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Personalised Pricing and Disclosure

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Executive Summary

This review suggests factors to consider when evaluating impacts of companies disclosing that they are “personalising” prices. A personalised price exists when the same product is sold by a company at different prices to different customers. Particularly over the internet, price personalisation is feasible, though empirical work suggests it is not common. The review builds on economic findings with either a theoretical or empirical focus.

It is well known that price discrimination can be welfare-enhancing. There is also substantial evidence that, on certain occasions, due to natural features of human behaviour, higher prices can apply to sub-groups of customers, in particular, those who do not engage in an active search for lower prices and have little price sensitivity. Intuitively, these harms may often apply to wealthier consumers with less time for search, with benefits arising for the poorer and less advantaged members of society. In such cases, mandatory disclosure could likely harm the poor by inducing companies to eliminate the price discrimination that benefitted the poor. At some other times, higher prices may apply to other groups with less inclination or ability to search. To the extent that those affected by price discrimination are demonstrably the less advantaged members of society, policymakers may wish to consider focused options, if they deem such intervention as appropriate and with substantial benefits that exceed costs.

General requirements to disclose price discrimination may reduce the incentive for internet retailers to engage in price discrimination, due to negative impacts on sales. Just as moving from uniform pricing to price discrimination will create winners and losers, so will moving from price discrimination to uniform pricing. Disclosure requirements may, perhaps surprisingly, often hurt the poor and the more active searchers due to an average price raising effect from a “one price for all” approach. While disclosure of price discrimination may dissuade price discrimination by large retailers, the impact may not be the same on smaller or more specialised internet businesses. The reason is that such businesses may be less dependent on reputation and less subject to social media pressure.

Main report

Introduction

This review has the purpose to synthesise and develop a policy perspective on the relationship between personalised pricing and disclosure. Personalised pricing is a pricing strategy where a good is sold by the same seller to different buyers at different prices. Disclosure of personalised pricing can take different forms: (a) informing consumers that the price is personalised, (b) explaining to consumers how the price is personalised, and (c) facilitating comparison between personalised prices amongst consumers. In this review, we:

- Conduct a review of relevant theoretical and experimental/empirical literature on disclosure and personalised pricing;
- Combine the insights from these with (behavioural) economic reasoning from first principles, to provide a view on the impacts of disclosure in markets in which personalised pricing is taking place;
- Consider the factors that affect whether disclosure will improve consumer outcomes and how consumers can be expected to react to such disclosure policy.

The topic of personalised pricing is one that has elicited substantial interest from policymakers, with a number of observers having suggested it occurs, can occur or should occur with profit-maximising companies. Jurisdictions outside the UK have considered transparency requirements. For example, the EU Enforcement & Modernisation ('Omnibus') Directive will require companies operating in the EU to make clear if they present a price that has been personalised based on automated decision making.

The question of how policymakers should respond to possible price personalisation on the internet is complex, particularly for policymakers interested in distributional consequences of their policies. While "price discrimination" can enhance total welfare compared to when there is none, it tends to create winners and losers. Although price discounts for select groups are relatively common and accepted, such as price discounts for students, there is a broad consensus among the public, based on survey results discussed later, that price personalisation overall is "unfair".[1] Personalised pricing may be beneficial in that it expands market access to consumers with a low willingness to pay. This waterbed effect involves some consumers paying more, helping to cover firms' fixed costs, which allows other consumers to pay lower prices closer to the marginal cost of the product. Very often, the waterbed effects could work to the advantage of poorer consumers. But some groups of consumers may be hurt under personalised pricing, especially those who suffer from behavioural biases such as optimism and naivety. For repeat-purchase products, for example, some empirical evidence suggests the consumers who switch least are more likely to be from groups deemed, in some sense, as 'vulnerable'. Due to these distributional concerns, the overall welfare consequences of personalised pricing depend on the market structure, market dynamics and information technology available to firms (for tracking) and consumers (for hiding who they are).

Firms may not find it profitable to practice personalised pricing, especially when consumers experience loss aversion and regret or have fairness concerns.[2] This may make personalised

[1] The exact way the survey question is framed could affect the answers to such surveys.
[2] Formally, loss aversion refers to people's tendency to prefer avoiding losses to acquiring equivalent gains.

pricing unprofitable as consumers may refrain from purchasing at all when they are given the choices of different products at different prices. This may be because they are uncertain about which product they like and hence want to avoid the loss of purchasing an unwanted product or making a decision that they may come to regret later. Similarly, they may shy away from buying a product when certain aspects of the offer seem unfair to them, e.g. they may view being charged a higher price as an unequal treatment and hence as unfair. In addition, firms with a high reputational profile amongst relevant consumers, in particular, may be especially unlikely to personalise prices, due to the negative impact on reputation and the potential loss of customers in the markets they serve.

Table 1. Pros and cons of price discrimination

Pros	Cons
1. Price discrimination can sometimes make it possible for customers with low incomes to obtain better pricing options than others, which may be considered socially desirable. 2. Firms' revenue under price discrimination may be higher than under uniform pricing which could allow products that would otherwise not exist to be provided. This extra revenue can be used to cover fixed costs on the supply side, such as infrastructure and innovation 3. In some cases, price discrimination intensifies price competition and does not raise overall profits, especially: when competing firms have the same information about consumers, when price discrimination stops firms from committing to future prices, and when discounts for new customers help to drive market engagement. These cases benefit the consumers, as they receive a lower price on average 4. Irrespective of the overall profit effects, price discrimination can open up markets, notably to poorer and lower valuation consumers 5. Price discrimination that takes the form of discount codes/coupons may drive higher demand and higher consumer utility	1. Price discrimination creates winners and losers, which could be considered socially undesirable if the losers are consistently the poorer and more vulnerable. However, the losers would often be wealthier customers. 2. Price discrimination can make price comparison more difficult, especially for consumers with bounded rationality. It may also raise search costs and dampen competition 3. Price discrimination that rewards active consumers could drive excessive switching which incurs costs 4. Price discrimination can damage consumer trust in markets 5. Price discrimination can create consumer concern about privacy due to excessive data collection. As a consequence, consumers may 'hide' their data, which may adversely impact the effectiveness of digital advertising

Demand-side remedies such as disclosure requirements and price transparency may be beneficial, as they enhance consumer awareness, facilitate price comparison, and prevent consumers from being misled. However, disclosure remedies may not always work well due to redistribution effects between the more “sophisticated” or savvy consumers and less savvy ones. For long-run purchases with repeated payment, disclosure of future prices may relax competition in the market and raise overall market prices if firms are able to commit to such prices. Interestingly, disclosure that improves market transparency and makes competitors more knowledgeable about actual transaction prices could facilitate less price personalisation along with tacit collusion; this effect could be exacerbated by the high data availability on personal characteristics when combined with enhanced possibilities to analyse data via artificial intelligence techniques.

