Search and Obfuscation in a Technologically Changing Retail Environment: Some Thoughts on Implications and Policy

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Abstract

Technologies, especially the internet, have transformed how consumers search for products and prices. Price search has become cheap and easy and, therefore, ubiquitous, for many products. Just as technologies have made price search easier, however, they have increased incentives that firms have to obfuscate, or make price search harder. In this article, we focus on these actions that firms take and their effects on market participants. We discuss empirical evidence on this phenomenon as well as its welfare impacts in the context of theories of search and obfuscation. Finally, we offer a framework for thinking about policy interventions based on this welfare analysis and outline some of the challenges facing policy makers.

I. Introduction

Dating back to at least Stigler (1961) and Diamond (1971), it has been recognized that the existence of positive costs associated with consumers' search for prices can lead to market prices well above competitive levels. Given that firms could benefit by raising prices above competitive levels if consumers bore a cost of price search, it stands to reason that firms might, collectively at least, have an incentive to raise those search costs. This phenomenon, which we term obfuscation, has been less extensively studied than price search, but bears careful consideration.

Obfuscation can arise in many forms. Basically any action by the seller that raises the cost of price (and attribute) search by potential customers can be thought of as obfuscation. One form of obfuscation is proliferating product varieties, even along dimensions that customers do not care about, so that comparing prices becomes a complicated and tedious process. Figure 1 shows the first nine products that Amazon offers with its default sort for "Ibuprofen." Sorting on price would be meaningless because these products, all with a chemically-identical active ingredient, differ on so many dimensions, such as strength of table, size of package, and type of packaging.

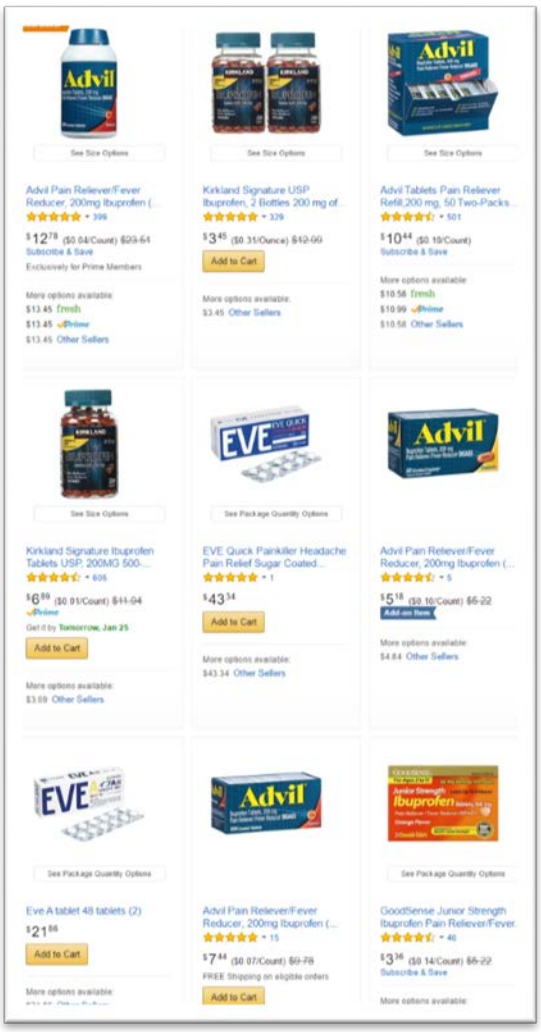


Figure 1---Price Comparison Made Difficult by Product Proliferation

Another form that obfuscation can take is making the price of a (necessary) add-on feature, such as shipping, difficult to find and compare. Yet another form would be for manufacturers to agree to give essentially identical products different model numbers for each retailer that carries it, thwarting comparisons across retailers. Figure 2 is a statement from a Consumer Reports article on how mattress purchasing is complicated by this practice. Firms can also opt out of price comparison sites or try to prevent scraping of their websites by shopbots to make comparisons by third parties more difficult.

These are all common and pervasive forms that obfuscation can take, but our focus will be on a particular type: add-on pricing. Let us start with a personal recollection. Several years ago, while shopping for a camera, we stopped in at a local store. This camera store had a reputation for good prices, and in fact advertised very low prices in the newspaper. We requested a particular model from the sales clerk, which he produced at the low advertised price. We then asked whether they carried spare batteries, carrying straps, and cases. "Of course," the sales clerk replied. "We'd be crazy not to---that's how we make our money." This example is a good illustration of the phenomenon: we can think of add-on pricing as the practice of offering additional features, options, complementary products, and quality upgrades to a basic

