Consumer behavioural biases in competition: A survey

Huck, Steffen and Zhou, Jidong

Office of Fair Trading

May 2011

OFFICE OF FAIR TRADING

CONSUMER BEHAVIOURAL BIASES IN COMPETITION

A SURVEY

Final Report

May 2011

A Report by Steffen Huck, Jidong Zhou, and London Economics
Charlotte Duke

OFT1324

FOREWORD BY AMELIA FLETCHER

This report was commissioned by the Office of Fair Trading (OFT) from London Economics in association with Steffen Huck and Jidong Zhou (University College London). It examines the implications of consumer behavioural biases for firms' decisions and hence for competitive equilibria.

Consumer behavioural biases imply that consumers may not behave in the fully rational way that many economic models presume. What impact do these biases have on competition? Specifically, how does competition and pricing change when consumers are biased? Can inefficiencies that arise from consumer behavioural biases be mitigated by lowering barriers to entry? Do biased consumers make rational ones better or worse off? And will biased consumer behaviour be overcome through learning or education?

This report reviews the empirical and theoretical behavioural economic literature to answer these questions. It looks at the key implications for consumer and competition policy in particular to understand how and when competitive equilibrium may change for the worse. It also contributes to our understanding of when, why, and how we should intervene.

The views of this paper are those of authors and do not necessarily reflect the views of the OFT nor the legal position under existing competition or consumer law which the OFT applies in exercise of its enforcement functions. Rather the aim of the report is to shed some evidence on this interesting issue, and promote economic debate in this area.

This report is part of the OFT's Economic Discussion Paper series. If you would like to comment on the paper, please write to me, Amelia Fletcher, at the address below. The OFT welcomes suggestions for future research topics on all aspects of UK competition and consumer policy.

Dr Amelia Fletcher,
Chief Economist
Office of Fair Trading,
Fleetbank House,
2-6 Salisbury Square
London EC4Y 8JX
amelia.fletcher@oft.gsi.gov.uk

CONTENTS

1 EXECUTIVE SUMMARY AND INTRODUCTION

1.1 This is a survey of studies that examine competition in the presence of behaviourally biased or boundedly rational consumers. It will tackle questions such as: How does competition and pricing change when consumers are biased? Can inefficiencies that arise from consumer behavioural biases be mitigated by lowering barriers to entry? Do biased consumers make rational ones better or worse off? And will biased consumer behaviour be overcome through learning or education?

1.2 Most traditional analyses of competition focus on the supply side. They study how industries will be organised under different informational and technological assumptions. Consumers feed into these models simply in the form of well-behaved demand functions. This is different in the literature surveyed here. In these models consumers have a presence and their decision rules are modelled in detail.

1.3 Consumers' behaviour may deviate from the orthodox ideal of perfect rationality in many different ways. Consumers may suffer from cognitive limitations that make the comparison of products and prices harder or they may be prone to a wide range of behavioural biases: They might be overoptimistic about the future or overconfident in their ability to avoid accidents. They might be overly afraid to lose compared to the status quo and sometimes their preferences might change from one day to the next.

1.4 Although bounded rationality and behavioural biases among consumers is not a new theme, most papers that we survey here are fairly recent, with the vast majority published in just the last five years. Looking at the rate with which this literature has grown, it seems fair to speak of an explosion that has taken place. There are many reasons why this explosion happened at this time.

1.5 Throughout the 1980s and 90s the economics literature gathered at an increasingly fast rate studies that demonstrated that something was wrong with the neoclassical rational actor paradigm. Most of these studies were economic experiments and more and more theorists turned

to empirical research either in the form of conducting laboratory experiments themselves or through designing new models of behaviour that make sense of the data generated by the experiments. It was this proliferation of new models of behaviour that started around the new millennium that made it possible to re-examine different areas of economics with new (and often more realistic) assumptions about human behaviour.

1.6 The new literature on 'bounded rationality and industrial organisation' (the title of the first graduate textbook on the field that has just appeared)[1] has to be seen in this 'revisionist' context. The literature is very model-oriented and mainly theoretical. Empirical studies that put it to a test - that is, studies that both prove the existence of behavioural bias among consumers in a particular setting and then examine actual firm behaviour - are extremely rare. Nevertheless, our survey includes a brief chapter on empirical strategies that can be employed for examining markets with biased consumers.

1.7 Our survey shows that the literature as it stands today deserves to be taken seriously. It is more than a collection of intellectually interesting curiosities. The literature can be grouped into relevant areas of consumer choice and shows substantial consistency and robustness within each area.

1.8 Perhaps the most striking result of the literature so far is that increasing competition through fostering entry of more firms may not always make consumers better off and in specific circumstances may even make consumers worse off.

1.9 The standard intuition within the traditional industrial organisation literature is that competition increases consumer welfare. This standard intuition holds if biases simply distort consumers demand without actually affecting their desire to search for the best deals in light of their demand. Examples of such biases include over or underestimating one's

[1] *Bounded Rationality and Industrial Organisation*, Spiegler (2010).

demand for certain goods or services, or shifts in willingness to pay due to reference points and loss aversion. Entry from more firms can never do harm to consumers in these scenarios and will mostly make them strictly better off. In these situations, profits made from biases are seldom fully dissipated unless competition approaches the level of perfect competition. However even if competition is perfect, it is unable to eradicate allocative inefficiencies that may arise in response to distortions driven by biases. For example, biases and the cross subsidies they generate may lead to overproduction of goods that in the end will be thrown away or suboptimal design of products that may have too much of one attribute and too little of another.

1.10 On the other hand, increasing competition may not always benefit consumers and, under specific conditions, may even harm consumers. When there are at least some consumers who do not search properly or have difficulties judging quality, firms may not need to compete by offering better deals (in the form of lower prices or better quality or both). Consumers may not search properly because they have a particular liking of specific brands, or may be particularly lazy or just misjudge prices. Likewise consumers that have difficulties judging quality can mistake inferior goods for superior goods. In these situations firms can focus on exploiting biased consumers who are likely to purchase from them regardless of price and quality. Under these conditions increased competition does not help because consumers do not improve their decision making.

1.11 The adverse effects of poor decisions with regards to search and quality can be made worse through firms' deliberate attempts to make price comparisons and search harder - through complex pricing, shrouding, obfuscation and other means. In general the literature shows that firms will engage in such obfuscation when possible as it 'softens' the level of competition between them. Furthermore, when the incentives to engage in such activities become more intense when there are more competitors, we may even get the result that competition harms consumers. For example if more competition leads to more complex pricing, under certain model specifications average prices may actually increase.

1.12 There are, of course, remedies other than increasing competition via entry that can improve market outcomes. We discuss consumer learning and education, reputation building by firms, better information leading to improved market transparency as well as standardisation of information. Each of these remedies is shown to be potentially effective in some classes of situations.

1.13 Learning and education have naturally the biggest scope for alleviating market failures where consumers' deviations from rational behaviour are due to errors that can be detected and realised ex post. A good example for this would be a consumer who overestimates the quantity that he desires of a certain good and, hence, will find out eventually that he has unused units that go to waste.

1.14 In situations where firms have an incentive to exploit errors in consumer decision making, there might, of course, also exist an incentive for firms to establish a reputation for not engaging in such exploitation. For example, firms might build a reputation for offering simple pricing structures and not hiding any extra charges.

1.15 Better information about price and quality is intuitively appealing whenever consumers need to engage in active search before purchasing a product. Search may involve travelling (or going up and down the high street) utilizing the internet. Regardless of the precise means of search, easier access to hard information about prices and reliable information about quality will discipline firms and aid consumers.

1.16 Of course, when consumers have cognitive limitations it is not only available information that may matter but also its presentation. The same tariff may be explained in a simple or more complicated manner. Moreover, different suppliers might present similarly structured tariffs in different ways which will make comparisons much harder if consumers struggle to process such complex information. The survey will also show how this very fact creates incentives for firms to present information, for example, about prices, in convoluted ways. Here enforced standardisation of information can be an effective remedy.

1.17 The survey is organised as follows. In Chapter 2 we introduce a taxonomy of the literature in order to classify different deviations from rationality. Chapter 3 contains the survey as such with six subsections, one for each of the six categories that we have identified. Chapter 4 discusses remedies – how competition, information, learning and reputation can help to improve outcomes for consumers. Chapter 5 discusses empirical strategies and Chapter 6 concludes.

2 A TAXONOMY FOR THE LITERATURE

2.1 There are different plausible ways of categorising studies into markets with behaviourally biased consumers. One natural way would be to take the biases themselves as starting point on the basis that they are the root cause of a consumer's particular choice. An alternative would be to start from the observable consequences of different biases, that is, to start from the choice that consumers make as a result of the biases.

2.2 From an applied perspective starting from the consumer's choice is attractive as choice is, in contrast to biased consumer preferences or beliefs, directly observable. Moreover findings about the key policy issues, sources of biases and remedies, can be organised along the categories that we are proposing. The deeper reason for this is, of course, that markets in the end react to what consumers do and not to how they feel.

2.3 The question then arises, how consumer choice can be biased away from fully rational behaviour. Fundamentally there appear to be three different dimensions along which choice might be biased:

- willingness to pay (WTP), consumers might pay too much for a given quantity of a good consumed
- search, consumers might not find the cheapest or best suited product because they do not search in a rational manner, and
- quality, consumers might purchase products ill-suited to their needs or of inferior quality.

2.4 Within these three dimensions, it is useful to establish slightly finer categories that will allow us to say slightly more about how the bias operates. Specifically, we will suggest two finer categories for each of the three categories of choice bias. This gives us a total of six categories. The six categories are:

2.5 **Willingness to Pay and Reference Point Effects:** A consumer's WTP may be affected through reference point effects, that is, the consumer's

valuation of a good can depend on the status quo, past experiences, recently sampled products, or expectations. Wherever the reference point comes from, a deviation to something worse than the reference point is felt to a greater extent than a deviation to something better. It is this **loss aversion** that renders reference points significant. For example, if a consumer has just sampled a product that was available in a particularly beautiful colour, his WTP for a product in a slightly less appealing colour might drop below the WTP he would have had for this good had he not seen the perfect colour. Similarly, if the consumer's reference price for a particular product is £5, then buying an identical product for £6 will cause more psychological harm to the consumer than buying an identical product for £4 would cause in joy.

2.6 **Willingness to Pay and Misperception of future desired quantities.** Consumers might also pay too much for a good or service (despite having searched intensely) if they misperceive their own future demand. For example, they may believe that they will go more often to the gym than they will actually do. Or, they might buy too much food when going through the aisles of a supermarket when hungry. But, sometimes consumers might also under-predict their desire to consume, for example, their desire to use their credit cards for purchases that they essentially cannot afford.

2.7 **Search and Inertia***.* Consumers' search might be hindered by different forms of idiosyncratic inertia, that is, by subjectively high search costs. Subjectively high search costs can stem from many different sources. For example, consumers might be particularly attached to a specific supplier (perhaps even when the supplier offers products that are essentially identical to that of its competitors). Other reasons could include laziness or a psychological aversion against walking along crowded high streets. In all cases, the high search costs are a matter of preference.