Previewing some of the findings, Table 1 summarises selected pros and cons of price discrimination. These will be important to keep in mind when considering implications of disclosure.

Section 2 discusses the definition of personalised pricing. Section 3 outlines the theoretical approaches to personalised pricing and disclosure. Section 4 focuses on the empirical and experimental findings about personalised pricing and disclosure. Section 5 presents the policy options. Finally, Section 6 concludes.

Definition of Personalised Pricing

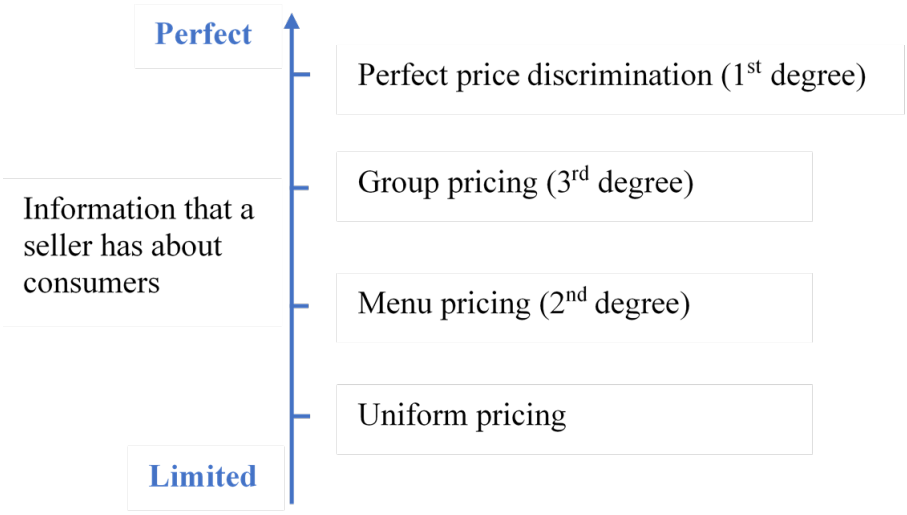
Personalised pricing (or price discrimination) is a pricing strategy where a good is sold by the same seller to different buyers at different prices. The logic is that knowing what each (group of) consumer(s) is willing to pay gives scope for charging different prices, and the price differential is not explained by quality and cost differences.

There are different types of price discrimination depending on how much information a seller has about consumers,[3] as illustrated in Figure 1.

Under uniform pricing, all consumers are charged the same price. Under menu pricing (second degree), there are no observable indicators that can segment the market. Hence, firms use self-selecting devices, i.e. all consumers are offered the same menu of price-product combinations and they self-select into different prices, such as for premium and basic services.[4] Under group pricing (third degree), firms offer different prices to different groups of consumers based on some indicators that correlate with consumers’ preferences (willingness to pay), e.g. gender, age, socioeconomic status, location, purchase history and type of device. Under perfect price discrimination (first degree), firms offer an individualised price to each consumer on the basis of their individual online behaviour, such as browsing patterns, shopping habits and viewing history.

[3] See Tirole (1988) chapter 3 for formal models of price discrimination.
[4] Note here there can be a difference in the product as well as price, e.g. business vs economy airfares. In this instance, price discrimination occurs where the difference in price between the variants of a product exceeds the difference in the cost of providing the products.

Figure 1: Typology of Price Discrimination.



In the past, it would be a seller's dream to identify perfectly each consumer's willingness to pay for each unit of a product so as to charge a different price for each unit. However, in today's online markets, firms collect a large amount of customer information via people's geolocation, internet browsing, online shopping and social networking. With the help of 'Big Data' and data mining (i.e. the capability to process very large sets of data), price discrimination is now more likely to occur at a more personalised level, even without consumers' explicit awareness of its existence. In this review, we take a broad view that personalised pricing could include all types of price discrimination highlighted in Figure 1, while focusing, where possible, on the extent of targeted price personalisation (arising from the information firms hold about a consumer) as being the core subject of interest.

Theory

Welfare Consequences

A preview and summary of the findings in the theoretical literature is as follows:

1. The total welfare consequences of personalised pricing are in general ambiguous, depending on the following factors:
    - Market structure – how many firms are competing?
    - Nature of competition – what do firms compete on, e.g. price or quality?
    - Market dynamics – how does the market evolve over time?
    - The amount and depth of information about consumers held by firms;
    - Information technology available to firms (tracking) and consumers (hiding their identity); and
    - Consumer "sophistication" or savviness (e.g. myopia and preferences for allocating time to search).

2. Personalised pricing may be beneficial in that it expands market access to consumers with a low willingness to pay.

3. Some groups of consumers may be hurt under personalised pricing, especially those who suffer from behavioural biases such as optimism and naivety.

4. Firms may not always find it profitable to price discriminate between consumers with bounded rationality. Firms may want to limit the extent of personalised pricing when consumers experience loss aversion and regret or have fairness concerns.

5. Variations in the price a firm charges consumers for a product do not necessarily imply the existence of price discrimination targeted using consumer information. Price variations may also occur due to other reasons such as randomising prices in the presence of search costs.

6. Demand-side remedies such as disclosure requirements and price transparency may be beneficial, as they enhance consumer awareness, facilitate price comparison, and prevent consumers from being misled.

7. However, disclosure remedies may not always result in socially desirable outcomes due to redistribution effects between savvy consumers and less savvy ones.

8. Disclosure of future prices may relax competition in the market and raise the overall market price, if firms are able to commit to such prices.

9. Disclosure that improves market transparency could facilitate tacit collusion, especially with the help of artificial intelligence.

