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Personalised Pricing in the Digital Era

Background Note by the Secretariat

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More documentation related to this discussion can be found at:

www.oecd.org/daf/competition/personalised-pricing-in-the-digital-era.htm

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Personalised Pricing in the Digital Era

Background Note by the Secretariat[*]

As data analytics and pricing algorithms become common business practice in the digital era, there are growing concerns about the possibility that companies use such tools to engage in personalised pricing, a form of price discrimination that involves charging different prices to consumers according to their willingness to pay. While personalised pricing has the potential to improve allocative efficiency and benefit low-end consumers who would otherwise be underserved, in some occasions it can also lead to a loss in total consumer welfare. Moreover, if these practices are conducted using non-transparent or deceptive means, there is also a risk that they reduce market trust and create a perception of unfairness, potentially dampening consumer participation in digital markets.

[*] This paper was prepared by Pedro Gonzaga of the OECD Competition Division, with inputs from Michael Donohue and Dries Cuijpers of the Division for Digital Economy Policy and from Antonio Capobianco of the Competition Division.

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1. Introduction

1. In the context of digitalisation and with the rise of new data-driven business models, personalised pricing is becoming an increasingly debated topic among policy makers and academics. Although this term is sometimes employed in a wide variety of circumstances, personalised pricing can essentially be seen as a form of price discrimination in which individual consumers are charged different prices based on their personal characteristics and conduct. Personalised pricing thus results in consumers paying each a different price, generally as a function of their willingness to pay, with implications for consumer welfare.

2. From a policy perspective, personalised pricing may require policy makers to trade-off different policy goals. On the one hand, personalised pricing has the potential to substantially improve allocative efficiency, by enabling companies to supply to low-end consumers who would otherwise be underserved. On the other hand, personalised pricing has an unclear effect on distribution outcomes – among firms and different types of consumers – and on dynamic efficiency, since such practices can both promote innovation and rent-seeking behaviour. In some circumstances, personalised pricing can also be perceived by consumers as an unfair practice, potentially dampening trust in digital markets.

3. In light of the ambiguous and multi-dimensional effects of personalised pricing, this background note analyses if and how competition and consumer policies can help addressing some of the risks of personalised pricing, while preserving its economic benefits. With this purpose in mind, this background note discusses whether personalised practices involving business-consumer relationships should be assessed under the scope of competition law, consumer policy, or both. It also attempts to identify some of the enforcement tools that the relevant agencies have at their disposal to address any possible risks.

1.1. Background and motivation

4. The current debate around personalised pricing appears to be largely motivated by the growth of the digital economy and the increasing access by firms to detailed consumer data. As digital markets evolve, there seem to be growing concerns about the risk that firms collect extensive consumer data online and use pricing algorithms to engage in so-called "perfect price discrimination". This behaviour consists in charging each consumer his or her exact willingness to pay, enabling the firm to capture the entire consumer surplus. While perfect price discrimination has been considered a highly theoretical concept, it is not unconceivable that new technologies can at least enable firms to estimate consumers' willingness to pay and to charge prices accordingly, even if such estimates are not perfect.

5. While the risks of personalised pricing have been mostly discussed in media articles, the topic has recently received some attention by academics and practitioners.[1] Some authorities have also looked at the implications of personalised pricing for competition and consumer protection policy (EC, 2018[1]) (DCCA and CE, 2017[2]) (OFT, 2013[3]) but no case law has yet developed. Moreover, there is a growing literature on algorithms and collusion that sometimes refers to the risks of personalised pricing (Ezrachi and Stucke, 2016[4]) (OECD, 2017[5]).

6. Despite the attention that this topic is starting to receive, the extent to which personalised pricing is generally happening in real markets still remains largely unknown, as there are few cases reported of such practices. The current lack of evidence might either

be explained by the fact that firms are not entirely transparent about their pricing strategies, or that they are abstaining from setting personalised prices due to fearing a negative response from consumers. Whatever is the case, in light of the fast technological developments that enable strategies that used to be impossible in the past, it is important to scrutinise the effects of personalised pricing and to identify when these practices may constitute a violation of competition or consumer protection law, so that businesses can more easily comply with existing rules.

1.2. Context within the OECD work

7. This background note was prepared for a joint meeting of the OECD Competition Committee and Consumer Policy Committee on personalised pricing, and is part of the wider OECD work stream in the digital economy. Previous OECD work has identified multiple interactions and overlap between competition and consumer protection, emphasising the importance of the co-operation between the two Committees.

8. The OECD Competition Committee work in the digital economy was launched in 2016 with the hearing on big data, which identified the general benefits and risks associated to the extensive collection and processing of personal data by businesses (OECD, 2016[6]). In a more recent publication on algorithms and collusion, the OECD has looked in detail at how the combination of data with advanced technology, such as machine learning, can lead to collusive outcomes (OECD, 2017[5]). This work also mentioned other risks of pricing algorithms, including the scope for discriminating consumers. Other recent projects of the Competition Committee in the digital economy includes a hearing on the use of antitrust tools in multi-sided markets (OECD, 2018[7]) and a roundtable on competition and e-commerce (OECD, 2018[8]).

9. The Competition Committee has recently looked at price discrimination within online and offline markets (OECD, 2016[9]), discussing the pro-competitive effects of price-discrimination, as well as the risks of exploitation, distortion and exclusion, with a focus on business-to-business relationships. In opposition, the present background note analyses particular forms of personalised pricing that are more likely to be observed in digital markets, supported by automated data tools and involving business-to-consumer relationships.

10. The OECD Committee for Consumer Policy has been actively engaged in preserving the interest of consumers within the context of the digital economy. Of particular relevance is the OECD publication on data-driven innovation, which was the result of a co-operative effort of several directorates and Committees (OECD, 2015[10]). Furthermore, the Committee for Consumer Policy is also currently engaged in an ongoing work to test the effectiveness of disclosures of personalised pricing practices.

1.3. Key findings

11. The analysis and research undertaken for this background note gave rise to the following preliminary findings:

1. Personalised pricing is the practice of price discriminating final consumers based on their personal characteristics and conduct, resulting in each consumer being charged a price that is a function – but not necessarily equal – to his or her willingness to pay.

2. Personalised pricing, like any price discrimination, is typically pro-competitive and often enhances consumer welfare. As compared to more traditional forms of price discrimination, personalised pricing generally has more accentuated effects, having the potential to optimise static efficiency and incentives for innovation.

3. In certain occasions, however, personalised pricing can also be harmful, by potentially enabling the exploitation of consumers and creating a perception of unfairness. In heavily regulated industries, there is also a concern that personalised pricing could encourage rent-seeking activities.

4. The risk of consumer harm from personalised pricing might be addressed through a combination of complementary policy tools, including competition policy, consumer protection and data protection, as well as anti-discrimination laws. Effective enforcement may therefore require the co-ordination of competition, consumer and data protection authorities.

5. Within competition law, personalised pricing may potentially be assessed under abuse of dominance rules, though there are some limitations to the application of competition law in this area:

   a. Rules on abuse of dominance only apply to firms that have substantial market power (even though these are the circumstances under which personalised pricing is arguably more problematic).

   b. In several jurisdictions, exploitative abuses are either not prohibited by competition law, or rarely investigated in practice.

   c. It is often unclear whether competition rules against discrimination apply to business-to-consumer relationships.

6. Consumer protection may have a more prominent role in addressing the risks of personalised pricing under the concept of unfair practices, which applies to business-to-consumer interactions and whose legal test to establish an infringement is easier to be met than in abuse of dominance cases, as no finding of market power is required. There are two important approaches that consumer protection authorities may consider:

   a. The first is to prohibit firms from implementing personalised pricing in a non-transparent way, requiring them to disclose information about their pricing strategies so that consumers understand well these practices and can engage in actions to circumvent them.

   b. The second is to investigate and sanction ancillary unfair practices that may reinforce the negative effects of personalised pricing, such as misleading practices that limit transparency and consumer choice.

7. Lastly, other policy tools such as data protection and anti-discrimination law can help ensure that personalised pricing does not result in consumers being profiled without their consent or being discriminated on sensitive grounds, such as their gender and race.

2. What is personalised pricing?

12. This section introduces the concept of personalised pricing, framing it in the context of more traditional definitions of price discrimination and distinguishing it from other common schemes, such as dynamic pricing. The section then explains how businesses may personalise prices in practice, discussing the process of data collection, the purpose or objective of a particular personalised pricing arrangement and the mechanisms to actually implement that arrangement. Finally, it discusses the markets that might be more prone to personalised pricing, providing a few examples.

2.1. Definition and categories of personalised pricing

13. The term personalised pricing has been used in a variety of circumstances, not always with the same meaning. Sometimes personalised pricing is used as an alternative term to price discrimination, other times it is implemented to refer exclusively to a particular form of price discrimination – such as "perfect" or "first-degree" price discrimination – and, not rarely, it is confused with other terms such as dynamic pricing. The lack of a legal definition or a generally accepted term makes it particularly important to clearly define the concept for the purpose of framing a discussion.

14. A good starting point to understand personalised pricing is to look at the 2013 report by the former Office of Fair Trade, which defines personalised pricing as:

> *"(…) the practice where businesses may use information that is observed, volunteered, inferred, or collected about individuals' conduct or characteristics, to set different prices to different consumers (whether on an individual or group basis), based on what the business thinks they are willing to pay." (OFT, 2013[3])*

15. The definition proposed by the OFT has at least two important components. Firstly, it characterises personalised pricing as the practice of discriminating prices to different *consumers*, focusing thus on business-to-consumer relationships as opposed to business-to-business relations. Secondly, it specifies that the discrimination is based upon information about *personal characteristics* or *conduct*. These two components are helpful to distinguish personalised pricing from the more general concept of price discrimination – which consists in charging different prices for similar products, for reasons not related to cost (OECD, 2016[9]).

16. Considering this definition, it appears to be the case that personalised pricing can take the form of alternative categories of price discrimination (Box 1). While most often personalised pricing is associated to "perfect" or first-degree price discrimination, there is no reason to exclude from the definition more realistic pricing schemes where consumers are only charged a proportional share (not necessarily the total value) of their willingness to pay. Likewise, when data available is limited, it is also possible that personalised pricing discriminates groups instead of individuals, thus resulting in third-degree price discrimination. In digital markets where offers tend to be highly customised, it is also plausible that firms tailor both prices and products to consumers, resulting in a very granular second-degree price discrimination (or "versioning").

Box 1. Categories of price discrimination

The economic literature usually defines three traditional categories of price discrimination (Pigou, 1920[11]):

- **First-degree price discrimination** (or perfect price discrimination): theoretical form of price discrimination where each consumer is charged his or her full willingness to pay. It is considered a benchmark of price discrimination (EC, 2018[1]) or an unattainable ideal (Odlyzko, 2004[12]), as it requires the firm to perfectly observe all relevant heterogeneity among consumers and to price discriminate them accordingly (OFT, 2013[13]).
- **Second-degree price discrimination** (versioning): price discrimination where the seller offers a number of versions of the same product at different prices, leaving for the consumers the decision of choosing a version according to his or her preferences. It is an indirect form of discrimination, as it does not rely on information about consumers (EC, 2018[1]).
- **Third-degree price discrimination** (group pricing): practice of setting different prices to different groups of consumers, which are partitioned according to their observed characteristics. As the seller does not perfectly observe heterogeneity among consumers, the pricing is based on known group characteristics instead of individual characteristics (OFT, 2013[13]).

17. In light of these considerations, this background note adopts a broad definition of personalised pricing, which is herein defined as *any practice of price discriminating final consumers based on their personal characteristics and conduct, resulting in prices being set as an increasing function of consumers' willingness to pay* (Figure 1). The range of practices contained within this definition deserves special attention in the context of digital markets, where the amount and variety of data collected online may enable firms to estimate more accurately consumers' willingness to pay, as compared to brick-and-mortar markets. Moreover, the fact that personalised pricing often involves a granular discrimination of consumers may lead to strong economic effects (see section 3).

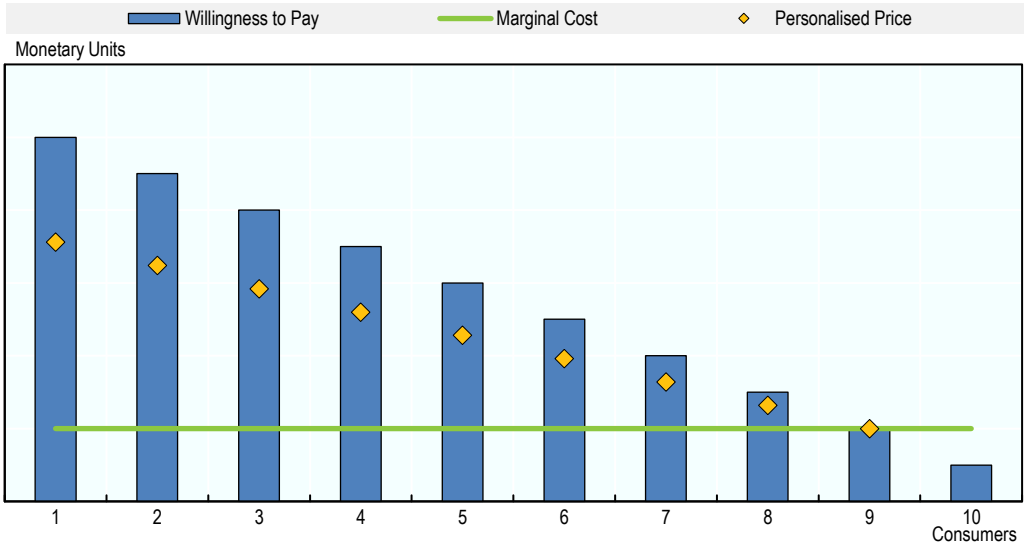
18. It is important to distinguish personalised pricing from dynamic pricing, as these two terms are often used interchangeably despite having different meanings. While personalised pricing involves charging a different price to consumers based on their personal characteristics, dynamic pricing involves adjusting prices to changes in demand and supply, often in real time, not implying any kind of discrimination between consumers. Therefore, from a policy perspective, dynamic pricing tends to pose fewer concerns, enabling price mechanisms to operate more effectively without implying any form of discrimination.

19. It is equally important not to confuse personalised pricing with other forms of online personalisation, such as:

- **A/B testing**: practice of setting multiple prices for the same product in order to test how consumers react to different price points.
- **Targeted advertising**: marketing practice of tailoring personalised adverts to consumers based on their preferences and behaviour, in order to increase the probability of acquiring the costumer.

- **Price steering** (also known as personalised offers or search discrimination): manipulation of search results according to consumers' preferences and behaviour, in order to display more expensive products to consumers with higher willingness to pay (Mikians et al., 2012[14]).

Figure 1. Illustration of personalised pricing



Note: Under personalised pricing, the price charged to each consumer varies according to an estimation of his or her willingness to pay.

2.2. The mechanisms behind personalised pricing

20. Once established the meaning of personalised pricing, the natural question that follows is how firms can personalise prices in practice as part of their business strategy. Naturally, there is not a single answer for this question, as the process may vary substantially across firms and change over time with the rapid evolution of digital markets and the development of better technologies. The fact that these practices are relatively new and not necessarily implemented in a transparent way makes it more challenging to understand them, though it is still possible to identify some common principles used by firms to personalise prices.

21. There are at least three important steps that any firm must follow in order to implement personalised pricing. First, the firm must collect data concerning consumers' personal characteristics and conduct. Second, the firm must use the data gathered to estimate consumers' willingness to pay. Third, based on the estimated willingness to pay, the firm must chose the optimal price for each consumer and decide how to implement personalised pricing. Each of these steps will be discussed in turn.

22. The data collection process is particularly resource-intensive, and potentially the most critical one for the successful implementation of personalised pricing. It involves identifying the variables that affect buying decisions, which can be classified in three broad categories: (1) data volunteered by consumers; (2) data directly observed by the firm; and (3) data inferred from consumer behaviour (Table 1). For each of these categories, the firm must set a different mechanism to collect data, such as requiring consumers to fill an online form (volunteered data), installing cookies in consumers' personal devices (observed data)

and using advanced data analytics or machine learning to infer certain consumer characteristics (inferred data).

Table 1. Categories of personal data collected online

Volunteered data	Observed data	Inferred data
Name	IP address	Income
Phone number	Operating system	Health status
Email address	Past purchases	Risk profile
Date of birth	Website visits	Responsiveness to ads
Address for delivery	Speed of click through	Consumer loyalty
Responses to surveys	User's location	Political ideology
Professional occupation	Search history	Behavioural bias
Level of education	"Likes" in social networks	Hobbies

Note: The categories of volunteered, observed and inferred data are discussed in previous OECD work on data-driven innovation (OECD, 2015[10]). Some of the examples in the table were extracted from other reports (OFT, 2013[3]) (EOP, 2015[15]).