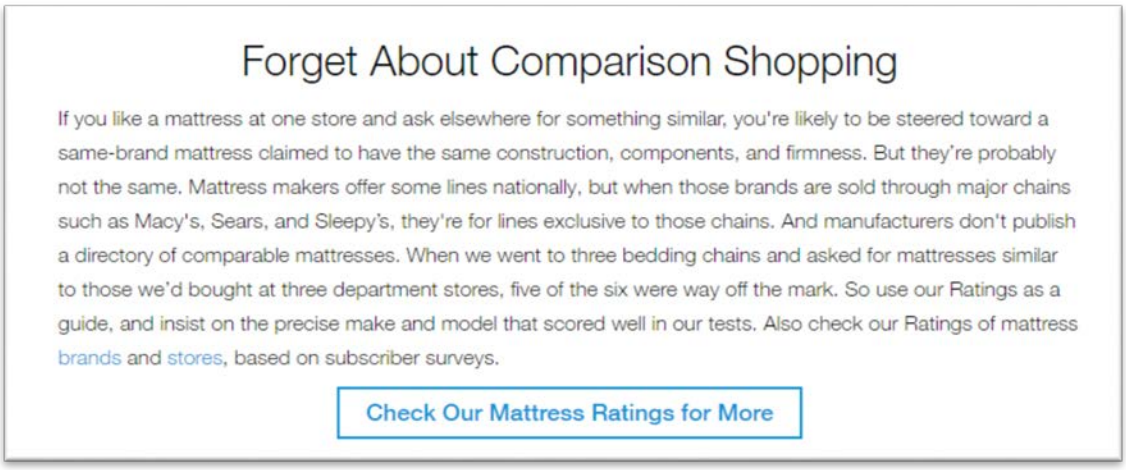
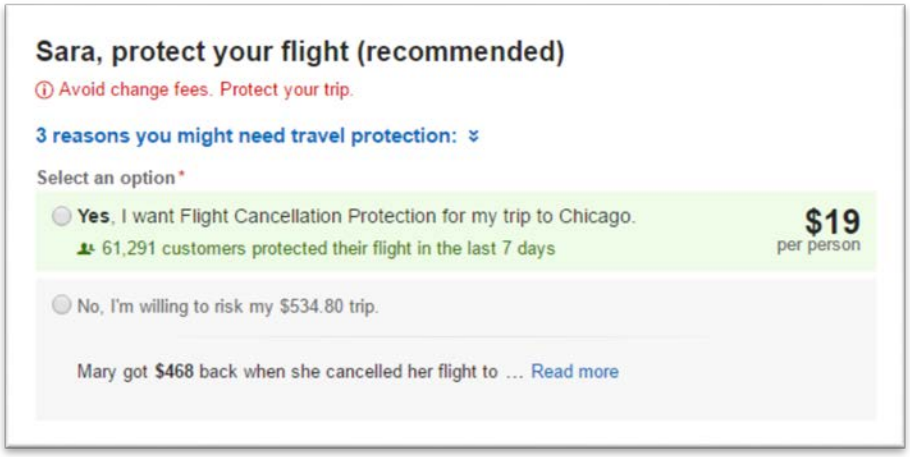


Figure 2---Obfuscation in Mattresses

product. We will often take these additional features or options as voluntary, but one could also think of non-optional add-ons, like shipping, in this paradigm. Note that in addition to "add-on pricing," one often hears the term "drip pricing," which seems to be preferred in policy circles.

Firms have, of course, employed obfuscation techniques since the dawn of retail, and examples of them abound. The careful study of those techniques, however, may have taken on added urgency with the growth of internet retail and other technological advances in retailing. In fact, according to a survey commissioned by the *Times of*

London, online shoppers pay up to 22 percent more in hidden charges than brick and mortar customers.[1] Advances in retail technology can interact with obfuscation in interesting ways. In particular, there are three reasons why obfuscation, add-on pricing in particular, may become more prevalent with technological innovation. First, technology, such as price search on the internet, can create a setting with very intense price competition. In such a setting, firms have a stronger incentive to escape that intense competition, and one way might be obfuscation. Second, holding fixed the characteristics and attributes of a group of products, technology might provide sellers the tools to more cheaply and effectively obfuscate the prices of these products. For instance, websites designed to convince customers to upgrade to a higher quality version of a product can substitute for a highly trained sales staff that would have been necessary in a brick and mortar setting. Figure 3 exhibits repeated attempts by Expedia to convince one of us to buy trip insurance, for instance. Third, technologies such as hand-held credit card readers and online micropayment facilities can allow for the proliferation of products, characteristics, quality levels, and so forth. In other words, if we think of the products themselves as endogenous, the ease with which sellers can offer add-ons and upgrades and accept payment can lead to more products in more varieties.



[1] *The New York Times,* January 6, 2010.



Figure 3---Illustration of Website Designed to Encourage Add-on Pricing

The market for video games is an interesting example of the third of these reasons. When video games were on physical media such as tapes and were sold in brick and mortar stores, the games tended to exist in one flavor and were sold for one price. As the technology of delivering the games and of receiving payment evolved, in-game purchases, unlocking new functionality, and purchasing various quality levels became not only feasible but also pervasive. Airline tickets have followed a similar trend, as airlines have become able to accept payments for early boarding, more legroom, and other amenities at unmanned kiosks in the airport and credit card payments onboard for drinks and food. Figure 4 is an illustration of a video game in-game purchase.



Figure 4---In-game Purchase in Video Game

One immediate issue from a theoretical point of view is that firms may not have the incentive to unilaterally increase search costs, even if they would like search costs to be uniformly higher in their market. The "collective action" problem is the focus of a number of theoretical papers on obfuscation, and we will revisit it in later sections. In the mattress example above, for instance, the collective action problem is solved essentially because the mattress manufacturer is complicit in the scheme to thwart price search and comparison.

We conclude our introduction with a cautionary note. Recall that one of the important lessons from modern industrial organization is that the characteristics and institutions governing markets can vary a lot across markets; therefore, the relevant models and useful policies may also be market-specific. This market specificity is the main reason why IO economists tend to study individual markets, and what led us to focus on one narrow market in our previous research on price search and obfuscation.