Static Personalised Prices

Under static pricing, a monopolist that personalises prices usually gains, as it can capture more (possibly the entire) consumer surplus by charging a different price to each consumer, i.e. targeting individual consumers based on their willingness to pay, which normally hurts at least some consumers. However, the welfare consequences of personalised pricing are less clear-cut in a competitive setting. For instance, Taylor and Wagman (2014) show that a switch from uniform pricing to personalised pricing can increase or decrease consumer welfare, depending on whether firms compete on quality or on price. Chen and Iyer (2002) consider an “addressability” model, where two horizontally differentiated firms compete in a Hotelling model where each can target personalised offers to consumers that it has information on. Montes et al. (2019) study a similar model where firms may achieve addressability by buying a list of customer information from a data broker. Belleflamme et al. (2020) study competition between firms that offer identical products but differ in their abilities to profile consumers and infer their willingness to pay.

A general message from this literature is that competing firms do not always benefit from more customer information and an enhanced ability to offer personalised pricing. Instead, the industry profit is usually maximised when firms have some customer information, but the datasets do not perfectly overlap with each other. More generally, firms face a trade-off between surplus extraction and intensified competition. On one hand, firms can extract more surplus from each consumer with better access to customer information. On the other hand, price competition for each consumer is exacerbated when competing firms hold a similar amount or quality of information about particular consumers. In summary, the movement from monopoly to oligopoly can have substantial impacts on price personalisation, with price

personalisation being much more difficult to sustain under more competitive circumstances, and a possibility of intensified competition when companies have more information about individuals and their demand. OFT (2013) provides a very useful discussion of this and consumer welfare impacts from price personalisation.

The welfare consequences can be more complicated if consumers have access to 'hiding' technologies that counteract a firm's tracking. For instance, Belleflamme and Vergote (2016) show that in a monopoly setup, consumer surplus can be higher when consumers have no access to any 'hiding' technology. If a 'hiding' technology is available, consumers with higher willingness to pay have more incentives to hide and, hence, the act of hiding itself partially reveals a consumer's information to the firm.

Dynamic Pricing and Personalised Discounts

Firms may not gain, and consumers may not lose out, when the market is more dynamic, i.e. runs over multiple time periods. This may arise from dynamic personalised pricing or loyalty pricing, where different consumers receive different prices as they build up their purchase history. Classic theory, such as Stokey (1979), demonstrates how a monopolist selling durable goods may be hurt by its ability to adjust prices over time, as consumers can strategically wait to buy in future periods when discounts are given. Acquisti and Varian (2005) show that personalised pricing is profitable when a large fraction of consumers are myopic and identifiable. A firm can easily exploit myopic consumers, as they only make decisions focusing on the price in the short run without taking into account the possibility of price rises in the long run, and these consumers have no access to hiding technologies, such as ad blockers and cookies management.

With consumer tracking, firms can also offer personalised prices conditioning on consumers' purchase histories, which is known as behaviour-based price discrimination. Chen (1997) shows in a two-period model that the market is more competitive when firms can offer different prices to old and new customers, which hurts firms but may benefit or harm consumers. However, total welfare is lower under price discrimination due to a deadweight loss related to excessive switching. In a setup with infinitely lived firms, Villas-Boas (1999) shows that the possibility of charging loyal customers higher prices than new consumers can actually benefit all consumers, due to a competition-intensifying effect, i.e. firms compete so aggressively for new consumers that the low initial prices offset the higher prices charged to them at a later stage. For excellent and more exhaustive reviews of earlier contributions, see Armstrong (2006) and Stole (2007).

Much of the earlier literature focuses on third degree price discrimination, i.e. all loyal consumers receive the same price. More recent contributions also study situations closer to first degree price discrimination, i.e. firms are able to charge their loyal customers different prices depending on their individual willingness to pay, based on information collected by, for example, cookies. Yet, the welfare consequences remain similar. For instance, Choe et al. (2018) show that firms are still worse-off when they can offer individualised prices to their loyal customers, due to the competition-intensifying effect. Using a similar framework, Chen et al. (2020) show that consumers remain worse-off when they can manage and hide their identities.

More generally, a common theme across this literature is the emergence of a 'loyalty penalty' in equilibrium, i.e. firms charge their loyal customers higher prices than new consumers (see also CMA (2018a) for a recent discussion about loyalty penalties in mobile, broadband, cash savings, home insurance and mortgages). However, the literature shows that consumers as a

whole may not be hurt by such practices, as consumers have also enjoyed the low prices in the early stages of engagements with the firm. The overall benefit to consumers is particularly significant when consumer sophistication is high, i.e. when consumers are more forward-looking and have a good understanding of the effect of their current consumption decision on their long-run utility.

Personalised Prices for Consumers with Bounded Rationality

A recent literature studies the phenomenon of firms offering personalised pricing to capture surplus from consumers who exhibit behavioural "biases". Such biases might arise because people are boundedly rational, for example, due to the difficulty of comparing all options and the tendency to use simple rules (heuristics) instead of fully analysing every situation. For instance, Eliaz and Spiegler (2008) illustrate how a monopolist can use menu pricing to screen consumers with different degrees of 'optimism' (i.e. consumers are too optimistic about obtaining large gains from trading with the firm). Heidhues and Köszegi (2017) study a model where consumers differ in their understanding of the market. In particular, some consumers may use heuristics, such as a 'what you see is what you get' rule, to make consumption decisions and do not consider the potential for future add-on pricing. In such situations, a low price in the current time period may be particularly attractive to these less savvy consumers, who may end up paying much higher add-on prices, compared to consumers who have a better understanding of the market. Bar-Gill (2018) shows that if price discrimination is based on consumers' mis-perceptions leading to over-valuation of a particular good or service, then price discrimination's potential efficiency characteristics are much reduced or eliminated.

A common message from this literature is that price discrimination can reduce aggregate consumer welfare, contrary to the classic theoretical conclusion that price discrimination, especially third degree price discrimination, can increase total consumer welfare by expanding the market and allowing more consumers (especially those from low income groups, who tend to have a low willingness to pay) to access products.