23. An important effect of digitalisation is that, with the development of sensor-equipped smart devices and advanced data analytics, businesses can increasingly rely on both observed and inferred data, unlike pre-digitalisation times when most business models would fundamentally rely on data volunteered by consumers (OECD, 2015[10]). This shift has key implications, enabling firms not only to personalise prices more effectively, but also to potentially do so without the awareness and consent of consumers, who may not be aware of the fact that firms keep detailed profiles about them. Concerns about privacy are well illustrated in a few anecdotal cases, such as the finding that the company Target was estimating "pregnancy scores" and sending coupons of baby products to clients with high probability of being pregnant (Hill, 2012[16]).

24. Once detailed personal data is available, the following step is to estimate how consumer's willingness to pay is explained by their personal characteristics, such as their professional occupation, past purchases and hobbies. The main challenge at this point is the fact that willingness to pay is not an observed variable that can be collected and run in a traditional regression model. Instead, what firms observe is whether a consumer visiting the company website decided or not to purchase a product at a given price. This information can be used to estimate consumers' willingness to pay as a function of personal characteristics, by implementing more advanced regression techniques such as discrete choice models.[2]

25. Lastly, after estimating consumers' willingness to pay, firms are faced with the decision of setting prices to maximise profits. While it is often assumed in the literature on personalised pricing that firms would charge consumers the full value of their willingness to pay, in reality there are several reasons why this may not be the case. Firstly, since estimations are imperfect by nature, firms might set lower prices in order to reduce the risk of losing consumers whose willingness to pay was overestimated. Secondly, the existence of some level of competition may constrain the ability of firms to charge the full willingness to pay, as suggested by some research in experimental economics (Box 2).

Box 2. Natural experiment in personalised pricing

Recent research in experimental economics has looked at the behaviour of everyday consumers that were invited to play the role of sellers setting personalised prices, under simulated competing conditions (Vulkan, N. and Shem-Tov, Y., 2015[17]).

Methodology

The study consisted in two independent online experiments involving respectively 128 and 122 individuals recruited through a social science laboratory pool from a UK University. In the first experiment, the subjects were asked to simultaneously set prices for a product sold to six fictional consumers with different (publicly-known) willingness to pay. The subjects were further informed that they were competing in groups of two and that each consumer would purchase a unit of product from the seller who offered the cheapest price, as long as the price would not exceed the willingness to pay. The second experiment was similar, but it included three different rounds where the subjects were organised in groups of two, three and four sellers competing for the same consumers. At the end of both experiments, some of the subjects were randomly selected and awarded their total earnings in Amazon vouchers.

Results

As expected, the price setting behaviour of individuals was different under uniform and personalised pricing:

- When required to set a uniform price to all consumers, the subjects set prices well above marginal costs. In average, prices were lower in the rounds where there were more sellers competing for the same consumers.
- When allowed personalised pricing, the subjects set prices as a fixed share (and not the full value) of consumers' willingness to pay. A curious finding was that the fraction charged was around 64% of the willingness to pay across all experiments, therefore not varying with the number of sellers competing against each other.

2.3. Market conditions for personalised pricing

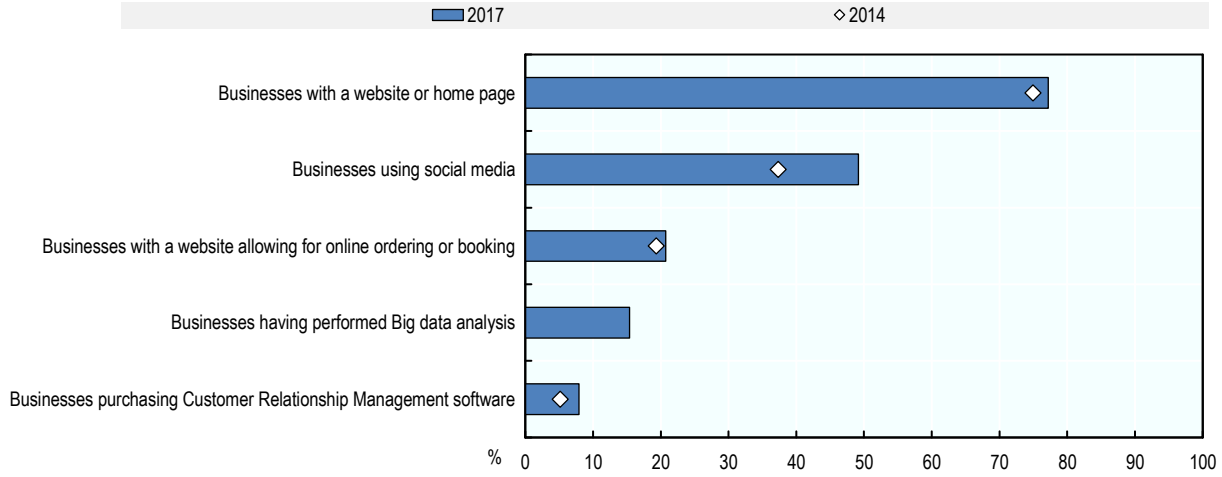
26. Another relevant question that should be addressed refers to the circumstances under which personalised pricing is more likely to be observed. The OECD has identified three necessary conditions for price discrimination in general to occur (OECD, 2016[9]), which also apply to personalised pricing:

- **Identification of consumer's valuation**: The first fundamental condition is that businesses have a mechanism to measure consumer's willingness to pay. This requires the firm to have good computational resources and access to a large volume and variety of data, as "*big data has lowered the costs of collecting customer-level information, making it easier for sellers to identify new customer segments and to target those populations with customized marketing and pricing plans*" (Council of Economic Advisers, 2015[18]). Accordingly personalised pricing might more easily be observed in online markets where data assets are highly concentrated, for instance due to network effects, economies of scale and economies of scope.

- **Absence of arbitrage**: Personalised pricing can only be effective if arbitrage is not possible, that is, if consumers with low valuation cannot resell the product to consumers with high valuation. This is easy to guarantee for the sale of services for offline consumption (such as booking of hotels, flights, concerts, museums, etc.), as tickets are often non-transferrable. Arbitrage may also be prevented in the sale of digital content such as movies, e-books, online courses or journal subscriptions, by guaranteeing that the content can only be accessed using a personal device or account. On the other hand, it might be harder to prevent arbitrage in the sale of tangible durable goods such as computer equipment, cosmetics or clothing, as compared to perishable or less expensive tangible goods for which arbitrage would be less feasible.
- **Element of market power**: Personalised pricing requires a minimum level of market power, as in perfectly competitive markets prices go down to marginal costs for all consumers. This means that personalised pricing may be particularly feasible in markets with some degree of economies of scale, economies of scope, network effects, entry costs or switching costs, enabling firms to exert some market power by differentiating prices above the marginal cost curve.

27. Out of the three conditions identified, the one that appears to have increased the most in recent years is the ability of firms to measure consumers' valuations, explaining the growing concerns about the risk of personalised pricing. Nowadays, the vast majority of businesses have a website or home page, and around half of them are using social media (Figure 2), enabling them to collect information on IP addresses, webpage visits, historical purchases or number of "likes" of a product or service, through the use of cookies and other automated data collection tools. A smaller but still noteworthy number of businesses are performing big data analysis or using Customer Relationship Management software, which may further assist companies personalising services and discriminating prices to consumers on an individual basis.

Figure 2. Use of information & communication technologies (ICTs) in OECD countries



Note: All indicators are calculated for a sample of at least 21 OECD countries. When data is not available for 2014 and 2017, data for the closest year is used.
Source: OECD (2018), *Improving Online Disclosures with Behavioural Insight*, OECD Publishing, Paris, www.oecd.org/sti/consumer/policy-note-improving-online-disclosures-behavioural-insights.pdf.

28. Moreover, the fact that personalised pricing requires some element of market power and a mechanism to prevent arbitrage may provide some hints about the type of firms that are more likely to engage in these practices. The most obvious candidates are online platforms and giant online retailers that sell services for offline consumption, digital content and less expensive tangible goods, particularly in markets with some level of entry costs and switching costs. Personalised pricing might also be observed among brick-and-mortar businesses, such as big supermarket chains with fidelity cards, or even utility service providers (e.g. telecom, energy) that keep close track of consumer behaviour. Naturally this list is non exhaustive, as personalised pricing may be also observed in other industries.

2.4. Empirical evidence of personalised pricing

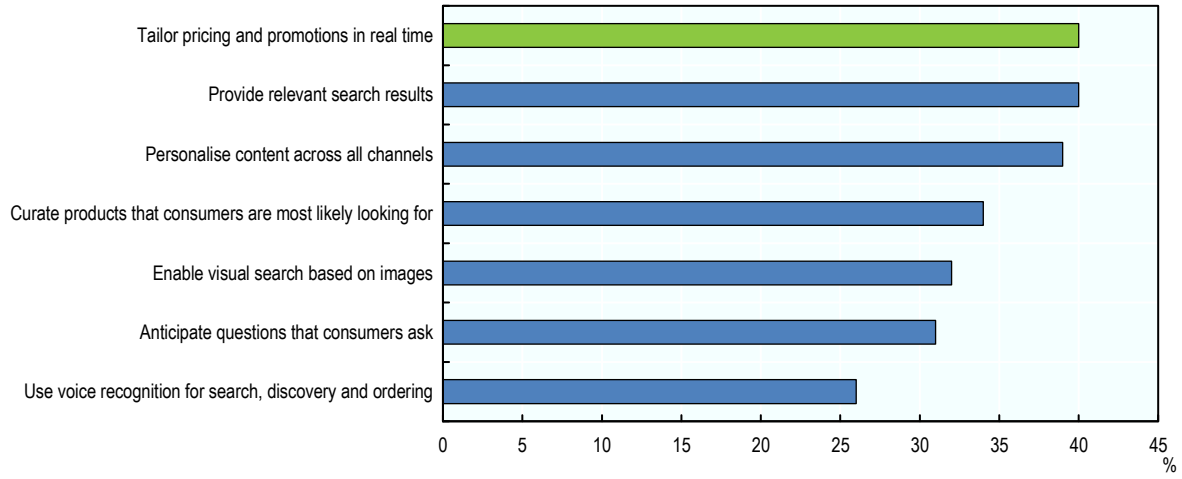
29. Although the basic conditions for personalised pricing are satisfied in several markets, it is still hard to find evidence of actual cases reported in the literature. This may be due to different reasons. On the one hand, it is possible that most businesses are still reluctant to engage in personalised pricing, due to fears of losing reputation or of triggering a negative reaction by consumers (Council of Economic Advisers, 2015[18]). On the other hand, it is also plausible that firms are already personalising prices, but chose to do so in a non-transparent way, for the same reasons previously stated. Either way, detecting personalised pricing is a complex task, as the "*technical possibilities for online personalisation have become much more advanced and hard to capture/measure*" (EC, 2018[1]).

30. Even though existing evidence is relatively limited, there is some data showing that personalised pricing is already occurring, at least to some extent. A recent survey by Deloitte involving over 500 companies (Hogan, 2018[19]) found that, among all retailers that have adopted artificial intelligence (AI) to personalise consumer experience, 40% of them used AI with the specific purpose of tailoring pricing and promotions in real time (Figure 3). In addition, the consumer survey of the European Commission revealed that between 12% to 20% of consumers have had bad experiences related to personalised pricing (Figure 4). Another study used the accounts and cookies of over 300 real-world users in order to test for the presence of price discrimination in 16 popular e-commerce websites, of which 9 were found to have some element of personalisation (Box 3) (Hannak et al., 2014[20]).

31. Further evidence of personalised pricing has been uncovered by some journals that identified companies setting personalised prices based on consumer information. A Wall Street Journal investigation in 2012 detected that the retailers Staples and Home Depot, the education technology company Rosetta Stone and the financial company Discover Financial Services have personalised prices based on different consumer characteristics, such as their geolocation, income level, browsing history and proximity to rival's stores, among others (Valentino-DeVries, Singer-Vine and Soltani, 2012[21]). In the same year, the New York Times also found evidence of personalised pricing undergoing in the supermarket chains Safeway and Kroger, with prices being set higher for loyal consumers and lower to those consumers that alternate between competing brands (Clifford, 2012[22]).

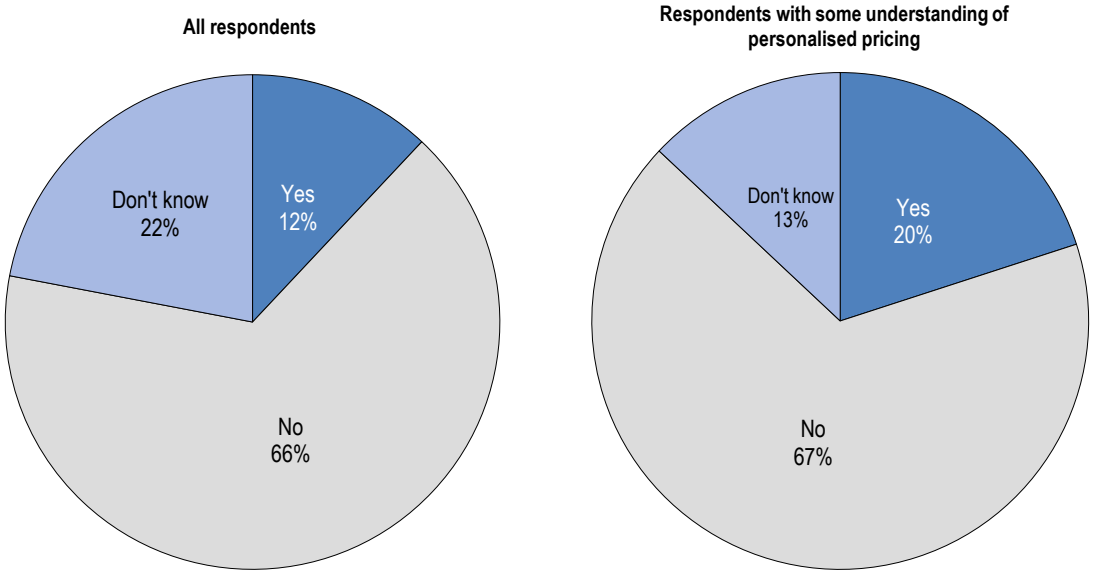
Figure 3. How brands use artificial intelligence (AI) to personalise the consumer experience

(Among retailers that have adopted AI for at least one application)



Note: "Based on a survey to more than 500 traditional retail, pure play, consumer goods, and branded manufacturing leaders from around the world."
Source: Hogan, K. (2018), Consumer Experience in the Retail Renaissance: How Leading Brands Build a Bedrock with Data, https://www.deloittedigital.com/us/en/blog-list/2018/consumer-experience-in-the-retail-renaissance--how-leading-brand.html.

Figure 4. Consumers who had bad experiences related to personalised pricing in the EU



Note: Based on a 2018 consumer survey to 21 734 respondents (of which 9 798 respondents have some understanding of personalised pricing).
Source: EC (2018), Consumer market study on online market segmentation through personalised pricing/offers in the European Union, European Commission, https://ec.europa.eu/info/sites/info/files/aid_development_cooperation_fundamental_rights/aid_and_development_by_topic/documents/synthesis_report_online_personalisation_study_final_0.pdf.

Box 3. A methodology to measure personalised pricing in e-commerce websites

Researchers from Northeastern University have proposed a new methodology to measure the extent to which personalised pricing is taking place online (Hannak et al., 2014[20]). The methodology was applied to 16 leading e-commerce websites of two categories: general e-commerce retailers and travel retailers.

Methodology

The authors wrote HTML programs specifically designed to automatically extract price information from the results of search pages of 16 e-commerce websites, which were accessed using 300 real-world user accounts, as well as synthetically generated fake accounts. Real and fake users varied in attributes such as tracking cookies, browser, operating system and IP address, which are all a potential source of price personalisation. However, because price differences can be observed at the same instant of time for reasons other than personalisation (for instance if firms are testing different pricing points), the authors attempted to eliminate any noise in price differences by running, as a control, the same programs through many identical user accounts.

Results

After applying this methodology to the 16 e-commerce websites, the authors found that some form of personalisation takes place within 9 of them, namely 4 general retailers and 5 travel websites. The results provide evidence of both price steering (that is, the practice of personalising search results in order to display more expensive products to some consumers) as well as price discrimination, which appears to be based on consumer attributes such as membership, history of clicks and past purchases. It is worth noting that the study did not account for price differences resulting from discounts or coupons, which may be an additional important mechanism that reinforces personalised pricing.

