Pricing and obfuscation with complexity averse consumers

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Abstract

Competition models typically assume that consumers who cannot compare prices, buy randomly. This paper models the idea that firms may obfuscate product information to confuse consumers, but confused consumers prefer simple alternatives. We show that complexity aversion generates competition in obfuscation, in addition to prices. Markets become more transparent, which enables more consumers to understand prices and stimulates price competition. Three results are most interesting. Firstly, even when simple products are the most expensive in the market, firm profit can be lower when confused consumers favour simple products. Secondly, profit is not always lower in less obfuscated markets. Thirdly, obfuscation can only be eliminated if some consumers are always confused and policies to improve consumer sophistication can stimulate obfuscation.

1. Introduction

The framing of product information strongly influences consumers' choices. In particular, retailers often complicate their product information to confuse consumers and soften price competition, referred to as strategic obfuscation.[1] Whilst the incentives for firms to obfuscate have been extensively explored for many variations in the supply side of the market, surprisingly little attention has been given to how consumers respond to obfuscation. Theoretical models typically assume that some consumers buy at the lowest price, whilst others (who cannot understand prices) choose randomly. When sellers compete only in prices, this random purchase rule is justified because products are homogeneous and consumers have no preferences over sellers. However, when sellers also choose their obfuscation, the rule requires that consumers are indifferent between complex and simple alternatives, which is contradicted by evidence. Instead, buyers exhibit complexity aversion and discriminate against obfuscating sellers.

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1 See Grubb, (2015) and Spiegler (2016) for recent surveys, and Kőszegi (2014) for a review of exploitative contracts.

Huck and Weizsäcker (1999), Mador et al. (2000), and Sonsino et al. (2002) gave initial traction to the existence of complexity aversion in experimental appraisals of expected utility theory. Participants bid lower prices for, or choose to avoid, more complicated lotteries irrespective of risk. Using survey data, Spenner and Freeman (2012) find that consumers are more likely to choose simple products, which are easier to evaluate and simplify decision-making. Homburg et al. (2014) document complexity aversion in a retail market experiment. Buyers are less likely to purchase complex promotions, which individuals associate with higher prices, lower price fairness and lower transparency. Iyengar and Kamenica (2010) show that individuals are biased towards less complex investments and De los Santos et al. (2012) find that the ease with which consumers can navigate around prices online affects choices. Huck and Wallace (2015) show that price framing influences decision-making significantly and Lesgards et al. (2015) show that individuals choose simple linear tariffs instead of more complicated but advantageous non-linear tariffs.

How does complexity aversion affect firms' obfuscation and pricing incentives? Does complexity aversion harm firms, consumers or both? When are consumer protection policies effective? Our objective in this paper is to address these important open questions. Our enquiry is motivated by two observations. Firstly, the increased regulatory concern that obfuscation induces imperfect and persistently low levels of consumer switching, which causes otherwise competitive markets to fail (Wilson and Waddams Price, 2010; CMA, 2015a, 2015b). Secondly, the growth in simplicity-orientated marketing (Siegel and Gale, 2017).

For example, some UK supermarkets have voluntarily simplified their pricing by removing jargon and replacing multi-buy offers with simple regular prices (Thomas, 2016).[2] Online estate agents champion simple flat fees (Hammond, 2018), NPower energy claim 'we're making our tariffs simpler,'[3] Santander bank advertises 'savings made simple,'[4] and Ryanair advertises 'low fares, made simple' (Faull, 2015). Furthermore, firms with simple branding outperform their competitors (Siegel and Gale, 2017), which suggests that the existing literature overstates firms' incentives to obfuscate. We find this to be true and provide a new explanation for firms to voluntarily reduce obfuscation. We also identify market characteristics that make such behaviour more likely, with strong regulatory implications.

We develop a duopoly framework in which sellers independently select a price and an obfuscation level. Aggregate obfuscation in the market determines the fraction of consumers that understand prices. Informed consumers, who understand prices, buy from the cheapest seller. Uninformed consumers, who cannot understand prices, are divided into two types. Some uninformed consumers purchase from the firm with the lowest obfuscation, whilst the remainder buy randomly. This division follows an exogenous proportional rule that we interpret as the degree of complexity aversion. This specification enriches the standard random purchasing rule, which is a special case when we set complexity aversion to zero.

Two types of obfuscation are considered. In the first model, prices and obfuscation are simultaneously adjustable for sellers. For instance, retailers naturally choose the quantity of dimensions of a pricing scheme when selecting prices, and comparing products with more dimensions is more challenging for consumers (Iyengar and Kamenica, 2010). In the second model, firms choose their obfuscation level before selecting their price to reflect types of

2   www.about.sainsburys.co.uk/news/latest-news/2016/11-02-2016. Accessed 23/04/2018.
3   www.npower.com/Campaigns/marketing-comms/home/index.htm. Accessed 24/04/2018.
4   In-store promotional materials. Accessed 31/03/2016.

obfuscation that cannot be adjusted as quickly as prices. Obfuscation in this model could include the complexity of a website or in-store promotional materials.

We show that introducing complexity aversion generates novel dimensions of competition. Sellers now compete to offer the simplest alternative, in addition to the lowest price, which leads to lower obfuscation in the market. This enables more consumers to act as informed buyers, which stimulates price competition. For a class of parameter values for consumer sophistication,[5] obfuscation can be eliminated by market forces. This benefits all buyers. However, when obfuscation is not fully eradicated, new distributional concerns can arise. For instance, when firms commit to obfuscation before prices, consumers who buy the simplest product pay the highest price in the market. However, their complexity aversion generates lower prices for other types of consumers.

Following the literature review, Section 2 outlines the main model and evaluates the rationality of complexity aversion (Section 2.2.3). We consider the simultaneous game first because this timing structure illustrates the effects of complexity aversion most simply and acts as a point of comparison with the sequential model. In Section 3 we discuss the main results and policy implications. Section 4 concludes.

1.1 Related literature

This article bridges the economic psychology literature on complexity aversion with the strategic obfuscation and bounded rationality literatures in Industrial Organization, where it is well-established that firms may find obfuscation profitable (Ellison, 2005; Gabaix and Laibson, 2006; Spiegler, 2006; Carlin, 2009; Grubb, 2015; Heidhues et al., 2017).[6] Two main theoretical approaches for consumer behaviour have been proposed. Firstly, a clearing-house structure: Conditional on firms' obfuscation efforts, some consumers are confused and cannot understand any prices, whilst others understand everything (Carlin, 2009; Piccione and Spiegler, 2012). The proportion of confused buyers, who typically buy randomly, increases with obfuscation. Secondly, search-theoretic models in which consumers engage in costly search. Obfuscation directs the order of search and increases the cost per search, reducing aggregate search (Wilson, 2010; Ellison and Wolitzky, 2012). Our model sits between these two approaches. The structure is rooted in a clearing-house set-up as consumers understand all or none of the prices. However, complexity averse consumers are attracted to the lowest obfuscation seller, which connects to directed search.

The closest related work is the analysis of framing effects (Salant and Rubinstein, 2008). Piccione and Spiegler (2012) allow firms to choose a price and a frame. Buyers are initially assigned to a random default seller and the probability that consumers can compare prices decreases when firms use different frames, which generates switching inertia. Spiegler (2014) generalizes their framework to study the analytical properties of consumer choice functions. Gaudeul and Sugden (2012) also consider consumers who cannot compare prices in different frames. They study the heuristic that uninformed consumers buy from the cheapest firm that uses the most common frame, which restricts the use of individuated framing unless firms can cooperate (Crosetto and Gaudeul, 2017).