2.8 **Search and Misjudgement of prices***.* The second search bias can arise even if consumers do engage in thorough search because they might misjudge prices that sellers quote. This may happen if pricing is

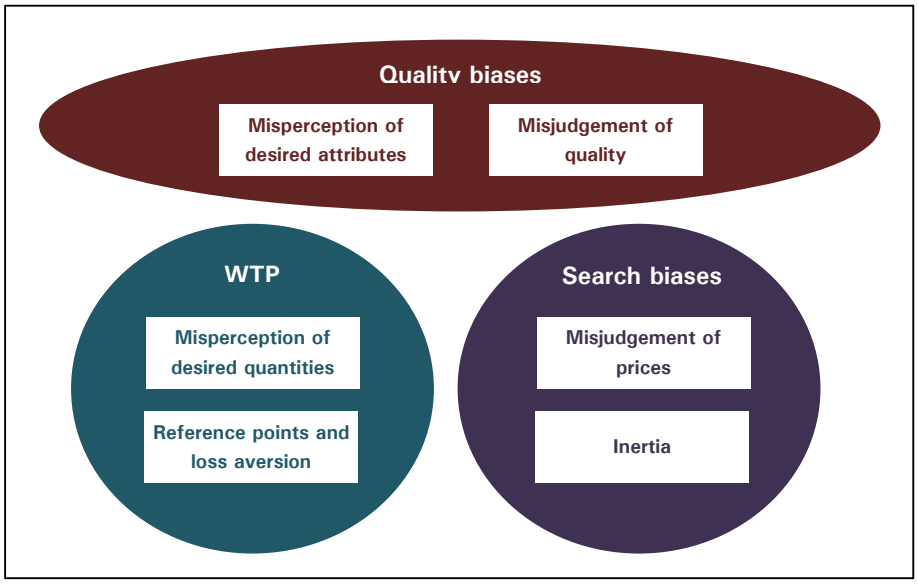
intrinsically complex but could also be a consequence of artificial presentational complexity.

2.9 **Quality and Misperception of desired product attributes.** Consumers may misperceive the type of product they need, that is, they might think that certain product attributes are more important to them than they turn out to be ex-post. In other words, they misperceive horizontal quality differences between products.

2.10 **Quality and Misjudgement of vertical quality.** Finally, in the presence of vertical product differentiation (that is, the same products but of higher and lower quality), consumers might misjudge the quality of a product they inspect and inadvertently a buy poor quality product.

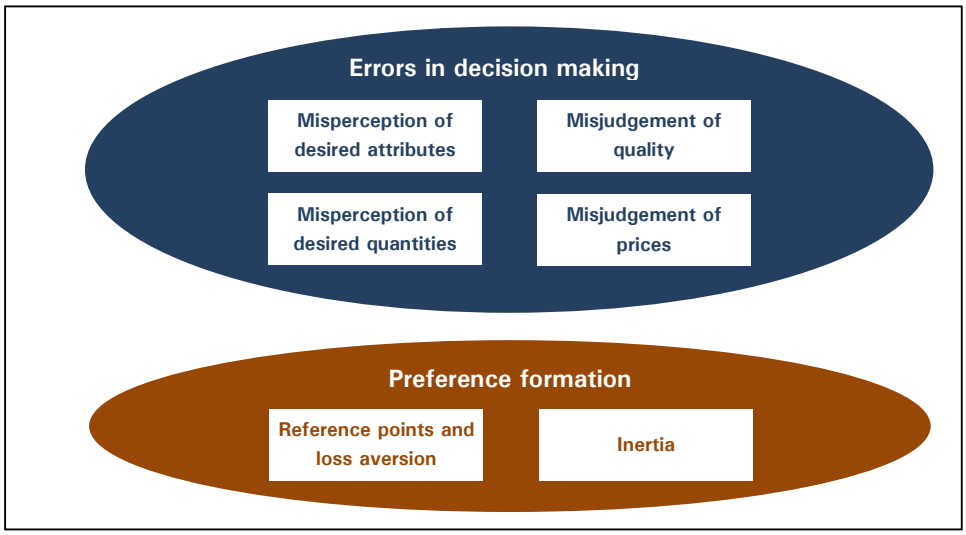
2.11 As we pointed out before, our six finer categories fall into three larger categories depending on which dimension of choice they affect: Willingness to pay, search, or quality. We illustrate this grouping based on consumer choice in Figure 2.1 which groups the six categories into these three consumer choice categories.

Figure 2.1: Behavioural biases grouped according to how they affect choice



2.12 On the other hand, we can group our six categories according to their behavioural root causes. In this case there are two groups: (1) those that stem from **errors** in decision making; and, (2) those that arise due to preference formation. Biases that stem from errors in decision making are misjudgement of future quantities demanded, misperception of product attributes (horizontal quality), misjudgement of product quality (vertical quality) and misjudgement of price). Biases that stem from preference formation are reference point effects and loss aversion, and inertia. We show this in Figure 2.2 which groups the six categories by the two root causes; errors in decision making and errors in the way that consumers form their product preferences.

Figure 2.2: Behavioural biases grouped according to their source



2.13 We can group the six categories according to choice for empirical purposes, or according to the root cause of bias for understanding how robust they are and whether they can be solved through remedies. The categories can also be used in order to answer some of the key policy questions, for example, to tell us where increasing the number of competitors will improve market outcomes and where the presence of more competitors might have (counterintuitive) adverse effects for consumers.

2.14 Crucially, we will never need more than these six categories. All key results from the surveyed literature that are robust and relevant can be discussed with reference to these six simple categories. Or by reference to our higher groupings based on consumer choice or the root cause of the bias.

3 THE LITERATURE

3.1 This chapter looks at the six different types of behavioural biases. First it looks at reference point effects. Next it looks at misperception of demand. Both of these can be classified more generally as willingness to pay biases. Third it looks at the two biases to optimal search behaviour – inertia and misjudgement of prices due to framing effects. Finally it looks at papers relating to the two biases regarding quality – misjudgement of quality required and misperception of demand for specific product attributes.

Willingness-to-pay bias I: reference point effects

3.2 This section looks at the resulting market equilibria when consumers do not have fixed preferences but rather have preferences that change given the context of their setting.

3.3 The idea that economic decision makers might evaluate products or prospects relative to some reference points rather than in an absolute manner has been successfully introduced into the canon of economic thinking by Kahneman and Tversky (1979) for choice under risk and Tversky and Kahneman (1991) for riskless choice. The basic idea is simple and psychologically appealing. Possible future outcomes are compared to the status quo. If the status quo moves, valuations of alternatives will change. Moreover, there is an asymmetry in the perception of gains and losses: Losses loom larger than gains. This is known as loss aversion. (Notice that without the 'kink' in the valuation of an item that is induced through loss aversion, a reference point would not affect choice. In other words, it is loss aversion that renders reference points economically important.)

3.4 When consumers think about how much they are willing to pay for a particular good or service, it seems natural that they might be prone to similar reference effects. References might come from past experience, expectations, or recently sampled products.

3.5 While the studies that we survey in this chapter make subtly different assumptions about how reference points are formed (with some dramatic consequences for consumer demand), they do agree on one basic competition relevant insight: If consumers are loss averse in the price dimension (that is, if they feel 'heightened pain' moving from a cheaper to a more expensive product), this will generally intensify competition – much in the same way as competition becomes more intense when demand becomes more price elastic. In contrast, when consumers are loss averse in the dimension of product fit or product characteristic (that is, if they feel 'heightened pain' when moving from a product that fits their tastes more to one that fits their tastes less), this will soften competition – much in the same way as increased product differentiation does.

3.6 One could summarise these effects of reference points by saying that loss aversion tends to serve as a magnifier of price and product differences.

3.7 While loss aversion shifts consumers' willingness to pay, it is important to notice that such shifts are **not** viewed as erroneous. The literature typically takes the stand that consumers evaluate outcomes relative to a reference point because this is what they prefer. These preferences may be non-standard but they are preferences, says the literature.[2] However, these are preferences that open up the scope for firms to change consumers' willingness to pay for their products. Consider for example a consumer who wants to buy a bottle of wine and considers two specific bottles, both of medium quality and price, but one a little finer and more expensive than the other. Reference point effects can imply that the consumer's willingness to pay for the finer bottle depends on the presence of other bottles on the shelf that are not even under consideration for purchase. For example, the consumer might be willing to pay more for the finer bottle if there is a top quality bottle on the

[2] While we follow this line in this review, it is, however, worth pointing out that there is empirical evidence that suggests that the display of loss aversion correlates with low cognitive ability (low IQ); see, for example, Burks et al. (2008).

shelf, compared to the situation where a poor quality bottle is nestling next to the two bottles under consideration. The reason is that the third bottle (that the consumer would never buy) influences the consumer's reference point and 'downgrading' quality would be perceived as a loss, while 'upgrading' quality would be perceived as a gain. Hence, if the reference point is shifted upwards (through the presence of the top quality bottle) the consumer may really want to avert the loss that comes with settling for the lesser bottle. On the other hand, if the reference point is shifted downwards (through the poor quality bottle) his extra willingness to pay for the gain that the finer bottle promises would be smaller. This explains why supermarkets may stock some expensive bottles that get dusty on the shelves. They may not be intended for selling but simply for shifting reference points or aspirations,

3.8 Models of loss aversion have been firmly established in the economics literature for a long time, but there are only a few recent attempts to model competition between firms in the presence of loss averse consumers. These models differ in the way consumers form reference points but make the same assumptions about the domains of loss aversion. There are horizontally differentiated products and consumers may be loss averse with respect to prices and with respect to product fit.

3.9 Heidhues and Koszegi (2008) assume that consumers compare products that they actually find in the market with their initial expectations about what the market will provide. Specifically, Heidhues and Koszegi assume that consumers have rational expectations about firms' supply choices and prices.[3] If a real product is more expensive or less suitable than what the consumer expected, the consumer will suffer an extra psychological loss (if she buys it) on top of the intrinsic loss. In the following discussion, let us temporarily ignore the loss aversion effect from the

[3] This requires consumers to compute the market equilibrium (which is, as the paper demonstrates, quite complicated). As a consequence, the rationality requirements for Heidhues and Koszegi's model are even more demanding on consumers than those of most orthodox models.

product suitability dimension. The main ideas and results of their study do not depend on it. Also notice that in this literature about price competition and consumer loss aversion, the unit strength of loss aversion is exogenously given, but firms' price choices obviously will affect the distance between the reference point and the actual price and so will influence how much consumers suffer from loss aversion.

3.10 Heidhues and Koszegi's main results are intuitive. Specifically, they show that equilibria can arise where all firms, even if they have different costs, or when costs change over time, charge the same uniform ('focal') price. This effect is essentially driven by the loss aversion in the price dimension. The logic is as follows. Suppose consumers expect a uniform market price to prevail, then increasing the price by some increment affects demand more dramatically than reducing the price by the same increment. This is simply a consequence of the assumed loss aversion. Consumers react to losses (price increases) more sharply than to gains (price drops). This generates an outward kink in the demand curve with the kink being precisely at the expected ('focal') price. Profit-maximisation then implies all firms should set actual price equal to the 'focal' price even if their costs are different (up to some bound) or change over time. In other words, Heidhues and Koszegi's model demonstrates that consumer loss aversion can give rise to **price stickiness**.