32. There are also some anecdotal cases where consumers themselves uncovered potential personalised pricing practices, though many of the companies involved have rejected such claims. The first case goes back to 2000, when a consumer found out that Amazon was selling products – including DVDs – to regular consumers at higher prices, and that deleting the cookies on the computer would cause those prices to drop. In light of the negative consumer reaction at the time, Amazon stated that the differences in prices were a random price test and refunded all consumers who overpaid (Abnett, 2015[23]). Since then, several other anecdotal cases have emerged:

- In 2015, the online employment marketplace ZipRecruiter did an experiment with algorithmic pricing based on customer data that resulted in an 85% increase in profits (Wallheimer, 2018[24]).
- In 2016, the online platform Coupons.com was reported to use proprietary data on consumer behaviour to target digital coupons to consumers (Ezrachi and Stucke, 2016[4]).
- In 2017, the airline AirAsia Bhd has started testing personalised baggage pricing in order to increase revenues, "using data and machine-learning to better understand what passengers were prepared to pay" (Reuters, 2017[25]).
- In 2018, some consumers have realised that Uber charges sometimes different prices for rides involving the same route at the same moment (Box 4).

Box 4. Personalised pricing in Uber

Uber Technologies Inc., the ride-sourcing and ride-sharing US company currently operating in hundreds metropolitan areas worldwide, has been implementing a new pricing system that seems to fit the category of personalised pricing. In an interview with Bloomberg, the head of product Daniel Graf said that "*the company applies machine-learning techniques to estimate how much groups of customers are willing to shell out for a ride*" (Newcomer, 2017[26]). For that, the company partitions consumers according to the particular route and time of the day they travel, eventually charging more to individuals commuting between wealthy neighbourhoods.

It is still unclear the extent to which Uber is using other personal data to discriminate prices on an individual basis. A consumer has reported identifying price differences, for instance, when interchanging between his personal credit card and the corporate credit card. It has also been hypothesised that prices may be based on observables such as the ride history, the brand of the phone or even the battery level of the phone, which could significantly affect the consumer's willingness to pay (Mahdawi, 2018[27]). Nonetheless, so far it appears that Uber's personalised pricing system is confined to group-level data (third-degree price discrimination), as suggested by an Uber spokesman: "*We may price routes differently based on our understanding of demand patterns, not individual riders*" (Mahdawi, 2018[27]).

The new "routed-based pricing" has led to different reactions among the public. On the one hand, drivers and riders are the ones that are more likely to have a negative response to a potential increase in the difference between rider fares and driver pay. The Microsoft researcher Glen Weyl commented that Uber "could really lose the trust of the riders", while some drivers have complained that the new pricing system is unethical (Newcomer, 2017[26]). On the other hand, Glen Weyl also recognises good economic reasons for the new pricing system, and the MIT Professor Chris Knittel suggests that "*Society is more willing to accept wealthy people paying higher fares*". In particular, this could be a mechanism for Uber to become profitable without sacrificing the quality of the service.

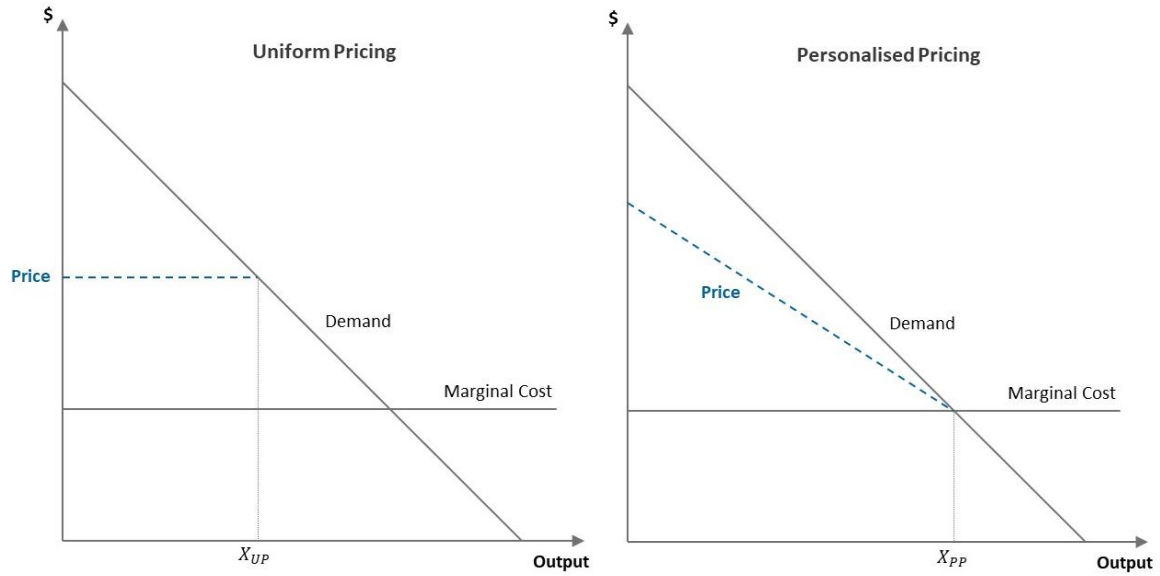
33. Naturally, the existence of some anecdotal cases does not provide enough evidence to conclude that personalised pricing is a generalised practice in the digital world. In the future it would be useful to engage in more comprehensive studies that can better quantify these practices. The existing evidence suggests, however, that at the very least it is worth understanding the economic effects of personalised pricing and its implications for competition and consumer policy.

3. Economic effects of personalised pricing

34. In light of the concerns that have been recently raised, this section attempts to analyse the economic effects of personalised pricing, which tend to be similar but somewhat stronger than those of more traditional price discrimination. Firstly, this section discusses the potential of personalised pricing to improve static efficiency, by leading to an output expansion. Secondly, it shows that personalised pricing may have either a positive or negative impact on distribution outcomes. Thirdly, it discusses the impact on dynamic efficiency depending on the particular characteristics of the market. Lastly, the section addresses questions about fairness and market trust that are often raised within the context of personalised pricing.

35. For the purpose of illustration, the analysis in this section assumes that personalised pricing is set as a linear function of consumers' willingness to pay, as portrayed in Figure 5. Although in reality firms may not always have enough data to implement personalised price at the individual consumer level – opting instead for classifying consumers in multiple disaggregated groups – this simplification is useful to illustrate the potential effects of personalised pricing at its best conditions. Naturally, changing this assumption may alter the magnitude of the effects identified.

Figure 5. Illustration of uniform pricing vs personalised pricing



Note: With uniform pricing (on the left), each consumer pays the same price for each unit. With personalised pricing (on the right), each consumer pays a different price for each unit, as a linear function of the willingness to pay.

36. It should be also pointed out that the economic effects of personalised pricing may differ significantly from those reported in this section if the pricing scheme is implemented with a different purpose than charging consumers according to their willingness to pay. For instance, firms could hypothetically use their ability to personalise price to undercut rivals' costumers with a predatory motive – also known as selective pricing. While this would likely harm the competitive process and have negative effects overall, it is not the purpose of this paper to analyse in detail such predatory strategies, whose effects and antitrust treatment are well established in the literature.

3.1. Impact on static efficiency

37. Personalised pricing has the potential to increase static (allocative) efficiency, by creating an incentive for firms to reduce prices to low-end consumers – who would otherwise be underserved – while preserving the profitability of high-end consumers. The impact of personalised pricing on static efficiency can be measured by changes in "social welfare" (also commonly known as total welfare or economic surplus), which is defined as the sum of consumers' and producers' surplus (Varian, 1985[28]). In other words, the social welfare corresponds to the difference between consumers' willingness to pay and

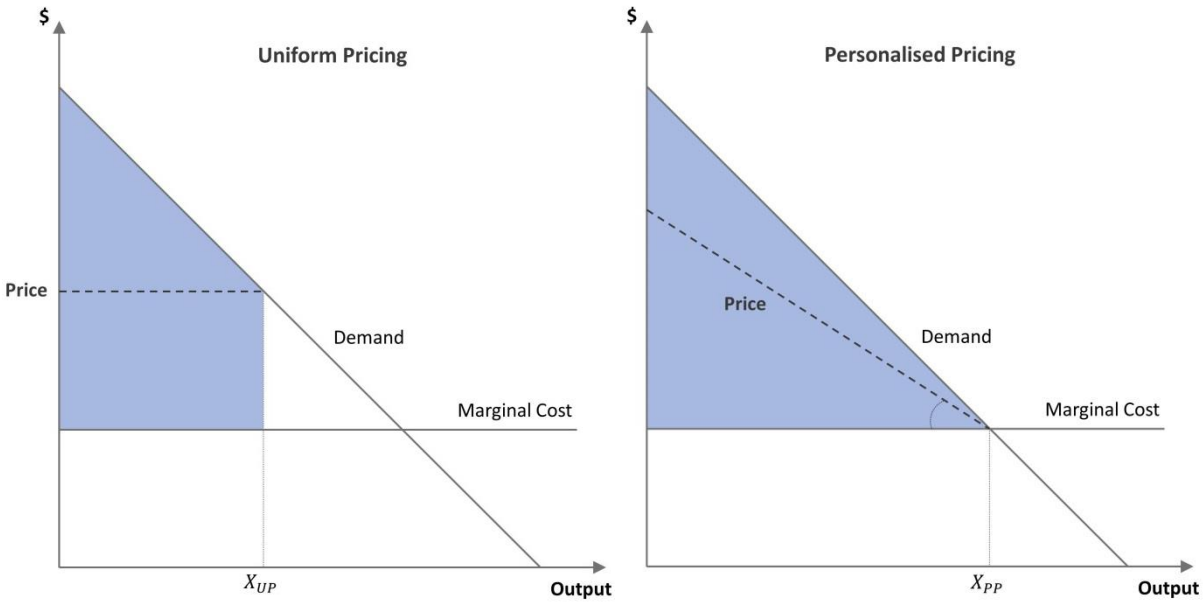
producers' willingness to sell – generally the marginal cost – for each unit of product transacted.

38. The effects of traditional price discrimination on social welfare are well established in the empirical economic literature, which tends to identify a positive link between the two in several industries, including in the UK intermediary brick market (Beckert, Smith and Takahashi, 2015[29]), the US market for coronary stents (Grennan, 2013[30]), the US market for ready-to-eat breakfast cereals (Nevo and Wolfram, 2002[31]) and in a Las Vegas hotel and casino (Cuddeford-Jones, 2013[32]). However, traditional price discrimination does not inevitably lead to greater social welfare, as "*a necessary condition for price discrimination to increase social welfare (...) is that output increase*" (Schwartz, 1990[33]) (Varian, 1985[28]).

39. While empirical studies about personalised pricing are still scarce or even non-existent, economic theory suggests that personalised pricing can improve static efficiency beyond the level of traditional price discrimination, potentially maximising the output transacted. The intuition for this result is that, as long as firms are able to tailor prices to consumers' valuations, and assuming that arbitrage is not possible, it is always optimal to serve each and every consumer whose willingness to pay exceeds the marginal cost of production, as that will not affect the profitability of other units sold.

40. The potential of personalised pricing to maximise social welfare is illustrated in Figure 6. Under uniform pricing (on the left), firms with a certain level of market power sustain prices above marginal cost, thereby restricting the total output transacted below the social optimum. In opposition, under personalised pricing (on the right), firms can always profitably serve all consumers, increasing social welfare to its maximum. It is important to note that this conclusion holds for any personalised pricing curve comprised between the demand and marginal cost curves, and not exclusively for scenarios of perfect price discrimination.

Figure 6. Impact of personalised pricing on social welfare



Note: Personalised pricing can increase social welfare / economic surplus, as measured by the blue area.

3.2. Impact on distribution outcomes

41. While personalised pricing has the potential to improve static efficiency by boosting social welfare to its maximum level, it also affects the way surplus is distributed among different agents, potentially leaving some individuals worse-off. Firstly, personalised pricing is likely to create a transfer of surplus from consumers with high willingness to pay, who are charged higher prices, to consumers with lower willingness to pay. Secondly, it may also affect the distribution of surplus between consumers and producers. This last effect is of particular concern for competition and consumer protection authorities, who usually have as legal standard the promotion of consumer welfare, often measured as the excess of consumer valuation of product over the price actually paid (OECD, 1993[34]).

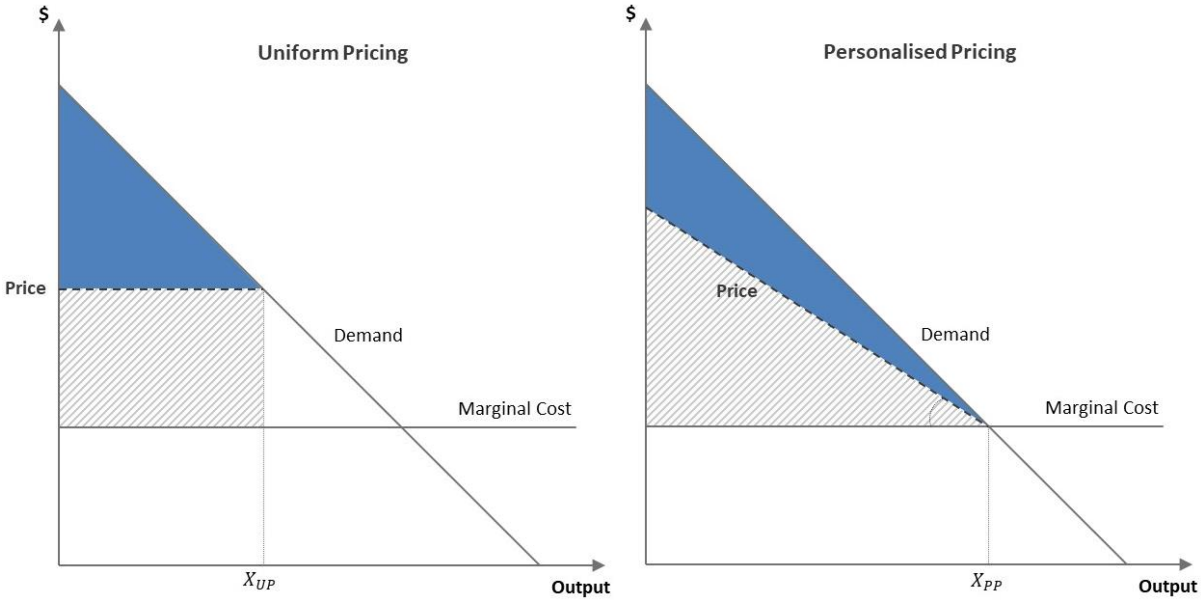
42. The empirical evidence about the impact of traditional price discrimination on the distribution of surplus among consumers and producers is mixed. Some studies find that price discrimination reduces average prices, increasing thereby consumer welfare (Beckert, Smith and Takahashi, 2015[29]) (Grennan, 2013[30]) (Nevo and Wolfram, 2002[31]). Other studies show that in some industries price discrimination can also lead to higher average prices, potentially resulting in a loss of consumer welfare – at least if the higher prices are not compensated by the output expansion (Cuddeford-Jones, 2013[32]) (Shiller, 2014[35]) (Shiller and Waldfogel, 2011[36]).

43. Just like traditional price discrimination, personalised pricing also creates redistribution effects that may either benefit or harm consumers, though the magnitude of the effect can be much stronger. In theory, if personalised pricing resulted in perfect or first degree price discrimination, the economic surplus would be entirely captured by the producer, reducing consumer welfare to zero. In opposition, if the degree of personalisation is small and prices are set at a level close to costs, almost the entire surplus would be captured by the consumer. So the potential outcomes of personalised pricing can theoretically range from maximising consumer welfare to a scenario where consumer welfare drops to zero.

44. Figure 7 illustrates the ambiguous impact of personalised pricing on the level of consumer surplus (blue area) and producer surplus (light grey). As seen, even though the total surplus is higher under personalised pricing, it is not clear how the total surplus is redistributed among consumers and firms, as that will fundamentally depend on the slope of the personalised pricing curve. Rotating the personalised pricing curve upwards in the direction of the demand curve would bring additional surplus to the firm, whereas rotating the personalised pricing curve downwards towards the marginal cost curve would increase consumer welfare.

45. Ultimately the impact of personalised pricing on consumer welfare is likely to depend on the competition conditions of the market. Indeed, if personalised pricing is implemented within a monopolistic market where little price competition is observed, firms may have a greater ability to use their knowledge about consumers' valuations to charge higher prices. Yet, in more competitive markets, personalised pricing may actually result in firms competing more aggressively for each individual consumer, potentially increasing the incentive of firms to cut down prices. Some academic work suggests that personalised pricing may, in fact, lead to more aggressive price competition even in duopoly markets, though perfect price discrimination can still be observed under some conditions (Chen, Choe and Matsushima, 2018[37]).

Figure 7. Impact of personalised pricing on consumer and producer surplus



Note: Consumer surplus is represented by the blue area and producer surplus is represented by the stripped grey area. The impact of personalised pricing on consumer and producer surplus depends on the slope of the personalised pricing line between the demand and the marginal cost curves.