However, firms may not always find it profitable to price discriminate between boundedly rational consumers. Firms may want to limit the extent of personalised pricing when consumers have concerns about being treated fairly. For instance, Chen and Cui (2013) consider a model where consumers are concerned about differences in prices paid by peer consumers, with these differences being perceived by some consumers to be unfair. They show that when fairness concerns are strong enough, firms may find it optimal to limit the extent of price differentials and offer uniform pricing. As a consequence, fairness concerns also tend to relax price competition between firms and improve profitability. Similarly, Courty and Nasiry (2018) show that uniform pricing for media and entertainment products may be a market outcome induced by consumers' loss aversion, i.e. consumers may feel regret to have bought some products that turn out not to be what they expected.

Other Reasons Why Consumers Pay Different Prices

There are a number of other reasons why consumers pay different prices for the same item. One of the most well-known causes is search costs, i.e. where there is a cost to discovering the different prices available in a market. As shown by Varian (1980), when consumers differ in their search costs, firms strategically randomise their prices to balance profits arising from competing for consumers with low search costs and making higher profits from consumers with high search costs. In this setting, consumers with low search costs search more and pay lower

prices, while those with high search costs search less and pay higher prices. Such a price randomisation strategy can also be a consequence of firms not knowing how many competitors exist in the market, as shown by, for example, Janssen and Rasmusen (2002). With the wide use of profiling technologies, firms' pricing strategies may have components of both price discrimination and price randomisation when they differ in their ability to profile consumers, as shown by Belleflamme et al. (2020). Furthermore, price randomisation can also be employed when there are behavioural considerations such as loss aversion. For instance, Heidhues and Köszegi (2008) show that firms may randomise between regular high prices and occasional discounted low prices to harness consumer loss aversion. In general, this strand of literature demonstrates the robustness of price randomisation in various settings. Hence, different consumers paying different prices for the same item from the same firm does not necessarily imply the existence of price discrimination.

Role of Disclosure and Price Transparency

Redistribution Resulting from Disclosure

Demand-side remedies are designed to improve consumer engagement and make the market work more efficiently. One core category of demand-side remedies is disclosure. On the positive side, disclosure can enhance consumer understanding and awareness of personalised pricing strategies and prevent consumers from being misled (see Fletcher (2016) for a review of the different categories of demand-side remedies). However, the literature shows that the overall welfare consequences of disclosure are ambiguous. There are often distributional concerns associated with cross-subsidisation under price discrimination, which is well-known in the behavioural economics literature. Specifically, under price discrimination, one group of consumers pay higher prices and hence "subsidise" the other group of consumers who pay lower prices.[5] The impact of disclosure on savvy consumers and less savvy ones can then be very different, which makes the overall effect ambiguous. For instance, Armstrong (2015) shows that by disclosing add-on prices and making more consumers aware of potential future charges, firms may respond by reducing add-on charges and raising prices for basic items. The consequence is that while those consumers, who were previously unaware of the add-ons, are better off, savvy consumers may now have to pay a higher price for basic purchases. Hence, enforcing strict disclosure rules can have ambiguous welfare impacts, hurting the savvy and benefiting the less savvy consumers.

This is related to the classic distributional concerns under third degree price discrimination. When consumers differ in their willingness to pay, allowing price discrimination enables more consumers to access the market, while in comparison enforcing a uniform price benefits some consumers but hurts others. Under certain circumstances, some consumer groups may not purchase a product if price discrimination is not possible.

Disclosure and Price Commitment

In a dynamic setting, firms often benefit from disclosure and being able to commit to prices. For instance, Stokey (1979) shows that, by committing to future prices, a monopolist is able to obtain the monopoly profit, which clearly reduces consumer welfare. Similarly, disclosure may also soften price competition between firms. For instance, Fudenberg and Tirole (2000) show that when firms compete by offering consumers a long-term contract, i.e. disclosing and

[5] This "subsidy" may involve paying a higher share of the fixed costs of a product.

committing to future prices, competition in the market is relaxed and firms obtain higher profits, hence harming consumers. More generally, in the literature on dynamic pricing, commitment from firms to long-term pricing can often raise the overall market price. Furthermore, with disclosure and price commitment, we may observe both a loyalty penalty and loyalty reward in the market, depending on whether consumer preferences are stable over time or not, as shown by Chen and Pearcy (2010).

Price Transparency and Collusion

Another concern of price transparency is that it may facilitate collusion. Although economic theory does not address the problem of when coordination and tacit collusion occur in markets, it does show that markets that have transparency and frequent interactions are conducive to collusion. For instance, Ezrachi and Stucke (2017) argue that Artificial Intelligence (AI) inevitably leads to tacit collusion, as it is much easier for firms to detect and punish deviations from the collusive agreement. In addition, with AI, firms are able to adjust their prices much more frequently, which tends to make tacit collusion easier. For instance, Calvano et al. (2019) show that algorithms could consistently learn to charge supra-competitive prices, without communicating with each other. However, on the demand side, price transparency may also benefit the consumers. With the availability of price comparison sites in addition to disclosure rules, it also becomes much easier for consumers to compare prices between firms, which tends to make collusion more difficult.

Empirics and Experiments

This section moves on to consider the nature of empirical evidence related to price discrimination and disclosure, with a particular focus on the internet. It begins with a discussion of evidence of price discrimination, before discussing empirical findings related to disclosure. While some highly provocative and interesting studies are discussed here, the extent of empirical evidence on these topics is still relatively low compared to that which would be most helpful for policymakers. Obtaining such evidence in appropriate ways is complicated due to the need to establish internet identities with different personal characteristics in order to assess the existence of digital price personalisation.

The table below summarises the evidence that could argue for or against disclosure. Subsequent sections describe the details of that evidence. An important caveat is that the overall evidence base is relatively weak.