Our paper develops in the opposite direction; some frames are intrinsically more complex to understand even if sellers choose the same frame. Furthermore, our buyers do not

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5   More specifically, for a class of values for the fraction of informed consumers for each level of aggregate obfuscation by sellers.

6   See Spiegler (2011) for a textbook treatment of Bounded Rationality in Industrial Economics.

simplify their decision process *ex ante*.[7] Instead, confused consumers prefer firms that obfuscate less. Therefore, the counter-obfuscation forces we study operate at the firm level as firms compete for complexity averse consumers. Gaudeul and Sugden's (2012) operates at the market level, as firms coordinate to a common format. The two approaches provide complementary but distinct explanations for market forces to restrict obfuscation.

Whilst very different in focus, our paper is closely related to Chioveanu and Zhou (2013) who comprehensively analyse the effects of two sources of consumer confusion: individuated framing and complex framing. They study the effect of greater competition on framing choices and show how competition can harm consumers. Notably, their equilibria are robust to a consumer bias towards simple framing but they do not explore this. Our work complements Chioveanu and Zhou (2013) by fixing complex framing as the main source of consumer confusion and analysing the important competitive, welfare and policy implications of complexity aversion. In Section 2.1 we state how our model nests part of their framework and position the model precisely within the literature.

Other reasons proposed within the literature for firms to reduce obfuscation stem from asymmetries in production technologies (Dahremöller, 2013; Wenzel, 2014) and (exogenous) market prominence (Gu and Wenzel, 2014, 2015). In our framework, firm asymmetries are not needed.

2. The model

Consider a perfect information game of competition between two identical firms who sell a homogeneous product to a unit mass of buyers. Each buyer will purchase one unit of the product at any price not exceeding their reservation threshold, normalized to 1. Production costs are symmetric and normalized to zero, with no capacity constraints. Firms independently select a price and an obfuscation level (k), where we follow the literature by limiting obfuscation to High (H) or Low (L). The combination of firms' obfuscation efforts determines market complexity.

For each level of market complexity, each consumer is informed or uninformed. Let $\phi(k_i, k_j)$ denote the function that specifies the fraction of informed consumers, for each combination of obfuscation choices. Define $\phi(L, L) = \mu_L$, $\phi(L, H) = \phi(H, L) = \mu_M$, $\phi(H, H) = \mu_H$ as the fraction of informed buyers. Informed consumers buy from the lowest priced seller. Uninformed consumers cannot compare prices. Therefore, a fraction of uninformed consumers, $\delta \in [0, 1]$, buy from the firm with the lowest obfuscation, with equal sharing at ties. The remaining $(1 - \delta)$ uninformed consumers buy randomly. δ is exogenous and captures the degree of complexity aversion amongst consumers. We assume that when obfuscation increases fewer consumers are informed:

Assumption 1 $0 \leq \mu_H < \mu_M < \mu_L \leq 1$.[8]

Obfuscation plays two roles. Firstly, each firm's obfuscation contributes to market complexity, which determines the fraction of informed consumers. This is the standard role

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7 Papi (2015) and Bachi and Spiegler (2018) also present models in which consumers simplify their decision process *ex ante* due to tradeoff avoidance.

8 This assumption has strong support in the literature. See Kalayci and Potters (2011), Kalayci (2015) and Huck and Wallace (2015) for experimental evidence and Wilson and Waddams Price (2010) for empirical evidence.

within the literature. Secondly, the relative obfuscation of each firm determines the allocation of uninformed buyers.

In our first model (Section 2.1), firms select obfuscation and prices simultaneously. In our second model (Section 2.2), firms select obfuscation before competing in prices. Distinguishing between these cases has both technical and economic significance. From a technical perspective, the sequential game allows firms to condition prices on the obfuscation decisions of all sellers. In the simultaneous model, firms set prices based on expectations of their rival's obfuscation. From an economic perspective, the frameworks capture different types of obfuscation.

Before solving the model, several remarks regarding the literature are helpful. Firstly, if we ignore obfuscation and all consumers are informed, we restore Bertrand competition. Secondly, if we ignore obfuscation but allow some consumers to be uninformed, the model collapses to Varian (1980) price competition. Thirdly, if we change the source of consumer confusion such that $1 = \mu_L = \mu_H > \mu_M$, the simultaneous model fits with Piccione and Spiegler (2012) and Gaudeul and Sugden (2012). Gaudeul and Sugden (2012) study aversion to individuated framing when n (number of firms) ≥ 3. In contrast, we consider confusion from complex framing ($\mu_L > \mu_M > \mu_H$), allow $\mu_L \leq 1$ and introduce complexity aversion: $\delta > 0$, with $n = 2$.

Fourthly, ignoring complexity aversion: $\delta = 0$, and imposing $\mu_L = 1$, captures Chioveanu and Zhou's (2013, Proposition 2) duopoly when $\mu_M > \mu_H$. They also allow $\mu_H > \mu_M$ and $n \geq 3$, consistent with their focus on framing as competition increases. Notably, their main results are robust to a bias towards simple framing but they do not study the implications.[9] In contrast, we fix the source of consumer confusion: $\mu_L > \mu_M > \mu_H$, allow: $\mu_L \leq 1$, and focus on the important effects of complexity aversion: $\delta > 0$. The restricted case: $\delta = 0$, $\mu_L = 1$, acts as our benchmark for analysis to illustrate the importance of these restrictions for generating previous results. Fifthly, if firms vary in obfuscation in the sequential model, they choose prices with uneven shares of uninformed buyers, which captures Narasimhan (1988). Pricing in the sequential model also relates to Gu and Wenzel (2014) when $\delta = 0$, except they assume one exogenously appointed 'prominent' seller receives a larger share of uninformed consumers independently of price and obfuscation. Our firms are *ex ante* identical but the lower obfuscation firm becomes 'prominent' endogenously in the sense that they receive a larger share of uninformed consumers when $\delta > 0$.

2.1 Simultaneous obfuscation and pricing

The simultaneous game unfolds over two stages. In period 1, firms choose prices and obfuscation. In period 2, consumers purchase according to their type. Equilibrium depends on the degree of complexity aversion (δ) exhibited by uninformed buyers. Define $\delta^c \equiv \frac{\mu_L - \mu_M}{1 - \mu_M}$. We begin with the case where the degree of complexity aversion is small: $\delta < \delta^c$, before considering the case with stronger complexity aversion: $\delta \geq \delta^c$, and exploring the importance of this critical threshold.

Proposition 1   For $\delta < \delta^c$ firms follow mixed strategies in prices and obfuscation: $\left(\lambda_k, F^k(p) \right)$. $\lambda_L = \frac{\mu_M - \mu_H + \delta - \delta \mu_M}{\mu_L - \mu_H}$ defines the probability firms select low obfuscation. When

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9   Let n_L and n_H denote the number of firms that use frames L and H, respectively, who jointly offer the lowest price for each frame. Consumers choose a frame L firm with probability: $\frac{\Phi(n_L, n_H)}{n_L}$, and a frame H firm with probability: $\frac{[1 - \Phi(n_L, n_H)]}{n_H}$, where $\Phi(n_L, n_H) \geq \frac{n_L}{n_L + n_H}$.

low obfuscation is selected, a price p' is drawn randomly from a distribution $F^L(p')$. When high obfuscation is selected, a price p is drawn randomly from a distribution $F^H(p)$. The price distributions have adjacent supports such that $SuppF^L(p') = [p^l, p^m]$, $Supp$ $F^H(p) = [p^m, 1]$.