3.11 However, the effect from consumer loss aversion on market prices will become weaker and weaker as the number of firms increases. With more firms the residual demand of each firm will become smaller. This requires the cost differences across firms to be relatively small in order to still give rise to focal pricing. In other words, price stickiness becomes less likely when the number of firms increases.

3.12 Karle and Peitz (2009, 2010) study a variation of Heidhues and Koszegi's model. They keep the assumption that (rational) expectations serve as reference points but assume that there are some fully informed consumers who do *not* experience loss aversion. Moreover, consumers who are not fully informed observe prices before they observe the quality match of the product (that is, how good it fits to their taste).

They show that Heidhues and Koszegi's result on price stickiness is not immune to such changes. Rather than uniform 'focal' pricing they find that price differences increase in the number of loss averse consumers.

3.13 Karle and Peitz also examine the question whether firms have an incentive to 'educate' consumers, for example, by advertising the precise nature of their product .This would turn uninformed consumers into informed consumers and would, hence, avoid loss aversion. They show that, while this would always be socially efficient, firms often do not have an incentive to engage in such prior disclosure. Only if disclosure leads to higher prices would firms engage in 'de-biasing' consumers through advertising quality.

3.14 Finally, Karle and Peitz also show that loss aversion in the price dimension **intensifies** competition while loss aversion in the quality dimension **softens** competition.

3.15 The same result is obtained by Zhou (2008) although in a different setting. Departing from the rational-expectation setting of the previous papers, Zhou assumes that reference points are formed during the consumer's search process. Specifically, Zhou assumes that the first product seen by a consumer serves as the reference point for the next product that is inspected. Zhou focuses on the duopoly case and assumes that the order in which consumers search the two firms is given.[4] One firm is more prominent than the other (on a similar theme, see the section on inertia) and is, hence, visited first and taken as the reference point by more consumers.

3.16 Zhou obtains a similar result on how loss aversion amplifies competition when it is centred on price differentials and weakens competition when it is centred on product suitability. The intuition for this is the same as before.

---

[4] Zhou also endogenises the order in which consumers inspect products by considering advertising competition before firms engage in price competition.

3.17 However, Zhou's results on consumer loss aversion and price volatility are opposed to Heidhues and Koszegi's. Specifically, Zhou shows that if reference points are formed during the search process, the prominent firm's demand curve displays an inward kink causing it to randomise its prices. In other words, Zhou's model predicts that consumer loss aversion can give rise to **price dispersion** rather than price stickiness. The intuition for this result is as follow. If the prominent firm charges a lower price than its rival, then consumers take this low price as the reference point and loss aversion makes them more 'antagonistic' to the other firm's high price, which increases the prominent firm's demand by more than in the standard case. In other words, the prominent firm's demand curve becomes steeper when its price is lower than its rival, so it has an inward kink at the rival's price level. Given an inward kinked demand curve, the prominent firm has incentive to randomise its price between a low and a high one.[5] The key difference of Zhou's model from Heidhues and Koszegi's is that in his model, a firm's price choice can directly influence consumers' reference point (and so their price sensitivity), while in Heidhues and Koszegi's consumers take their rational expectation of the market price as the reference point, so no firm's choice can affect it. This difference causes the opposite shapes of demand curves: one has an inward kink causing price dispersion, the other has an outward kink causing price stickiness.

3.18 While the previous models discuss how reference point effects and loss aversion can drive actual pricing in markets, a recent empirical study by the OFT illustrated interesting theoretical implications concerning the optimal **presentation** of prices under loss aversion (OFT 2010). The authors show in an experiment that consumers pay higher prices (and search less) when the first shop they visit employs drip pricing, that is, first shows a low (base) price and only drips in additional (compulsory) charges when the consumer has decided to purchase the product. While the consumer can, of course, abort the purchasing process after being

[5] More precisely, the prominent firm's isoprofit curve will now be tangent with its demand curve at two points: one has a price lower than its rival and the other has a price higher than its rival.

confronted with additional charges, (OFT 2010). Observe that consumers have a tendency to 'bite the bullet' and, as a consequence, are willing to pay higher prices under drip pricing compared to straight per-unit pricing. The authors analyse different possible reasons for this effect and conclude that it must stem from loss aversion. Upon seeing the low (base) price (which is indistinguishable from a low final price at this stage), consumers' reference points apparently shift to thinking about the good as already bought. This implies that abandoning the purchase would be construed as a loss which raises consumers' willingness to pay. It is, of course, questionable whether this would be a stable phenomenon. Presumably, if this were to happen again and again, consumers would learn that the apparent bargain is none, such that the reference point should only shift when the actual total price is seen. This suggests that drip pricing would only be used to push up willingness to pay in markets for infrequently purchased goods or as part of an equilibrium where some but not all firms employ this method such that what looks like a bargain at least might be one.

3.19 Summarising the literature on competition under reference point effects, we observe that the existing models' predictions are extremely sensitive to the way reference points are formed, that is, whether they are formed through expectations as in Heidhues and Koszegi or through sampling as in Zhou. In the absence of robust empirical evidence, this suggests some of the models' implications should be taken with care. Specifically, the question whether reference points cause more or less variation in prices cannot be viewed as settled.

3.20 There are, however, some more robust policy-relevant findings. Loss aversion in the product suitability dimension softens competition which is why firms have little incentive to take measures that would reduce loss aversion in that dimension such as more detailed advertising of a product's true characteristics. If consumers had complete information about all products' characteristics at the beginning of the purchasing process, loss aversion would be rendered completely irrelevant and all consumers would benefit from more intense competition.

3.21 In regard to the effect of increasing the number of firms (for example, through lowering barriers to entry), all existing results suggest that consumers will benefit from this as in most orthodox models.[6]

Willingness-to-pay bias II: misperception of demand

3.22 This section looks at how consumers' mistakes or misperceptions of their demand can distort market equilibria. There are a comparatively large number of papers surveyed here are characterised by introducing consumers who, due to some reason or other, misperceive the quantities they would like to consume of a given good at given a price. They may over- or underestimate their actual demand. These misperceptions may arise from a number of deeper psychological roots that we will discuss below.

3.23 A common basic insight from this category of models is that firms will cater to consumers' misperception. Consequently, allocative inefficiencies will arise in these markets ex-post when the actual true demand is realised. These allocative inefficiencies (such as, for example, distorted prices or waste) cannot be overcome through competition (precisely because competition is driven by what consumers want initially). Increasing the number of firms in such environments can never eradicate these inefficiencies completely. However, increased competition usually makes consumers better off. After all, consumers still seek the best deal that they can get. Hence, entry of additional firms will imply that there is fiercer competition for consumers' business.

3.24 In the following we will illustrate the basic mechanics of misperception through two simple models. We will then discuss the different papers

[6] A subtle point is that if consumers display stronger loss aversion in the price dimension than in the product suitability dimension (so, if the number of firms is fixed, loss aversion has a positive effect on consumers by intensifying price competition), then increasing the number of firms has a negative effect on consumer surplus since it weakens the loss aversion effect. But this negative effect is outweighed by the usual positive competition effect.

offered in the literature in a little more detail and finally turn to common policy-relevant implications.

3.25 In order to illustrate how over predicting own demand can affect market outcomes, consider a simple model where a monopolist uses linear pricing and a consumer overestimates the quantity he actually desires. Such a model is explicitly developed in Annex B, Box 1 and its accompanying figure. The key driving force in such a model is that consumers order larger amounts of a certain good or service than they will actually need, that is, the demand function shifts outwards. Once actual demand materialises itself, the model assumes that firms will only deliver the quantity that is actually required, not the quantity ordered. This implies that the price paid for units that are not consumed becomes a pure transfer of surplus from consumers to firms. The assumption that these extra units are not delivered is particularly appealing in markets for services, say, the consumer who bought a big mobile phone package just never causes the traffic he has paid for. For physical goods, one could imagine that consumers would mostly take delivery of everything they ordered as long as there is free disposal. However, there may be large or heavy items (say, bricks for building a house) where the consumer would be happy not to take delivery of units she does not need. Generally, these models are, however, more appealing for markets for services.

3.26 The model shows how the monopolist's price increases in costs (as usual) and the degree of overestimation. It also shows how the deadweight loss increases in the overestimation parameter and how it exceeds the deadweight loss under rational expectations.

3.27 We can also examine the case of perfect competition in the same situation. The simple model shows how allocative inefficiencies would still arise. The reason is as follows. If price were equal to marginal costs, firms would still make a positive profit through a simple transfer of money from consumers to firms (the amounts they pay for units the firm need not deliver). Hence, under perfect competition (in which the zero-profit condition must be satisfied in equilibrium) prices would fall below

marginal costs and there would be an inefficiency arising from overproduction.

3.28 While this model captures the essential intuition and indeed the essential mechanics in markets where at least some consumers mispredict their own demand, the surveyed papers differ substantially in the stories they tell, specifically in where the misperceptions stem from. The lesson obtained from comparing these studies is, however, that, from a practical perspective, it is not so important after all what the precise source of the misperception is.

3.29 The sources discussed are hyperbolic discounting (DellaVigna and Malmendier 2004 and 2006) where consumers tend to put too much weight on the present moment, or other forms of time-inconsistent preferences (Eliaz and Spiegler 2006, and Heidhues and Koszegi 2010); overconfidence (Grubb 2009, and Sandroni and Squintani 2007) where consumers think they can handle their lives better than they actually can; and, finally, unawareness or limited attention (Gabaix and Laibson 2006) where consumers might overlook the prices of essential components of a complex consumption bundle.

3.30 These underlying biases may affect the individuals in a variety of ways. The over-optimists may, for example, exert too much or too little effort at the workplace depending on how incentives are designed and people who suffer from time-inconsistencies and self-control problems may delay quitting smoking or going on a diet or starting a new fitness regime from one day to the next and then again to the day after. However, all that matters for competition among firms is that, if individuals are affected by these biases, they might behave as consumers who mispredict the quantities of goods that they plan to consume.

3.31 The hyperbolic discounters (for whom the present is always a little too important) think they will, from tomorrow, go to the gym more often than they will actually do. Similarly, they will also be convinced that, from tomorrow, they will cease buying luxury goods on credit cards that they cannot afford (DellaVigna and Malmendier 2004 and 2006). Or they will think they will repay their consumer debt before incurring penalties

but then will not because of the sudden desire for more liquidity (Heidhus and Koszegi 2010).

3.32 The overconfident may have unrealistically precise estimates of their future demand for making mobile phone calls when in reality demand fluctuates much more wildly (Grubb 2009), and may underestimate the amount of insurance that they need. In the extreme, unawareness might imply that consumers completely neglect their need for certain products, for example, add-ons that improve the performance of a basic good (Gabaix and Laibson 2006).

3.33 Firms will not particularly care about these underlying roots of misperception. What matters to them is how these root biases affect demand. One may think that it is obvious that firms can exploit consumers who predict that they will consume more than they will actually do, but it is perhaps slightly less intuitive to see why consumers can suffer (and firms benefit) from under-predicting future demand. In Annex B, Box 2, we sketch again a simple model that illustrates the logic. Essentially, when consumers initially think they will not need much of a certain good or service, the firm can exploit the fact that, once the initial quantity demanded turns out to be insufficient, the consumer will come back and demand more. This puts the firm into a position where it can price discriminate between infra-marginal units.