Table 2. Empirical and qualitative evidence on price discrimination and disclosure

Evidence questioning disclosure	Evidence for supporting disclosure
1. Limited evidence of price personalisation being pervasive on the internet 2. Sectors with purported evidence of price personalisation include air travel and hotels, though this may be a function of demand management programs. 3. Discounts to certain selected groups considered unobjectionable 4. Some companies claim reluctance to implement price personalisation 5. Price discrimination can be subject to waterbed effects, in which high prices for some are associated with lower prices for others, and eliminating the difference may lead to an average price for all (and increased price for some) 6. Small print disclosure likely to have only limited impact in general 7. Substantial disclosures often have little or only modest effects 8. Transparency over pricing can support cartels	1. Price personalisation often considered unfair in surveys (though questions rarely focus on specific discounts) 2. Prominent disclosures may have larger awareness raising effects for vulnerable groups

Price Discrimination

There is relatively little evidence that personal price discrimination is a generalised activity on the internet. However, there is some evidence that it occurs. Note that this is distinct from the personalisation of offers. The personalisation of offers, which means personalising the selection of products that are presented to a potential customer, seems much more common and demonstrable than the personalisation of prices. For example, when a customer is filling an online basket from a grocery store and searching for “chocolate”, the store may not present all the items that include chocolate to the customer as doing so could create an extremely slow and complicated decision making problem for consumers, as there might be hundreds of product/size combinations. The store may instead reduce the “offer” or “menu of choices” shown to a smaller selection, which can in turn facilitate consumer decision-making but could also result in higher priced offers being presented to customers with a higher willingness to pay. Offer personalisation, including ranking, could take into account factors such as past online behaviour (search, cookies) and access route to the information, e.g. search engine,

price comparison website, device type (mobile vs desktop) and browser. Offer personalisation may include systematic elements as well as random ones. In the airline sector, offer personalisation applied to 92% of websites and in the hotel sector, 76%, while shoes and TVs showed much lower levels of personalisation (41% and 36% respectively).[6]

The ways in which price personalisation occurs, based on current evidence, seems to be focused on some sectors more than others, despite the fact that customer-specific data is available for many internet users regardless of the product they are purchasing.

Sectors where digital price discrimination seems particularly prevalent, according to Ipsos et al. (2018), include the air travel and the hotel sectors. It is notable that both of these involve services that are specifically reserved by name and cannot be traded between people. Of the sectors covered by its mystery shopping exercise, Ipsos et al. (2018) find that the magnitude of the price personalisation in the airline ticket and hotel sectors tends to be small, in the order of 0.67% and 0.30% across 8 European countries (0.31% and 0.12% in the UK) for the two respective sectors (Ipsos et al. 2018, p. 188), compared to the price in which consumer characteristics are hidden.[7] The largest average difference on websites in the airline and hotel sector was under 4%. The effects seem to be larger on smaller websites (p. 197) and price personalisation seems to be lower for physical goods. It is possible that even this finding of personalisation is exaggerated, because the airline and hotel sector use dynamic pricing, in which more demand (potentially from the experiment) can generate sequentially higher prices and prices found nearer to a trip are often higher.[8] More generally, prices may vary substantially over time. Vissers et al. (2014) examine prices from 25 airlines twice a day over three weeks, for 66 different user profiles. They could not find any evidence of price "targeting", though they did find very volatile pricing.

This is not the only empirical evidence of price personalisation. Hannak et al. (2014) propose a method in which the same query is run multiple times as a control to detect the level of "noise", and then test against queries run by different personalities. When queries from different user characteristics have more variation than the control group, that extra variation is considered evidence of price personalisation. They find that, of 16 websites tested, 9 were implementing some form of price personalisation, with travel sites showing a higher percentage of price inconsistency than general retailers. The sites tested were not chosen randomly, but focused on particular sectors.

Citizens Advice (2018) finds that for four essential services, – post, water, energy and telecommunications – there is very little reason to believe that price personalisation exists, though there may be forms of price discrimination for different types of groups. CMA (2018b) tested for personalised pricing and was not able to identify substantial personal pricing in their data. FCA (2019) finds that insurance firms often use margin optimisation, in which they set renewal prices based on customer characteristics and other information, raising prices for some customers more than others. The FCA also finds, on the other hand, that initial prices for insurance are "priced at a discount". This discount likely exists due to later expected profits from clients.

Perceptions may differ from the actual pricing experience. In the UK, the perceived incidence of online personalised pricing is that 42% believe some or nearly all websites use it, (Ipsos et

[6] See Ipsos et al. (2018).
[7] There is a methodological question about whether comparing to prices when personal characteristics are hidden is the appropriate comparator, as such people may be more likely to be privacy conscious and middle class.
[8] Prices may be differentiated between consumers due to price randomisation, which would not count as focused pricing based on personal characteristics but could be considered price discrimination, as well as due to identifying different willingness to pay, which is more the focus of concern from internet "personalised" pricing.

al., 2018, p.215) though these figures do not seem borne out by the main mystery shopper findings. The perceived incidence of price personalisation is not a reliable indication of its likely true incidence.

Informal Evidence Concerning Price Discrimination and Personalisation

Ezrachi and Stucke (2016) suggest that Coupons.com was using proprietary data on consumers to target digital coupons. AirAsia was allegedly using machine learning to test personalised baggage pricing (Reuters, 2017 as reported in OECD, 2018). Uber may be applying personalised pricing as it estimates how much "groups of customers are willing to shell out for a ride". (OECD, 2018) The travel site OrbitzWorldwide allegedly showed more expensive hotel offers to Mac users than PC users, according to WSJ (2012). But the full extent to which this is personalised as opposed to group pricing is unclear.

Glen Weyl of Microsoft suggested that personalised pricing could make consumers lose their trust in Uber; while Chris Knittel of MIT suggested that "society is more willing to accept wealthy people paying higher fares." (OECD, 2018). Overall, there are many informal stories of price discrimination or personalisation.

Price Personalisation to Counter-Act Coordination Risks

Personalised pricing may have particularly advantageous effects in counter-acting risks of algorithmic coordination, as the personalised pricing may be non-observable to other parties to coordination (OECD, 2018). Further research and better methodologies are needed to identify when price personalisation is occurring, particularly if it is occurring in a way that would harm groups for whom policymakers may find it problematic.