In equilibrium, sellers randomize their price and obfuscation. The intuition follows that sellers prefer to choose high obfuscation to soften price competition. However, if both firms choose high obfuscation, a seller prefers to deviate to low obfuscation and undercut the rival's price (Chioveanu and Zhou, 2013). This increases the amount of informed buyers, which the firm subsequently attracts, and increases the firm's share of uninformed buyers due to complexity aversion. These competing incentives induce sellers to randomize their obfuscation. The presence of informed and uninformed consumers also induces firms to randomize their price to prevent their competitor from undercutting and stealing the informed consumers (Varian, 1980).

2.1.1 Equilibrium payoffs and pricing   Let the expected payoff to firm *i*, given their price-obfuscation combination (k_i, p_i), be written $\pi_i(k_i, p_i)$.

Lemma 1   For $\delta < \delta^c$, the price-obfuscation combination $(H, 1)$ belongs to the equilibrium mixed strategy.

All proofs are given in the Appendix. A seller charging the maximum price only attracts un-informed consumers, which fixes the highest equilibrium price at the reservation price. A less competitively priced seller benefits most from confusing consumers. That is, $\pi_i(H, 1) \geq \pi_i(L, 1)$ for any $\delta \in [0, \delta^c]$, where:

$$\pi_i(H, 1) = \frac{1}{2} \cdot [\lambda_L \cdot (1 - \delta)(1 - \mu_M) + \lambda_H \cdot (1 - \mu_H)] \tag{1}$$

If the rival also chooses high obfuscation, complexity averse consumers and random purchasers are shared equally. If seller *i* reduces his price to $p < 1$, he also attracts informed consumers with probability $[1 - F^H(p)]$. If the rival chooses low obfuscation, only random purchasers buy from the high obfuscation seller. Equilibrium requires that a high obfuscation firm is indifferent between charging 1 and any other price p in the support of $F^H(p)$:

$$\lambda_L(1 - \delta)(1 - \mu_M) + \lambda_H(1 - \mu_H) = \left[\lambda_L \cdot (1 - \delta)(1 - \mu_M) + \lambda_H\left(1 + \mu_H[1 - 2F^H(p)]\right)\right]p \tag{2}$$

Equally, the firm must be indifferent between $(H, 1)$ and (L, p'), where p' is any price in the support of $F^L(p')$:

$$\lambda_L(1 - \delta)(1 - \mu_M) + \lambda_H(1 - \mu_H) = \left[\lambda_L\left(1 + \mu_L[1 - 2F^L(p')]\right) + \lambda_H(1 + \delta + \mu_M - \delta\mu_M)\right]p' \tag{3}$$

When both firms choose low obfuscation, complexity averse consumers and random purchasers are shared equally. Firms compete in prices for informed buyers. When the rival selects high obfuscation, the low obfuscation firm secures all complexity averse consumers, all informed consumers and half of the random purchasers. Solving (3) yields explicit solutions for p^l and p^m where $F^H(p^m) = 0$, $F^L(p^m) = 1$ and $F^L(p^l) = 0$.

The price distributions must have adjacent supports. The reason that the supports cannot be disjoint is similar to Varian's (1980) explanation for the absence of a gap within the

support of a single price distribution: Profit would increase by deviating upwards to a price in the gap. More precisely, a seller would earn higher profit by choosing low obfuscation and increasing their price from the upper bound of $F^L(p')$ until the lower bound of $F^H(p)$, which yields the same demand but at a higher price. We show below that an intersection with several prices cannot exist because a firm with a higher price requires that more consumers are confused.

2.1.2 Equilibrium obfuscation We can now derive the optimal obfuscation strategy and demonstrate that a firm will never choose a price from the support of the distribution associated with the other level of obfuscation. This translates into: $\pi_i(H, p) \geq \pi_i(L, p)$ and $\pi_i(L, p') \geq \pi_i(H, p')$. A sketch of the proof (contained in the Appendix) is as follows. From the adjacency of the price supports, the firm is indifferent between low and high obfuscation at the boundary price: p'''. Therefore, at p''' the two conditions above for optimal obfuscation hold with equality. Solving either condition yields a closed form expression for the probability of low obfuscation: $\lambda_L = \frac{\mu_M - \mu_H + \delta(1-\mu_M)}{\mu_L - \mu_H}$, which can be used to confirm the equilibrium obfuscation-price strategy. We now characterize the optimal strategy when $\delta \geq \delta^c$.

Proposition 2 For $\delta \geq \delta^c$ firms choose low obfuscation. Prices are drawn from the distribution: $F^L(p') = 1 - \frac{1-\mu_L}{2\mu_L}\left[\frac{1-p'}{p'}\right]$ with support: $\left[\frac{1-\mu_L}{1+\mu_L}, 1\right]$.

Proposition 2 restores Varian's (1980) classic model of sales as a special case when $\lambda_L = 1$. For generality, define: $\lambda_L = Min\left\{\frac{\mu_M - \mu_H + \delta(1-\mu_M)}{\mu_L - \mu_H}, 1\right\}$.

2.1.3 Profit, welfare and analysis We now examine the effects of complexity aversion on competition and welfare. Policy implications are considered separately in Section 3.1. Expected profit can be written:

$$\pi_i = \frac{1}{2} \cdot \left[1 - \mu_H - \frac{[\mu_M - \mu_H + \delta(1-\mu_M)]^2}{\mu_L - \mu_H}\right] \qquad (4)$$

Proposition 3 When prices and obfuscation are simultaneous, the effects of complexity aversion are:

i. For $\delta < \delta^c$, higher complexity aversion (δ) increases the probability of low obfuscation, reduces the lower bound of the lowest price distribution and increases price dispersion. Average prices and firm profit decrease.

ii. For $\delta \geq \delta^c$, an increase in complexity aversion has no impact on pricing, profit or obfuscation.

In the benchmark case ($\delta = 0$, $\mu_L = 1$), firms randomize their price and obfuscation. When we allow some consumers to always be confused ($\delta = 0$, $\mu_L < 1$), the probability of low obfuscation increases and profit decreases. Firms are more willing to choose low obfuscation because more consumers are always confused.

Introducing complexity aversion ($\delta > 0$, $\mu_L = 1$) increases the probability of low obfuscation because the cost of high obfuscation, in terms of the expected reduction in demand, increases. This creates more informed buyers, which incentivizes firms to make deeper price cuts and reduces profit. Importantly, a low obfuscation equilibrium ($\lambda_L = 1$) cannot exist when $\mu_L = 1$ if some uninformed consumers buy randomly ($\delta < 1$). The intuition is if both

firms choose low obfuscation, Bertrand competition drives profit to zero.[10] By deviating to high obfuscation, a firm generates uninformed consumers and earns positive profit from his share of the random purchasers. In the extreme case where no uninformed consumers buy randomly ($\delta = 1$), a firm that deviates to high obfuscation receives zero demand. Therefore, equilibrium profit is zero and sellers become indifferent between low obfuscation and deviating to high obfuscation.

In the general case: $\mu_L < 1, \delta > 0$, increasing complexity aversion (δ) increases the probability of low obfuscation and reduces profit at a faster rate than when $\mu_L = 1$. Firms are less reluctant to choose low obfuscation because more consumers are already confused and the marginal benefit from one firm using high obfuscation ($\mu_L - \mu_M$) is smaller. Therefore, complexity aversion has stronger effects in markets where more consumers are always uninformed. A low obfuscation equilibrium is also possible and exists whenever $\delta \geq \delta^c$.