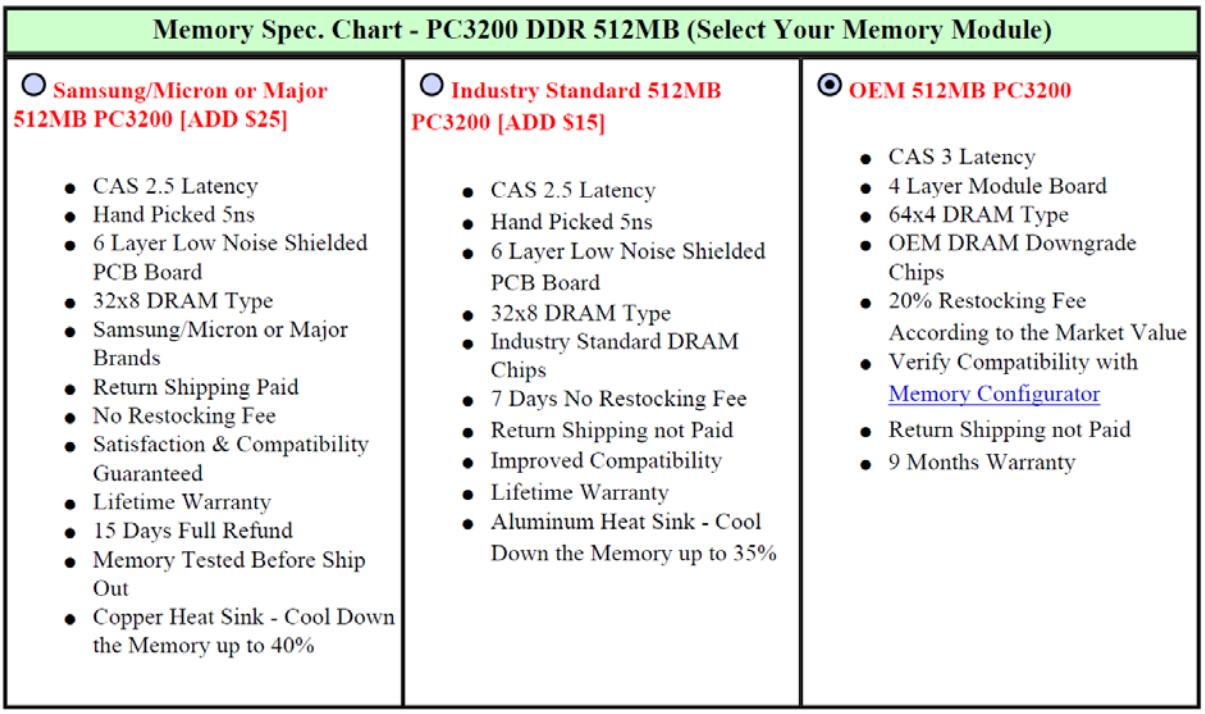
With that caveat in mind, our plan is to discuss insights from our joint work on search and obfuscation in some detail, in Section II. Section III talks more generally about the theory of obfuscation, highlighting welfare issues and sources of inefficiency. We provide a brief discussion of related empirical work in Section IV. Section V discusses various policy levers, intended to address the sources of inefficiency highlighted in the theory section. We also discuss practical challenges in implementing various policies. In the conclusion, we bring the discussion back to technological change and how we see its role in the evolving use of obfuscation techniques.

II. A Recap of "Search, Obfuscation, and Price Elasticities on the Internet"

In Ellison and Ellison (2009), we study an online price search engine for computer components and electronics, pricewatch.com, and we focus on a small set of products sold through Pricewatch. The firms listing products on Pricewatch engage in a number of different obfuscation techniques, but the most salient is an add-on pricing, or upgrade, strategy. The firms aggressively promote and price low-quality versions of products, hoping that the low prices will attract customers to their website. Once there, the customers encounter vendors' websites designed to encourage them to add on additional features to their chosen product, in other words, upgrade to a higher quality (and higher markup) product. Requiring that customers upgrade would typically be considered an illegal business practice (bait and switch), but allowing for the possibility of customers upgrading is perfectly legal, and typically some fraction would.

Figure 5 shows a webpage from a seller listing computer memory modules on Pricewatch. The right column describes a "low quality" product which was listed on Pricewatch at a price of about $50. Consumers who saw that listing and clicked on the link were taken to this page. The right column describes the product they can buy at the advertised prices in not very flattering terms, *e.g.* 'downgrade chips.' The middle column describes a higher quality product that that is being offered for $15 more. And the left column describes an even higher quality product that is available at a $25 premium. The price premia are not primarily due to cost differences. In fact, the product described in the middle column only costs the retailer $1 or $2 more. Hence, the retailer's markups are much higher on these products. Various elements of the page---the left-to-right ordering, the use of words like 'improved', 'hand picked', and

'satisfaction,' and so forth---seem designed to entice consumers to buy the higher-quality products.



Memory Spec. Chart - PC3200 DDR 512MB (Select Your Memory Module)

○ Samsung/Micron or Major 512MB PC3200 [ADD $25]	○ Industry Standard 512MB PC3200 [ADD $15]	◉ OEM 512MB PC3200
• CAS 2.5 Latency • Hand Picked 5ns • 6 Layer Low Noise Shielded PCB Board • 32x8 DRAM Type • Samsung/Micron or Major Brands • Return Shipping Paid • No Restocking Fee • Satisfaction & Compatibility Guaranteed • Lifetime Warranty • 15 Days Full Refund • Memory Tested Before Ship Out • Copper Heat Sink - Cool Down the Memory up to 40%	• CAS 2.5 Latency • Hand Picked 5ns • 6 Layer Low Noise Shielded PCB Board • 32x8 DRAM Type • Industry Standard DRAM Chips • 7 Days No Restocking Fee • Return Shipping not Paid • Improved Compatibility • Lifetime Warranty • Aluminum Heat Sink - Cool Down the Memory up to 35%	• CAS 3 Latency • 4 Layer Module Board • 64x4 DRAM Type • OEM DRAM Downgrade Chips • 20% Restocking Fee According to the Market Value • Verify Compatibility with Memory Configurator • Return Shipping not Paid • 9 Months Warranty

Figure 5---Illustration of Add-on Pricing

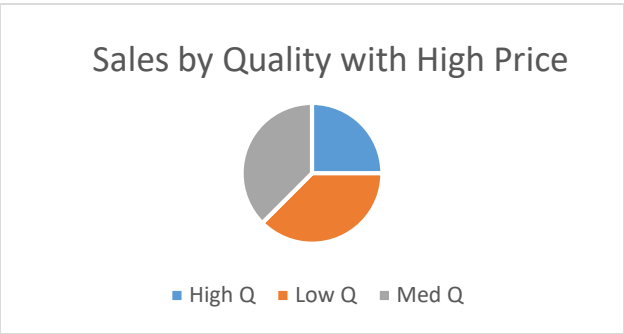
In the simplest perfect competition model of add-on pricing, firms would lower the price of their low quality product below cost to attract customers to their websites. The prices of the low quality product would be low enough, in fact, so that profits that firms make on the customers purchasing upgrades are competed away with the below-cost pricing. Such a model suggests that there could be distributional consequences across different types of customers, but that firms are still earning zero profits. We realized, however, that in the market we studied, instead of recreating this perfect competition in a slightly different form, firms were, instead, using this add-on pricing to soften competition and earn positive profits. In the example above, instead of the "low quality" module being sold at a price well below cost, it tended to be sold at a price that was close to cost, while the firms earned substantial profits on the