46. Another important consideration is that personalised pricing decreases the ability of firms to engage in concerted practices to fix prices, making it substantially harder to agree on a common policy and to monitor the agreement, especially if personalised pricing is implemented through secret discounts that are not observed by competitors. This effect may be particularly relevant when there is a substantial risk of algorithmic tacit collusion (OECD, 2017). Personalised pricing also renders agreements to restrict output useless, because when firms can discriminate each consumer individually it is in their interest to expand output, not to reduce it.

47. In conclusion, while personalised pricing has ambiguous distributional effects, the risk of a loss in consumer surplus is smaller when companies engage in aggressive price competition to acquire each individual consumer. In opposition, if firms have substantial market power, there is a greater risk that personalised pricing approaches perfect or first-degree price discrimination.

3.3. Impact on dynamic efficiency

48. Another potential effect of personalised pricing that is less frequently addressed in the literature relates to its impact on dynamic efficiency. By creating a mechanism for firms to raise revenues without sacrificing sales, personalised pricing can encourage firms to innovate and to differentiate themselves (OECD, 2016[9]), but in other instances it may also promote rent-seeking activities that can reduce social welfare (Ezrachi and Stucke, 2016[38]). The overall effect on dynamics efficiency may depend on the particular market conditions observed.

49. In dynamic and highly innovative markets where firms can obtain market power through means of innovation and differentiation – as it is often the case of digital markets – personalised pricing is more likely to improve dynamic efficiency, as it increases the

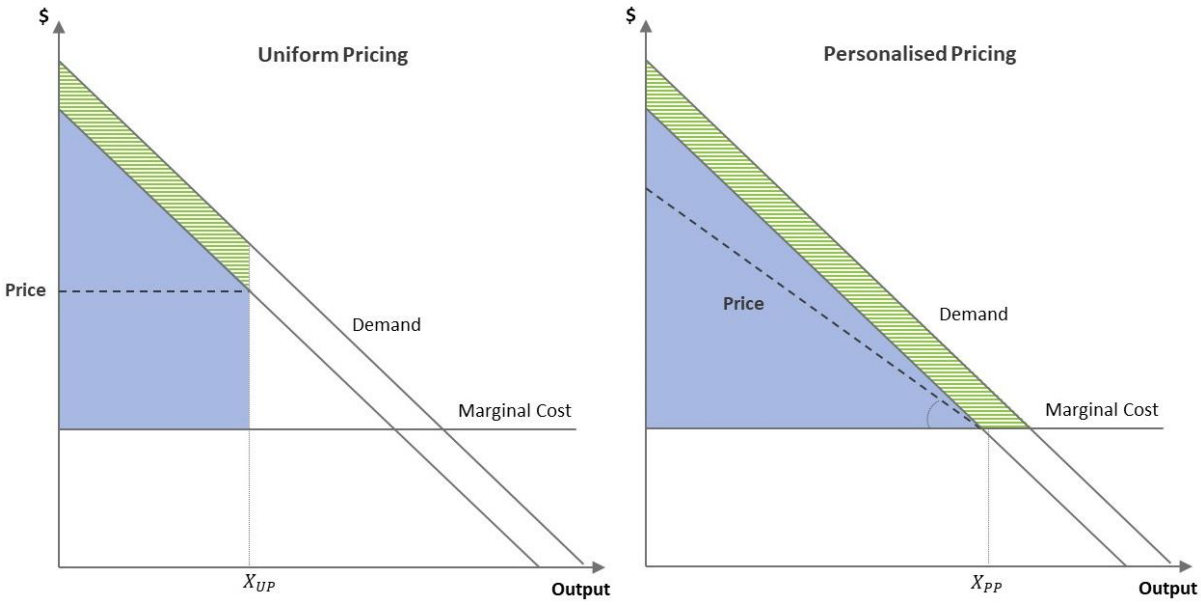
reward from any future innovation. Moreover, as long as market power is temporary and not preserved through anti-competitive means, new entry would imply that dynamic efficiency gains would be passed through to consumers over time.

50. The potential of personalised pricing to increase dynamic efficiency under certain conditions is shown in Figure 8, which portrays the effect of a product innovation as an upward shift in demand, reflecting the higher consumers' willingness to pay for the new product. As illustrated, under uniform pricing (on the left), a firm with market power can only capture a part of the value of the innovation, as it is forced to restrict total output in order to keep prices high. Yet, under personalised pricing (on the right), the firm can capture the entire value of the innovation, by charging to each consumer the additional willingness to pay for the new product. The additional profit incentives for the firm mean, in turn, that the innovation has greater probability of actually taking place.

51. Apart from its potential to increase incentives for innovation, personalised pricing may also affect the risk of rent-seeking activities. This effect is more likely to be observed in regulated industries – such as utilities, communication, transport, professional services and, in some cases, retail – where firms may engage in lobbying activities and political action to convince governments to introduce regulations that protect incumbents from competition, in what is often called regulatory incumbency.

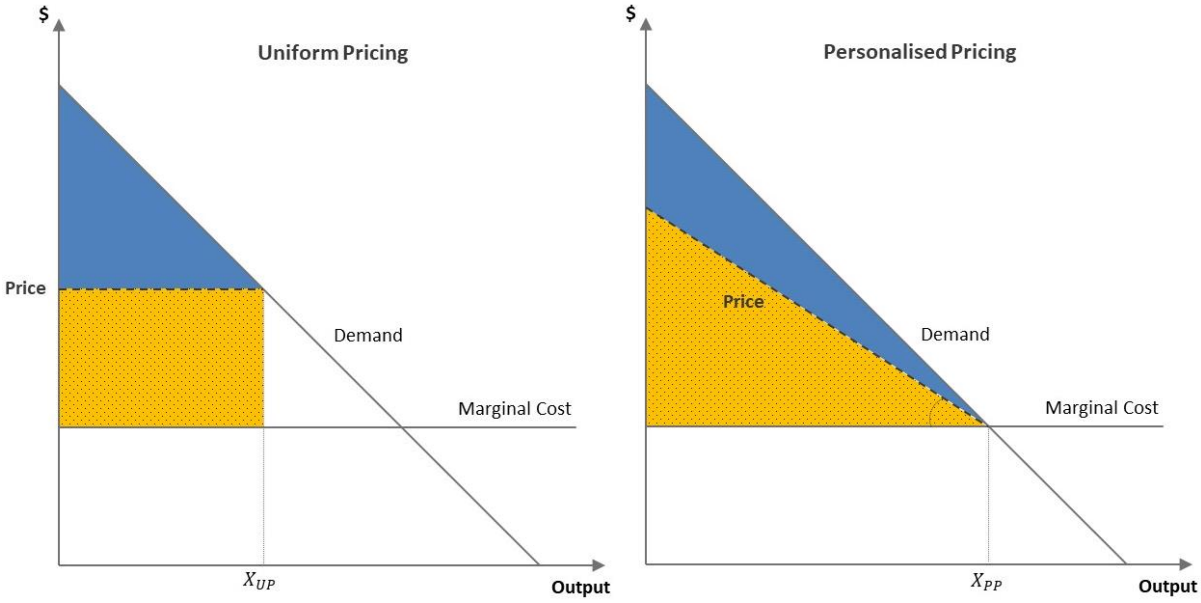
52. However, even in heavily regulated industries the effect of personalised pricing on rent-seeking activities is ambiguous and may depend on the degree of market power that firms hold. While in highly monopolised markets personalised pricing may increase profits and enhance incentives for rent-seeking behaviour, in more competitive markets it can actually foster competition and reduce rent-seeking conduct. This is illustrated in Figure 9, where the total profits lost due to rent-seeking behaviour (yellow area) ultimately depends on the slope of the personalised pricing line.

Figure 8. Impact of personalised pricing on incentives for innovation



Note: The light blue area represents social welfare before the innovation takes place, while the striped green area represents the surplus generated by the innovation.

Figure 9. Impact of personalised pricing on rent-seeking activities



Note: The blue area represents consumer surplus and the yellow dashed area represents deadweight loss through rent-seeking activities by firms. The impact of personalised pricing on deadweight loss due to rent-seeking activities depends on the slope of the personalised pricing line between the demand and the marginal cost curves.

53. In conclusion, personalised pricing can in general create incentives for innovation and differentiation, but in some occasions it may also promote rent-seeking behaviour by firms. The overall effect on dynamic efficiency depends thus on the specific market conditions and is more likely to be negative in highly regulated industries where firms have a certain degree of market power.

3.4. Impact on fairness and trust

54. Lastly, apart from traditional economic effects than can be more easily quantified, personalised pricing also tends to raise concerns about fairness and trust that are more challenging to address by policy makers. Some difficulties arise, in part, due to the fact that definitions of fairness vary across social sciences and, more importantly, applying the general principles of fairness to a practical case can be a highly subjective exercise.

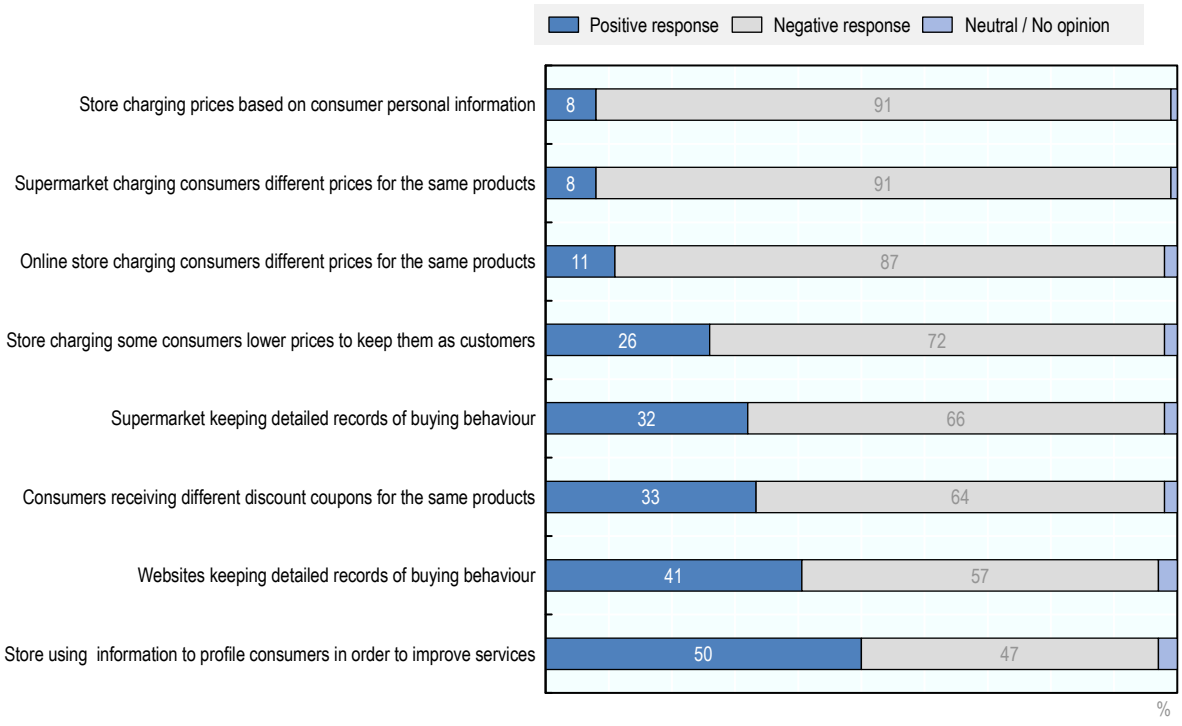
55. A common definition of fairness is attributed to the philosopher John Rawls, who describes a fair society as one that provides equal basic rights and an egalitarian economic system for its citizens (Rawls, 1985[39]). More broadly, within applied ethics, addressing fairness issues involves establishing certain principles of justice that can be generally accepted as reasonable:

> *"The most fundamental principle of justice – one that has been widely accepted since it was first defined by Aristotle more than two thousand years ago – is the principle that 'equals should be treated equally and unequals unequally.' In its contemporary form, this principle is sometimes expressed as follows: 'Individuals should be treated the same, unless they differ in ways that are relevant to the situation in which they are involved.'" (Andre and Velasquez, 1990[40])*

56. Within these principles, assessing a certain personalised pricing practice as fair or unfair would involve making a judgement of whether consumers have different personal characteristics or behaviours that are relevant to determine the price they pay for a given product. Such judgement is nonetheless hard to make, as while consumers certainly differ in their willingness to pay, it is not clear whether this should justify consumers being charged different prices for the same or very similar product. Moreover, the perception of what is fair may depend not only on the specific beliefs of the consumers, but also on the dimensions upon which consumers are subject to discrimination.

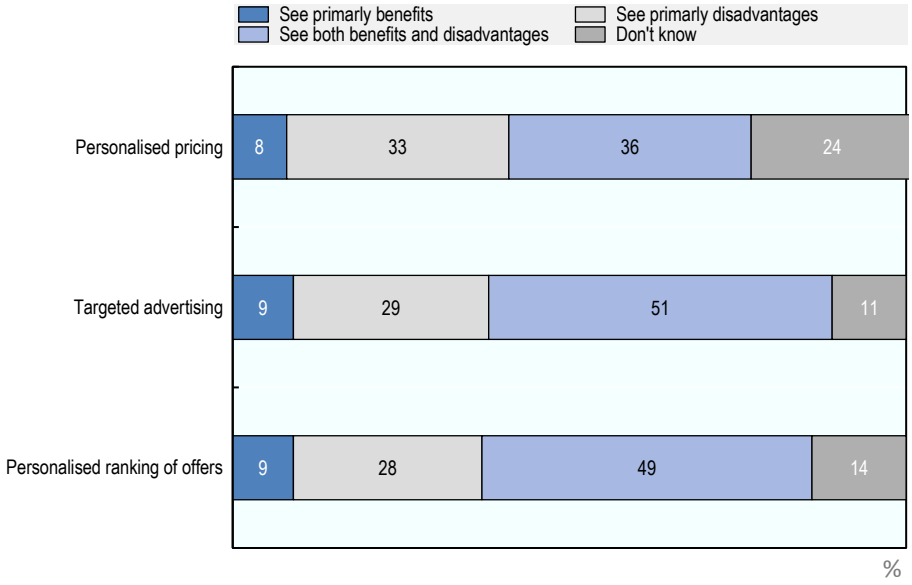
57. Some literature suggests that personalised pricing tends to be generally perceived by consumers as unfair.[3] This finding is supported by the results of a survey to 1500 households in the US, where a vast majority of 91% of the respondents revealed strong objections to retailers charging different prices for the same product using personal information, against 8% who had a positive response (Figure 10). In comparison, the recent 2018 survey by the European Commission to over 20 thousand consumers revealed an equally small share of respondents seeing personalised pricing as having primarily benefits, though a much larger share of individuals with a neutral position (Figure 11).

Figure 10. Consumer's attitude towards retailer activities online and offline in the US



Note: Adapted from the responses to a survey to a representative sample of 1500 US households.
Source: Turow, J., L. Feldman and K. Meltzer (2005), Open to Exploitation: America's Shoppers Online and Offline, Annenberg Public Policy Center of the University of Pennsylvania, https://repository.upenn.edu/asc_papers/35.

Figure 11. Overall opinion about online personalised practices in the EU



Note: Based on a 2018 consumer survey to 21 734 respondents.
Source: EC (2018), Consumer market study on online market segmentation through personalised pricing/offers in the European Union, European Commission, https://ec.europa.eu/info/sites/info/files/aid_development_cooperation_fundamental_rights/aid_and_development_by_topic/documents/synthesis_report_online_personalisation_study_final_0.pdf.

58. An interesting insight that seems to follow from these surveys and other studies is that the perception of fairness by consumers can be highly influenced by the specific way personalised pricing is implemented. In particular, there are at least three mechanisms that retailers can use to personalise prices in a way that is more likely to be well accepted by consumers:

1. Firstly, retailers can set personalised prices in the form of personal discounts over a listed price. In the US survey one third of the respondents found it acceptable that different people get different discounts for the same products. Other studies reached similar conclusions, suggesting that *"coupons aren't perceived as unfair to nearly the same degree as listing different prices for different consumers, even if the result in either case is identical"* (Narayanan, 2013[41]).
2. Secondly, retailers can allow consumers to participate in the price-formation process, by enabling an element of negotiation between sellers and buyers, for instance through online auctions. Using experimental data, a study shows that *"the effect of adverse fairness perceptions can be at least partially overcome by allowing consumers to participate in the price setting process, or by negotiating prices (…)"* (Richards, Liaukonyte and Streletskay, 2016[42]).
3. Thirdly, retailers can combine personalised pricing with versioning or second-degree price discrimination, for instance by creating different customised products to consumers based on their online data:

"In practice, sellers have usually solved the problem of determining customers' willingness to pay and at the same time avoided the fairness issue through versioning. Almost identical products are sold at differing prices, although production costs are almost the same." (Odlyzko, 2004[12])

59. There are, of course, many other factors that could potentially play a role in mitigating consumers' perception of unfairness and their general distaste for personalised pricing. For instance, by making pricing policies more transparent (i.e. explaining clearly the circumstances under which personalised pricing takes places and explaining the motive for that policy), businesses may in some occasions obtain a better reaction from consumers (Cox, 2001[43]). Likewise, explicitly asking for consumers' permission to use their data to send personalised discounts can help building consumer trust in digital markets and at least partially solve existing concerns about unfairness.