Remark 1   In the simultaneous game with $\delta < 1$, high obfuscation can only be eliminated by complexity aversion if some consumers are always confused: $\mu_L < 1$.

The intuition is when $\mu_L < 1$, firms earn positive profit in a low obfuscation equilibrium due to the presence of uninformed buyers and this payoff can exceed the (positive) payoff from deviating to high obfuscation. As discussed above, this cannot occur when $\mu_L = 1$ because profit in a low obfuscation equilibrium is zero and deviating to high obfuscation generates strictly positive profit. The interpretation for $\delta = \delta^c$ is clearer when rewritten as: $\delta(1 - \mu_M) = \mu_L - \mu_M$. The LHS corresponds to the value of complexity averse consumers and the R.H.S. corresponds to the marginal effect of obfuscation. When the benefit from high obfuscation is equal to the cost (in terms of the foregone demand), high obfuscation is not profitable. This result is important because market forces can eliminate obfuscation and existing studies that neglect complexity aversion systematically overestimate obfuscation incentives.

The pro-competitive effect of complexity aversion is intuitive from the pricing analysis but the precise forces require explanation. Firstly, complexity aversion has a direct effect on profit because these consumers inadvertently buy at the lowest price, which erodes profit. Secondly, complexity aversion generates a positive market externality by incentivizing firms to reduce their obfuscation, which allows more consumers to understand prices and erodes profit further. We decompose the Direct and Externality effects in more detail later.

Example 1   Let $\mu_L = 0.75, \mu_M = 0.5, \mu_H = 0.25$. Figure 1 demonstrates the probability that each firm chooses low obfuscation. $\delta^c = 0.5$. Figures 2 and 3 indicate the price distributions for $\delta = 0.25$ and $\delta = 0.4$, respectively. The solid (dashed) curve indicates the price distribution for a low (high) obfuscation seller. When complexity aversion is larger (Fig. 3), the probability of low obfuscation is higher and price competition is stronger. p^m increases because high obfuscation firms require higher prices to compensate for the loss of complexity averse buyers.

2.2 Sequential obfuscation and pricing

In the simultaneous environment, firms that obfuscate less charge lower prices. Therefore, consumers who buy from the least obfuscating firm buy at the lowest price and profit decreases with complexity aversion. One might suspect that in an alternative model, where the least obfuscated products are most expensive, the pro-competitive effects of complexity

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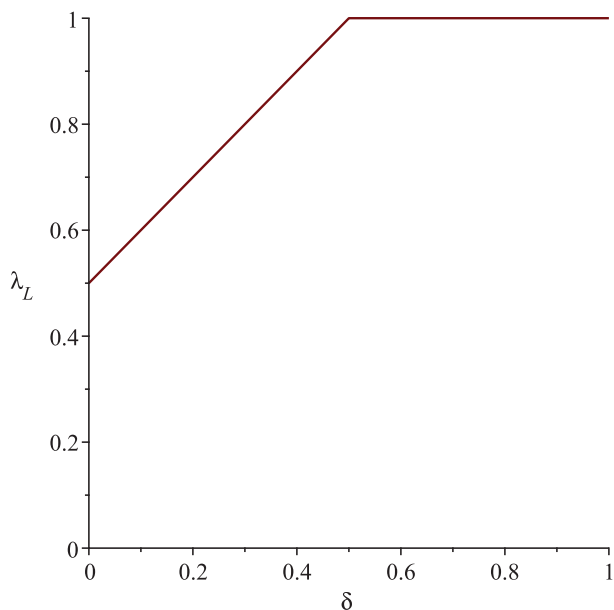10   See Vives (2001), Ch. 5 for a textbook treatment of the Bertrand framework.

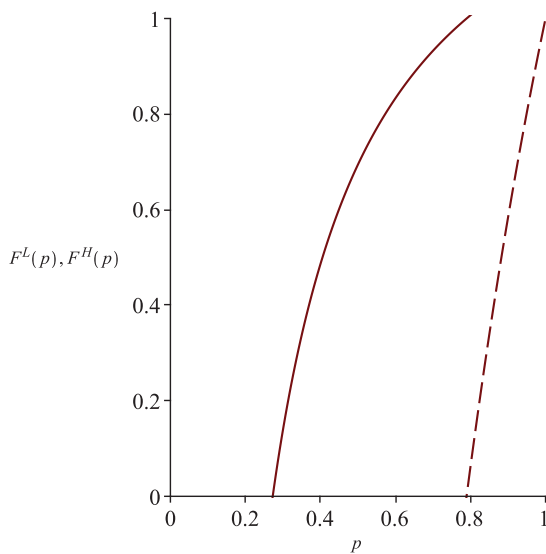**Fig. 1.** Probability assigned to low obfuscation.

Fig. 2. Price distributions ($\delta = 0.25$).

aversion would disappear. We now show that, surprisingly, this reasoning often fails. In period 1, firms select their obfuscation level. In period 2, obfuscation decisions become common knowledge and firms choose prices. In period 3, consumers buy as before. We solve the game using backward induction. The following definition aids the discussion.
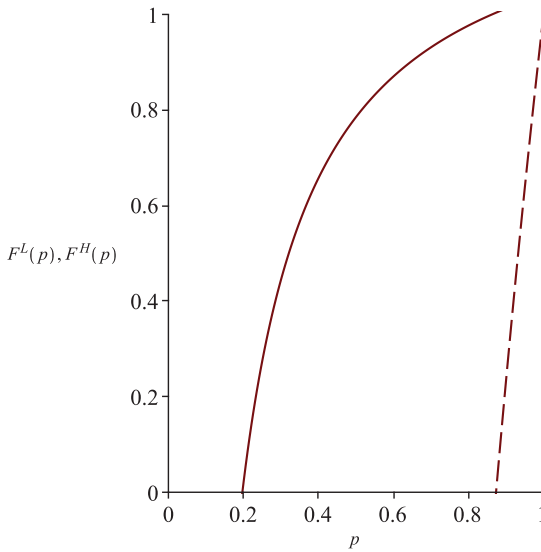
Fig. 3. Price distributions ($\delta = 0.4$).

Definition 1   Captive Consumers: The captive consumers for a firm correspond to the proportion of buyers that are guaranteed to buy from that firm at any price not exceeding their reservation threshold, once obfuscation decisions have been committed.

When firms select the same obfuscation level, captives are distributed equally. This produces a Varian (1980) style price equilibrium (Section 2.2.1). When firms differ in obfuscation, one seller has more captives when setting prices. This produces a Narasimhan (1988) style price equilibrium (Section 2.2.2).

2.2.1 Symmetric pricing   Consider first the case where both firms select low obfuscation. Lemma 2 establishes several well-known results.

Lemma 2   There exists no pure strategy Nash equilibrium in prices. For any $\phi(k_i, k_j) \in (0, 1)$ all firms earn positive profit and compete in price distributions bounded from above by 1. If both sellers choose high obfuscation, the lower bound on prices is higher and prices are less dispersed than if both sellers choose low obfuscation.

