheses.
Table 6a: Equilibrium Pricing Model Results.

<table>
<thead>
<tr>
<th>Obfuscation →</th>
<th>Exogenous Obfuscation</th>
<th>Endogenous Obfuscation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>T. 1</td>
<td>T. 2</td>
</tr>
<tr>
<td>No Obfuscation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$W_j$</td>
<td>$\gamma_1$</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$W_j * D_{AI}$</td>
<td>$\gamma_2$</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Full or Partial Obfuscation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$W_j$</td>
<td>$\gamma_1$</td>
<td>0.6820*</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.0086)</td>
</tr>
<tr>
<td>$W_j * D_{AI}$</td>
<td>$\gamma_2$</td>
<td>0.0029</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.0090)</td>
</tr>
<tr>
<td>Residuals¹</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Observations: 1,749
R-Squared: 0.854

* Indicates significance at the 5% level. The Constant is omitted.
Standard error of the parameter estimates are in parentheses.
¹ The residuals from the first stage obfuscation equation used to correct for endogeneity (control function approach).

Table 6b: Price Information for the Endogenous Obfuscation Treatments.

<table>
<thead>
<tr>
<th>Obfuscation →</th>
<th>Treatment 4</th>
<th>Treatment 5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>Median</td>
</tr>
<tr>
<td>Equilibrium Prices with No Obfuscation (i.e. $OB_i = 0$)</td>
<td>82.71</td>
<td>80.00</td>
</tr>
<tr>
<td>Equilibrium Prices with Obfuscation (i.e. $OB_i = 1$)</td>
<td>87.63</td>
<td>90.00</td>
</tr>
<tr>
<td>Additional Profit from Obfuscation</td>
<td>12.21</td>
<td>10.38</td>
</tr>
</tbody>
</table>
A Experiment Instructions Given to Subjects

Please do not use the computers in front of you until instructed to do so. While we wait for all the participants to arrive feel free to use your cell phone or talk with your neighbor. However, once the experiment starts we ask that you do not use your cell phones and refrain from talking with the other participants. As promised, you will receive at least $20 for coming to the experiment and will have the chance to earn an additional $10. The way in which you can earn the additional $10 will be explained in a moment. Taking part in this study is completely voluntary and you are free to withdrawal at any time. Since we are paying you a significant amount of money, we expect that you will take the decisions that you make throughout the experiment seriously.

This experiment is designed to simulate a retail environment. Two-thirds of you will be assigned to a buyer role that will represent someone making purchases at a grocery store, for example, and the other third will be sellers who will make pricing decisions similar to those made by a seller. You will remain in these roles throughout the duration of the experiment. Each period a seller will be randomly matched with 2 anonymous buyers. The three market participants (1 seller + 2 buyers) will change every period.

The sellers will be selling a fictitious product. The cost the sellers incur for selling the fictitious product is $50EC, or experimental dollars, and this will remain constant throughout the entire experiment. Each seller will set 2 different prices for each buyer based on the buyer’s randomly generated willingness to pay each round. In case anyone is not familiar with the term ‘willingness to pay’ it represents the maximum amount of money a person is willing to pay for an item. Once all the sellers have made their pricing decisions it will be the buyers turn. Buyers will decide whether to accept or reject the price the seller set.

Everyone will then accumulate wealth throughout each round, and the total amount accumulated at the end of the experiment will dictate how much of the added $10 you will earn. The way that buyers accumulate wealth is the difference between the willingness to pay that period, and the price the seller set. Sellers, on the other hand, accumulate wealth as the difference between the price charged and the cost of selling, which is $50EC. As a result, buyers accumulate more each period if the price charged is lower, whereas sellers accumulate more if the price charged is higher. However, a transaction only takes place if the buyer(s) accept the price. If the buyers reject the price the seller set then the transaction does not take place and neither the buyer nor the seller accumulate any wealth that period. This is similar in spirit to a seller setting a price that is more than a buyer is willing to pay so the buyer opts to not purchase the item. After all the buyers have made their decision, a screen will be shown telling you how much you earned that period, and the total you’ve earned up to that point. We want to emphasize that the proportion of the $10 bonus you earn is directly related to the total wealth you accumulate throughout the experiment. So, you want to earn as much as possible each period to increase the chances of obtaining the full $10 bonus.

In summary, buyer’s willingness to pay will change randomly each period. Sellers will see the new willingness to pay for both buyers he/she is randomly matched with and set prices for each. Buyers will then decide whether to accept or reject the price offers. Earnings will be calculated and shown. We will then move on to the next period and this process will repeat itself until our hour is up (but was stopped 5 minutes before the hour to allow time for the participants to complete a brief demographic questionnaire).