3.34 One of the first papers that models misperception resulting from an underlying behavioural bias is DellaVigna and Malmendier's (2004) study of optimal contract design for firms selling to consumers with self-control problems. The idea is that consumers never like to incur pain immediately but are always keen to have pleasures now. Of course, this is true for any agent who discounts the future but the consumers studied here are very extreme in how much weight they put on the present. They have an immediacy bias and value today over tomorrow much more than tomorrow over the day after. This causes inconsistencies in behaviour and gives rise to behavioural patterns where, for example, a smoker decides on any given day that he will give up tomorrow and is known in the literature as (quasi) hyperbolic discounting (see, for example, Laibson 1997).

3.35 As such hyperbolic discounting is just a preference and not a hindrance in the market place. However, as soon as consumers are unaware of their immediacy bias, they will mispredict their demand for certain types of goods. A consumer who knows that she is a hyperbolic discounter and, say, plans to go to the gym regularly from tomorrow will understand that she will actually not do it. Hence, she will not pay for an expensive all-inclusive memberships that, in contrast, a consumer who has an immediacy bias and is unaware of this fact might decide to purchase.

3.36 For goods that create pleasure now and pain later (say, credit card purchases of luxuries) the naïve hyperbolic discounter will underestimate her demand. DellaVigna and Malmendier call such goods 'leisure goods.' For goods that come with pain now and pleasure later (say, a hard-body that requires exercising in the gym) she will overestimate her demand. The authors call these goods 'investment goods.'

3.37 The main finding of DellaVigna and Malmendier's analysis is that firms will design contracts that cater to consumers' misperception. In case of overestimation (investment goods), they will set high fixed fees and low per-usage charges such that a biased consumer who over estimates her usage will think that the average price she will pay is quite low while, in fact, it will be much higher. An example would be the already mentioned all-inclusive memberships at a gym with a substantial annual fee and zero charges per visit.

3.38 The opposite strategy is optimal when consumers underestimate demand (leisure goods). Here the firm will set a very low (perhaps even negative) fixed fee but a per-usage price that is higher than marginal costs. An example would be a credit card that comes with a free gift initially (say a zero-interest balance transfer) and high interest rates for not fully paid bills or other charges. In such environments, sophisticated consumers (who are either not biased at all or are aware of their bias)[7] may switch

[7] A consumer who is aware of his bias will anticipate his future demand correctly and can, hence, adjust his behaviour optimally (for example, through committing to paying of credit card bills via direct debit).

from one credit card to another but those who are unaware of their bias will not, that is, they will succumb to the temptation of buying yet another luxury good they cannot afford without having planned for that in the form of a new credit card with a cheap initial rate.

3.39 From a welfare perspective, it is important to notice that these distortions in the contract design can actually benefit sophisticated consumers. They can enjoy zero-interest balance transfer and avoid costly charges by paying their bills on time. (For an empirical study of credit card markets that contains this logic, see Ausubel 1991). Similarly, the avid gym goer can indeed achieve a very low price per visit (and use the contract effectively as a commitment device).

3.40 For the reasons already discussed above (that is, firms will compete to cater to consumers' misperception), competition cannot eliminate the allocation inefficiency in such markets. But consumers (even naïve ones) can benefit from increased competition. For example, profits from the high marginal price for a luxury good might be competed away by setting negative fixed fees such as providing free gifts. The extent to which this will happen depends crucially on the underlying parameters of a market, for example, the extent to which there exists some form of product differentiation as well as on the precise number of firms.

3.41 Eliaz and Spiegler (2006) essentially generalise the analysis of DellaVigna and Malmendier. They consider markets with many different degrees of naiveté and allow for more complicated tariffs. They show that, while the fundamental insights from DellaVigna and Malmendier still hold in this setting, firms will offer different contracts to screen consumers. One contract will essentially commit consumers to a specific consumption profile and will be taken by the relatively sophisticated. The other contract will exploit the more naïve consumers' misprediction pretty much in the same manner as the contracts discussed by DellaVigna and Malmendier. Namely, the contract will typically consist of a non-linear pricing scheme with a low price for some action and a high price for another. The biased consumers will expect to pay the low price only but then discover that they actually want the more expensive option.

3.42 While this paper focuses on the monopoly case, it appears that competition will not change the nature of the contracts and, hence, not eliminate the fundamental allocative inefficiencies. However, once again naïve consumers should benefit from competition as firms will try to attract them with lower prices for the action they predict they will take.

3.43 Another paper that examines markets with consumers who suffer from the self-control issue is Heidhues and Koszegi (2010). Their approach is very similar to both previous papers but tailored towards a credit market setting and assumes perfect competition. Consumers underestimate their future demand for liquidity which implies they overestimate their ability to pay back loans. As a consequence, banks offer loans that are cheap if paid back on time but expensive when not. Biased consumers think they will pay the loan back on time but may fail to do so. As they underestimate the true costs of taking out loans, they will also borrow more than they should which creates substantial welfare losses. This occurs even under perfect competition as the same argument from above applies here: The market caters to consumers' misperceptions.

3.44 In Grubb (2009) consumers neither over or underestimate their expected demand, rather they underestimate the variance of their demand. They are overconfident about their ability to predict their precise demand. Firms can exploit this overconfidence by offering three-part tariffs, that is, a fixed fee, a low price for the first units (which can potentially be zero) and a higher price for more units. A consumer with higher variance than expected will not put enough weight on the two scenarios where consumption is considerably below or considerably above expectations. A three-part tariff can exploit both these mistakes. In the former case (where demand is actually very low) the consumer will still have to pay the fixed fee and in the latter case (where demand is actually quite big) the consumer will pay the high price for extra units. In both cases, the average price per unit paid is considerably higher than for medium

demand where the fixed fee is spread across several units of consumption and the high price for extra units does not kick in.[8]

3.45 Overconfidence as a source of misprediction is also studied in Sandroni and Squintani's (2007) analysis of insurance markets. Building on the classic Rothschild and Stiglitz (1976) model, they study a case with three types of consumers, the standard low-risk consumer, the standard high-risk consumer, and a biased consumer who is high-risk but mistakenly believes she is low-risk and, thus, misperceives her demand for insurance.

3.46 The existence of the behavioural type has significant consequences for the entire market since insurers cannot distinguish real low-risk types from the overconfident type who only thinks she is low-risk. There is simply no visible sign that would make the biased consumer identifiable. If there were such a sign or if insurance companies could run a simple test to identify the existence of the bias, this would, of course, change matters. But, in the absence of such signals, the fact that the overoptimistic are indistinguishable from the true low-risk consumers will drive up the insurance premium for the low-risk contract and, thus, harm the true low-risk consumer. After all, the insurer needs to cover his actual average costs from the contract and the biased consumers will simply have more or bigger claims than the true low-risk consumers. The same is true if insurance is made compulsory.

3.47 We end this subsection with a discussion of another modern classic, the study by Gabaix and Laibson (2006) who focus on the most extreme case of misperception of own demand considered in the literature – the case where (some) consumers are completely unaware that they will demand a certain product.

---

[8] The lowest average price is, of course, realized if demand equals exactly the amount of units for which the low price is charged, for example, if it equals exactly the amount of free minutes that come with a mobile phone package.

3.48 How can such complete unawareness harm a consumer? If I am unaware of Coca-Cola presumably, I will simply never drink it and this will mainly harm the supplier. So, for ordinary goods firms will find it impossible to exploit such unawareness. On the contrary, they will engage in activities to overcome it, such as informative advertising.

3.49 However, if the good the consumer is unaware of is a strong complement to another (base) good she intends to consume, the picture changes drastically. Now, the consumer might discover his desire for the complementary good once he has purchased and/or consumed the base good. Gabaix and Laibson assume that at least some consumers in the population do not anticipate their desire for the complementary good when they are considering purchasing the base good. For example, some consumers may not realize that they need room service once they check in the hotel. (That is why the paper falls into the category of misperceived demand.)

3.50 Gabaix and Laibson assume that firms always advertise the price of the basic good but have the choice whether to advertise the add-on price or instead to shroud it. There are sophisticated consumers who will have rational expectations about the add-on price even if it is not advertised and there are biased consumers who are initially unaware of the add-on but would learn about its existence and, thus, their own desire to consume it if it were advertised. Moreover, sophisticated consumers have the ability to exert effort to avoid the add-on (they can buy a meal elsewhere if they find room service to expensive) while biased consumers are assumed to consume the add-on once they have purchased/consumed the basic good which triggers their discovery of the desirable add-on for which they now do not have an alternative (for example, because all shops where one could buy a simple sandwich as substitute for room service are now shut).

3.51 The main result of the paper is that, if there are sufficiently many unaware consumers, firms will not advertise the add-on even if advertising had zero costs. Instead, they will offer low prices for the basic good and charge inflated prices for the add-on. In other words, they will systematically exploit the unawareness by charging

comparatively low prices for the basic good and inflated prices for the add-on. The reason for this is simple enough. Sophisticated consumers will avoid an overly expensive add-on and advertising the price of it ('unshrouding') will turn a biased unaware consumer who does buy it into a sophisticated one. Moreover, the firm also has little chance to adopt a different pricing strategy - advertising a lower priced add-on and compensating for that through a (slightly) higher base price - as all the sophisticated consumers would then prefer to buy from a firm that does shroud and offers the attractive lower base price.

3.52 In this scenario biased consumers cross-subsidise sophisticated consumers who are able to find useful substitutes for the add-on while enjoying the basic good at a low price. This result is robust to even very intense competition. Competition will lower the base price since both sophisticated and naïve consumers compare sellers according to the offered base prices, but competition will not affect the add-on price since, once a naïve consumer chooses a seller, she can only buy the add-on from that firm and so the firm will act as a local monopolist. Of course, to what extent competition can reduce the base price (and so the profits from add-ons will be competed away) depends on how differentiated the base products are across sellers.

3.53 The question whether rational consumers, that is, those who predict their demand accurately, will benefit or suffer from the presence of biased consumers is a theme common to the entire strand of the literature. Unfortunately, there is no general answer to this question. When firms use nonlinear pricing schemes rational consumers with truly high demand can, for example, benefit from subscribing to an 'all-inclusive' (gym) plan which offers them very low effective prices per visit. In essence, biased consumers cross subsidize rational consumers in this kind of market. However, rational consumers can also suffer from the misperception of others. For example, in the case of (high-risk) consumers underestimating the amount of insurance needed, this can push up the price of insurance paid by real low-risk consumers.

3.54 In terms of policy, we have seen that the standard intuition that increasing the number of firms will benefit consumers still holds even though allocative distortions might not fully disappear.