60. A more general concern is the implication of personalised pricing for consumer trust. In its 2013 study, the OFT's most significant concern was: "*the potential for personalised pricing to harm consumers by leading to a reduction of trust in online markets*" and the impact this could have on consumer engagement in e-commerce. Again, it notes that this is more likely where personalisation is carried out in ways that are not transparent and where it is hard to understand what is taking place (OFT, 2013[3]).

4. Competition policy approach to personalised pricing

61. The potential risks of personalised pricing can be addressed through different policies and legal instruments, of which competition law is one. To the best of the OECD Secretariat's knowledge, to date there is no case law where personalised pricing – strictly defined as a form of price discriminating *final consumers* based on their personal characteristics – was established as an infringement of competition law. Yet, as these practices become more common, it is possible that some competition authorities decide to open investigations in the future and tackle some forms of personalised pricing, using the antitrust tools they have in their arsenal.

62. This section focus on how personalised pricing can be assessed as a potential abuse of dominance, whenever the conduct is implemented by a dominant firm and has the effect of harming consumers, by forcing some of them to pay higher prices than they otherwise would.[4] For that, the section firstly summarises the current law and practice on abuse of dominance. Then it discusses the circumstances under which personalised pricing may qualify as an abuse, as well as the different enforcement procedures that competition authorities may consider.

4.1. Law and practice on abuse of dominance

63. Abuse of dominance is one of the fundamental infringements of competition law, consisting in any "*anticompetitive business practices in which a dominant firm may engage in order to maintain or increase its position in the market*" (OECD, 1993[34]). In most jurisdictions, qualifying a conduct as an abuse of dominance requires three fundamental conditions to be met: (1) the offender must be dominant in the relevant market; (2) the conduct must fit a generally accepted category of abuse; and (3) the conduct must be shown to have anti-competitive effects that are not counter-balanced by efficiencies. These three conditions are discussed in turn.

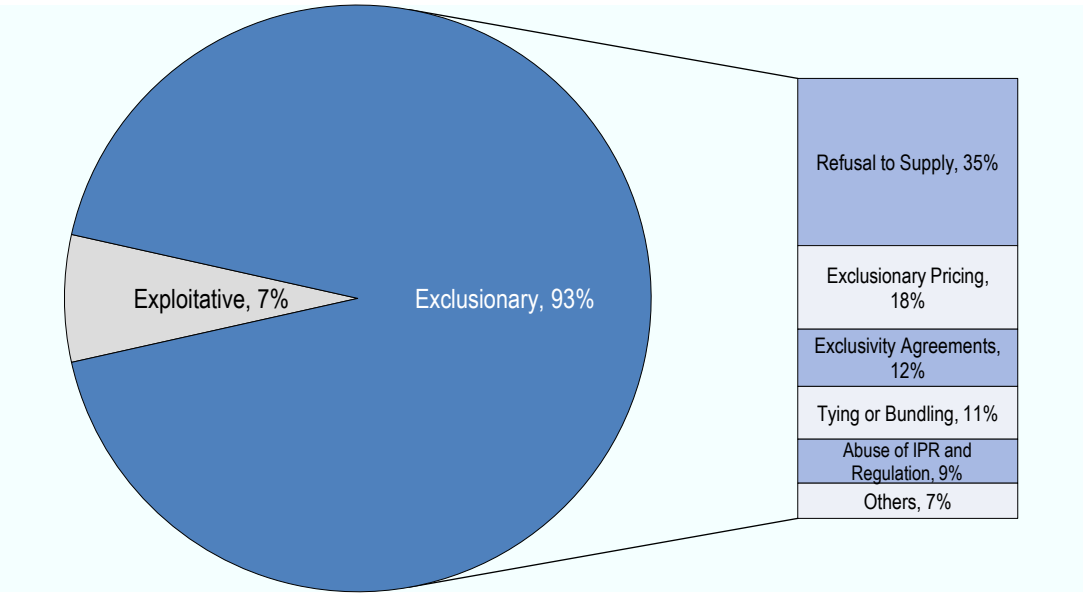
64. Firstly, the fact that provisions on abuse of dominance only apply to dominant firms is consistent with the idea that, for a firm to be able to unilaterally harm the competitive process, it must have a degree of market power in the relevant market. Secondly, as dominance is in itself not unlawful, but only its abuse, it is necessary to identify an anti-competitive conduct in order to establish an infringement. There are several types of anti-

competitive conduct that can amount to an abuse of dominance, and which are often distinguished in two broad categories, exclusionary and exploitative:

> "*'[E]xclusionary' abuses refer to those practices of a dominant undertaking which seek to harm the competitive position of its competitors or to exclude them from the market, whereas 'exploitative' abuses can be defined as attempts by a dominant undertaking to use the opportunities provided by its market strength in order to harm customers directly*." *(Akman, 2008[44])*

65. While exclusionary abuses, such as refusal to supply and predatory pricing, are at the core of competition law enforcement, exploitative abuses are rarely prosecuted in most OECD jurisdictions. In some countries in the North and Latin America, including the US, Canada and Mexico, exploitative abuses are not contemplated within competition rules. In other countries, such as Brazil and Japan, competition law covers exploitative practices but the respective authorities have not found any exploitative conduct to amount to an antitrust infringement to date. In opposition, exploitative abuse cases have been occasionally investigated in Europe (Figure 12) and also in other OECD countries, such as Australia, Korea and Turkey.

Figure 12. Categories of abuse of dominance enforced by the EC between 2000 and 2017



Note: Exploitative abuses include excessive pricing, price discrimination, and unfair commercial terms and conditions.[5]
Source: Adapted from Dethmers, F. and J. Blondeel (2017), "EU Enforcement Policy on Abuse of Dominance: Some Statistics and Facts", European Competition Law Review, Vol. 38/4, https://awards.concurrences.com/IMG/pdf/eu_enforcement_policy_on_abuse_of_dominance_some_statistics_and_facts_f_dethmers_and_j_blondeel.pdf.

66. Thirdly, provisions on abuse of dominance are generally subject to the so-called effects-based approach, which is currently endorsed by most competition authorities.[6] This approach implies that if a dominant firm engages in a behaviour that fits any potential category of abuse, such conduct does not automatically amount to a *per se* infringement, but it must be assessed on a case-by-case basis and subject to a "rule of reason". The

conduct will then be qualified as unlawful only if the potential anti-competitive effects exceed any countervailing efficiencies.

4.2. Qualifying personalised pricing as an abuse

67. In order to understand whether personalised pricing may potentially qualify as an abuse of dominance, and therefore amount to an antitrust violation, one must consider whether such conduct is an acceptable category of abuse that is likely to be investigated by competition authorities. This question remains largely unanswered, because competition provisions in many countries appear to *explicitly* forbid only the discrimination of business trading partners, and not final consumers, as in the case of the EU (Maggiolino, 2017[45]). Moreover, the question of whether personalised pricing amounts to a competition law infringement can hardly be answered by the scarce case law on price discrimination, as so far competition authorities have not investigated cases where price discrimination directly targets final consumers.

68. Despite the legal uncertainty and lack of case law in this area, hypothetically it may be possible to treat personalised pricing as an exploitative abuse, at least in jurisdictions where exploitative practices are covered by competition law. For that it would be necessary to prove that personalise pricing is a form of excessive or unfair pricing, under the rational that some consumers are charged higher prices for reasons not related to costs. A similar approach could be observed in Japan, where exploitative price discrimination is regulated as an abuse of superior bargaining position (although there are no cases to date). Still, none of these options appears to be a clear cut case for competition enforcement.

69. In some circumstances it might also be possible to qualify personalised pricing as an exclusionary abuse, specifically whenever firms use their pricing strategies to target lower prices to rivals' customers, in an attempt to foreclose the market. This strategy is known as selective pricing and has been investigated in a few cases by the Commission, including the 1996 case against Compagnie Maritime Belge Transports (C-395/96 P) and the 1999 case against Irish Sugar (T-228/97). Nonetheless, such infringement can only be established where some form of predation takes place, not addressing the more general concerns about personalised pricing as a mechanism to exploit consumers.

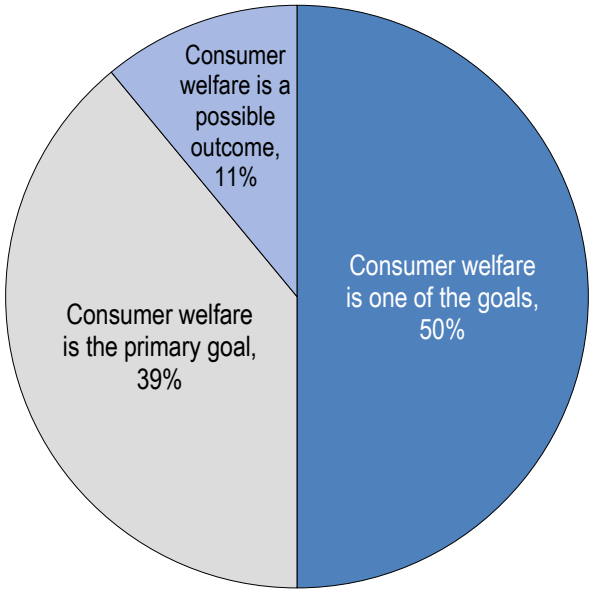
70. In the event that personalised pricing fits an existing or even a new category of abuse, it matters then to identify the circumstances under which a particular instance of personalised pricing is anti-competitive. The effects-based approach to abuse of dominance appears to play a particularly important role in the context of personalised pricing, whose effects are often ambiguous. Therefore, even though in practice competition authorities sometimes establish an infringement based on presumed effects of a conduct (Dethmers and Blondeel, 2017[46]), personalised pricing should not be assumed to be harmful and its effects on competition should be analysed on a case-by-case basis:

> *"The welfare effects of personalised pricing are a priori ambiguous. As we have shown, the economic literature emphasises that price discrimination is not necessarily detrimental to welfare or consumer surplus, and that it can increase welfare and/or consumer surplus in comparison to uniform pricing. From an economic viewpoint, there is therefore no rationale for banning personalised pricing per se (as there is no rationale for banning price discrimination)." (Bourreau, Streel and Graef, 2017[47])*

71. It is important to note that the effects-based analysis of personalised pricing may depend on the legal standard or general mission of the competition law in a specific jurisdiction. According to a survey by the ICN, in 89% of the jurisdictions consumer welfare is *the* primary goal or one of the goals of competition law (Figure 13), but there are other countries where the standard is total welfare, such as Australia, Canada, New Zealand, Norway and South Africa. Also, among those countries where consumer welfare is one of the goals, some also have the institutional role of promoting efficiency (not necessarily passed through to consumers), potentially requiring the respective competition authorities to balance a trade-off between total and consumer welfare.

72. In general, competition authorities that prioritise the promotion of consumer welfare are more likely to find instances where personalised pricing can be harmful and, hence, to establish an infringement of competition law. Naturally, as personalised pricing can always favour some consumers while leaving others worse-off, the analysis of the effects should be based on consumer welfare as a whole, and not on the harm imposed on a subgroup of individuals.[7]

Figure 13. The role of consumer welfare in competition law enforcement



Note: Results based on the answers of 56 competition authorities. A common alternative or complementary goal is total welfare.
Source: ICN (2011), "Competition Enforcement and Consumer Welfare – Setting the Agenda", *International Competition Network*, Conference 17-20 may 2011, The Hague, http://www.internationalcompetitionnetwork.org/uploads/library/doc857.pdf.

73. In opposition, competition authorities that give more weight to total welfare may find personalised pricing to be harmful in a narrower range of circumstances, given that the effects on static and dynamic efficiency are often positive. An exception is when there is evidence that personalised pricing actually promotes rent-seeking activities, for instance in highly regulated industries, case in which efficiency could potentially drop. It is interesting to note that this trade-off between consumer welfare and total welfare is very specific to personalised pricing (as well as merger review), not being commonly observed in other types of abuse that generally affect consumer welfare and total welfare in a similar way.

74. In conclusion, it seems possible to address some of the risks of personalised pricing through competition law, particularly in jurisdictions that investigate exploitative abuses and apply a consumer welfare standard (Box 5 proposes a step-by-step enforcement framework). At the same time, competition law has also clear limitations, due to the fact that provisions on abuse of dominance only apply to dominant firms, while the vast majority of online businesses have little to no market power. This is not, however, necessarily problematic, as the risk that personalised pricing results in consumer exploitation tends to be notably higher when firms have substantial market power, as already discussed in section 3.

Box 5. A step-by-step framework to analyse personalised pricing

When faced with an allegation of personalised pricing, competition authorities may consider following the next steps in order to determine whether such conduct is abusive.

- **Step 1: Identify price differences not based on costs**. Identifying price differences across consumers is not a sufficient condition to establish that a practice is discriminatory, as those price differences may reflect different marginal costs of serving different consumers. Thus, in order to infer that discrimination has occurred, differences in prices should not be cost-based.
- **Step 2: Establish dominance**. While personalised pricing can be observed in markets that are relatively competitive (Levine, 2012), there is a higher risk of exploitation when a firm has substantial market power in the relevant market. Also, establishing dominance is a legal requirement in most jurisdictions to apply rules on abuse of dominance.
- **Step 3: Analyse effects on consumer welfare and efficiency**. As the effects of personalised pricing are ambiguous, an infringement should only be established if there is evidence of harm. The analysis may give a different weight to consumer welfare and total welfare, depending on the antitrust standard of a particular jurisdiction.
- **Step 4: Assess the persistency of the effects**. Even if personalised pricing harms consumers by increasing average prices, this does not necessarily merit an antitrust intervention, as those effects may be temporary and likely to be resolved by the market. In opposition, an intervention may be preferable when the existence of barriers to entry or switching costs may extend the negative effects over time.
- **Step 5: Identify the source of discrimination**. Discrimination can be facilitated by many factors, such as business strategies to partition the market, consumer inertia, lack of price transparency, data collection and even regulations. Identifying the source of the discrimination can be useful to define the appropriate remedies.

Source: OECD (2016), Price Discrimination - Background note by the Secretariat, https://one.oecd.org/document/DAF/COMP(2016)15/en/pdf.

4.3. Enforcement procedures and remedies

75. In the event that a personalised pricing conduct by a dominant firm is assessed to have negative and persistent effects on consumers, competition authorities have a range of procedural options at their disposal, of which *infringement decisions* and *commitments* are the most likely to apply. In opposition, *interim measures* can be hardly used in the context of personalised pricing, as it is very hard to determine *a priori* that a conduct is harmful due to the ambiguous effects of personalised pricing on consumer welfare. With respect to

antitrust guidelines, while these would certainly be very useful to increase legal certainty, the current lack of case law and experience in this area makes it very challenging to come up with a good set of rules that businesses should follow.

76. The choice among the use of infringement decisions and commitments may depend, among other things, upon the dimension of the effects of personalised pricing. On the one hand, in instances where there is a clear negative impact on consumer welfare or efficiency, infringement decisions can be useful to establish that the practice is unlawful and to deter similar practices in the future. On the other hand, if the potential negative effects of personalised pricing are unclear to prove, commitments may enable competition authorities to impose remedies that can help reducing the risk of consumer harm.

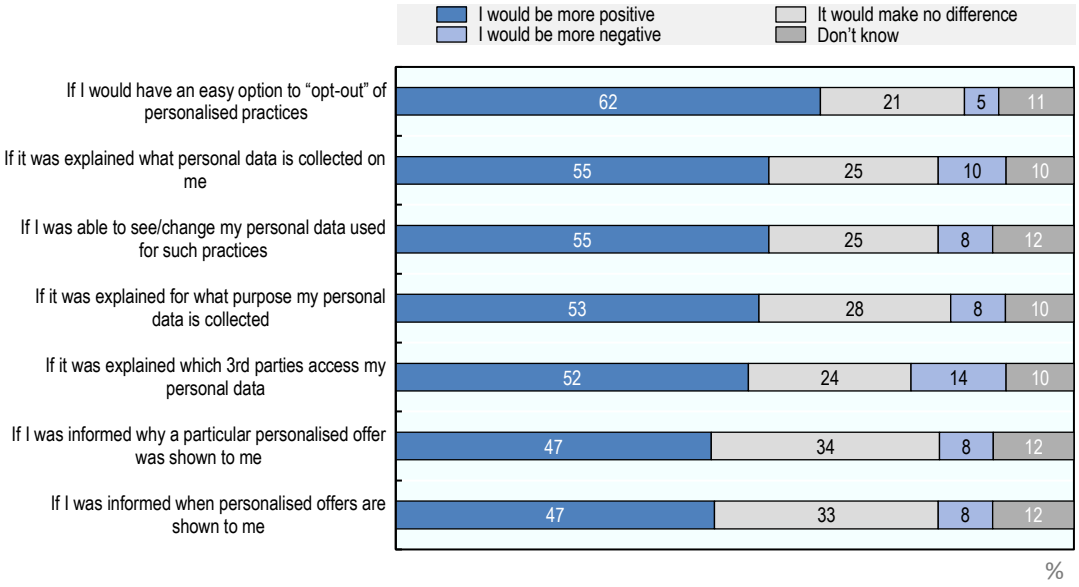
77. Whenever a personalised pricing conduct results in an infringement decision, competition authorities should be cautious not to set disproportionally high fines, as that could have the undesirable effect of deterring personalised pricing even when this practice is welfare enhancing. With this in mind, some scholars have suggested that competition authorities may consider reducing the amount of fines under certain *mitigating circumstances*, such as when the firm immediately terminates the practices as soon as the authority intervenes (Barbier de La Serre and Lagathu, 2013[48]).