A pure strategy equilibrium cannot exist due to standard undercutting incentives and the presence of uninformed consumers guarantees positive profit (Varian, 1980). At the reservation price, the firm is definitely more expensive than the rival and the payoff can be written: $\pi_i(p_i, p_j | k_i = k_j = L, p_i = 1) = \frac{1 - \mu_L}{2}$. Each firm must be indifferent across all prices in the support of the price distribution, $G^L(p)$, such that:

$$\frac{1 - \mu_L}{2} = \left[\frac{1 - \mu_L}{2} + \mu_L[1 - G^L(p)]\right] p \tag{5}$$

Firms trade-off charging a higher price to exploit captive demand with charging a lower price to increase the probability of attracting informed consumers. In equilibrium these tensions balance and the minimum price is: $\underline{p}_L = \frac{(1 - \mu_L)}{1 + \mu_L}$. Solving (5) yields: $G^L(p) = 1 - \frac{1 - \mu_L}{2\mu_L} \left[\frac{1 - p}{p}\right]$. By symmetry,

when both firms select high obfuscation, prices are drawn according to: $G^H(p) = 1 - \frac{1-\mu_H}{2\mu_H}\left[\frac{1-p}{p}\right]$ with support $\left[\frac{(1-\mu_H)}{1+\mu_H}, 1\right]$. Price competition is weaker when fewer consumers are informed. Therefore, average prices are higher and price dispersion is lower under high obfuscation. This illustrates the collective incentive for firms to obfuscate.

2.2.2 Asymmetric pricing   Consider now the pricing strategy when firms adopt different obfuscation levels. Captive consumers are unequally distributed, which produces a mass point in the distribution for the low obfuscation firm at the reservation price (Narasimhan, 1988). The high obfuscation rival chooses prices strictly below the reservation price. Fix the profit of the low obfuscation firm, firm i, at the reservation price. The firm attracts only captive consumers, which yields a payoff: $\pi_i(p_i, p_j|k_i < k_j) = \frac{(1+\delta)(1-\mu_M)}{2}$. The mixed strategy equilibrium makes the firm indifferent between any price in the support:

$$\frac{(1+\delta)(1-\mu_M)}{2} = \left[\frac{(1+\delta)(1-\mu_M)}{2} + \mu_M[1 - G_j(p)]\right]p \tag{6}$$

Solving for $G_j(p)$ yields the probability distribution over prices for the high obfuscation firm, defined over $\left[\frac{(1+\delta)(1-\mu_M)}{1+\delta+\mu_M(1-\delta)}, 1\right)$. To compute the price distribution for the low obfuscation firm, write a similar indifference condition for the rival at the minimum price, noting that the reservation price is not strictly contained in its support. At the lower bound, the firm is guaranteed all informed consumers and half of the random purchasers:

$$\left[\frac{(1-\delta)(1-\mu_M)}{2} + \mu_M\right] \cdot \frac{(1+\delta)(1-\mu_M)}{1+\delta+\mu_M(1-\delta)} = \left[\frac{(1-\delta)(1-\mu_M)}{2} + \mu_M[1-G_i(p)]\right]p$$

Solving for $G_i(p)$ yields the optimal price distribution for the low obfuscation firm, defined over a near-identical support: $\left[\frac{(1+\delta)(1-\mu_M)}{1+\delta+\mu_M(1-\delta)}, 1\right]$, with a mass point at 1 of: $\frac{2\delta(1-\mu_M)}{1+\delta+\mu_M(1-\delta)}$. It can be demonstrated that the price distribution of the low obfuscation firm is higher in terms of first-order stochastic dominance (see Narasimhan, 1988). The low obfuscation seller is less willing to compete for informed consumers because of his monopoly power over complexity averse consumers.

Remark 2   In the sequential model, the lowest obfuscation firm has the highest (average) price. In the simultaneous model, the lowest obfuscation firm always has the lowest price.

The mass point reflects the value of complexity averse consumers relative to the maximum demand the seller could obtain if he also offered the lowest price. It can be interpreted as the probability that the headline price is charged. Prices below the headline reflect 'sale' prices (Spiegler, 2011). The low obfuscation firm randomizes over headline and 'sale' prices but the high obfuscation firm only randomizes over 'sale' prices. This is consistent with the observation that firms vary in their use of discounting. The value of the mass point also increases with δ and decreases with μ_M When complexity aversion is stronger, more consumers are captives for the low obfuscation firm, which increases the cost of competing for informed buyers. When fewer consumers are informed, the incentive to compete in prices is weaker. Proposition 4 summarizes these equilibria:

Proposition 4   The pricing equilibria in period 2 of the sequential game can be summarized as follows:
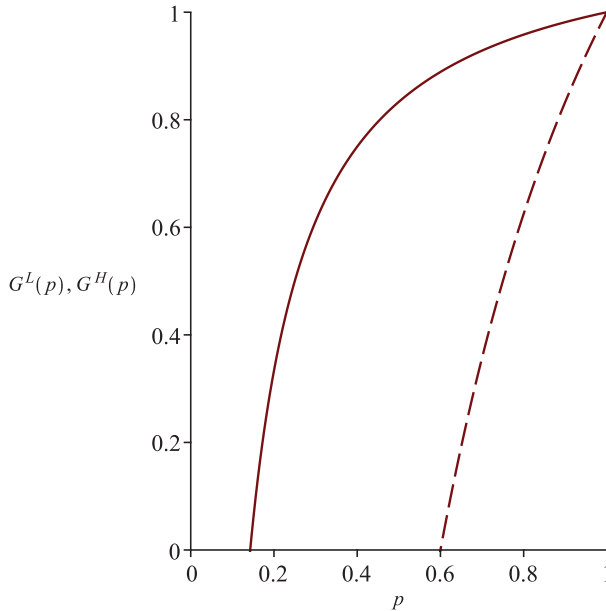
Fig. 4. Symmetric pricing.

i. If obfuscation choices are identical (k), each firm draws a price according to the associated price distribution function $G^k(p)$, defined over $[p_k, 1]$.
ii. When obfuscation choices vary, each firm selects prices according to asymmetric probability distribution functions. The low obfuscation firm has an atom at 1. The high obfuscation firm sets prices strictly below 1.

Example 2 Following Example 1, let $\mu_L = 0.75, \mu_M = 0.5, \mu_H = 0.25$. Suppose $\delta = 0.5$. Figure 4 shows the probability distributions over prices when both firms choose low (solid curve) or high (dashed curve) obfuscation. Figure 5 shows the probability distributions when firms differ in obfuscation. The solid (dashed) curve indicates the low (high) obfuscation seller.

2.2.3 Rationality of complexity aversion   At this point, a natural question is why consumers exhibit complexity aversion? This is distinct from the heavily researched question of why some consumers fail to buy at the lowest price?[11] If the least obfuscated products are always cheapest (as in the simultaneous model), this behaviour is easily rationalized. Consumers who cannot understand prices learn that obfuscated products are more expensive and avoid them. Similarly, in Gaudeul and Sugden (2012) where $1 = \mu_L = \mu_H > \mu_M$, aversion to individuated framing is rational because firms that use common standards face tougher competition with each other and therefore charge lower prices. However, in the sequential model, where the least obfuscated products are most expensive, rationalizing complexity aversion is more challenging. Here we outline several explanations.