3.55 In contrast to the WTP biases discussed in part 1 above, misperception of demand discussed in part 2 is due to erroneous reasoning and can as such improve through learning. In all models discussed in this second part of the section on WTP biases, consumers are, ex post, aware of their mistake. They learn that they do not go to the gym as often as they thought they would; they can see that they have unspent free minutes on their mobile phone contracts; and they might regret not having bought a sandwich when they order expensive room service. Consequently, time itself should improve consumers' ability to predict their demand more accurately. If this is true, the pricing strategies discussed here should be more prevalent in markets for comparatively new products or in markets that have a constant inflow of unsophisticated 'first-time' buyers.

Search bias I: inertia

3.56 The next category of papers reviewed in this survey concerns models where consumers exhibit a tendency to purchase at the first shop they visit or, if they purchase repeatedly, stay at their current provider. The orthodox economics literature has paid considerable attention to such models assuming that consumers have search or switching costs. Often these costs reflect material costs in terms of time or travel expense that consumers have to bear when they want to find a (new) supplier and, as far as this remains a plausible assumption for fully rational consumers, these models fall outside the scope of this survey.

3.57 However, several of these classical papers appear more realistic when one interprets high levels of search costs stemming from some kind of 'unhealthy' inertia. Of course, if modelled as costs, inertia is stemming from a preference, and laziness is justified through very high valuations of search time saved. While this survey is not the place to discuss the philosophical issues behind this distinction, we think it is important to incorporate this classic on-its-surface-orthodox literature as it highlights

many distinct features of markets where consumers do not search 'properly'.

3.58 Specifically, we will discover one of the most fundamental results in the literature surveyed here, namely that increasing the number of firms, for example, through easing entry, can actually have adverse consequences for consumers. Essentially, the logic for this result is that, as soon as some consumers do not search properly, firms no longer have a clear incentive to compete by offering better deals. Rather, an alternative strategy arises which offers low value items to consumers who do not engage in adequate search (in Part 1 because of their inertia and further down below in Part 2 because of misjudging the prices of products).

Classic search papers

3.59 Several of the classical studies on consumer search explicitly justify their approaches by alluding to behavioural biases or bounded rationality of consumers. For example, Salop and Stiglitz (1977) write in the introduction of their seminal paper on 'bargains and rip-offs': 'Most people do not understand even the simple laws of probability; [...] Many people do not calculate unit-prices in the supermarket.'

3.60 Salop and Stiglitz assume that consumer search reveals all prices in the market, that is, search is simultaneous. They show how consumers with high search costs can have negative externalities for consumers with low search costs, namely when the inertia of some consumers leads to average cost pricing (similar to monopolistic competition). However, different types of market equilibria can arise and consumers with low search costs benefit from those that display price dispersion In equilibria with price dispersion some firms will charge low prices and consumers with low search costs are likely to find these firms.

3.61 The intuition for equilibria with price dispersion can be obtained in three steps. First, notice that undercutting a high price slightly does not generate extra demand from consumers who do not search (and no extra demand at all if the price cut is small and all consumers have at least some small search costs). Second, marginal price increases do not

necessarily reduce demand and this pushes prices upward. Third, once prices are really high large price cuts might be profitable as they would attract all consumers with low search costs. Hence, firms either want to edge prices upwards or drastically undercut which will result in price dispersion.

3.62 Price dispersion is also obtained in Varian's (1980) search model where some consumers are informed and others completely uninformed. Firms have to balance the desire to compete for informed consumers with the temptation to exploit inert consumers. Annex B, Box 3 presents a simple model of Varian-type search models.

3.63 It is this need to balance that creates price dispersion in these models. In Varian's model there are, in fact, no symmetric pure strategy equilibria because at any common price level firms could slightly undercut and gain all informed consumers, rather than having to share them. This 'Bertrand force' drives prices down but at very low prices firms would have an incentive to charge really high prices instead to make profit from uninformed inert consumers. In other words, it is never optimal to charge the same price as your competitor does. If your competitor charges a comparatively high price you want to marginally undercut, if he charges a sufficiently low price you want to charge a really high price. Hence, there are no equilibria where all firms charge the same price.

3.64 Both these classic papers, Salop and Stiglitz (1977) and Varian (1980) assume a zero-profit condition so that any rents obtained from uninformed inert consumers are competed away. However, inefficiencies can arise from the fact that too many small firms might produce in the region of decreasing average costs such that total output could be produced more efficiently by shifting it to larger firms.

3.65 The effect that inert consumers have on the welfare of informed consumers is ambiguous in these models and generally depends on the precise nature of equilibria. With more uninformed consumers entering a market, Varian's model predicts an increase in price dispersion from which informed consumers will gain. There are simply more firms charging lower prices which are observable for the informed consumers.

Similarly, in the equilibria with price dispersion identified by Salop and Stiglitz, the fully competitive price will be charged by some firms which can be located by the informed consumers.

3.66 While these models of consumer search capture an important behavioural element and highlight important market consequences (such as the possibility of price dispersion for a homogenous good), a more realistic class of models will assume **sequential** search where consumers pay finite search costs each time they look up a different supplier instead of incurring search costs only once for observing all prices charged by all suppliers.

3.67 Such sequential search is studied by Stahl (1989) who also assumes that there are two types of consumers, those who are 'shoppers' with zero search costs (the same as the informed consumers in Varian's model) and others who find search costly (in equilibrium they will behave as the uninformed consumer in Varian's model, that is, they only sample one firm). Stahl's paper is important for three reasons. The first pertains to the orthodox literature on search (which we do not survey in full) by showing how both the Betrand paradox and the Diamond paradox can be obtained 'smoothly' by varying population parameters. More specifically, if the fraction of 'shoppers' tends to one (that is, when we move to situation with zero search costs for everybody), then firms will undercut intensively such that equilibrium prices approach the marginal cost (the Betrand paradox); if the fraction of 'shoppers' tends to zero (so all consumers will have a positive search cost), then all firms will charge the monopoly price and consumers will only sample one firm (the Diamond paradox). The intuition for the latter is that if some firm is charging a price lower than the monopoly one, then it always has an incentive to raise its price slightly, say, by an amount smaller than the search cost because doing that will not induce any consumers to leave and the firm will earn more from each existing consumer.

3.68 The second reason for the importance of Stahl's paper (and which is more relevant for our purposes here) is that he shows that prices can increase if the number of firms increases. The reason is that with more and more competitors, firms face, in a mixed strategy equilibrium, an

even smaller probability of being the cheapest firm which reduces the incentive to charge low prices.[9]

3.69 The welfare effect of increased competition is ambiguous in Stahl's model. While fully informed consumers benefit from the presence of more firms, those that experience costly search are worse off. (The same is true in the Varian model if we give up free entry.) In both cases, the reason for this result is that there is more price dispersion which makes it more likely for informed consumers to see good prices but makes search less effective for others. Consequently, the total welfare effect depends on the composition of consumers with bleaker consequences when there are more consumers for whom search is costly.

3.70 The final reason why Stahl's paper is important for this survey is that his model serves as a blueprint for various recent studies, several of which deal with non-standard consumer behaviour.

Complexity and inflated consumer search costs

3.71 From the viewpoint of behavioural economics, the most intriguing models that build on the classic search literature are those that assume that firms can effectively influence search costs. While these papers retain an orthodox flavour in their modelling approach (all agents choose rationally and have rational equilibrium beliefs), the very idea that firms might influence search costs through the design of their stores or through the framing of prices has a behavioural core. For a fully rational consumer it does not matter whether he compares two prices that are framed in the same or different ways and a fully rational consumer does not get mentally tired if he searches for a longer time.

3.72 Using the Stahl framework, Ellison and Wolitzky (2009) assume that firms can make in-store search more costly for non-shoppers through increasing the complexity of prices. This assumption is coupled with an

[9] A similar result had been obtained earlier by Rosenthal (1980) for a variant of Varian's model.

assumption of increasing marginal search costs (the non-shopper gets increasingly 'tired' as the search progresses in the sense that if she has paid a higher search cost in the first store, visiting the second store becomes more costly). Ellison and Wolitzky's most important result concerns comparative statics with respect to variations in between-store search costs. For example, search between stores might become easier in the presence of price search engines. Ellison and Wolitzky show that, in equilibrium, firms will offset this reduction in between-store search costs through increasing price complexity within stores, thereby completely neutralising the effect of easier search between stores.

3.73 Notice that in Ellison and Wolitzky's model consumers cannot observe the in-store search cost in each firm directly and they will find it out only if they reach the store. Since consumers hold equilibrium beliefs that all firms set the same in-store search cost, they will visit firms in a random order and a firm's unilateral deviation (for example, reducing its in-store search cost) cannot influence consumers' search orders. (See Wilson (2010) below for a different assumption about the observability of in-store search costs.)

3.74 Another paper where firms choose prices and their complexity simultaneously is Carlin (2009). However, in contrast to Ellison and Wolitzky who build on Stahl's model, Carlin adapts Varian's model where, eventually, some consumers will search the entire market and become fully informed, while others will not search at all. Firms' choice of price complexity is influencing consumers' search costs. The more complex the prices chosen by firms the more difficult becomes search. And, as search becomes more difficult, an increasing number of consumers will decide to remain uninformed. In other words, firms can and will soften competition through complex price schemes.

3.75 A key result obtained by Carlin is that increasing competition through more firms will increase each firm's incentive to resort to more complex

pricing schemes. As a consequence, equilibrium prices can increase in the number of competitors.[10]

3.76 There is another interesting behavioural element in Carlin's study. In equilibrium, there is a positive correlation between price and price complexity, yet uninformed consumers do not make any inference from the presentation of a price, that is, they do not understand that complicated prices are likely to be high prices.

3.77 It should perhaps be added here that both papers, Ellison and Wolitzky's and Carlin's, simply assume that there is such a variable as price complexity which makes the consumers' problem harder. Empirical evidence available on the link between price complexity and the quality of consumer choice is discussed in OFT 2010 (see paragraph 3.103).

3.78 While firms choose prices and complexity simultaneously in the last two studies that we discussed, Wilson (2010) assumes that firms first choose price complexity (or more generally, how difficult they make search) and, only after that is observed by their competitors and by consumers, choose prices. Consumers choose the order in which they search suppliers after having observed price complexity. Analysing the duopoly case,[11] Wilson shows that asymmetric equilibria can arise where one firm obfuscates and the other does not. The incentive for obfuscation is subtle: by deliberately refraining from attracting consumers with high search costs (who will shun the obfuscating firm), competition for the remaining informed consumers is softened simply because the competing firm (that now attracts the consumers who avoid the obfuscating firm) has an incentive to charge higher prices. Wilson's study is also interesting from a conceptual point of view as it belongs to the small set of papers that examines non-random search sequences. In

[10] Ellison and Wolitzky, discussed earlier, assume an infinite number of firms and, hence, do not study this question.)

[11] Wilson does not analyse markets with more than two firms, presumably because the price subgame becomes very difficult to analyse.

traditional search models firms look identical ex ante and, hence, consumers have no choice but to search them in random order. In Wilson's study, consumers can choose a search sequence because firms differ in an observable dimension, the complexity or accessibility of their price schemes.

Non-random consumer search

3.79 In random search models asymmetric outcomes (say, where firms charge different prices for identical goods) are typically viewed as stemming from a symmetric mixed strategy equilibrium, that is, the asymmetries only arise **ex post** as realisations of the randomisation. However, this is at odds with persistent asymmetries in many markets where, for example, certain firms are simply more prominent than others.