78. On the contrary, when competition authorities opt for commitments, they may consider a wide range of measures, which could be designed to increase competitive pressure and thereby reduce the risk of exploitation. Apart from more extreme remedies such as prohibiting personalised pricing all together, the following non-exhaustive list provides some possible alternatives for future consideration:

- Requiring the firm to inform consumers that the prices or discounts offered are personalised.
- Requiring the firm to disclose to consumers how the personalised pricing was calculated, including the personal information that was used to set the price.
- Requiring the firm to obtain consumers' permission to use their personal data to personalise prices.
- Requiring the firm to publish a listed uniform price for all consumers who wish to opt out of personalised pricing.
- Restricting certain activities to partition the market, such as selling services that are personal and non-transferrable, and hence not possible to resell.

79. Some of these remedies could potentially improve transparency, empower consumers with control over data and expand their choice, eventually enhancing the ability of consumers to compare prices and to switch to other offers. If remedies are carefully designed, they may have the effect of reinforcing competition, and therefore reducing the risk of harm associated to personalised pricing. Moreover, some remedies may also help improving consumers' acceptance of personalised pricing, potentially contributing to increase their trust in digital markets (Figure 14).

Figure 14. What would change consumers' opinion of online personalisation in the EU?



Note: Based on a 2018 consumer survey to 21 734 respondents.
Source: EC (2018), Consumer market study on online market segmentation through personalised pricing/offers in the European Union, European Commission, https://ec.europa.eu/info/sites/info/files/aid_development_cooperation_fundamental_rights/aid_and_development_by_topic/documents/synthesis_report_online_personalisation_study_final_0.pdf.

5. Consumer protection approach to personalised pricing

80. Consumer protection law offers a range of policy tools that can have an important role in addressing existing concerns about personalised pricing. Consumer policy shares similar goals with competition policy, including promoting consumer welfare and improving economic performance by driving competition and innovation, even though the tools differ. Moreover, while competition authorities address mostly business-to-business relationships, consumer protection authorities focus on business-to-consumer interactions, putting them in a good position to look at personalised pricing that targets final consumers.

81. This section discusses whether potential risks of personalised pricing can be addressed under the scope of unfair practices laws, though for the moment this largely remains an open-ended question. After providing some initial insights about unfair practices laws in OECD countries, this section discusses two potential consumer protection approaches to deal with personalised pricing. The first is to qualify personalised pricing as an unfair practice *as such*. The second is to tackle ancillary unfair practices that, when combined with personalised pricing, are likely to result in consumer harm. Lastly, this section discusses the administrative and civil sanctions that may be applied if an unfair practice is found.

5.1. Law and practice on unfair practices

82. Unfair practices – also known as *unfair trade practices* (e.g. US, Japan) or *unfair commercial practices* (e.g. EU) – commonly refer to business practices that cause substantial harm to consumers and which, within a certain cultural and social environment, are interpreted as being unethical or unjust. The subjectivity of such concept necessarily

implies that the specific behaviours that amount to unfair practices vary across jurisdictions and are often subject to an extensive debate. Unfair practices are prohibited in most countries by consumer protection rules and usually investigated by consumer protection authorities, though in rare cases they may also be investigated under the scope of competition law.[8]

83. The criteria to qualify a practice as unfair for the purpose of consumer protection law vary considerably across jurisdictions and tend to have some element of subjectivity. While some countries specify in the law some broad criteria for what constitutes an unfair practice, other countries do not explicitly define these practices, identifying instead categories of behaviour that are deemed as unfair. These are a few examples of contrasting approaches:

- In the US, the Federal Trade Commission Act determines that *"[a]n act or practice is unfair if causes or is likely to cause substantial injury to consumers; cannot be reasonably avoided by consumers; and is not outweighed by countervailing benefits to consumers or to competition."* The same Act also distinguishes unfair practices as a separate category from deceptive practices, in contrast with many jurisdictions that consider deceptive and misleading behaviours as a category of unfair practices.
- In the EU, according to Directive 2005/29/EC, a commercial practice is unfair if *"(a) it is contrary to the requirements of professional diligence, and (b) it materially distorts or is likely to distort the economic behaviour with regard to the product of the average consumer whom it reaches or to whom it is addressed (…)"*. Apart from the general definition, the directive identifies two broad categories of unfair practices, (1) misleading commercial practices and (2) aggressive commercial practices, though these two categories are not exhaustive.
- In Australia, the Competition and Consumer Act does not provide a general definition of unfair practices, but it classifies them in five categories: (1) false or misleading representations; (2) unsolicited supplies; (3) pyramid schemes; (4) pricing-related unfair practices; (5) and other unfair practices.
- A similar approach is used in the Canadian province of Ontario, whose Consumer Protection Act identifies three categories of unfair practices: (1) false, misleading or deceptive representation; (2) unconscionable representation; and (3) renegotiation of price.

84. In practice, in order to determine what practices are unfair, enforcers often refer to the existing case law in their jurisdictions. Sometimes, consumer protection authorities also rely on "blacklists" published in the law, which list specific behaviours that are considered unfair and prohibited in all circumstances. Nevertheless, it is important to note that unfair practices laws generally tend to be broad enough so that at any moment consumer protection authorities can identify and test in court whether a novel business practice is likely to harm or distort consumer behaviour. As pointed out by Senator Newlands over a century ago when the US Federal Trade Commission Act was passed:

> *"The committee gave careful consideration to the question as to whether it would attempt to define the many and variable unfair practices which prevail in commerce and to forbid their continuance, or whether it would, by a general declaration condemning unfair practices, leave it to the commission to determine what practices were unfair. It concluded that the latter course would be the better, for the reason (…) that there were too many unfair practices to define, and after writing 20 of them into the law it would be quite possible to invent others."*[9]

5.2. Qualifying personalised pricing as an unfair practice

85. Since the legal criteria to establish a novel unfair practice are broad and vary across jurisdictions, it is hard to determine whether personalised pricing may qualify as unfair for the purpose of consumer protection law. With this question in mind, one can look at the legal framework of a few countries in order to try to understand whether existing rules on unfair practices could eventually apply to personalised pricing, though given the lack of case law this exercise is highly speculative.

- In the US, for personalised pricing to qualify as an unfair practice, the conduct would have to (1) risk causing substantial injury, (2) be hardly avoidable and (3) not counter-balanced by benefits to consumers. These conditions do not seem to be met in many cases, as personalised pricing has generally positive efficiency effects and may often increase consumer welfare. However, it may be the case that some forms of personalised pricing can be identified as systematically harmful and, eventually, qualified as an unfair practice.
- In the Canadian province of Ontario, the unfair practices rules against "unconscionable representation" could arguably impose some limitations on personalised pricing. As stated in the Consumer Protection Act, for the purpose of determining whether a representation is unconscionable, it may be taken into account, among other things, *"that the price grossly exceeds the price at which similar goods or services are readily available to like consumers"*. Thus, it could be argued that where personalised pricing results in some consumers paying substantially more than others, unfair practices law may apply.
- In Mexico, unfair trade practices against discriminatory conduct may also restrict the ability of companies to personalise prices, at least in some dimensions. In particular, the Federal Consumer Protection Law specifically prohibits discrimination based on certain grounds, such as gender or nationality:

> *"A supplier of goods, products or services shall not deny nor condition the same upon the consumer due to reasons of gender, nationality, ethnicity, sexual orientation or religious preference, or any other peculiarity. (…) In no case may said suppliers apply nor collect fees higher than the ones authorized or registered for customers in general, nor offer or apply discounts in a biased or discriminatory manner. They can neither apply nor collect extraordinary or compensatory fees to disabled persons by reason of the medical, orthopaedic, technological, educational or sporting implements required for their personal use, including guide dogs in the case of blind persons."*[10]

86. Taking into account the legal provisions of the US and Mexico, it seems hard to establish personalised pricing as an unfair practice *as such*, that is, as a practice that is unfair in all circumstances. Indeed, such an approach would eventually lead to all forms of personalised pricing being prohibited, even when such practices are pro-competitive or when the risk of consumer harm is not significant. A similar conclusion can be reached for other OECD countries where similar consumer protection laws exist.

87. In light of the limitations of giving a sort of *per se* treatment to personalised pricing, a sensible alternative could entail not to prohibit personalised pricing in itself, but to try to identify specific circumstances under which personalised pricing should qualify as an unfair practice. One possibility would be to qualify as unfair any personalised pricing scheme that overcharges groups of consumers who are particularly vulnerable, for instance

due to their mental health, age, lack of education, etc. An alternative would be, following the example of Mexico, to restrict personalised pricing from taking place when based on sensitive grounds, such as the gender of the consumer.

88. An approach that might be particularly useful to consider is to qualify as unfair any personalised pricing that is non-transparent or does not provide consumers with an option to opt out. The importance of transparency in personalised pricing is associated to the fact that consumers are less likely to engage in actions to protect themselves from being exploited if they do not have the knowledge of the purpose for which that their data is being collected, or that prices are personalised. Likewise, personalised pricing may be particularly harmful if there are no effective mechanisms for consumers to change privacy options and prevent their data from being collected to personalise prices.

89. The crucial role of transparency and consumer choice in personalised pricing is supported by the recent survey by the European Commission, which provides evidence that consumers have a more positive reaction to online personalisation when they are aware that data collection and personalisation is taking place, and also when they can opt out of such practices (EC, 2018[1]). Accordingly, the UK House of Lords recommends "*that online platforms be require to inform consumers if they engage in personalised pricing*" (House of Lords, 2016[49]). A similar recommendation has been proposed by the Centre on Regulation in Europe:

> *"Our main policy recommendation would therefore be that personalised pricing strategies, if they exist, should be transparent to ensure consumers' trust in online markets, which would affect positively all players." (Bourreau, Streel and Graef, 2017[47])*

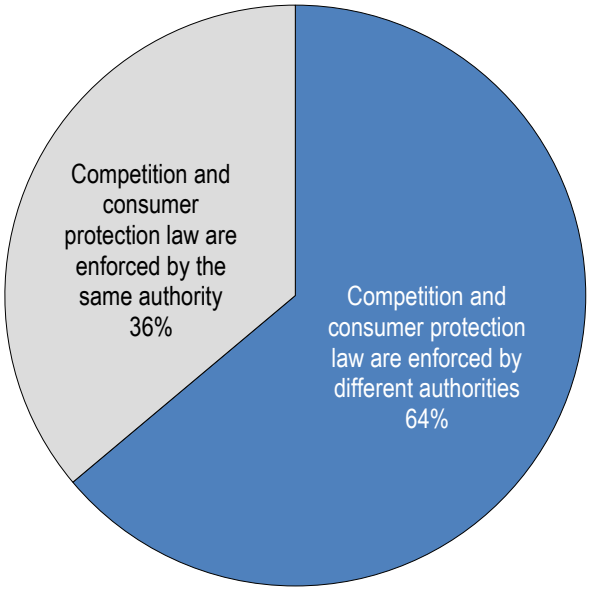
90. Likewise, the former UK Office of Fair Trade stated that:

> *"We support the EU self-regulatory initiative principles of **Notice**, **Choice** and **Education** to consumers about any personalisation, this would improve consumer trust significantly." (OFT, 2013[3])*

91. In light of these proposals, unfair practices laws could be a useful tool to tackle forms of personalised pricing that are non-transparent or that cannot be averted by consumers. As concerns about consumer protection in digital markets grow, it is possible that consumers' aversion to personalised pricing will put pressure on authorities to consider such an approach. Whether such considerations will result in actual enforcement and infringement decisions, only the future will tell.

92. If certain forms of personalised pricing start eventually being assessed under unfair practices rules in some jurisdictions, an additional challenge for authorities would be to decide whether to open a competition probe or a consumer protection probe when faced with a new case. This may require some form of co-ordination between competition authorities and consumer protection authorities, namely in the large share of countries where competition law and consumer protection law are enforced by different agencies (Figure 15).

Figure 15. Institutional separation of competition and consumer policy in OECD countries



Note: The countries where at least one authority enforces both competition and consumer protection law are AUS, CAN, DNK, FIN, IRE, ITA, KOR, LUX, NLD, NZL, POL, GBR and USA.
Source: FTC (2018), "Competition & Consumer Protection Authorities Worldwide", https://www.ftc.gov/es/policy/international/competition-consumer-protection-authorities-worldwide.

5.3. Unfair practices ancillary to personalised pricing

93. In addition to the possibility of qualifying certain forms of personalised pricing as an infringement, an alternative or even complementary approach would be to use consumer protection law to prevent any practices ancillary to personalised pricing that are traditionally deemed as unfair. In other words, consumer protection law could be used to tackle unfair practices that can have the effect of reinforcing the negative impact of personalised pricing, i.e. those practices that facilitate effective personalised pricing. This approach appears to be consistent with the views of the Centre on Regulation in Europe:

> *"In principle, the consumer protection rules leave traders free to set prices as long as they inform consumers about the prices, or how they are calculated. However, the combination of personalised pricing with unfair commercial practices is prohibited." (Bourreau, Streel and Graef, 2017[47])*

94. The unfair practices that are more likely to harm consumers in a context of personalised pricing are, again, those that have the effect of substantially reducing *transparency* and limiting *consumer choice*. Accordingly, consumer protection authorities might give special attention to preventing the combination of personalised pricing with **misleading or deceptive practices**, which consist in any actions to provide false or misleading information, or in omissions of relevant information. Misleading practices ancillary to personalised pricing may include:

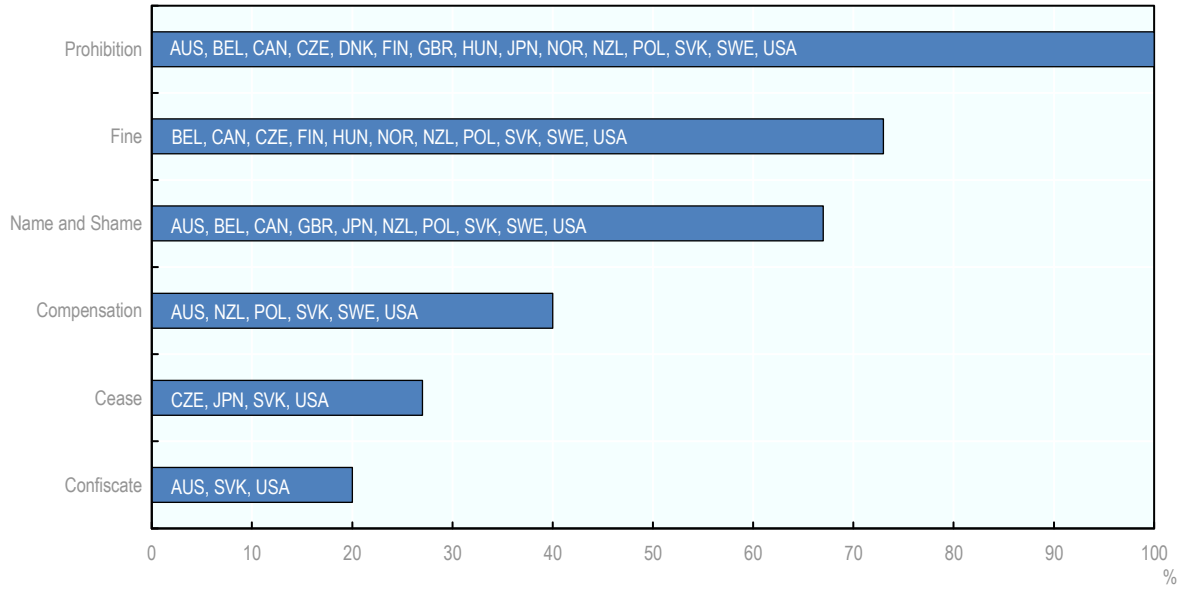
- Stating that a personalised price is the "best price" when other consumers are offered better prices.
- Making an invitation to buy a product at a specified price and then adjust the personalised price upwards as the consumer goes through the buying process.