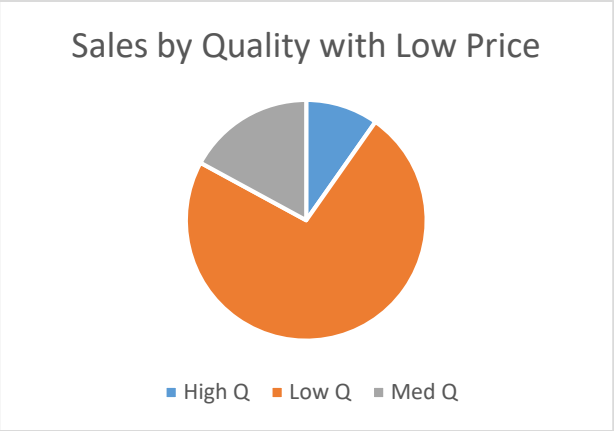
medium and higher quality products. With such prices, the distributional consequences across different types of customers would still exist, but firms would price above marginal cost on average, which yields positive profits for the firms and "deadweight losses" in social welfare.

The key factor allowing the sellers to price above marginal cost on average was that the customers choosing to upgrade were not a random sample of all customers but rather a selected sample. In particular, the customers willing to upgrade tended to be the less price-sensitive ones. In equilibrium, then, firms do not want to cut the price on their low-quality product so low as to compete away the profits they make on their upgrading customers because doing so would attract a very price-sensitive, and therefore, upgrade-averse, mix of customers. They would rather price slightly less aggressively on their low-quality products and attract a less price-sensitive, and therefore less upgrade-averse, mix of customers. In equilibrium, add-on pricing can thereby dampen competition and result in positive profits.

Firms create an adverse selection "problem" by adopting these add-on pricing strategies, but, of course, it is not a problem for them because it allows pricing above marginal cost. A simple numerical example may help illustrate this mechanism. Suppose that the costs to the firm of selling low-, medium-, and high-quality memory models are $50, $55, and $60, respectively. The pie charts below illustrate how the firms' sales mix might differ depending on whether it set a relatively high price of $55 for its low-quality module or a more aggressive price below-cost of $49. With a relatively high price for the low-quality product the firm does not attract many consumers, but those that it attracts are not very price sensitive, and many can be talked into upgrading. At the lower price it gets so many more consumers, but its mix of customers is worse---in other words, less likely to upgrade. It more than doubles

its sales of medium- and high-quality modules, but this comes at a cost of taking on many, many more consumers who cannot be talked into buying anything other than the low-quality product. If the firm were pricing well below its marginal cost for the low-quality product, losses from sales to these consumers could be overwhelming.





For a specific numerical example, suppose that the medium- and high-quality modules are priced at $15 and $25 above the price of the low cost module, respectively. Suppose that the firm sells 30 low-, 30 medium-, and 20 high-quality modules when its low-quality module is priced at $55 (which means the others are $70 and $80). And suppose that sales increase to 300, 70, and 40 at prices of $49, $64, and $74. In this case, profits at the $55 price are 30·$5 + 30·$15 + 20·$20 = $1000. Profits at the $49 price are slightly lower, 300·(-$1) + 70·$9 + 40·$14 = $930. And if the firm were to price even slightly more below cost, profits could be much, much lower. For example, if it goes to $48, it might sell 500 low-quality unit at a loss of $2 per module, and this $1000 loss could completely overwhelm any gains from selling a few more of the higher-quality products.

Our 2009 "Search and Obfuscation" paper provides striking empirical estimates showing that the adverse selection effect described above is a real phenomenon and can be quite powerful. Figure 6 reproduces a matrix of own- and cross-price

elasticities that we found when estimating demand for low-, medium-, and high-quality memory modules sold through Pricewatch. For instance, the figure in the upper-left corner can be interpreted as meaning that a 1% increase in the price of the low-quality memory modules results in a 25% decrease in the sales of those modules. The off-diagonal elements are cross-price elasticities between different quality levels of otherwise-identical memory modules. For instance, the figure in the middle of the left column can be interpreted as meaning that a 1% increase in the price of the medium-quality module results in a 0.7% increase in the sales of the low-quality modules.

	128MB PC100 Modules		
	Low	Mid	Hi
*P*Low	−24.9*	−12.5*	−7.2*
*P*Mid	0.7	−6.7*	2.4
*P*Hi	0.2	2.7	−4.8*

*Figure 6---Price Elasticities from Ellison and Ellison (2009), statistical significance denoted by **

There are a number of interesting features about these estimates to highlight. First, note that the estimated demand of the low-quality module is remarkably elastic! Rarely does one see elasticities of that magnitude. Recall that the low-quality product is the one listed on the price search engine and, therefore, easily found and compared with similar products from other sellers. Such an elasticity could support only the slimmest of margins above marginal cost, likely too slim to allow a firm selling only this product to survive. This extreme elasticity is, therefore, a striking illustration of a point we made in the introduction: price search on the internet has the potential to create very fierce competition.

Second, note that the own-price elasticities on the medium- and high-quality modules are much lower in magnitude. They, too, face elastic demand but much less elastic than the low-quality modules. These elasticities could support larger margins. In other words, firms facing these elasticities can raise prices somewhat above marginal cost without inducing lower profits.

Third, most of the cross-price elasticities are small and not very precisely estimated, but positive, as simple models of substitute products would suggest: If the price of one product goes up, customers will tend to shift to another similar and substitutable product.