3.80 Armstrong, Vickers and Zhou (2009) tackle the issue of prominence in a search framework. Consumers are assumed always to start their search with one particular prominent firm. There are many (partly behavioural) reasons for justifying such an assumption. Consumers with limited attention might first look at prominently displayed products at the beginning of an aisle in a supermarket. Or it might be natural to start a search process on the internet by first clicking on the top result that a search engine delivers.

3.81 Armstrong, Vickers, and Zhou consider a search framework with horizontal product differentiation, where consumers need to search for both lower prices and higher product suitability. They show that, if there are no systematic quality differences across firms, the prominent firm charges a lower price than its non-prominent rivals, and the presence of a prominent firm harms consumers and total welfare. As consumers search for horizontally differentiated products, any non-prominent firm that is visited by a consumer knows that the consumer must have been dissatisfied with the prominent firm's offering. The fact that the consumer was unsatisfied is information which conveys some monopoly power to the non-prominent firm, and that is the reason why the prominent firm's price is lower than the non-prominent firms'. (In models

of random search order such information is never conveyed as firms do not observe buyers' search order.)

3.82 Consumer surplus and total welfare decrease when some firm becomes more prominent than others mainly because the unequal prices across firms caused by non-random consumer search induce consumers to stop searching too early, which reduces the match efficiency (that is, consumers stop searching at the prominent firm too often because of its low price even if they have not found a sufficiently satisfactory product). However, industry profits rise when a firm becomes prominent and profits are shared more unequally among firms with the prominent firm (despite charging lower prices than others) receiving the largest share. Industry profits increase mainly because non-prominent firms raise their prices more than the prominent firm reduces its price. (The prominent firm reduces its price relatively little because all non-prominent firms are now charging higher prices.)[12]

3.83 In this non-random search model with prominence, increasing the number of firms will improve consumer welfare. This is not only because of the standard competition effect (that is, more firms lead to lower prices) but also because with more firms the price discrepancy between the prominent and the non-prominent firms shrinks, which mitigates the match efficiency loss we discussed before.

3.84 With non-negligible search costs, firms have an incentive to be the first that consumer visits. This is true in Armstrong, Vickers, and Zhou but holds more generally. As a consequence firms might compete in other dimensions to influence consumers' search order. Depending on the nature of this competition, welfare outcomes can be better or worse. If sellers try to attract consumers by offering and advertising another product very cheaply, some of the extra profits that search costs convey to firms will be redistributed to consumers. If on the other hand, firms compete for consumers' attention through (wasteful) advertising, firms'

[12] Notice that prominence is exogenous in this analysis. A natural extension would be to study competition for prominence.

rents might be competed away without any additional benefit for consumers. This point is formally made by Hann and Moraga-Gonzalez (2009) in a search framework with (attention-grabbing) advertising competition.

Inertia in repeated purchase

3.85 The idea that firms may compete vigorously in order to attract consumers first is, of course, also familiar from Klemperer's (1987) seminal analysis of markets with switching costs. Even earlier it can be found in Selten's (1965) model of an oligopoly with demand inertia.

3.86 Selten models an oligopoly where firms compete repeatedly for a finite number of periods for the same consumers. Consumers tend to stay with the same firm as long as price differences are not too high, that is, they switch from one supplier to another only when they get frustrated by prices that, in comparison, appear excessive. Selten shows that, while firms will eventually exploit their customers' inertia, they will compete vigorously early on. They make, however, still substantially greater overall profits than they would in the absence of inertia.

3.87 We should not end this first part on search biases without briefly alluding to the reference point effects we discussed previously as shifting consumers' WTP. In environments where consumers search sequentially, a loss averse consumer may be less likely to continue her search after having sampled a product with particularly good fit. In that respect, loss aversion also causes inertia. The difference is, however, that the loss averse consumer might not even buy an **ex ante** more attractive alternative if it were shown to her for free **after** she inspected the first good.

3.88 Lowering search costs through increasing market transparency does not fundamentally affect competition in the presence of loss averse consumers (only full transparency at the very beginning of the purchasing process would), but it improves market performance in environments discussed in this section. If search becomes easier, more consumers will seek out better deals, which generates a welcome

competitive pressure on firms. However, as we have seen, firms might react to such improvements through making in-store search more difficult or active obfuscation. The extent to which this is a viable strategy for firms will depend on the specifics of the market. For example, it would be much harder for a fruit and vegetable dealer to make pricing more complicated than it would be for sellers of electronic equipment that comes with a multitude of accessories.

3.89 Moreover, we find that increasing the number of firms can hurt consumers in the presence of inertia while this has not been shown to be possible for loss aversion.

Search bias II: misjudgement of prices caused by framing effect and limited memory

3.90 If consumers face the choice between two identical products that they see at the same time, the standard assumption and indeed the standard intuition is that they will choose the one that is cheaper. When they instead have to engage in search to find out about prices, the assumption is that they will memorise prices and choose the one that minimises the sum of (expected) price and (expected) search costs. For example, if they have searched the entire market, the intuition is that they will either pick the last one that they have seen or will return to a cheaper supplier provided that the extra (transaction or travel) costs offsets the price difference.

3.91 There are two main behavioural obstacles to this standard approach. First, the comparison of prices might be more difficult than the picture suggests. Prices might be framed differently which makes the comparison much less trivial than the comparison of two simple numbers. For example, if prices are broken down into several parts ('partitioned pricing') the comparison requires more advanced numeracy skills. This problem is enhanced if the pricing is more complicated. (See also the OFT study on price framing and drip pricing a form of partitioned pricing, paragraph 3.103)

3.92 Second, sequential search is demanding on memory and consumers may have trouble remembering the exact prices they have encountered earlier. Again, the problem gets amplified if tariffs are more complicated.

3.93 In this part we review models of competition where consumers search but this search is hampered because of some form of bounded rationality. In contrast to the previous discussion of search biases the search biases in Part 2 are much more explicitly modelled.

3.94 The broad picture in the class of models reviewed in this part is that firms will employ strategies that are carefully tailored to the consumers' biases. They will exploit imperfect recall of prices and will tailor their price framing such that in equilibrium consumers' problems in making accurate judgements about price differences will come into play. Some of this will be reminiscent of what we have seen in Part 1 in models with endogenous search costs. While these previous models could be interpreted as behavioural in 'reduced form', the models we turn our attention to now offer micro foundations.

3.95 Some of the basic intuition of the literature in this part of the survey is conveyed in the simple model shown in Annex B Box 4. In this model firms face the choice between two different price frames. If they choose identical frames, consumers will find comparisons very easy such that the outcome will be Bertrand competition with very low prices. On the other hand, if firms manage to coordinate on different price frames, they can achieve higher prices and larger profits.

3.96 A theme we first discovered above will, unsurprisingly, reappear. If there are (some) consumers who have difficulties comparing (complicated) prices, increasing the number of firms can make things worse for consumers.

3.97 Piccione and Spiegler (2009) examine markets where consumers are initially with one firm and consider switching. While some may switch whenever they encounter a better price, there may also be a fraction of consumers who will only switch if the price offered by the competitor is better and **framed identically** to the price at the current firm. As a

consequence, firms can avoid cut-throat competition simply by choosing price frames that are different. Essentially, this is similar to a form of artificial product differentiation that helps soften competition.

3.98 Piccione and Spiegler focus on the duopoly case and show that in equilibrium firms will randomise over prices and frames. If both firms were to choose identical frames, intense price competition would result and it would obviously be profitable for a firm to deviate to a different frame. At the same time, if they were to choose different frames and higher prices, there would be an incentive for each firm to choose the same frame as its rival and slightly undercut. Consequently, there can only be a mixed strategy equilibrium in which each firm randomizes its frame choices to keep its rival guessing.

3.99 Piccione and Spiegler show how regulatory interventions can backfire in such a setting. If, for example, a regulator enhances the comparability of two slightly different frames, firms might in response switch to different frames that are even harder to compare and consumers may as a result be worse off. Of course, if the regulator could enforce full comparability that would eliminate the problem completely, this would indeed render price competition much fiercer. However, in many markets (specifically in markets for more complex products) it might be naïve to think one could enforce a single price frame.

3.100 Chioveanu and Zhou (2009) study similar markets but with an arbitrary number of firms and two sources of price misjudgement. First, consumers might have difficulties in comparing non-identical frames just as in Piccione and Spiegler. Second, they consider errors that stem from the complexity of frames as such, that is, they allow for the possibility that consumers do not choose the cheapest firm even if they use identical frames, simply because the employed frame is difficult to

understand. For example, consumers might make mistakes when adding up base prices to shipping and handling fees.[13]

3.101 In equilibrium, markets will exhibit both price frame dispersion and price dispersion as in Piccione and Spiegler, and consumers will suffer from their inability to make accurate comparisons. Moreover, Chioveanu and Zhou show how increased competition can make things worse for consumers. With more firms (but given a fixed number of frames), it becomes more difficult for firms to differentiate their framing choices. In response, they will resort to frame complexity by adopting the more complicated frames more often, which enhances the second source of consumer error. As a result, firms have an incentive to charge even higher prices, and consumers can end up being strictly worse off.

3.102 Kalayci and Potters (2010a and 2010b) show that the results of Piccione and Spiegler and Chioveanu and Zhou do not only occur in theorists' models but actually do occur in markets. In two experimental studies they show how firms do resort to more complex pricing strategies (and more artificial product differentiation) when this is possible. They also show how this reduces the quality of consumer decision making and increases firms' profits.

3.103 More empirical evidence on how difficult consumers may find it to pick the lowest price can be found in a laboratory study reported in OFT 2010. In this study six different price frames are examined in a simple search environment (drip pricing, offers of the 'was X, is now Y' type, time-limited offers, baiting where offers are in place only 'as long stocks last', complex '3 for 2' pricing, and as a baseline simple straight-per unit pricing). They find that all more elaborate price frames impact negatively on the quality of subjects' decisions. The worst offender is drip pricing that, compared to the baseline, wipes out 25 per cent of consumer surplus. Firms (which are simulated in this experiment) do not

[13] Piccione and Spiegler actually consider a fairly general frame structure which can include both misjudgement sources discussed in Chioveanu and Zhou. The main difference between these two papers is that the latter allows for a general market structure.

necessarily gain from this but generally have an increased incentive to be the first firm that is visited by a consumer.[14]

3.104 Chen, Iyer and Pazgal (2010) examine the second type of price misjudgement discussed above, imperfect recall of prices in a sequential search process. Building on the duopoly version of Varian's search model they introduce a third type of consumer who can only remember whether the previously seen prices fall into one of a number of categories, for example, with two categories, whether a price was 'high' or 'low'. Consumers can form a given number of categories and are assumed to choose the cut-offs that separates the categories rationally.[15]

3.105 The authors consider two different cases depending on whether the consumer who suffers from limited memory codes both prices encountered in the market into the existing categories, or only the first price which is then compared to the precise price encountered at the second firm. Surprisingly, expected prices in the latter case can increase with finer memory partitions. That is, improved consumer memory may harm themselves. The intuition is that with finer categories, if one firm undercuts, its rival is more able to respond by setting only slightly lower prices to retain its customers, which may dampen the firm's incentive to undercut in the first place.