Price Personalisation as an Unfair Corporate Behaviour

Many consumers potentially view personalised pricing as unfair. This finding is supported both by a U.S. study (Turow et al.,2005), finding that 91% of respondents had "strong" objections to price personalisation, and a European study (Ipsos et al., 2018), where a majority of consumers saw primarily disadvantages from price personalisation. Such studies must be confronted, though, with other evidence that might suggest special pricing for students or the elderly is considered unobjectionable and is common for theatre tickets, travel and even computer sales. The way in which personalisation is presented may have a high impact on consumer attitudes towards it. Discounts and negotiation over prices can create a greater sense of fairness than if prices are stated as being higher for some groups. (Narayanana, 2013; Richards et al.,2016). Versioning, or offering different features for fundamentally similar products, is a way to make consumers self-select into different groups that pay different prices. Such self-selection can result in some consumers paying higher prices and others paying lower prices, with many consumers who are "winners" and "losers", even in markets with active competitors, due to what can be termed as 'waterbed effects'. (Borenstein and Rose, 1994; Ennis, 2006)

The high perception of unfairness from "blunt" price personalisation, in which firms are able to take a higher share of what would otherwise be consumer surplus for themselves, raises the possibility that disclosure could generate a natural market-correcting mechanism that would reduce companies' incentives to engage in price personalisation.

For example, Amazon experimented with price discrimination and experienced a public backlash that led its CEO to declare the experiment was a “mistake”. CEO Jeff Bezos said “We've never tested and we never will test prices based on customer demographics.” The prices in the experiment were allegedly varied randomly between customers. See Computerworld (2000).

Disclosure of Price Discrimination

The empirical evidence on possible disclosure policies on price discrimination is relatively sparse. This section analyses the limited evidence available. Before doing so, it is worth emphasising that, as a practical matter, disclosure of price personalisation could extend to different types of information revelation. It is important to be clear about which options are examined in each empirical study. De Streel and Florian (2019, p.9) identify three types of information revelation:

1. Informing the consumer that the price is personalised;
2. Explaining to the consumer how the price is personalised; and
3. Showing the consumer how the price they are offered fits into the prices offered to others.

A fourth option might to target product educational support, possibly independently of disclosure, to potentially vulnerable groups, as discussed by CDEI (2020).

Most empirical evidence, though, focuses just on the first scenario, the impact of revealing the existence of price discrimination to customers. In the Ipsos et al. (2018) experiments, “increased transparency that personalisation was taking place and simplification of the cleaning cookies process lead to a decrease in the proportion of participants choosing to switch platforms at the point of purchase confirmation.” (p. 247) Under high transparency and easy cleaning of cookies scenario, participants switched 26.3% of the time compared to 33.6% of the time in the low transparency treatment.

In the questions to survey participants about real life actions they would take, in the low transparency treatment, 39% of respondents stated they would proceed with the purchase, while the figure was 41% in the high transparency treatment. Reasons given for not proceeding included the possibility that prices would be higher than normally paid (43% to 46% gave this reason) and that data would be used to build an online profile (about 44% in the case of price discrimination.)

Interestingly, connecting to the theoretical comments about vulnerable customers and the findings of the FCA that certain customer types are less likely to search repeatedly for good deals, Ipsos et al. (2018) find that “potentially” vulnerable customers, namely those who are economically inactive, have difficulty making ends meet or with low experience of online transactions, had some of the highest awareness increases from transparency. Most interesting was that, when price personalisation was occurring in the purchasing experiment, for respondents above 65, 28% reported awareness of personalisation in the low transparency communication treatment, while 44% did so in the high transparency treatment.

With respect to the survey responses, it is important to be clear that purchase intentions as reported in surveys are likely to overstate, to some degree, actions that will be taken while being generally positively correlated with actions taken. This means that survey results are

often correct about the direction of impact but would overstate the quantum of sales impact. Findings on the relation between purchase intention and actual purchase behaviour are a mainstay of the marketing literature, as illustrated, for example, by Kalwani and Silk (1982), and must be kept in mind when considering the extent of policy reliance on expressed intentions from surveys, no matter how solid the survey methodology.

More broadly, it is worth considering the impact of public price transparency, as would occur under disclosure policy scenarios two and three, which reveal substantial information about price differentiation to purchasers. Price transparency can be a key element in supporting cartels or coordinated pricing. Albaek et al. (1997) show that rules requiring reporting of cement prices and government publication of these prices can have the unintended side effects of raising prices generally and supporting collusive outcomes. Similarly, Fuller et al. (1990) show that disclosure of contract rail shipping rates under a U.S. law from 1986 was followed by an upward trend in shipping rates.

With respect to the fourth disclosure option of a targeted approach to disclosure and support, CDEI (2020) suggests that participants in discussion sessions were “positive but cautious about suggestions that online platforms should proactively identify and support vulnerable groups, due to privacy concerns, risks of false positives and negatives, and other possible unintended consequences”.

Summary of Empirical Findings

Overall, the evidence cited is, in many respects, not compelling about the likely or actual effects of disclosure. In many cases, behavioural impacts, even if statistically significant, are relatively modest. Drawing wide-ranging policy conclusions from the current evidence base would be difficult.

Particular points to emphasise include:

1. There is limited empirical evidence of price personalisation on the internet, with stronger evidence for search order personalisation than price personalisation.
2. Price discrimination over the internet is perceived as relatively common compared to the actual evidence of such price discrimination.
3. Sectors with large price differences between consumers include travel and hotel accommodation, though some of these differences may come about because of demand management programmes.
4. Price personalisation is generally considered unfair in surveys of consumers, and this is true across different types of consumers.
5. Companies claim a reluctance to engage in wide-scale price personalisation, for fear of negative public reaction.
6. Discounts to selected groups or individuals are considered less objectionable by the public than the targeting of higher prices to some individuals.
7. Price discrimination can be subject to waterbed effects, in which higher prices for some groups are counter-balanced by lower prices for others. Thus eliminating price discrimination will often create losers.

8. Small print disclosure generally has little practical impact.
9. Transparency and price standardisation do at times support cartel-like outcomes and can lead to higher prices.
10. Prominent disclosure may have larger awareness-raising effects for vulnerable groups.
11. Even prominent disclosures may have little impact on actions in ordinary transactions.

Policy

In the face of personalised pricing that exists to an unknown extent on the internet, there is evidence that, generically, people find personalised price-setting unfair. Whether policy responses in such situations are appropriate is a matter of debate. On the one hand, see FCA (2018) which appears to scale potential policy responses to unfairness and on the other Lyons, Sugden and Vickers (2018) who would seek a careful and rigorous definition of unfair actions that would reduce perceptual differences and limit grounds for intervention. There seems to be a much broader acceptance of the value of personalised advertising and, perhaps by analogy, personalised presentation of product options.