Fourth, quite strikingly, two of the cross-price elasticities are large in magnitude (although not as large as the low-quality own-price elasticity), statistically significant, and *negative*. These two cross-price elasticities are of the sales for the medium- and high-quality modules with respect to the price of the low-quality, and they are, in fact, strong evidence of two important aspects of the add-on pricing mechanism. First, the reason that the cross-price elasticities of such similar products are negative is that when the price of the low-quality module goes down, more customers are attracted to the website that sells it, and some will upgrade to the medium- or high-quality. In other words, the low-quality product's price is being used to advertise *all* quality levels the seller offers. Second, the reason that these elasticities are smaller in magnitude than the low-quality own-price elasticity is that the effects on the medium- and high-quality modules are not as large as the effects on the low-quality.

This adverse selection mechanism, based on a correlation between the customers likely to be initially attracted to the lowest-priced products and those unlikely to upgrade or add on, might be strong in certain markets and weak or absent in others.

The implications for social welfare are clear. In markets where the adverse selection mechanism is weak, add-on pricing strategies are not likely to raise average prices and firm profits very far above competitive levels. In markets where the adverse selection effect is strong, average prices could be significantly above competitive levels, leading to increased profits, decreased consumer surplus, and deadweight loss.

In any case, there will be distributional effects across customers of add-on pricing strategies. The ones who choose not to upgrade will receive low prices, perhaps even below marginal cost, whereas the customers who upgrade will pay significant increments above marginal cost.

III. Theory of Obfuscation

To think about the potential welfare consequences of obfuscation it is useful to start from the classic perfect competition model in which markets are fully efficient. The perfect competition model does not specify how the outcomes it predicts come about. Informally, we can think of it as a model of situations in which: (1) consumers are fully informed about the prices and attributes of all goods without needing to spend any resources on information; (2) consumers perfectly optimize their consumption given prices and product attributes; and (3) intense competition, sometimes referred to as "Bertrand competition," leads firms to price at marginal cost.

Our search and obfuscation paper identified two main channels through which firms appeared to have altered the market to depart from the perfect competition ideal. First, obfuscation prevents consumers from being fully informed. Second, obfuscation can create an adverse selection problem which softens competition. The

subsequent theory literature has developed coherent models explaining why each effect of obfuscation might arise in an unregulated market and providing insights on the welfare consequences.

A. Prevents consumers from being fully informed

First, our work suggested that firms had worked to make it more difficult, time-consuming, or both for consumers to find the products they wanted. Classic papers by Stigler, Diamond and others noted long ago that even small departures from costless search can lead to dramatic differences in market outcomes. Diamond's classic (1971) model in which all firms produce identical goods and all consumers must incur an incremental search cost to learn each firm's price brings out this insight simply and clearly. In the model, moving from zero search cost to any positive search cost shifts the equilibrium all the way from competitive pricing to monopoly pricing. Intuitively, if consumers expect all firms to set the monopoly price, then there is no reason to shop around---consumers will simply purchase from the first firm they visit even if it is charging the monopoly price. And if all consumers behave this way, there is no reason for a firm to charge anything less than the monopoly price. It is a striking observation, albeit one that clearly we cannot take all that seriously due to the special assumptions involved in the model.

Many subsequent authors have noted that making the model more realistic, *e.g.* adding heterogeneity in consumer search costs or tastes leads to more robust and intuitive results. Price levels tend to increase smoothly as consumer search costs are increased. Given this result, we can think of welfare as being reduced when consumer search costs increase for three reasons. First, consumer utility is directly reduced when the

consumers expend resources on search instead of leisure and consumption. Second, consumers may choose not to gather all available information, which can lead them to choose a consumption bundle that they like less than another bundle that they overlooked. Third, with prices set above marginal cost there is "deadweight loss"---consumers refuse to buy products that they would enjoy consuming (and firms lose out on profits they could have made selling to these consumers) because prices are not tailored to the consumer's willingness to pay.

In most models of consumer search, the firms collectively benefit from moderate increases in consumer search costs. (When search costs get too large, consumers will not bother to search and a market collapse hurts firms as well as consumers.) While it is less obvious that firms will individually want to increase consumer search costs, several papers including Wilson (2010) and Ellison and Wolitzky (2012) note that there is not necessarily a collective action problem here. The mechanism highlighted in Ellison and Wolitzky (2012) is that a firm that makes it more arduous for consumers to learn everything they want to know about its product may deter consumers who make it to the end of the process from deciding to investigate another firm. One reason is that it can just make consumers tired of searching if they have already expended so much time. A second is that consumers' beliefs about the cost associated with additional searches could change, leaving them to think that they will also be equally arduous.[2]

[2] The opportunity cost of time spent searching will be convex in a standard time-allocation problem, and consumers' beliefs about how time consuming it will be to conduct additional searches also naturally increase in models with uncertainty about the fundamental difficulty of conveying information.

Obfuscation of this variety is a concern for regulatory authorities. Social welfare losses occur for all three reasons highlighted at the start of this section. Consumers waste resources learning about products and their prices. Consumers end up with products they like less than other products they could have bought. And prices rise, creating deadweight loss.

B. Creates adverse selection

The second effect of obfuscation highlighted in our previous research is the adverse selection induced by add-on pricing, first identified in Ellison (2005). Implementing add-on pricing also involves altering the characteristics of the goods, but in a very particular way: the firm sells both an (inefficiently) low-quality version its product at a low price and a high-quality version at a substantially higher price. One of the main observations of Ellison (2005) is that an important dichotomy is between voluntary and mandatory add-on charges. Traditionally, competition authorities have regarded mandatory add-on charges (such as a "fuel cost surcharge" added to every airline ticket) with great suspicion and been less concerned with add-ons that are clearly voluntary (such as checked bag fees). The paper argues that this concern may be misplaced---there are reasons to be more concerned with voluntary add-on charges than with mandatory ones.