3.106 Another interesting result in Chen et al. is that consumers calls for finer categorization toward the bottom of the price distribution. Thus consumers have a motivation to invest in greater memory resources in encoding lower prices. Even with few memory categories, Chen et al.

---

[14] In the context of retail finance markets, Choi, Laibson and Madarian (2008) show how consumers struggle to select index funds with low fees and Betrand, Karlan, Mullainathan, Shafir and Zinman (2009) show how lenders can employ simple marketing strategies (clear presentation, photos of female bank employees) can push up the interest rate consumers are willing to pay on loans.

[15] The model of limited memory and search (but without the supply side price competition) is initially proposed by Dow (1992).

show that the expected price consumers pay and their surplus is close to the case of perfect recall. So limited consumer memory seems not a big issue in this setting.

3.107 However, the result needs to be taken with care as the demands on consumers' computational ability (to choose optimal categorization) are extremely high in this model. It is not clear how the results would change with less sophisticated consumers.

Quality bias I: misjudgement of vertically differentiated products

3.108 As the standard IO literature discusses, consumers might in some cases struggle to identify high quality products in markets. In the standard literature, this is invariably due to the nature of the product and not to limitations of the consumer. If the quality of goods cannot be inspected at the point of purchase, consumers have to form beliefs about the likely quality of a product they face and full rationality implies that these expectations will be correct.

3.109 These asymmetric information problems come in two flavours. There are experience goods where the quality will eventually be revealed during consumption. Second there are credence goods where the quality will never be revealed (for example, a patient might never know whether an expensive scan was really necessary for her diagnosis). However, in standard treatments of markets for such products consumers will never experience (bad) surprises. They will either abstain from buying when the expected quality is too low or they will know perfectly that certain products or services entail risks when they do buy them.

3.110 This assumption of rational expectations is, of course, problematic as it is cognitively demanding, and introspection as well as casual observation suggest that people do experience surprises. The literature surveyed in this part of the survey offers alternative ways of thinking about how consumers actually choose among products of potentially different qualities.

3.111 Bohnet, Harmgart, Huck, and Tyran (2005) examine markets for experience goods in a laboratory environment. These markets fail in the absence of facilities that allow for reputation building. Firms succumb to moral hazard and consumers anticipate this correctly and do not buy at all.[16] This holds in both, theory and practice. An eBay-style feedback mechanism enhances market outcomes considerably, benefitting both firms and consumers. Huck, Lunser, and Tyran (2006 and 2007) replicate these results and also examine the role of competition. They show how competition magnifies the effect of reputation building. Huck, Lunser and Tyran compare experimental monopolies and oligopolies, either with free pricing or in a setting with a fixed (regulated) price set at 25 per cent above marginal costs.

3.112 In markets with fixed (regulated) prices consumers pay very careful attention to firms' track records and switch away from sellers of poor quality. This leads to high concentration with reliable high-quality sellers taking over the largest market shares.

3.113 When prices become flexible, the consumer's decision problem becomes more complex. They now have to examine two bits of information: past track records about quality and price. It turns out that the vast majority of consumers simply focus on price. This leads to Betrand-style competition and very low prices but also to poorer average quality of products traded. Prices fall to such a low level that high-quality production becomes hardly sustainable for firms and low quality almost acceptable for consumers. In other words, there is both, a push and a pull, towards lower quality and, thus, total welfare is lower in the presence of price competition than under a (comparatively high) regulated price.

3.114 While, as this survey shows, consumers' bounded rationality is mostly an impediment to market performance, Huck and Tyran (2007) show in a theoretical analysis how simple decision heuristics can also improve the performance of markets for experience goods. Specifically, they

[16] For example, Akerloff (1970) and the market for lemons.

study a market that would completely break down if all consumers were fully rational (simply, because in the presence of a moral hazard problem rational consumers will anticipate that once they trust a seller, the seller will have no incentive to provide high quality).

3.115 If consumers demand an experience good repeatedly, a simple and plausible heuristic is to buy from the same supplier as long as he delivers high quality. Huck and Tyran show that such 'reciprocal' consumers exert a positive externality on all consumers. As firms want to keep their 'loyal' consumers they will continue to provide high quality to them and to others, because they cannot distinguish between the two types. Of course, firms have to be sufficiently patient for this result to arise: They must prefer selling high quality over several periods to selling low quality in one period followed by zero sales in all subsequent periods. Thus, reciprocity among consumers can serve as a substitute for reputation building of firms.

3.116 In a similar spirit to the experimental papers above, Dulleck, Kerschbamer, and Sutter (2010) examine markets for credence goods in a laboratory experiment. In a very large design they study the role of reputation and competition as well as the role of liability (the consumer's problem must be solved) and verifiability (the firm can only charge for what it provides). The data shows that, in contrast to theoretical predictions, verifiability does not improve market outcomes. This is perhaps not surprising as the theoretical reason for why verifiability can improve market outcomes is very subtle. Firms need to learn to avoid the temptations of under-treatment through employing a price policy of equal mark-ups such that they earn the same amount from both treatments and consumers need to understand this.

3.117 On the other hand, liability has a strong efficiency-enhancing effect. However, notice that liability only rules out 'under-treatment', that is, a situation where the consumer's problem for which he seeks a supplier remains unsolved. The problem of 'overtreatment' where the consumer's problem is solved with the provision of an expensive good or service, say, a new engine for the consumer's car, while a cheaper solution, say, a new v-belt, would have had the same effect, remains unaffected.

3.118 In contrast to markets for experience goods, reputation building for credence goods does not really work (which is not surprising as consumers never learn more than they know at the point of purchase) and competition is unable to improve welfare. It shifts profits, however, to some extent from firms to consumers.

3.119 When the quality of a product is inherently uncertain (it may or may not break down), consumers face an additional complexity when forming beliefs about the likely quality of a product. Spiegler (2006a) argues that it is realistic that consumers base their expectations in such cases on small samples of observations or 'anecdotal reasoning'. Specifically, Spiegler examines the case where each consumer has exactly one observation for each product in the market and assumes that this observation is a perfect estimator for the true quality. Thus, for each product each consumer believes that it is either of high quality for sure (in which case the consumer's valuation for the product is positive) or of poor quality for sure (in which case the consumer's valuation is zero). This creates artificial product differentiation - in the sense that consumers believe identical products to be of different quality.

3.120 If consumers understood the true technology, the market would be a simple Bertrand market where firms would price at marginal cost. Now, however, the consumer's decision rule is not 'buy the cheapest product' but 'buy the cheapest of those products for which you have seen that they do not break down.'

3.121 As a consequence of this decision rule, firms will, in equilibrium, charge prices above marginal costs. The equilibrium will involve price dispersion as firms will randomise over a range of prices.[17] The logic behind this randomisation is simple: Charging a very high price will give a high payoff with a small probability (namely, when all of the competitors' products actually broke down and the product in question does not such

[17] This randomization result is partly because of the assumption of binary quality levels. If we consider a continuum of quality levels, then the model will be similar to Perloff and Salop (1985) in which firms charge a deterministic price above the marginal cost.

that consumers believe the only good-quality product is the high-price one), while charging a low price will give a small profit with a higher probability (namely, when some other products are also judged of high-quality but their prices are higher). In equilibrium, the expected profits from high and low prices will simply equate.

3.122 A surprising feature of Spiegler's analysis is that consumers can be harmed from too much competition. With more firms, it becomes more likely that a consumer hears at least one 'positive anecdote', so more consumers will participate in the market and buy an 'overpriced' product. In other words, with more firms the objective quality of each product stays the same, but it becomes more likely that there are more firms where no breakdowns have been witnessed. Hence, higher prices can be charged.

3.123 Notice that this is subtly different from models where consumers do not fully understand the price. Here consumers do understand the pricing, but their expectation of the quality is biased such that *ex post* they might end up being exploited. Again, it is this empirical angle that drives our classification. A disappointed consumer in Spiegler's world would not say 'I did not fully understand the pricing of my supplier and paid more than I thought I would'. Rather she would say 'The product I bought was not as good as I hoped it would be'.

3.124 A similar analysis for more complex products is carried out in Spiegler (2006b). Firms offer products with multiple characteristics (for example, insurance contracts with various contingencies; a bank account with many services). Each firm charges separate prices along each dimension of the product. Evaluating such multi-dimensional price scheme is usually a complicated task for ordinary consumers, so they are assumed to simplify their decisions by examining one dimension at random and comparing offers only along that particular dimension. (But consumers will eventually pay for all dimensions.)

3.125 As a consequence, firms choose to randomize prices in each dimension. The intuition is that setting low prices in some dimensions can attract consumers who happen to compare products along these dimensions.

The firm can then earn money back by charging them high prices in other dimensions since consumers eventually pay for all dimensions.

3.126 With more competitors, firms will make their pricing more extreme: with greater competition, the firm needs to set lower prices in some dimensions in order to attract consumers, but to compensate that, it will charge higher prices in other dimensions. This leads to more variable prices in each dimension. More precisely, Spiegler shows that increasing the number of firms does not change the expected price in each dimension, but only increases the variance. One interpretation of this result is that firms will respond to greater competition by 'obfuscating' consumers. If consumers are risk averse, this reduces their welfare.[18]

3.127 An earlier contribution on products that fail probabilistically is Spence (1977). He analyses the case where consumers underestimate the failure probability of a product systematically (they are overoptimistic). Even a competitive market will then not provide efficient quality. This result is intuitive and resembles some of the logic we have seen in our sections on misperception of own demand. Markets will cater to consumers' beliefs and preferences, whether these are biased or not.

Quality bias II: misperception of demand for product attributes

3.128 We have included this category mainly for conceptual reasons as we believe that it covers an important area of our map of competition with behaviourally biased consumers. However, as important as this area may be, relatively little research has been done on this topic. Zhou (2008) is an attempt in this direction.

3.129 Many products have a large number of attributes. It is usually a complicated task for ordinary consumers to value them in a proper way. Zhou studies a model in which the firm can use single-attribute

[18] This result still holds if consumers are risk neutral but firms can choose both price and quality in each dimension and there are diminishing returns to quality improvement. The last condition leads to a concave surplus function, which has a similar effect as consumers being risk averse.

advertising which only highlights one attribute of the product to manipulate the way consumers value the product.[19] In particular, naïve consumers who are not knowledgeable enough will thus overvalue the importance of the advertised attribute but undervalue the importance of the unadvertised one. For example, a consumer might find a digital camera's number of pixels more important than it actually is after seeing an advertisement that focuses on the number of pixels.

3.130 Together with advertising, the firm has an incentive to design different products to screen naïve consumers from sophisticated consumers who are immune to advertising. Zhou shows that the product designed for naïve consumers has a too high quality in the advertised dimension and a too low quality in the unadvertised dimension, while that designed for sophisticated consumers is distorted in the opposite way. The outcome is that naïve consumers will end up consuming a product that scores extremely well on an attribute but has a mediocre overall performance, while sophisticated consumers cannot find the product they most want, which reflects the negative externality imposed by the presence of naïve consumers. (Notice that the naïve type gets indeed what she wants but her demand is distorted because of misperception.)