Firstly, from a theoretical perspective, the most obfuscated products are always most expensive in the simultaneous setting. However, the most obfuscated products are only more

11   See Grubb (2015) for an excellent overview of the literature on this topic.
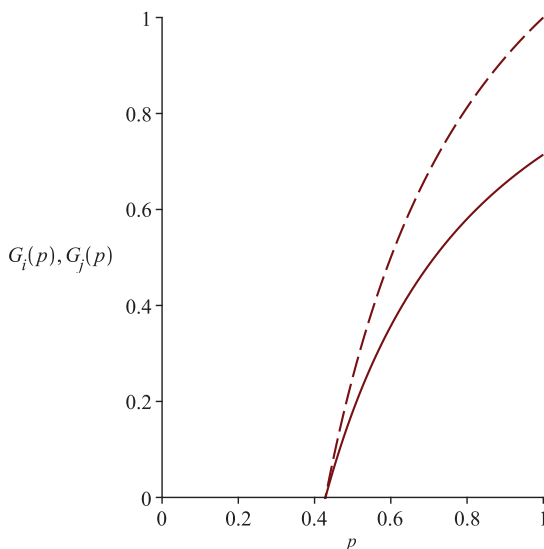
Fig. 5. Asymmetric pricing.

expensive on average in the sequential setting. Therefore, the negative correlation may not be visible to consumers. Secondly, for uninformed consumers to learn that obfuscated products are cheaper, consumers need to repeatedly buy both types. However, recent evidence indicates that consumers often fail to learn of the sub-optimality of their choice because they do not consider the counter-factual alternative (Wilson and Waddams Price, 2010; Huck and Wallace, 2015).

Thirdly, consumers may derive additional benefits from avoiding complex products. For instance, more complicated price frames may be costlier for consumers to understand in terms of effort, inducing buyers to select the simpler alternative. Consumers may also prefer to use a 'fast' decision-making heuristic of choosing the simplest alternative to avoid the 'slow' and intellectually taxing price-comparison process (Spenner and Freeman, 2012).[12]

Recent evidence also indicates that consumers perceive obfuscated products to be unfair and consider obfuscating sellers to be untrustworthy (Homburg et al., 2014). Therefore, consumers choose simple alternatives that they trust more. These explanations are also consistent with evidence that consumers will pay a price premium for simplicity (Homburg et al., 2014; Siegel and Gale, 2017). Finally, confused consumers may incorrectly estimate that complex products are most expensive, which induces buyers to choose the simplest alternative (Homburg et al., 2014).

We now characterize the optimal obfuscation strategy in period 1. Firms face competing incentives. Higher obfuscation softens price competition but reduces the probability that the firm attracts complexity averse consumers. The relative strength of these incentives depends on the parameters governing consumer sophistication (μ_L, μ_M, μ_H) and complexity aversion (δ). We outline the equilibria before evaluating the incidence of complexity aversion.

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12 We are grateful to the anonymous referees for suggesting these two explanations.

2.2.4 Symmetric obfuscation equilibria   First consider pure strategy symmetric equilibria. Let the expected payoff for firm i (j), given the obfuscation choices of each seller, be written $\pi_i\{k_i, k_j\}$ ($\pi_j\{k_i, k_j\}$). For a low obfuscation equilibrium, we require: $\pi_i\{L, L\} \geq \pi_i\{H, L\}$, such that:

$$\frac{1 - \mu_L}{1 - \mu_M} \geq \frac{1 - \delta^2 + \mu_M(1 + \delta)^2}{1 + \delta + \mu_M(1 - \delta)} \tag{7}$$

Proposition 5   A low obfuscation equilibrium is more likely when:

i. The degree of complexity aversion (δ) is high.
ii. The natural level of consumer sophistication (μ_L) is low.

An increase in the natural level of consumer sophistication (μ_L) makes low obfuscation less likely, for two reasons. Firstly, a higher level of market complexity is required to achieve the same level of consumer confusion. Secondly, for a fixed μ_M, the marginal effect of one firm deviating to high obfuscation ($\mu_L - \mu_M$) increases, which strengthens firms' incentives to choose high obfuscation.

Remark 3   In the sequential game, a low obfuscation equilibrium may fail to exist for all levels of complexity aversion (δ).

Consider now a high obfuscation equilibrium. This requires $\pi_i\{H, H\} \geq \pi_i\{L, H\}$ and translates into:

$$\frac{\mu_M - \mu_H}{1 - \mu_M} \geq \delta \tag{8}$$

Proposition 6   A high obfuscation equilibrium is more likely when:

i.   The degree of complexity aversion (δ) is low.
ii. The intermediate level of consumer sophistication (μ_M) is high.
iii. The minimum level of consumer sophistication (μ_H) is low.

The intuition for (8) is clearer when rewritten as: $(\mu_M - \mu_H) \geq \delta(1 - \mu_M)$. Intuitively, high obfuscation is sustained when the marginal effect of obfuscation exceeds the value of complexity averse consumers. High obfuscation is also more easily sustained when μ_M is higher. We provide three reasons. First, higher obfuscation is required to achieve the same level of consumer confusion. Second, the marginal effect of one firm deviating from high obfuscation ($\mu_M - \mu_H$) increases. Therefore, price competition would be more intense if any firm deviated. Third, more informed consumers implies fewer complexity averse consumers, which reduces the gains from deviating to low obfuscation. The intuition for a high obfuscation equilibrium becoming more likely when μ_H decreases follows from the same arguments, approached from the opposite direction.

Remark 4   In the sequential game, a high obfuscation equilibrium is sustained for any degree of complexity aversion (δ) if $\mu_M - \mu_H > 1 - \mu_M$.

2.2.5 Mixed strategy obfuscation equilibrium   There exists parameter constellations where a symmetric pure strategy equilibrium does not exist. Instead, there exists an asymmetric pure strategy equilibrium and a symmetric mixed strategy equilibrium. Asymmetric
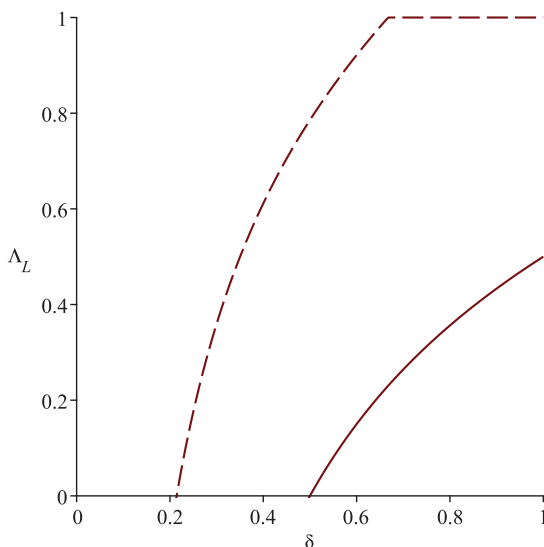
Fig. 6. Equilibrium obfuscation

equilibrium requires: $\pi_i\{L,H\} \geq \pi_i\{H,H\}$ and $\pi_j\{L,H\} \geq \pi_j\{L,L\}$ and the pricing stage mirrors the asymmetric equilibria in Proposition 4. We focus on the case where firms cannot coordinate such that sellers follow symmetric mixed strategies.[13] Complexity aversion disrupts the high obfuscation equilibrium but fails to discipline firms to low obfuscation. Let Λ_L denote the probability that each firm selects low obfuscation where $\Lambda_H = 1 - \Lambda_L$. In equilibrium the firm is indifferent over these pure strategies:

$$\Lambda_L \cdot \pi_i\{L,L\} + \Lambda_H \cdot \pi_i\{L,H\} = \Lambda_L \cdot \pi_i\{H,L\} + \Lambda_H \cdot \pi_i\{H,H\}$$

Insert the relevant payoffs and rearrange to yield:

$$\Lambda_L = \frac{\delta - \delta\mu_M + \mu_H - \mu_M}{\delta - \delta\mu_M + \mu_H - \mu_M - 1 + \mu_L + \left[\frac{(1-\mu_M)(1-\delta^2+\mu_M(1+2\delta+\delta^2))}{1+\delta+\mu_M(1-\delta)}\right]} \tag{9}$$

As in the simultaneous model, we restrict $\Lambda_L \in [0,1]$. For $\Lambda_L \leq 0 \, (\geq 1)$, a high (low) obfuscation equilibrium exists.