In particular, mandatory add-on charges are not harmful in equilibrium if they are fully understood to exist. For example, if truth-in-advertising laws were modified to allow firms to charge consumers up to $17 more than the price they had advertised, then we would reach a new equilibrium where all products are advertised at exactly $17 less than current prices. Consumers would get charged $17 more than the

advertised price at the point of sale, but this would simply recreate the current equilibrium because they anticipated the surcharge perfectly. Advertising simply becomes a language issue without any economic consequence. We can think of sales taxes in the US in this context. American consumers are not surprised when sales tax is added on at the register, and they do not feel tricked or fooled.

In contrast, Ellison (2005) shows that voluntary add-ons need not be neutral. They can lead to higher equilibrium prices when they create an adverse selection problem for firms that cut prices. For example, the consumers who decide to switch to a less convenient flight because it is $5 cheaper may be "cheapskates" who are much less likely than an average consumer to pay extra to reserve an aisle seat, receive expedited security screening, board earlier, or check luggage. In this case, the normal incentive of firms to slightly undercut rivals can be reversed as firms are also tempted to slightly overcut rivals to dump less profitable consumers on their rivals and save their seats for higher-margin consumers. In equilibrium, obviously, firms cannot want to either raise or lower their prices. The result of adverse selection is that equilibrium prices end up higher.

The base model of Ellison (2005) is a fully rational model in which consumers suffer both from inefficient product selection and high prices. There are two types of consumers, "high value" ones who are willing to pay extra for both the base good and the quality upgrades or add-ons relative to the "low value" ones. Note that these "high types" could be thought of as high-income consumers. Indeed, the model suggests that both low- and high-income consumers may both be worse off than they would be if add-on pricing were prohibited. High-income consumers are worse off because equilibrium prices have increased. Low-income consumers are worse off because they buy a good of inefficiently low quality. In a more general model there

will be deadweight loss both from consumers who do not buy any version of the good, and from consumers who do not buy upgrades. The magnitudes of these losses depend primarily on two parameters: the incremental quality that firms have been able to move from the base good to the add-on; and the strength of the adverse selection relationship between price levels and the fraction of consumers who buy add-ons.

In some markets, regulation will not be necessary to prevent inefficient add-on pricing. Add-on pricing can be disrupted in a fully rational model if one firm can simultaneously switch to a product lineup in which add-ons are priced more reasonably and cheaply advertise this fact to consumers. Ellison (2005) notes, however, that, in practice, one substantial obstacle to this mechanism would be if some fraction of consumers are boundedly rational consumers and are not fully aware of how much they will end up paying for add-ons and get "tricked" into buying something they will regret ex post. When such consumers are present, a two-pronged case for regulation appears: one wants to protect the boundedly rational consumers, and also protect rational consumers from the add-on pricing which their presence facilitates. Hence, the likelihood that there are some such consumers is one factor that should be weighed in thinking about whether there is a strong case for trying to rein in add-on prices via regulation.

One other paper we would mention is Athey and Ellison (2011), which develops a model of search engines as intermediaries which help consumers search more efficiently. It focuses on "sponsored link" advertisements, noting that they can make consumer search more efficient both by providing a list of sites at which consumers are likely to find products that meet their need and by ordering the list so that searching in that order is more efficient than examining the products in a random order. Regulators seeking to create more efficient search can learn from companies

like Google: they want to ensure that information is presented to consumers in the manner that makes the more detailed search that consumers will need to do as efficient as possible.

IV. Empirical Evidence on Obfuscation and its Effects

Not surprisingly, a literature on add-on pricing exists in marketing, although much of this takes on the form of documenting the practice and how it alters customers' beliefs. In other words, it is not focused on questions of welfare and consumer surplus and typically does not seek to understand mechanisms with rational actors through which firms can raise prices in equilibrium through these practices. Ahmetoglu, Furnham, and Fagan (2014) provides a comprehensive and useful review of this literature. Note that two of the categories of pricing that they discuss, drip pricing and bait sales, are formally similar or identical to the phenomenon we discuss here. Although the economics literature documenting and analyzing obfuscation strategies is still nascent, we mention here a number of empirical papers that serve as recent examples. Hackl et al. (2014) document firm pricing strategies, which are consistent with obfuscation and which exploit boundedly rational consumers. Li and Dinlersoz (2012) find that the design of shipping menus of Internet book retailers is consistent with an add-on-pricing-style obfuscation. McDonald and Wren (2014) study the online auto-insurance market. They find brand proliferation and patterns of pricing across brands within firms that are consistent with search obfuscation.

More formal evidence---testing models of obfuscation or demonstrating evidence of the benefits of these strategies---has been more scarce. In addition to Ellison and Ellison (2009), two other papers in this mold are Seim, Vitorino, and Muir (2016a, 2016b). They collected detailed data on auto driving schools in Portugal, a setting

where standardized reporting of prices is rare, and issues such as price search and obfuscation might loom large. They estimate a model of demand where consumers have limited price information and where, in fact, their degree of price information is a function of measures of price complexity and search costs. In one paper, they find that consumers are willing to pay a significant premium for price transparency, on the order of 11% of the transaction. In the other paper, they find results consistent with complexity significantly limiting consumer price information, suggesting that price complexity obfuscates.

Finally, Kalaycı and Potters (2011) offer a different type of evidence of the effects of price obfuscation. They carry out a lab experiment in which sellers decide on the number of attributes of their good and then set prices. The number of attributes of the good affects neither the cost to the sellers nor the value to the buyers but simply makes prices more complex (and more difficult to compare). In this stylized setting of a lab, they find that buyers make more suboptimal choices and that prices are higher when the number of attributes of the goods is higher. This result is consistent with our informal observation in the introduction that sellers might benefit from proliferating product varieties as a means of obfuscation.