- Falsely stating that the personalised offer will only be available for a very limited time to prevent consumers from making an informed choice.
- Offering a personalised "discounted" price that is higher that the listed price.
- Collecting private data to personalise prices without the consent of consumers.
- Using private data to personalise prices, when such data was requested for other stated reasons.
- Omitting the fact that the price or discount offered is personalised.
- Creating the false impression that the consumer has won a special price offer or discount, when other consumers have received the same or better personalised offers.

5.4. Sanctions and disclosure remedies

95. In case certain forms of personalised pricing or ancillary practices to personalised pricing are found to be unlawful, there is a range of administrative and civil sanctions that can be applied under consumer protection law in order to deter such practices. According to a survey about enforcement practices in 15 OECD jurisdictions, the most common sanctions are prohibitions, which consist in orders or injunctions to cease a certain conduct in the future (Figure 16). The majority of countries also use fines and policies of "naming and shaming" the firms that engage in such practices, while less frequent sanctions include awarding compensation to consumers, ceasing orders forbidding the firm from continuing trading and confiscating goods or profits of the offender.

Figure 16. Categories of administrative and civil sanctions in 15 OECD countries



Note: Data collected through a survey of approaches to sanctions and enforcement in 15 OECD jurisdictions: AUS, BEL, CAN, CZE, DNK, FIN, GBR, HUN, JPN, NOR, NZL, POL, SVK, SWE, USA.
Source: Faure, M., A. Ogus and N. Philipsen (2008), "Enforcement Practices for Breaches of Consumer Protection Legislation", *Loyola Consumer Law Review*, Vol. 20/4, pp. 361-401, https://pdfs.semanticscholar.org/4b93/ce8e0a689443b68e8fffe55e1caa9334ca05.pdf.

96. The different types of sanctions available can be combined for a greater probability of successfully reducing the risks of personalised pricing. For instance, prohibitions can be useful to put a rapid end to personalised pricing when this poses a risk of consumer harm, but their execution is hard to monitor and they might not be effective at deterring other businesses from engaging in the same conduct. Fines, on the other hand, are more likely to be deterrent, and can thus be applied to prevent businesses from engaging in certain forms of personalised pricing as well as ancillary misleading practices that are generally harmful. Authorities might also consider applying higher fines whenever blacklisted unfair practices are combined with personalised pricing, as this may result in greater harm to the consumer.

97. Some of the less traditional categories of sanctions, such as "name and shame" and "compensation", may also be particularly useful enforcement tools in this context. Given that personalised pricing is more likely to be harmful when consumers are not aware that it is happening, policies to publicly identify and publicise the firms who are engaging in personalised pricing in a non-transparent way can help raising consumer awareness. In addition, compensation mechanisms may also be an effective tool to deter firms from violating the law and to reimburse consumers for any price differences they were "unfairly" overcharged.

98. Lastly, apart from administrative and civil sanctions, an important enforcement tool available for consumer protection authorities is the imposition of remedies requiring businesses to disclose personalised pricing practices. It is crucial that any mandated disclosure procedures are simple, clear and relevant, as opposed to lengthy and complex disclosures that are unlikely to be read by consumers. For this reason, requiring information disclosures to be included within the website's terms and services might be of little use as a policy tool and fail to promote consumer awareness. When designing legal requirements for online disclosure of information, policy makers may refer to the OECD report on the best practices in communicating and disclosing information to consumers (OECD, 2018[50]).

99. While designing and enforcing disclosure procedures might be an important mechanism to achieve better outcomes in digital markets, the approaches adopted should be tailored to avoid undermining beneficial implementations of personalised pricing strategies. For instance, policy makers should balance carefully the risks of imposing remedies on businesses to disclose in detail all prices they practice, including their lowest offers. This excessive price transparency could not only facilitate collusion outcomes, but it would also likely eliminate any incentives for firms to personalise prices:

> *"Considering the popularity of price-labeling laws and other similar laws that empower consumers, one may be tempted to adopt a similar law against price discrimination that would compel retailers to clearly display the lowest offered price or disclose their pricing practices. However, such a law would almost amount to coercing uniform prices across marketing channels; there would be little sense in offering consumers a higher price in one location if the existence of a lower price somewhere else must be announced alongside it." (Miller, 2014[51])*

6. Other policy approaches to personalised pricing

100. Apart from competition and consumer protection policy, there are other policy tools that could be used to influence the form and grounds upon which firms personalise prices. This section briefly mentions two alternative policy approaches: the application of privacy and data protection laws; and the consideration of more general anti-discrimination laws. It should be noted, however, that it is not within the scope of this background note to address these two approaches in detail, but only to mention them for future consideration by policy makers when dealing with existing concerns about personalised pricing.

6.1. Privacy and data protection

101. Privacy and data protection policy plays an increasingly important role in a digital world where firms may engage in many personalising strategies – including personalised pricing – that are dependent on the collection and use of consumer data.[11] Although it is not within the reach of privacy and data protection laws to directly regulate businesses pricing decisions, these laws can still govern some of the means required to implement personalised pricing, namely the collection, storing and processing of personal data.

102. Privacy laws in most OECD countries are consistent with the OECD Privacy Guidelines principles that require the disclosure of the purposes for which personal data is collected and typically a consumer's consent to those uses (OECD, 1980[52]). The use of personal data to determine the price to be charged would fall within those requirements and provide an independent legal basis for demanding transparency around the data use. This and other privacy and data protection laws may help insuring that personalised pricing practices are transparent and fully understood by consumers.

103. A relevant example of privacy and data protection laws that may apply to personalised pricing are rules related to *profiling*, which have gained particular importance in the EU with the release of the General Data Protection Regulation (GDPR), where profiling is defined as:

> *"Any form of automated processing of personal data consisting of the use of personal data to evaluate certain personal aspects relating to a natural person, in particular to analyse or predict aspects concerning that natural person's performance at work, economic situation, health, personal preferences, interests, reliability, behaviour, location or movements."*

104. Under the new GDPR, businesses are only allowed to carry out profiling in instances where this is either necessary for the activity of the business, authorised by law, or based on the consent of the individual. Other requirements include providing individuals with information about the profiling process, and giving them the right to change or request a review of their profiles. Box 6 provides a checklist with the conditions under which profiling and automated individual decision-making comply with the GDPR.

Box 6. Checklist for profiling and automated individual decision-making

"To comply with the GDPR...

- ☐ *We have a lawful basis to carry out profiling and/or automated decision-making and document this in our data protection policy.*
- ☐ *We send individuals a link to our privacy statement when we have obtained their personal data indirectly.*
- ☐ *We explain how people can access details of the information we used to create their profile.*
- ☐ *We tell people who provide us with their personal data how they can object to profiling, including profiling for marketing purposes.*
- ☐ *We have procedures for customers to access the personal data input into the profiles so they can review and edit for any accuracy issues.*
- ☐ *We have additional checks in place for our profiling/automated decision-making systems to protect any vulnerable groups (including children).*
- ☐ *We only collect the minimum amount of data needed and have a clear retention policy for the profiles we create.*

As a model of best practice...

- ☐ *We carry out a DPIA to consider and address the risks before we start any new automated decision-making or profiling.*
- ☐ *We tell our customers about the profiling and automated decision-making we carry out, what information we use to create the profiles and where we get this information from.*
- ☐ *We use anonymised data in our profiling activities."*

Source: ICO (2018), Guide to the General Data Protection Regulation (GDPR), Information Conmmissioner's Office, https://ico.org.uk/media/for-organisations/guide-to-the-general-data-protection-regulation-gdpr-1-0.pdf.

6.2. Anti-discrimination law

105. Finally it is also important to consider the role of anti-discrimination and equality laws which, despite not prohibiting personalised pricing in general, restrict the ability of firms to discriminate consumers in certain ways that are contrary to human rights. In particular, in many jurisdictions it is prohibited to discriminate consumers based on protected characteristics such as gender, race, religion, age, political views, nationality, disability, sexual preferences and marital status. Regardless of whether or not these characteristics are relevant to estimate consumers' willingness to pay, it is understood that price discriminating on such grounds could potentially lead to a more fragmented society.

106. In order to respect principles of non-discrimination, some authors have argued that firms wishing to engage in personalised pricing should be required to make sure that protected groups are not charged higher or lower prices, even if such price differences are the result of differences in income levels or other relevant variables that may affect consumers' willingness to pay. For that purpose, it is argued that pricing algorithms could

be designed in such a way that all different groups are charged, in average, the same prices, with the intention of eliminating any *de facto* discrimination.

107. Although the possibility of enforcing equal prices across groups might appear attractive at first sight, it is crucial to consider the risks of such an approach. Firstly, this would give companies the legitimacy and even the obligation to collect sensitive information about consumers (such as their gender or nationality), which could eventually be used to discriminate consumers on those grounds. Secondly, and more importantly, this approach could actually have the effect of reinforcing discrimination against unprivileged groups; for instance, if two different groups receive in average different wage levels and have, accordingly, different willingness to pay, an individual from the disadvantaged group would be forced to pay a higher price than an individual from the privileged group, even if the first and second individuals earn exactly the same amount.

108. In light of these concerns, an alternative approach could entail prohibiting firms from collecting and processing sensitive information with the purpose of personalising prices. Likewise, firms could also be prevented from using observed consumer data to infer their age, gender and nationality, in an attempt to profile consumers according to these or other protected characteristics. These and other policy options could potentially help insuring that personalised pricing does not result in the violation of human rights.

7. Concluding remarks

109. Personalised pricing is an interesting feature of digital markets that has generated strong reactions among consumers and scholars, even though the fundamental principles behind such practices are not by any means new. In old times, when buying a tailcoat at the tailor, a piano at the music shop or a pocket watch at the watchmaker, the seller would carefully screen the appearance of the customer and ask all kind of apparently harmless questions, with the purpose of assessing the consumer's willingness to pay. Nowadays similar strategies are observed online, with the difference that data mining algorithms can do a much better job at guessing consumers' valuations and setting prices, potentially without consumers being aware that their behaviour is being closely inspected under a magnifying glass.

110. Although consumers appear to reveal a particular distaste for personalised pricing, which is often perceived as unfair, these practices may be pro-competitive and enhance consumer welfare. Indeed, as a very granular form of price discrimination, personalised pricing has the potential to increase static and dynamic efficiency, by bringing output transacted to its maximum level and creating incentives for innovation. Still, the redistributive effects of personalised pricing imply that, in some circumstances, consumers may overall become worse-off.

111. As established along this background note, some of the existing concerns about personalised pricing might be addressed not only through competition policy and consumer protection policy, but also in part through data protection and anti-discrimination laws. While in some cases there could be an overlap between the different approaches, the wide range of policy tools available can actually complement each other in tackling the risks of personalised pricing. Therefore an effective enforcement is likely to largely benefit from a close co-ordination between authorities responsible for the enforcement of different policies, as well as a good understanding of both the benefits and risks of personalised pricing.

Endnotes

[1] (Ezrachi and Stucke, 2016[38]), (Maggiolino, 2017[45]), (Graef, 2017[60]) and (Townley, Yeung and Morrision, 2017[75]).

[2] Examples of discrete choice models are the "probit" and the "logit" models. Within these models, the explained variable – in this case the consumer' decision to buy a product – is a binary variable that takes value 1 if the consumer purchases the product and 0 otherwise. In order to explain how the purchasing decisions are affected by a set of explanatory variables (consumers' characteristics), the probit and logit models estimate a latent function that reflects the consumer's utility or willingness to pay. Then, it uses the maximum likelihood method to estimate the parameters by assuming that consumers only buy a product if their willingness to pay is higher than the price.

[3] (Garbarino and Lee, 2003[58]), (Odlyzko, 2004[12]) and (Levine, 2012[63]).

[4] Note that, in some instances, price discriminating final consumers can also amount to an exclusionary conduct. This could be the case, for instance, when a firm engages in "selective pricing", which consists in setting lower prices in markets where competitors are present, with the intention of excluding them from the market.

[5] Since 2000 there have been three main cases where the European Commission identified an exploitative abuse: DSD (Case COMP/D3/34493), British Post/Deutsche Post AG (Case COMP/C-1/36.915) and Standard & Poor (Case COMP/39.592) (Dethmers and Blondeel, 2017[46]). Exploitative abuses have also been investigated by national competition authorities of EU countries, including in France, such as Gibmedia (Case 15-D-13), Carrefour (Case 11-D-20) and STGM (Case 10-D-06); Germany, such as Stadtwerke Leipzig (Case B8-34/13), BWB Berlin (Case B8-40/10), Stadtwerke Mainz Netze GmbH (Case B8-159/11); Spain, such as Agedi/Aie Radio (Expte. S/0500/13), SGAE – Conciertos (Expte. S/0460/13), Mensages cortos (Expte. S/0248/10), Agedi/Aie (Expte. S/0297/10), EGEDA (Expte. S/0157/09); and in the UK, for instance in the pharmaceutical and transport sectors (Dethmers and Blondeel, 2017[46]).

[6] See for example the European Court of Justice and the Commission: "*On 3 December 2008, the Commission issued Guidance on its enforcement priorities in applying Article 82 to abusive exclusionary conduct by dominant undertakings. (1) In so doing, the Commission formally endorsed an effects-based approach to exclusionary conduct by dominant undertakings*" (Peeperkorn and Viertiö, 2009[78]).

[7] In the EU, which follows a consumer welfare standard, this idea was supported by the Court of Justice in the Asnef-Equifax case: "Under Article (101(3) TFEU), it is the beneficial nature of the effect on all consumers in the relevant markets that must be taken into consideration, not the effect on each member of that category of consumers." Case C-238/05, *Asnef-Equifax*, *Servicios de Información sobre Solvencia y Crédito, SL and Administración del Estado y Asociación de Servicios Bancarios (Ausbanc)*.

[8] In Japan unfair trade practices are regulated under the Anti-Monopoly Act and enforced by the Japanese Federal Trade Commission.

[9] Senate Report No. 597, 63d Cong., 2d Sess., 13 (1914).

[10] Federal Consumer Protection Law, Chapter VI, article 58, https://www.profeco.gob.mx/juridico/pdf/l_lfpc_06062006_ingles.pdf.

[11] While often used interchangeably, privacy and data protection have different meanings: privacy is "*the appropriate use of personal information under the circumstances*", and data protection consists in "*the management of personal information*". This distinction is however not always clear in a legal context, with some countries commonly using the term "privacy" in their laws and regulations (e.g. US), and others applying the term "data protection" to refer to privacy-related issues (e.g. EU) (IAPP, 2011[52]).