Proposition 7   In a mixed strategy obfuscation equilibrium, the probability placed on low obfuscation (Λ_L) increases with the degree of complexity aversion (δ).

Proposition 7 is the sequential model analogue of Proposition 3 in the simultaneous game. Following an example, the models are compared in detail.

Example 3   Suppose $\mu_L = 0.75, \mu_M = 0.5$ and $\mu_H = 0.25$. The probability of low obfuscation for varying degrees of complexity aversion (δ) is given by the solid curve in Fig. 6. For $\delta \leq 0.5$, a high obfuscation equilibrium exists. As δ increases, the incentive to compete in

13   Full details of the asymmetric equilibrium are provided in the Appendix. There is no systematic ranking of the asymmetric pure strategy equilibrium and symmetric mixed strategy equilibrium in terms of welfare.

obfuscation grows until firms randomize according to ΛL. When all uninformed consumers are complexity averse ($\delta = 1$), firms randomize equally between high and low obfuscation. There exists no low obfuscation equilibrium. If consumers are less sophisticated: $\mu_L = 0.45, \mu_M = 0.3, \mu_H = 0.15$, a high obfuscation equilibrium is overturned by $\delta > 0.21$ and a low obfuscation equilibrium arises whenever $\delta > 0.66$, as illustrated by the dashed curve in Fig. 6.

2.2.6 *Profit, welfare and analysis* To maximize comparability with the simultaneous model, we follow the same analytical structure.[14] In the benchmark case ($\delta = 0$, $\mu_L = 1$) firms choose high obfuscation. This differs from the simultaneous game where firms randomize their obfuscation because the correlation between prices and obfuscation is reversed. In the simultaneous game, a firm with a lower price chooses low obfuscation to increase the amount of informed buyers. However, in the sequential game, the pricing-related incentive to choose low obfuscation disappears because a low obfuscation firm charges the highest (average) price.

Allowing $\mu_L < 1$ has no substantive effect when $\delta = 0$ because firms share a common incentive to maximize consumer confusion, regardless of the amount of consumers that are always confused. In contrast, reducing $\mu_L < 1$ in the simultaneous game increases the probability of low obfuscation.

Introducing complexity aversion ($\delta > 0$, $\mu_L = 1$), weakens firms' obfuscation incentives. Depending on the values for consumer sophistication and complexity aversion, a mixed strategy equilibrium may exist or a high obfuscation equilibrium may persist. Consistent with the simultaneous model, a low obfuscation equilibrium cannot exist when $\mu_L = 1$.

In the general case: $\mu_L < 1, \delta > 0$, the probability of low obfuscation increases (or remains 0) with complexity aversion (δ) and a low obfuscation equilibrium becomes possible but only for some parameter values for consumer sophistication. This reinforces two important insights from the simultaneous model: High obfuscation can only be eliminated when some consumers are always confused and complexity aversion incentivizes lower obfuscation. However, there are four important differences.

Firstly, the sequential model admits a wider range of obfuscation equilibria because a high obfuscation equilibrium never exists in the simultaneous game. Secondly, a low obfuscation equilibrium may not exist for any degree of complexity aversion in the sequential model but always exists in the simultaneous model when $\delta \geq \delta^c$. The intuition follows that even when all uninformed consumers are complexity averse ($\delta = 1$), a firm in the sequential game may earn higher profit by deviating to high obfuscation, to soften price competition, and selling to informed buyers. This cannot occur in the simultaneous model because a high obfuscation firm charges the highest price and would receive zero demand.

Thirdly, if $\mu_M - \mu_H > \delta(1 - \mu_M)$, complexity aversion has no substantive effect in the sequential game but always increases the probability of low obfuscation in the simultaneous game. The explanation is that the incentive to choose low obfuscation grows with complexity aversion but this need not overturn the high obfuscation equilibrium in the sequential model. In contrast, firms in the simultaneous game place positive probability on low obfuscation without complexity aversion. Therefore, strengthening the incentive to choose low obfuscation increases the probability of low obfuscation.

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14   We are grateful to an anonymous referee for suggesting this structure.

Fourthly, the intuition for the mixed strategy in obfuscation differs: Firms choose low obfuscation to compete for complexity averse consumers but if both firms choose low obfuscation, price competition becomes too strong and a seller prefers to deviate to high obfuscation (even though this deviation benefits the low obfuscation firm most). In contrast with the simultaneous model, there exists no additional pricing-related incentive to choose low obfuscation.

We now evaluate the effects of complexity aversion on profit, which are more complicated in the sequential framework because the relative magnitudes of the direct and externality effects come into play. Prices and obfuscation are negatively correlated. Therefore, complexity averse consumers buy at the highest (average) price, which increases profit (Direct effect). However, complexity aversion continues to incentivize lower obfuscation, which increases the fraction of informed buyers and reduces profit (Externality effect). We characterize the circumstances under which complexity aversion harms firms before discussing consumer welfare.

Proposition 8 When obfuscation and prices are sequential, the effect of complexity aversion on profit is:

i. Profit decreases if complexity aversion is sufficient to generate a low obfuscation equilibrium.
ii. If a low obfuscation equilibrium is not obtained:

   a. For $\mu_M + 2\mu_H \leq 1$, an increase in complexity aversion always reduces profit.

   b. For $\mu_M + 2\mu_H > 1$, an increase in complexity aversion may increase or decrease profit depending on parameter values for consumer sophistication.

Without complexity aversion, all firms select high obfuscation. If complexity aversion causes a shift from high to low obfuscation equilibrium, which is equivalent to an increase in the fraction of informed buyers in Varian (1980), profit decreases because price competition intensifies. In the intermediate case where firms randomize their obfuscation, welfare analysis is more complicated. A sufficient condition for profit to decrease with complexity aversion is $\mu_M + 2\mu_H \leq 1$. One might wonder when this condition would be satisfied? In practice, this condition fits well with many retail markets. For example, the Advertising Standards Authority report that only 23% of consumers could identify the total cost of broadband contracts on first viewing (ASA, 2016).

In markets where consumers are more informed, such that $\mu_M + 2\mu_H > 1$, we are confined to numerical analysis. The absolute and relative values of the consumer sophistication parameters interactively determine the direct and externality effects. Numerical analysis indicates that for a wide range of parameter values the externality effect dominates, causing profit to decrease with δ. However, this need not always be the case. This paradox is striking. Complexity averse consumers pay the highest price, yet complexity aversion can reduce profit. Furthermore, there exists parameter values where profit is higher when obfuscation is lower and more consumers are informed. The explanation is that the additional profit from exploiting complexity averse buyers outweighs the strengthening of price competition from lower obfuscation. Therefore, profits are not always higher in more obfuscated markets.

2.2.7 Consumer welfare Our metric of consumer welfare has been solely monetary. As discussed, a general measure is inherently sensitive to the specification of the utility

function. It is easy to imagine that consumers may gain additional utility from engaging with a less obfuscated marketplace. In the simultaneous game, this type of additional utility has no impact on the results: Consumers are always better off when complexity aversion is higher. However, in the sequential case this need not be true.