V. Some Thoughts on Policy Levers

Antitrust authorities in the US Justice Department and the Federal Trade Commission, the Australian Competition and Consumer Commission, and the European Competition Authority, among others, have shown significant interest in the issue of obfuscation generally, and add-on, or drip, pricing specifically. For instance, in 2012, the FTC organized "A Conference on the Economics of Drip

Pricing," inviting researchers who had done theoretical and empirical work in the area. Also, a number of actions have been brought against firms for drip pricing by various authorities, notably in the markets for air travel and lodging. Finally, agencies are engaging in their own research: Sullivan (2017) is a study of the causes and likely effects of hotel "resort" fees, or compulsory add-ons to hotels rooms to cover services such as internet and exercise room access, issued by the FTC.

Using this interest in policy circles as a backdrop, we recall our discussion in the theory section. There we highlighted three potential ways in which obfuscation can reduce welfare relative to the perfect competition benchmark: consumers expend resources to search, consumers may never find the consumption bundle that is best matched to their preferences, and deadweight loss results from higher equilibrium prices.

This taxonomy can help guide our thoughts about potential regulation, suggesting areas that policies could target. In particular, we can think of regulations as having at least one of the following goals: First, they could be designed to minimize the search costs that consumers expend in equilibrium. We think of these search costs as the time costs of investigating prices and offerings. Second, they could promote efficient consumer choice, *i.e.* choosing the products that are best matched to their tastes. If consumers are rational, these first two goals should be closely aligned, but promoting efficient choice could be a separate important consideration if many consumers are boundedly rational. Third, they could be designed to encourage efficient pricing. This type of regulation could encompass the pricing of both the base good and any add-ons, encouraging marginal cost pricing of both.

In practice, an important issue for a regulator interested in mitigating this type of obfuscation is whether there are feasible policies that will make it easier for consumers to obtain price and product information. While most models take the set of available products as given, an important element of obfuscation can be that firms invent many variants of their products with different attributes. This product proliferation can make it time-consuming for consumers to understand the meaning of an advertised price, and it can create a substantial search problem if consumers wish to find a product with other attributes.

One may also be concerned about the distributional impacts of obfuscation and of regulations designed to address them: policies may affect sophisticated and unsophisticated consumers differently and this issue can be particularly concerning if sophistication is correlated with socioeconomic status. There will not, however, be any simple formula for achieving these goals. What, if anything, works well will depend on the nature of the products and their markets.

With these thoughts in mind, let us first consider a simple case: a product that has a well-defined standard version that most consumers want. In this case, all that one needs to do to make competition efficient is to ensure that prices for the standard version are visible. For example, in the gasoline market, requiring the visible posting of the price for the lowest grade of gasoline is effective in informing consumers about prices. Intermediaries such as price comparison sites will also naturally arise to help consumers compare offerings in some such markets.

In most markets, however, products are more complex and firms will naturally want to offer multiple varieties to better match consumers tastes. For example, consumers will display different preferences over credit cards with different terms, some

preferring a low annual fee and high interest rate, while some have a strong preference for the lowest interest rate and are willing to pay the high annual fee to obtain it. Likewise, some consumers care a lot about the speed of their internet access and will naturally be willing to pay more for plans with high speed whereas others will not. Regulation is more difficult in such markets, both because different consumers are interested in prices for different products and because there is more scope for firms to obfuscate by manipulating their set of offerings. Several approaches to price regulation can be considered:

- **Scoring rules**: One can think of such a rule as a formula for quality-adjusting prices so that consumers can more easily compare similar but non-identical offerings. For instance, firms advertising loans are typically required to disclose a loan's APR. Similar approaches might be available in other markets.

- **Price disclosure mandate for a standard variety**: A second approach to facilitating consumer comparisons is to require firms to post prices for a standard variety, just as gas stations post their price for the lowest-grade gasoline. For example, airlines could be required to prominently post the price for a flight that includes one checked bag and a standard size carry-on. Online merchants could be required to post prices that include shipping with arrival within seven days.

- **Standardized menu display**: Such a rule would require posting prices for a variety of different product options in a format common across retailers, perhaps dictated by regulators. A familiar example of a similar standardized display is the required window stickers on new cars which display price, fuel economy, and crash test ratings. In the case of a product offered in many

varieties at different prices, one could adapt this idea so that firms would be required to report all prices for a set of particular varieties. For an online retailer, for instance, the prices inclusive of 7-day, 2-day, and 1-day shipping would be listed in a standard format. A similar rule might be applied to checking accounts or credit card offers.

- **Regulation of add-on prices**: If regulators understand a market well enough to know the costs of add-ons, they can use this knowledge to directly regulate prices. For example, regulation could limit the fees that banks are allowed to charge when consumers make debit purchases that overdraw their accounts. The price search engine we studied in our previous research required that firms charge no more than $11 for ground shipping. Mandating that add-ons are priced at marginal cost could serve two purposes: it leads consumers to purchase efficient varieties; and it eliminates the adverse-selection mechanism that can raise aggregate markups.

The effects and even feasibility of these policies will depend on the product and market under consideration. We will note a few of these considerations relevant to these proposed policies.

Scoring rules are most effective if regulators understand product attributes sufficiently well so that consumers can then treat the score as a quality-adjusted price. For products with very complex pricing, such as bank accounts, a scoring rule could require firms to disclose their average revenue per consumer given all of the add-on fees that are incurred. There, consumers may not have very strong *ex ante* preferences over the relative sizes of ATM fees, wire transfer fees, bounced check charges, and so forth, so they might be willing to treat an average revenue per consumer as a price that could be compared. In other cases, however, it may be difficult to create a score

that captures what all consumers care about and is not subject to manipulation. In these cases, scoring rules would be limited and might have only moderate effects on market functioning. They become something more like the search assistance discussed in Athey and Ellison (2011), where a sorted list can provide consumers with guidance on where to search first, but where consumers will still need to incur search costs to investigate each product. Note, though, that a guided search, or any mechanism to lower search costs, is a welfare improvement over an unguided search.