Policy Considerations

There is some evidence of personalised pricing. At the same time, the possibility of gathering a variety of information about internet search and purchase behaviour, can be considered a risk factor for making personalised pricing feasible (CMA, 2018, pp. 49-50). There is much broader evidence of the top ranked choices in the search results shown to consumers being influenced by personal factors, but the ordering of results is not the topic of this review, though it may be a tool that both is desired by consumers while potentially increasing opportunities to extract consumer (or producer) surplus.

This review does not intend to comment on potential laws that would simply ban differentiated pricing if specific groups or individuals are targeted. It is worth noting that group targeting can have the effect of offering lower prices to low-income individuals. Preventing such targeting through a broad-based ban may then lead to higher prices for the poor.

The evidence on unfairness tends not to consider societal acceptance of certain types of discounts that are available to certain types of individual, such as students, the elderly and low-income groups. Moreover, many theories of personalised pricing would logically lead to higher prices paid by wealthier consumers. To the extent that targeting can occur - as potentially with Uber targeting route origins, individuals, business credit cards and expensive phones - there is a likely correlation with higher income and lower price sensitivity for personalised pricing. Noting that companies like Uber face financial challenges staying afloat and returning profits to their investors, it is not obvious that price personalisation is always harmful, as the price personalisation could be a factor that enables such companies to stay in business. In other words, without price personalisation some products may disappear from the market. Similar low-price, high-price behaviour exists for train pricing in the UK, based on high prices for trips reserved closer to the date of travel.

On the other hand, some behaviours may be considered problematic for policymakers, such as the so-called loyalty penalty, which can result in, for example, insurance costing more for those who are not searching actively and regularly at renewal (see Citizens Advice, 2018 and FCA, 2019). There may be a correlation between such characteristics and being poor or elderly, though the majority of those affected were not deemed as vulnerable by FCA (2019). Concerns about such outcomes must not focus just on group averages but also how policy responses will affect behaviours. Disclosures to people that they may face higher prices if they do not switch provider can have an effect on some consumers. But one mortgage lender has informally found that disclosures combined with offers to customers of better deals after their initial period have take-ups of well under 50%, even though contractual conditions are no worse. One outcome from mandating the movement of customers to better deals over time could be to reduce the willingness of firms to offer initially attractive deals. A principle of market economies is that it is important to maintain the incentive of consumers to scan the market for better deals. Often marginal consumer decisions protect broader groups. One concern about personalised pricing is that it may pick off marginal consumers, while leaving higher prices for the remaining consumers. As Citizens Advice (2017, p. 23) says, “To the extent that personalised pricing is based on consumers’ ability to switch, or lack of, it is important to consider whether this has a disproportionately negative impact on vulnerable customers.”

Policy Options

Particularly because of feelings of unfairness, disclosures could in principle be effective in stopping personalised pricing, because clear, simple and prominent disclosures may lead consumers to cease their purchase or cease dealing with a company that they consider is using unfair tactics. De Streel et al. (2017, p. 48) recommend that personalised pricing strategies, if they exist, “should be transparent to ensure consumers’ trust in online markets”.

There is little evidence that standard “small print” disclosures achieve much of value (Fletcher, 2020). Moreover, some recent and not yet public, experimental evidence varies the prominence of disclosures and finds more prominent disclosures have more effects. Such disclosures still tend not to be noticed by a majority. But a major question is whether modified behaviour by the marginal customers will lead companies to change their pricing behaviour. The main danger may arise if companies are able to identify these marginal customers – the ones who are active and who search the market – and separate these price-sensitive consumers from non-searchers to whom higher prices can be charged. While this can be viewed through a distributional lens, there is a more general point on the positive externality that searchers provide to non-searchers in a market system.

In a recent joint report focused on disclosure, prepared by the Australian and Dutch financial market regulators, the broad conclusion drawn was that disclosure “shouldn’t be the default”. (ASIC and AFM, 2019) Their reasons for caution are numerous: (i) disclosure does not solve the complexity problem in financial markets, (ii) disclosure must compete for consumer attention, (iii) disclosure’s effects differ “from person to person and situation to situation”, (iv) unexpected impacts are likely, and (v) warnings do not work well for making all consumers understand risks.

A risk from a generalised requirement for disclosure is that this may lead to higher prices for some consumers, if the response of companies is to adopt a uniform pricing strategy. Perfect transparency of pricing can also create conditions that could support cartel behaviour. Other options include targeted regimes to help markets work better, for example via providing competitors with ways to identify and seek out the less engaged consumers.

Policy options include:

- No disclosure requirement. Under this option, there is no disclosure required when price personalisation or other types of personalisation are performed. This has the benefit of avoiding some of the unintended effects that are likely from disclosure policies, while preserving financial incentives for consumers to search for lower prices. Absent compelling evidence of a problem for a specific product, the absence of a disclosure requirement may be a sensible default. From a distributional perspective, the impact of price discrimination may be to lower prices for those with less ability to pay, and disclosure may effectively limit price discrimination, thus potentially leading to higher prices for those with less ability to pay.

- Broadly mandated disclosure. Another option is to require disclosures. The nature of disclosure matters. A company that personalises materials for a user may say it does so to make them more appropriate to the user, and this may be true, but it also may also be misleading if the true effect is to raise prices for one group compared to another. Disclosure can take multiple forms including: (1) that the price a consumer is offered differs from that offered to other consumers, (2) the factors that are leading to price personalisation and (3) the range or central tendency of prices. Any disclosure regime requires monitoring/reporting and enforcement of improper disclosure. Yet the very spotting of price discrimination by an enforcer can itself be difficult, suggesting that enforcement will be difficult. If disclosure does nonetheless occur effectively, disclosures may raise prices and lead to uniform pricing; this could be an issue if this occurs for products that the poor would have received better prices under price personalisation. Of even more concern, full transparency may support cartel and coordinated pricing. Further, the ability of price personalisation to allow marginally profitable companies and products to stay in business should not be ignored.

- Make price personalisation illegal. A third option is to prevent all price personalisation. This type of rule may not only lead to higher prices for the poor but, depending on how it is drafted, it could also lead to a stronger effect of driving out business models that require price discrimination, potentially including yield management approaches such as train, airline and hotel systems. The challenge of monitoring and enforcement of legal violations remains.