Under a low obfuscation equilibrium in the sequential model, complexity averse consumers buy at the same price as their random-purchase counterparts and all consumers are better off due to the externality effect of complexity aversion. However, when a low obfuscation equilibrium does not arise, complexity averse buyers pay the highest (average) price and the total prices paid by all consumers need not decrease. Introducing additional utility when obfuscation is lower could allow both consumers and firms to benefit from complexity aversion. Firms benefit from higher prices and consumers benefit from consuming simple products. It is beyond the scope of this paper to quantify additional utility gains from purchasing simple products but this is an interesting avenue for future work.

3. Discussion

Our main message is that complexity aversion creates new dimensions of competition by incentivizing sellers to reduce their obfuscation. This enables more consumers to behave as informed buyers, which strengthens price competition. However, high obfuscation can generally only be eliminated if some consumers are always confused. In the simultaneous game, complexity aversion increases the probability of low obfuscation and reduces profit. In the sequential game, complexity aversion continues to increase the probability of low obfuscation but the welfare implications are less clear and two surprising outcomes emerge. Firstly, whilst complexity averse consumers purchase from the most expensive seller in the market, profit can decrease with complexity aversion because of the positive externality exerted on the market. Secondly, there exists parameter values where firms earn higher profit when obfuscation is lower. Therefore, consumers need not be better off in less obfuscated markets.

Complexity aversion also introduces a prisoner's dilemma in the sequential game. Firms could earn higher profits by collectively selecting high obfuscation but complexity aversion disciplines firms to a lower level. Therefore, the persistence of obfuscation in retail markets may be symptomatic of non-price collusion. This collusion-based argument cannot be obtained without complexity aversion because firms would have no incentive to deviate from high obfuscation.

For given parameters, firms (consumers) are generally better (worse) off in the sequential model because of the additional pricing-related incentive for firms to choose low obfuscation in the simultaneous model, which generates more informed buyers and stimulates price competition.[15] More precisely, if the marginal effect of obfuscation is non-decreasing ($\mu_L - \mu_M \leq \mu_M - \mu_H$), profit is always lower in the simultaneous model. If the marginal effect of obfuscation is decreasing ($\mu_L - \mu_M > \mu_M - \mu_H$), we can show profit remains lower in the simultaneous model for a wide range of parameter values: $\delta \in [0, \frac{\mu_M - \mu_H}{1 - \mu_M}]$ and $\delta \in \left[\frac{\mu_L - \mu_M}{1 - \mu_M}, 1\right]$.[16] One exception occurs when a low obfuscation equilibrium exists across

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15   We are grateful to an anonymous referee for suggesting this comparison.

16   For $\delta \in \left(\frac{\mu_M - \mu_H}{1 - \mu_M}, \frac{\mu_L - \mu_M}{1 - \mu_M}\right)$, a mixed strategy obfuscation equilibrium exists in both models and systematic welfare comparisons become analytically intractable. Full details are provided in the Appendix.

both models; pricing and welfare are identical. However, the degree of complexity aversion required to induce low obfuscation is always higher in the sequential model. There also exists parameter values where complexity aversion disciplines firms to low obfuscation in the simultaneous game without affecting the high obfuscation equilibrium in the sequential game. Therefore, obfuscation is more persistent when divorced from price competition.

3.1 Policy implications

3.1.1 Should regulators improve consumer sophistication? Regulators have developed a reputation for market intervention to protect and empower consumers. For instance, intervention in retail banking has motivated calls for intervention in other consumer-focused industries, such as Energy and Broadband (BBC, 2017). Consumer protection policies can be separated into two types. Some aim to improve aggregate consumer sophistication (e.g. independent price comparison website). Others focus on protecting the least sophisticated consumers (e.g. money advice services). How do these policies interact with obfuscation incentives when consumers are complexity averse? We focus on the implications for obfuscation as consumer welfare is inherently sensitive to the specification of the utility function.

Proposition 9   Policy implications in the simultaneous model can be summarized as follows:

i. Policies that increase the proportion of informed consumers lead to higher obfuscation.

ii. Policies that reduce the marginal effect of obfuscation may lead to higher or lower obfuscation. Specifically: λ_L is increasing in μ_M but decreasing in μ_H and μ_L.

In the simultaneous game, sellers attempt to counteract policies that increase the fraction of informed consumers by increasing their obfuscation. Most concerning, in markets where firms do not use high obfuscation, policies to increase the natural level of consumer sophistication (μ_L) can induce high obfuscation. Gu and Wenzel (2014) previously established that a firm may obfuscate more in response to policies that improve consumer sophistication. However, their arguments are very different and rely on an exogenous unequal sharing rule for uninformed consumers. A similar policy message emerges in the sequential game:

Proposition 10   Policy implications in the sequential model can be summarized as follows:

i. Policies that increase the natural fraction of informed consumers (μ_L) can lead to higher obfuscation: A low obfuscation equilibrium becomes less likely.
ii. Policies that increase the intermediate fraction of informed consumers (μ_M), or decrease the minimum fraction of informed consumers (μ_H), can lead to higher obfuscation: A high obfuscation equilibrium becomes more likely.

In both models, increasing the natural fraction of informed consumers (μ_L) and reducing the marginal effect of obfuscation can generate higher obfuscation.

3.1.2 Should regulators encourage consumers to select simple alternatives? Policymakers may also ask whether consumers should be encouraged to buy simple products? When sellers choose prices and obfuscation simultaneously, complexity aversion benefits all

consumers and reduces profit. However, new distributional concerns arise when firms choose obfuscation before prices. For a wide range of parameter values, complexity aversion reduces profit but the surplus is shared asymmetrically across consumer types: Complexity averse buyers pay the highest (average) price in the market but informed and random purchasing consumers benefit from the increase in price dispersion. Only when complexity aversion disciplines firms to low obfuscation are all consumer types guaranteed to benefit.

4. Conclusion

This paper provides a thorough treatment of the consequences of complexity aversion for firms' pricing and obfuscation strategies, consumer welfare and regulatory policy. Most significantly, we present a new mechanism for obfuscation to be costly for sellers and demonstrate that obfuscation can be reduced endogenously by complexity aversion in consumer choice, without requiring policy intervention. However, obfuscation can only be fully eliminated if some consumers are always confused.

Surprisingly, complexity aversion need not be detrimental to consumer welfare even when this implies that these consumers gravitate towards the most expensive seller. Choosing the simplest product can also be rational. When obfuscation is instantly adjustable for firms, the simplest products are also cheapest. However, when obfuscation cannot be adjusted as quickly as prices, the situation is less clear and new distributional concerns can arise. Complexity averse consumers pay a higher average price than their random-purchasing counterparts but their choice process incentivizes firms to reduce their obfuscation. This leads to lower prices across the market.

This work also highlights a unique circumstance in which firms' profits are not always lower in less obfuscated markets. Therefore, regulatory intervention should not be motivated solely by high obfuscation. Policies to improve consumer sophistication may also be ineffective and induce higher obfuscation by sellers, even with symmetric firms. Most generally, we have exposed the sensitivity of models underpinned by a random purchasing rule for uninformed buyers and demonstrated that the existing literature systematically overestimates firms' incentives to obfuscate.

Supplementary material

Supplementary material is available on the OUP website. This is the online appendix.

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