References

Abnett, K. (2015), "Will Personalised Pricing Take E-Commerce Back to the Bazaar?", *Business of Fashion*, https://www.businessoffashion.com/articles/fashion-tech/personalised-pricing-turns-e-commerce-online-bazaar. [23]

Akman, P. (2017), "The Theory of Abuse in Google Search: A Positive and Normative Assessment under EU Competition Law", *Journal of Law, Technology and Policy*, Vol. 301/2, https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2811789. [53]

Akman, P. (2008), "Exploitative Abuse in Article 82EC: Back to Basics?", *ESRC Centre for Competition Policy* , Working Paper No. 09-1, http://competitionpolicy.ac.uk/documents/107435/107587/1.105848!wp09-1_exploitative_abuse_in_article82EC_PA.pdf. [44]

Andre, C. and M. Velasquez (1990), "Justice and Fairness", *Issues in Ethics*, Vol. 3/2, https://legacy.scu.edu/ethics/publications/iie/v3n2/homepage.html. [40]

Barbier de La Serre, É. and E. Lagathu (2013), "The Law on Fines Imposed in EU Competition", *Journal of European Competition Law & Practice*, Vol. 4/4, pp. 325-344, http://awa2014.concurrences.com/IMG/pdf/de_la_serre_lagathu_fines.pdf. [48]

Bar-Gill, O. (2018), *Algorithmic Price Discrimination When Demand is a Function of Both Preferences and (Mis)Perceptions*, Harvard Law School, https://bit.ly/2vJsx3r (accessed on 10 August 2018). [66]

Beckert, W., H. Smith and Y. Takahashi (2015), "Competitive price discrimination in a spatially differentiated intermediate goods market", *University of London* , Working Paper, https://pdfs.semanticscholar.org/c186/77152642b1bb9b4dd0440102c24cf73045a7.pdf. [29]

Borgesius, F. (2017), "Online Price Discrimination and EU Data Privacy Law", *Journal of Consumer Policy*, Vol. 40/3, pp. 347-366, https://link.springer.com/article/10.1007/s10603-017-9354-z. [54]

Bourreau, M., A. Streel and I. Graef (2017), "Big Data and Competition Policy: Market Power, Personalised Pricing and Advertising", *Centre on Regulation in Europe*, Project Report, https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2920301&download=yes. [47]

CERRE (2017), *Big Data and Competition Policy: Market power, personalised pricing and advertising - project report*, Centre on Regulation in Europe, http://www.cerre.eu/publications/big-data-and-competition-policy (accessed on 10 August 2018). [65]

Chen, Z., C. Choe and N. Matsushima (2018), "Competitive Personalized Pricing", *The Institute of Social and Economic Research*, Osaka University, Discussion Paper No. 1023, http://www.iser.osaka-u.ac.jp/library/dp/2018/DP1023.pdf. [37]

Chloe, C., S. King and N. Matsushima (2017), "Pricing with Cookies: Behavior-Based Price Discrimination and Spatial Competition", *Monash Business School*, Discussion Paper No. 07/17, https://www.monash.edu/business/economics/research/publications/publications2/. [55]

Clifford, S. (2012), "Shopper Alert: Price May Drop for You Alone", *The New York Times*, https://www.nytimes.com/2012/08/10/business/supermarkets-try-customizing-prices-for-shoppers.html. [22]

Council of Economic Advisers (2015), *Big Data and Differential Pricing*, The White House, https://obamawhitehouse.archives.gov/sites/default/files/whitehouse_files/docs/Big_Data_Report_Nonembargo_v2.pdf (accessed on 10 August 2018). [18]

Cox, J. (2001), "Can differential prices be fair?", *Journal of Product and Brand Management*, Vol. 10, pp. 264-276, http://dx.doi.org/www.emeraldinsight.com/journals.htm?articleid=857764. [43]

Cuddeford-Jones, M. (2013), "Effective Revenue Management in the Hospitality Industry", *Eye for Travel*, White Paper, https://www.eyefortravel.com/sites/default/files/rem_for_hotel_extractt.pdf. [32]

DCCA and CE (2017), "Digital Competition and Price Differentiation", *Danish Competition and Consumer Authority and Copenhagen Economics*, Conference Proceedings, https://www.copenhageneconomics.com/dyn/resources/Filelibrary/file/1/71/1499068255/summary-19-june.pdf. [2]

Deane, H. (2017), *Dynamic Pricing - Can consumers achieve the benefits they expect?*, Consumers Council of Canada, https://bit.ly/2LSu4d4 (accessed on 10 August 2018). [68]

Dethmers, F. and J. Blondeel (2017), "EU Enforcement Policy on Abuse of Dominance: Some Statistics and Facts", *European Competition Law Review*, Vol. 38/4, https://awards.concurrences.com/IMG/pdf/eu_enforcement_policy_on_abuse_of_dominance_some_statistics_and_facts_f_dethmers_and_j_blondeel.pdf. [46]

Dickson, P. and R. Kalapurakal (1994), "The use and perceived fairness of price-setting rules in the bulk electricity market", *Journal of Economics Psychology*, Vol. 15, pp. 427-448, http://dx.doi.org/www.sciencedirect.com/science/article/pii/016748709490023X. [56]

EC (2018), *Consumer market study on online market segmentation through personalised pricing/offers in the European Union*, European Commission, https://ec.europa.eu/info/sites/info/files/aid_development_cooperation_fundamental_rights/aid_and_development_by_topic/documents/synthesis_report_online_personalisation_study_final_0.pdf. [1]

EOP (2015), "Big Data and Differential Pricing", Executive Office of the President, United States, https://obamawhitehouse.archives.gov/sites/default/files/whitehouse_files/docs/Big_Data_Report_Nonembargo_v2.pdf. [15]

Ezrachi, A. and M. Stucke (2016), "The Rise of Behavioural Discrimination", *European Competition Law Review*, Vol. 37/2, pp. 485-492, https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2830206.. [38]

Ezrachi, A. and M. Stucke (2016), *Virtual Competition: The Promise and Perils of the Algorithm-Driven Economy*, Harvard University Press, United States. [4]

Faure, M., A. Ogus and N. Philipsen (2008), "Enforcement Practices for Breaches of Consumer Protection Legislation", *Loyola Consumer Law Review*, Vol. 20/4, pp. 361-401, https://pdfs.semanticscholar.org/4b93/ce8e0a689443b68e8fffe55e1caa9334ca05.pdf. [70]

Gabaix, X. and D. Laibson (2006), "Shrouded Attributes, Consumer Myopia, and Information Suppression in Competitive Markets", *Quarterly Journal of Economics*, Vol. 121/2, pp. 505-540, https://dash.harvard.edu/bitstream/handle/1/4554333/Laibson_Shroude. [57]

Garbarino, E. and O. Lee (2003), "Dynamic Pricing in Internet Retail: Effects on Consumer Trust", *Psychology and Marketing*, Vol. 20, pp. 495-498, http://onlinelibrary.wiley.com/doi/10.1002/mar.10084/abstract. [58]

Ghose, A. and K. Huang (2009), "Personalized Pricing and Quality Customization", *Journal of Economics & Management Strategy*, Vol. 18/4, pp. 1095-1135, http://pages.stern.nyu.edu/~aghose/PPQ.pdf. [59]

Graef, I. (2017), "Algorithms and Fairness: What Role for Competition Law in Targeting Price Discrimination Towards End Consumers?", https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3090360&download=yes. [60]

Grennan, M. (2013), "Price Discrimination and Bargaining: Empirical Evidence from Medical Devices", *American Economic Review*, Vol. 103/1, pp. 145-177, https://faculty.wharton.upenn.edu/wp-content/uploads/2014/09/PriceDiscriminationBargaining_Grennan2013AER.pdf. [30]

Ha, A. (2018), "Appeals Court Rules that Tinder's Pricing Violates Age Discrimination Laws", *Techcrunch*, https://techcrunch.com/2018/01/30/appeals-court-rules-that-tinders-pricing-violates-age-discrimination-laws/?guccounter=1. [61]

Hannak, A. et al. (2014), *Measuring Price Discrimination and Steering on E-commerce Web Sites*, https://www.ftc.gov/system/files/documents/public_comments/2015/09/00011-97593.pdf. [20]

Hill, L. (2012), "How Target Figured out a Teen Girl Was Pregnant before Her Father Did", *Forbes*, http://www.forbes.com/sites/kashmirhill/2012/02/16/how-target-figured-out-a-teen-girl-was-pregnant-before-her-father-did/#4e4def1434c6. [16]

Hogan, K. (2018), *Consumer Experience in the Retail Renaissance: How Leading Brands Build a Bedrock with Data*, https://www.deloittedigital.com/us/en/blog-list/2018/consumer-experience-in-the-retail-renaissance--how-leading-brand.html. [19]

House of Lords (2016), *Online Platforms and the Digital Single Market - 10th Report of Session 2015–16*, House of Lords, https://publications.parliament.uk/pa/ld201516/ldselect/ldeucom/129/129.pdf. [49]

Hupperich, T. et al. (2018), *An Empirical Study on Online Price Differentiation*, https://bit.ly/2nDqnhy (accessed on 10 August 2018). [67]

IAPP (2011), *Glossary of Common Privacy Terminology*, IAPP Information Privacy Certification, https://iapp.org/media/pdf/certification/CIPP_Glossary_0211updated.pdf. [71]

ICN (2011), "Competition Enforcement and Consumer Welfare – Setting the Agenda", *International Competition Network*, Conference 17-20 may 2011, The Hague, http://www.internationalcompetitionnetwork.org/uploads/library/doc857.pdf. [62]

ICO (2018), *Guide to the General Data Protection Regulation (GDPR)*, Information Conmmissioner's Office, https://ico.org.uk/media/for-organisations/guide-to-the-general-data-protection-regulation-gdpr-1-0.pdf. [72]

Iordanou, C. et al. (2017), *Who is Fiddling with Prices? Building and Deploying a Watchdog Service for E-commerce*, ACM, https://bit.ly/2Mi067n. [73]

Laibson, D. and R. Goldman (2018), *Behavioral Economics and Behavior Change*, https://www.acm.nl/sites/default/files/documents/2018-05/presentation-mr-laibson-acm-2018-conference.pdf.. [74]

Levine, M. (2012), "Price Discrimination without Market Power", *Harvard Law School* Discussion Paper No. 276, https://techliberation.com/wp-content/uploads/2012/04/276.pdf. [63]

Maggiolino, M. (2017), "Personalized Prices in European Competition Law", *Bocconi Legal Studies*, Research Paper No. 2984840, https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2984840. [45]

Mahdawi, A. (2018), *Is Your Friend Getting a Cheaper Uber Fare Than You Are?*, The Guardian, https://www.theguardian.com/commentisfree/2018/apr/13/uber-lyft-prices-personalized-data. [27]

McMahon, P. (2016), "Gender-Based Sales Promotions: Good Business or Unlawful Discrimination", *Labour & Employment Law Perspectives*, https://www.laboremploymentperspectives.com/2016/04/11/gender-based-sales-promotions-good-business-or-unlawful-discrimination/. [64]

Mikians, J. et al. (2012), "Detecting price and search discrimination on the internet", *11th ACM Workshop on Hot Topics in Networks*, Conference Proceedings, pp. 79-84, http://dx.doi.org/10.1145/2390231.2390245. [14]

Miller, A. (2014), "What Do We Worry About When We Worry About Price Discrimination? The Law and Ethics of Using Personal Information for Pricing", *The Journal of Technology Law & Policy*, Vol. 19, pp. 41-104, https://bit.ly/2B97AEb. [51]

Mohammed, R. (2017), *How retailers use personalized prices to test what you're willing to pay*, https://bit.ly/2qWuYjh%20. [69]

Narayanan, A. (2013), *Personalized Coupons as a Vehicle for Perfect Price Discrimination*, https://33bits.wordpress.com/2013/06/25/personalized-coupons-price-discrimination/. [41]

Nevo, A. and C. Wolfram (2002), "Why do manufacturers issue coupons? An empirical analysis of breakfast cereals", *RAND Journal of Economics*, Vol. 33/2, pp. 319-339, https://www.jstor.org/stable/3087436?seq=1#page_scan_tab_contents. [31]

Newcomer, E. (2017), *Uber Starts Charging What It Thinks You're Willing to Pay*, Bloomberg, https://www.bloomberg.com/news/articles/2017-05-19/uber-s-future-may-rely-on-predicting-how-much-you-re-willing-to-pay. [26]

Camp, L. and S. Lewis (eds.) (2004), *Privacy, Economics, and Price Discrimination on the Internet*, Springer, https://doi.org/10.1007/1-4020-8090-5_15. [12]

OECD (2018), *Implications of E-Commerce for Competition Policy*, https://one.oecd.org/document/DAF/COMP(2018)3/en/pdf. [8]

OECD (2018), *Improving Online Disclosures with Behavioural Insight*, OECD Publishing, Paris, https://www.oecd.org/sti/consumer/policy-note-improving-online-disclosures-behavioural-insights.pdf. [50]

OECD (2018), *Rethinking Antitrust Tools for Multi-Sided Platforms*, http://dx.doi.org/www.oecd.org/competition/rethinking-antitrust-tools-for-multi-sided-platforms.htm. [7]

OECD (2017), *Algorithms and Collusion: Competition Policy in the Digital Age*, http://www.oecd.org/daf/competition/Algorithms-and-colllusion-competition-policy-in-the-digital-age.pdf. [5]

OECD (2016), *Big Data: Bringing Competition Policy to the Digital Era*, https://one.oecd.org/document/DAF/COMP(2016)14/en/pdf. [6]

OECD (2016), *Price Discrimination - Background note by the Secretariat*, https://one.oecd.org/document/DAF/COMP(2016)15/en/pdf. [9]

OECD (2015), *Data-Driven Innovation: Big Data for Growth and Well-Being*, OECD Publishing, Paris, http://dx.doi.org/10.1787/9789264229358-en. [10]

OECD (2013), "Exploring the Economics of Personal Data: A Survey of Methodologies for Measuring Monetary Value", *OECD Digital Economy Papers*, No. 220, OECD Publishing, Paris, http://dx.doi.org/10.1787/5k486qtxldmq-en. [81]

OECD (1993), *Glossary of Industrial Organisation Economics and Competition Law*, compiled by R. S. Khemani and D. M. Shapiro, commissioned by the Directorate for Financial, Fiscal and Enterprise Affairs, http://www.oecd.org/dataoecd/8/61/2376087.pdf. [34]

OECD (1980), *Recommendation of the Council concerning Guidelines Governing the Protection of Privacy and Transborder Flows of Personal Data*, http://www.oecd.org/sti/ieconomy/oecdguidelinesontheprotectionofprivacyandtransborderflowsofpersonaldata.htm#recommendation. [52]

OFT (2013), *Personalised Pricing - Increasing Transparency to Improve Trust*, Office of Fair Trading, http://webarchive.nationalarchives.gov.uk/20140402142426/http:/www.oft.gov.uk/shared_oft/markets-work/personalised-pricing/oft1489.pdf. [3]

OFT (2013), *The Economics of Online Personalised Pricing*, Office of Fair Trading, https://web.archive.org/web/20130806043426/http://oft.gov.uk/shared_oft/research/oft1488.pdf. [13]

Peeperkorn, L. and K. Viertiö (2009), "Implementing an Effects-Based Approach to Article 82", *Competition Policy Newsletter* No. 1, http://ec.europa.eu/competition/publications/cpn/2009_1_5.pdf. [78]

Pigou, A. (1920), *The Economics of Welfare*, McMillan & Co. [11]

Proust, O. (2015), *CNIL Enforces Cookies Rules in France*, https://privacylawblog.fieldfisher.com/2015/cnil-enforces-cookies-rules-in-france. [79]

Rawls, J. (1985), "Justice as Fairness: Political not Metaphysical", *Philosophy and Public Affairs*, Vol. 14/3, pp. 223-251, http://links.jstor.org/sici?sici=0048-3915%28198522%2914%3A3%3C223%3AJAFPNM%3E2.0.CO%3B2-0. [39]

Reuters (2017), *AirAsia testing personalised baggage pricing, eyes more add-on revenues*, https://www.reuters.com/article/airasia-strategy/airasia-testing-personalised-baggage-pricing-eyes-more-add-on-revenues-idUSL3N1NM2DS. [25]

Richards, T., J. Liaukonyte and N. Streletskay (2016), "Personalized Pricing and Price Fairness", *International Journal of Industrial Organization*, Vol. 44, pp. 138-153, http://dx.doi.org/10.1016/j.ijindorg.2015.11.004. [42]

Schwartz, M. (1990), "Third-Degree Price Discrimination and Output: Generalizing a Welfare Result", *American Economic Review*, Vol. 80/5, pp. 1259-1262, https://www.jstor.org/stable/2006776?seq=1#page_scan_tab_contents. [33]

Shiller, B. (2014), "First Degree Price Discrimination Using Big Data", *Brandeis University, Department of Economics and International Business School*, Working Paper No. 58, http://benjaminshiller.com/images/First_Degree_PD_Using_Big_Data_Jan_27,_2014.pdf. [35]

Shiller, B. and J. Waldfogel (2011), "Music for a Song: An Empirical Look at Uniform Pricing and Its Alternatives", *The Journal of Industrial Economics*, Vol. 59/4, pp. 630-660, http://dx.doi.org/|https://doi.org/10.1111/j.1467-6451.2011.00470.x. [36]

Townley, C., K. Yeung and E. Morrision (2017), "Big Data and Personalised Price Discrimination in EU Competition Law", *Yearbook of European Law*, https://kclpure.kcl.ac.uk/portal/files/81502904/Big_Data_Personalised_Price_Discrimination_and_EU_Competition_Law.pdf. [75]

Tse, H. (2016), *Ladies' Nights Ruled to be Discriminatory on the Ground of Sex*, http://www.info.gov.hk/gia/general/201605/04/P201605040390.htm. [76]

Turow, J., L. Feldman and K. Meltzer (2005), *Open to Exploitation: America's Shoppers Online and Offline*, Annenberg Public Policy Center of the University of Pennsylvania, https://repository.upenn.edu/asc_papers/35. [77]

Valentino-DeVries, J., J. Singer-Vine and A. Soltani (2012), "Websites Vary Prices, Deals Based on Users' Information", *The Wall Street journal*, https://www.wsj.com/articles/SB10001424127887323777204578189391813881534. [21]

Varian, H. (1985), "Price Discrimination and Social Welfare", *American Economic Review*, Vol. 75/4, pp. 870-875, https://www.jstor.org/stable/1821366?seq=1#page_scan_tab_contents. [28]

Vulkan, N. and Shem-Tov, Y. (2015), "A Note on Fairness and Personalised Pricing", *Economic Letters*, Vol. 136, pp. 179-183, https://www.sciencedirect.com/science/article/pii/S0165176515003705. [17]

Walker, T. (2017), *Are You Ready for Personalised Pricing?*, https://www.theguardian.com/global/2017/nov/20/dynamic-personalised-pricing. [80]

Wallheimer, B. (2018), *Are You Ready for Personalised Pricing?*, http://review.chicagobooth.edu/marketing/2018/article/are-you-ready-personalized-pricing. [24]