At this time, we kindly ask that you take your cell phones out and place them on the desk. If there are no questions, then we will go through 2 practice rounds. These practice rounds will not affect your total wealth at the end of the experiment. After the practice rounds are over you will have another opportunity to ask any remaining questions prior to the experiment starting. Once
the experiment starts it is imperative that you do not use your cell phones nor talk with your neighbors. If you have a question, or an issue arises, please raise your hand and one of our staff will come around to help you.

The instructions above were common across all treatments. The instructions below were treatment specific.

A.1 Treatment 1 - Full Obfuscation

No additional instructions were needed.

A.2 Treatment 2 - No Obfuscation

After the seller chooses individual prices for buyer 1 and buyer 2, each buyer will see the price quoted for oneself and the price offer made to the other buyer as well. For example, the screen may show that you were offered the price of $90EC and the other buyer was offered $100EC for the same exact product.

The buyer will then decide whether his/her transaction should take place by accepting or rejecting his/her price offer.

A.3 Treatment 3 - Partial Obfuscation

After the seller chooses individual prices for buyer 1 and buyer 2, each buyer will see the price quoted for oneself and a range of prices the other buyer’s price quote falls in. The other buyer’s price has an equal chance of being anywhere inside the quoted price range. For example, the screen may show that you were offered a price of $90EC and the other buyer was offered a price that falls into the range of $70EC – $80EC for the same exact product. The size of the price range is randomly determined and will change each period.

The buyer will then decide whether his/her transaction should take place by accepting or rejecting his/her price offer.

A.4 Treatment 4 - Endogenous Full Obfuscation & Obfuscation Decision

The seller will set prices for both buyers and have the option of paying an added cost to avoid the buyers seeing their peer’s price offer. Namely, if the seller chooses to pay the additional cost a buyer will only see the price offer made to him/her specifically (and will not know the price the other buyer was offered). On the other hand, if the seller declines to pay the additional cost, then each buyer will see the price quoted for oneself and the price offer the seller made to the other buyer as well. For example, the screen may show that you were offered the price of $90EC and the other buyer was offered $100EC for the same exact product. The seller’s added cost will be randomly determined each period to be between $5EC and $15EC.

The buyer will then decide whether his/her transaction should take place by accepting or rejecting his/her price offer given the information available to him/her based on the seller’s decision.

We will now do 2 practice rounds that will not affect your total profit at the end of the experiment. When we go through the first practice round the buyers will see the pricing information of their own and their peer’s offer - as if the seller had decided not to pay the added cost. In the second practice round the buyers will only see their own price - as if the seller had paid the added cost. The seller’s actual price transparency choice will not affect these first two practice rounds. We specifically designed these practice rounds this way so buyers are aware of what both screens look like so they know if the sellers are purposely removing the other buyer’s price offer (and incurring
the added cost), or not. Once the practice rounds are over the sellers’ price transparency decisions will dictate whether or not a buyer observes his/her peer’s price offer in addition to his/her own.

A.5 Treatment 5 - Endogenous Partial Obfuscation & Obfuscation Decision

The seller will set prices for both buyers and have the option of paying an added cost to avoid the buyers seeing their peer’s exact price offer. Namely, if the seller chooses to pay the additional cost a buyer will see a range of prices the other buyer’s price quote is in. The other buyer’s price has an equal chance of being anywhere inside the price range, so it is not necessarily at the midpoint. For example, the screen may show that you were offered a price of $90EC and the other buyer was offered a price that falls into the range of $70EC – $80EC for the same exact product. The seller’s added cost will be randomly determined each period to be between $5EC and $15EC.

If the seller declines to pay the additional cost, then each buyer will see the price quoted for oneself and the price offer the seller made to the other buyer as well. For example, the screen may show that you were offered the price of $90EC and the other buyer was offered $100EC for the same product.

The buyer will then decide whether his/her transaction should take place by accepting or rejecting his/her price offer given the information available to him/her based on the seller’s decision.

We will now do 2 practice rounds that will not affect your total profit at the end of the experiment. When we go through the first practice round the buyers will see the pricing information of their own and their peer’s offer - as if the seller had decided not to pay the added cost. In the second practice round, the buyers will see their own price and a range in which their peer’s price offer is in - as if the seller had paid the added cost. The seller’s actual price transparency choice will not affect these first two practice rounds. We specifically designed these practice rounds this way so buyers are aware of what both screens look like so they know if the sellers are purposely removing the other buyer’s price offer (and incurring the added cost), or not. Once the practice rounds are over the sellers’ price transparency decisions will dictate whether or not a buyer observes his/her peer’s price offer in addition to his/her own.