- Selective disclosure, when price targeting actually or effectively results in broadly higher prices for groups of concern. A fourth option is targeted rules to focus on a product in which behavioural biases or high switching costs may be statistically correlated with characteristics of concern to policymakers, such as poverty or being elderly. Such behavioural biases may exist in insurance markets, even if the treatment of consumers is ‘fair’ (e.g., under the definition of unfair pricing of Lyons and Sugden (2018)). This may be particularly the case with subscription products, where a consumer typically purchases multiple times from the same provider, where the default (or low effort option) is for renewals to occur and this provides opportunities for raising prices. To the extent that price personalisation results from AI and is not directly related with characteristics of concern, but indirectly related, it may be difficult for companies themselves to identify when their price personalisation would be problematic. For the sake of legal clarity, any law would need to provide companies with a clear legal framework for knowing when they comply with the law and when they do not. Randomised control trials would then be useful for testing disclosures prior to any implementation. Policy encouragement of “simplified switching” in which consumers can sign up for a product that automatically switches them towards cheaper products (e.g., cheaper energy suppliers) when prices

go up for the current supplier are well worth exploring and may provide a direct market solution to price differentiation for consumers based on non-engagement.

Conclusion

This review has examined the intersection of price personalisation and disclosure from the perspective of economic impacts. It has not considered broader questions, such as the extent to which disclosure may enhance (or decrease) trust in commercial transactions.

Ultimately, the fundamentals underlying this topic are not new and are not limited to situations with boundedly rational consumers acting in ways that could be described as “irrational”. The core elements to consider for price personalisation and disclosure impacts are: what is the nature of demand and substitution between products, how does information (and the cost of getting different kinds of information) impact consumer decision making and what happens to pricing over time (and the way that consumers may act inconsistently over time)?

The extent to which the topic is of broad interest depends on how common price personalisation is or will become in the future, particularly given relatively modest evidence of price personalisation at the moment. One reason for modest evidence may simply be the difficulty and product-specific challenges of spotting such personalisation. Another may be that targeted price personalisation (unlike advertising or offer personalisation) is simply uncommon. Figuring out the full extent of price personalisation is a major empirical challenge, which may be exacerbated by AI-influenced pricing in the future. Disentangling cost and price margin effects for some products may be difficult when product cost is also associated with particular personal characteristics, as with insurance.

Should any policy be implemented around disclosure of price personalisation, criteria for successful rules would include that they provide clear guidance to firms about when they would violate the law; ensure that enforcers could identify and, potentially, take legal action against all violators; have clearly defined objectives; achieve their objectives effectively at low cost; and avoid unintended negative consequences.

With respect to internet based price personalisation, risks of it happening are perhaps greater than with non-internet based price discrimination due to the enhanced data availability around personal characteristics available to digital companies. Should personalisation happen in a way that substantially harms consumers in vulnerable groups, and should this harm be deemed socially unacceptable, remedies apart from disclosure or price uniformity are difficult to identify. One remedy that has been suggested in other contexts by DCEP (2019) is data sharing. This could be useful if it generates effective competition, which would generally reduce price discrimination. Any data sharing that takes place would need to meet GDPR requirements. Sharing could be facilitated by the existence of “data dashboards” that would allow for more sophisticated and generalised agreement by the consumer of sharing to benefit that user, potentially across services and providers. This could become a way for customers to ensure that multiple companies have similar information about them, which theory suggests will strengthen competition for those customers’ business.

There is a substantial economic likelihood that price personalisation can benefit consumers who are financially disadvantaged. This follows from the finding that, in its most basic implementation, group pricing acts to lower prices to those with less ability to pay. For example, lower prices for movie tickets may be offered to students and the elderly, groups that are identifiably associated with lower than average income. Price personalisation may replicate

group-based price discrimination in a more fine-grained way. If so, the same business-oriented logic that generates lower prices for low-income groups may be extended to lower prices for those individuals with less ability to pay. These pricing patterns may be broken when behavioural biases or switching costs that allow higher prices are more associated with vulnerability, ethnicity, mental health or gender.

A policymaker concerned with protecting the vulnerable must take great care in considering whether to put companies generally into a situation in which price differentiation between consumers disappears. Requiring firms to set “uniform” prices risks raising the price for the vulnerable compared to what they would receive with personalisation.

In contrast, when behavioural biases lead to the vulnerable paying systematically more than others, policy interventions would be less likely to raise prices for the vulnerable. Moving to uniform prices in such cases may improve the situation of the average member of a vulnerable group. In such a situation it is worth recognising that not all group members of a “vulnerable” group would exhibit the same behavioural biases, and that those who exert high effort as savvy product searchers, less subject to “behavioural” biases, may also be harmed from moving towards uniform prices. In short, average effects do not reveal the distribution of experiences in a group, or across groups.

This review identifies policy options available to a government that may be concerned with internet price personalisation. These options are not recommendations and are not purported to represent a complete list. Options include: (a) no disclosure requirement; (b) broad disclosure requirements, applying to all products; and (c) narrow disclosure requirements, applying to product categories in which there is evidence of price personalisation that damages a large share of the vulnerable consumers and for which eliminating price personalisation would benefit a very large portion of those customers identified as vulnerable, not simply the average member of the groups.

Disclosures themselves, if required, could take various forms:

- One would be to disclose the simple fact of personalisation.
- Another would be to state those factors that led to personalisation in an individual case.
- A third would state the range of prices available for the product.

Research suggests that disclosures would need to be simple and prominent to have the most effect. Having said this, there is a high risk of unanticipated consequences from general implementation of one of these forms of disclosure.

There is some limited evidence that simple and prominent disclosures could have more substantial perceptual effects for vulnerable consumers than others. Further evidence and randomised controlled trials for specific products would ideally be in place before taking any policy decisions based on this evidence, both in terms of the number of vulnerable individuals benefitting and the follow-through from disclosure to actual changes in purchasing behaviour or corporate behaviour in a way that would benefit such groups. Nonetheless, this limited evidence does raise the possibility that those who are most vulnerable could receive a particular benefit from disclosures for products in which the vulnerable are disadvantaged by price personalisation; this thesis merits future consideration and research to identify products of potential concern, due to its potential policy implications.

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