Mandating that price be disclosed for a standard variety is an option that could be particularly effective when two conditions are met: (1) it is possible to describe some version of the good sufficiently fully that firms cannot create a significantly inferior version that meets the standard description; and (2) the standard version will meet the needs of many consumers. When these conditions are true, a posted prices for the standard variety can both promote competition for the standard variety and be a strong constraint on what firms can charge on other varieties. A regulation of this type could be useful when the product is sufficiently complex or regulators know sufficiently little about the importance of various attributes to make scoring rules and menus infeasible. The details of mandating price disclosure, however, would need to be tailored to the market to ensure that the standard variety is sufficiently well defined. Simply mandating price disclosure of an airline ticket plus one checked bag, say, may not be an effective counter measure for obfuscation if airlines can just charge large fees for reserving a seat, forcing non-upgraders to board later and have no room for their carryon.

In some cases, consumers mostly care about a small number of attributes and have quite heterogeneous preferences over those attributes. In such a case if would be difficult to post a relevant quality-adjusted price through a scoring rule or a price for a

standard variety. Requiring firms to post price menus in a standard form could be a feasible alternative then. Again, such a regulation must be tailored to the market to reflect the primary attributes that matter to consumers. Such policies might be considered for markets like those for cellular phone service and internet access where a few attributes like speed, capacity, and over-quota charges are typically what consumers care about but their preferences over them vary. In many applications, however, it could be difficult to identify a small number of attributes to be disclosed in the menu. As with other policies, it is also a challenge to keep up with a changing retail environment and prevent firms from inventing products that are damaged in some way that does not appear in the price menu (perhaps forcing consumers to pay more for an upgrade).

Finally, direct regulation of add-on prices could be a useful policy lever because it helps consumers buy the efficient variety of the good. To the extent that regulation results in identical prices for add-ons, it can also simplify the search, allowing consumers to focus on the base good. Of course, the requirements for a regulatory body to enact such a policy are steep: too-aggressive regulation could destroy the market for an add-on that is valuable. In some markets, intermediaries can institute such rules obviating the need for government intervention. For example, we noted above that Pricewatch was able to limit shipping fees for firms who chose to list on their comparison site. Indeed, intermediaries like travel websites may be in a better position than the government to enact such policies because they do not need legal authority to exclude firms from participating if they are not willing to comply with add-on pricing rules and can monitor what consumers end up paying relative to the initially viewed price.

One issue addressed in Sullivan (2017) is the legality of mandatory add-ons such as "resort fees" at hotels, or fees with tax-like names added to cellular phone and internet service bills. Mandatory fees obviously cannot play a useful role in allowing different consumers to purchase different versions of a product. Accordingly, their main effect is to make consumer search more costly and lead some consumers to make mistakes in purchasing. Prohibiting such fees or requiring that they be included in advertised prices could, therefore, be a policy option. It is, however, worth emphasizing that if these fees are well-known and anticipated by consumers, their welfare effects should be minimal, making policy interventions unnecessary.[3]

It is worth saying a little more about intermediaries at this point. We have noted in a few instances that platforms, market mediators, or third parties have entered and performed some or all of the functions that a regulator might perform. They have both advantages and disadvantages relative to regulators, as well as facing many of the same challenges that regulators face. As we noted directly above, intermediaries, such as a price search engine, do not need legal authority to exclude firms from participating if they are not willing to comply with transparency rules they set. Furthermore, these intermediaries might have very detailed information about consumer behavior, better helping them to tailor these rules to help consumers.

Relative to regulators, though, intermediaries have at least one distinct disadvantage: they might compete with other intermediaries. StubHub's attempt to require transparent, all-in pricing is an interesting illustration of this phenomenon. After the rule change was implemented, consumers who visited their website were immediately

[3] Sullivan (2017) raises an additional question regarding mandatory fees and intermediaries. If, in fact, the transfer from the firm to the intermediary for listing its product is a percentage of the advertised price, mandatory fees added later will lower the transfer to the intermediary, and could, perhaps, mitigate double marginalization.

put off by the high prices they were shown, and they abandoned StubHub for other ticket platforms that did not require all-in pricing. StubHub's experiment was short-lived.[4]

Intermediaries would also encounter the same challenges of product, add-on, and quality proliferation as regulators would. They potentially would need to alter transparency rules and search categories every time a firm develops a new add-on or a different dimension of quality.

VI. Conclusion

Technology that makes price search and product proliferation cheap and easy can have large consumer benefits, to be sure. Downward pressure on prices in many markets has conferred enormous benefits on consumers. And the ease with which firms can create new products in new varieties has ushered in a new era of consumer choice. Both of these benefits to consumers, however, have come at a price. Easy price search can lead not only to intense price competition, but can also give firms strong incentives to obfuscate. Markets that have been transformed by easy price search include those for airfares, hotel stays, and electronics. It is not a coincidence that obfuscation has become more central to those markets since they moved online, and that those markets have become the focus of policy scrutiny. Likewise, innovations in payment technologies that make add-on options, upgrades, and product proliferation easy have offered, for instance, video gamers almost infinite variety in their gaming experiences, but could raise policy questions in those markets as firms become more sophisticated at raising prices for their products above marginal cost through obfuscation techniques. As we emphasized in our earlier work, new

[4] *Wall Street Journal,* August 31, 2015.

technologies can have unintended and unforeseen consequences on the markets where they are adopted. Whether technological innovation in retailing will tend to increase or decrease consumer welfare is not clear *ex ante*, which suggests careful study of individual markets by researchers and policy makers alike.

Finally, we want to emphasize that, although thinking about general policy remedies to address the issue of obfuscation seems both overly ambitious and counterproductive, we do think that market-specific policies could have scope to help mitigate some of the welfare effects of obfuscation, if applied with an eye towards the specific characteristics and institutions of that market. We hope that this consideration of market specifics combined with the general discussion we have offered for thinking about welfare generally can suggest a framework for considering and assessing policy interventions.

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