3.131 As is well-known from the competitive price discrimination literature, competition may completely eliminate such distortions but that depends crucially on a number of assumptions, for example, a fully covered market and the symmetry between firms (see Armstrong and Vickers 2001, and Rochet and Stole 2002 for details). If these assumptions are violated, the distortion in product design may survive even under competition.

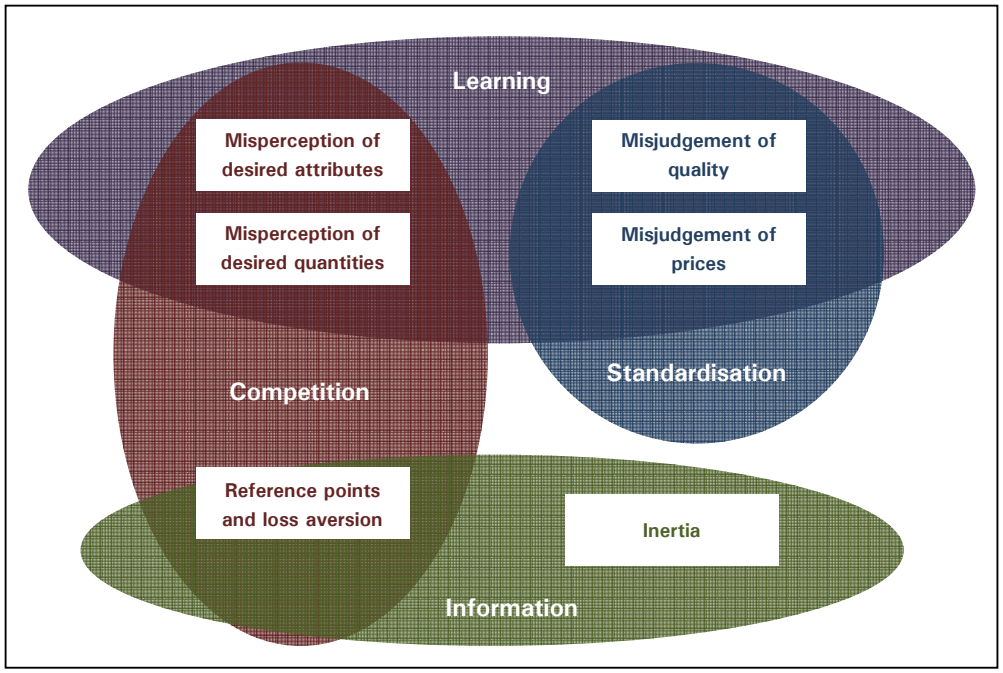
[19] The idea that consumers may value a multi-dimensional option in an improper way bears a resemblance to Spiegler (2006b), but here the distorted valuation is induced by the firm's marketing activity rather than being intrinsic to consumers.

4 REMEDIES

4.1 Our survey has shown that generally markets do not work well in the presence of behaviourally biased consumers. Hence, it is natural to ask whether there are any remedies, mechanisms, or other channels that can improve the quality of consumers' choices and ultimately market outcomes.

4.2 Figure 4.1 provides a schematic overview of which remedies can assist to improve outcomes for consumers depending on the bias and its root cause. As will be discussed below, some remedies work on some biases but not on others. For example whilst learning has the potential to help regarding both the Misperception and Misjudgement biases, competition only helps when consumers have misperceptions.

Figure 4.1: Remedies



Intensifying competition through increasing the number of firms

4.3 More competition through lower barriers to entry and a greater number of competing firms is, of course, the economist's standard tool when it comes to the question of how to improve markets and what they deliver to consumers. However, we have seen in this survey that in the presence of behavioural biases competition may not always solve behavioural problems. Specifically, we have seen the possibility of adverse effects of competition emerging in that part of the survey (reviewed in Chapter 3) that dealt with search biases arising from inertia and misjudgement of prices, and quality biases arising from misjudgement of vertical quality as illustrated in Chapter 2, Figure 2.1. In contrast, models reviewed in Chapter 3 that examine willingness to pay biases arising from reference point effects and loss aversion, misperception of future demand and quality biases arising from horizontal misperception of quality (shown in Figure 2.1), while not necessarily a pancea, competition was never seen to do harm.

4.4 The logic for this is that for models from the left half of the panel in Figure 4.1 competition works in the same way as it does in standard models, only with 'distorted' demand curves. Reference points generate kinks in demand curves and misperception of demand and desired attributes either shifts demand curves outward or inward, or redresses the balance of desired product quantities. But once these demand patterns are given, the forces of competition work as they do in the standard literature and there is little surprise in that. Fundamentally these biases do not change the consumers' desire to find the best deal. Hence, increasing competition through more firms will always have (at least weakly) positive effects although in many circumstances some allocative inefficiencies may remain even under perfect competition.

4.5 The picture is radically different for models from the right half of the panel in Figure 4.1 where the behavioural biases affect consumers' search and decision rules such that they might no longer buy from the cheapest, best-value firm - sometimes because they do not search long enough due to inertia, sometimes because they have difficulties comparing the prices arising in misjudgement of prices and misjudgement

of quality. In these type of models there are some consumers who don't care if things are expensive or can't tell good quality from bad.[20] Here competition might no longer work as effectively simply because it is less clear that firms have an incentive to undercut each other. Why would they if consumers do not necessarily go for the cheapest firm?

4.6 Once the clear incentive to undercut is removed, firms have to weigh their options: They can go for low prices trying to attract those consumers that search a lot and do make the right judgements, or they can go for higher prices trying to prey on those consumers who do not search much or, if they do, fall victim to poor judgement.

4.7 As we have seen, this tension on its own can be enough to neutralise the beneficial effects of competition. However in specific cases it may also create adverse effects of competition, simply think of Stahl's model where entry reduces firms' incentives to charge low prices because consumers will be less likely to locate the good offers (see paragraphs 3.67 to 3.70). Things may turn even worse when firms can engage in activities that deliberately make search and judgements harder, simply because the incentive to do so will often increase when the number of firms goes up.

4.8 In summary, competition may not always be able to solve consumer issues and indeed in specific cases may even be problematic. However as long as firms have a clear incentive to undercut, or more generally, to offer a better deal to consumers, competition can only improve market outcomes. In environments when firms lack this universal incentive to undercut because some consumers might, for lack of time or prudence, buy from a more expensive firm, competition through more firms can backfire and make consumers strictly worse off.

---

[20] One might argue that some of the biases such as reference points may affect the ability to search indirectly because consumers stop search earlier than they should. However, although consumers like something more than they initially thought they would (because they compare other products to the product they have perhaps seen first), it does not fundamentally change their desire to find the best deal.

Learning

4.9 Again we can go back to Figure 4.1 this time cutting through it horizontally .The models in the bottom half (reference points and inertia) model consumer biases through preferences. Accordingly, there is no scope for learning as consumers do maximise without error given their preferences. Of course, preferences might change over time and there is some evidence that professionals are less prone to reference point effects (for example, List 2003).[21] Moreover, as we have discussed in the inertia section above at some length, the interpretation of some models with high search or switching costs, specifically those where firms can influence these costs, is suggestive of cognitive limitations which with more practice may be overcome (see paragraphs 3.71 to 3.76). When viewed from this angle, there might also be some scope for improvement of consumers' search behaviour through experience and learning. Therefore, if inertia arises due to cognitive limitations causing misjudgement of prices, then learning can potentially help.

4.10 The models that fall into the top half of the panel in Figure 4.1 represent much more obvious cases for learning to be relevant. This is because these are models where consumers make errors and will often find out about their suboptimal choice. For example, if consumers mispredict their future demand, they will eventually find this out when their actual demand is realised. This gives them the chance not to repeat their mistakes. Of course, if their misperception is driven by some underlying bias (say, over-optimism or a self-control problem or a vicious combination of both) then learning requires that the consumer admits to herself that she has a problem, for example, that she admits to herself that she is an impatient hyperbolic discounter suffering from self-control problems. It requires more than just a simple adjustment of behaviour: it requires dropping one's naiveté to become sophisticated.

[21] List observes using economic experiments that experienced traders in a naturally occurring market (sports cards) are less prone to this bias,

4.11 Similarly, consumers have the scope to learn when the source of their errors is misjudgement of (vertical) quality or misjudgement of prices. Clearly, they will have reason to re-think their choice rules when they bought a product of inferior quality that soon breaks down. But there is also scope for learning when consumers tend to misjudge price. Repeated experience with complicated price frames will probably make it easier for consumers to see through them (OFT 2010, see paragraph 3.18). Also, friends or family might point out better deals that would have been available elsewhere.

4.12 Insofar as some of these errors are driven by poor numeracy or cognitive skills there is, of course, only limited scope for learning. Moreover, with age performance might even drop due to a general decline of cognitive ability (for example, Banks and Oldfield 2007).[22]

4.13 From the viewpoint of learning and cognitive skills it might be worthwhile to think about and to identify particularly vulnerable consumers in such markets. Currently there is little formal discussion of this in the literature.

Information and standardisation of information

4.14 More information and market transparency is generally predicted to improve market outcomes in all models considered here with the exception of those in the top left corner of Figure 4.1, the models on misperception of own demand. There consumers would need better information about their own future demands and this may well be impossible to provide.

4.15 In the bottom left of Figure 4.1, the case of reference point effects, there is scope for information to have an impact even though the consumer bias is driven by preferences. However, these preferences

[22] Banks and Oldfield consider a sample of older people in England and find that a large proportion of this sample have low levels of numeracy, and that numeracy is strongly related to the understanding of pension arrangements and the choice to invest in retirement savings.

shape ('distort') behaviour only when consumers initially do not know all prices and characteristics of goods in the market. It is this uncertainty that gives scope for reference point effects. If consumers had all options on the table from the first moment and considered them **simultaneously**, their status quo bias and loss aversion would simply not matter.

4.16 That more information about the price and quality of available goods tends to improve markets where consumers might not search enough or might misjudge price and quality is intuitive. There are, however, some subtle exceptions that can arise in search markets. If for example, increased price transparency only lowers the search costs for consumers who do engage in search but leaves those who do not unaffected, then, in equilibrium, prices might be higher because it is now relatively more attractive to exploit inert consumers rather than to compete for price aware consumers (Baye, Gatti, Kattuman and Morgan 2006).[23] A similar counter-intuitive result on adverse effects of lower search costs is demonstrated in Zhou (2010) who examines markets where consumers search for multiple products simultaneously. When consumers find the comparison of products difficult then standardisation of the way in which information is presented to the consumer can have a significant beneficial effect (see, for example, Chater, Huck, and Inderst (2010)).[24] However, such standardisation can backfire if not complete, as has been discussed in Piccione and Spiegler (2009) (see paragraphs 3.97 to 3.99).

---

[23] Baye et., al. study the introduction of the Euro, they observe that average prices for a set of 28 commodities on an online shopping site rise post Euro introduction. The model they use to explain this observation is one which looks at the trade-off firms face to reduce prices and capture consumers that search or raising prices to increase rents from their loyal (or inert) consumers.

[24] This study for The European Commission used two controlled experiments (one with university students and one with a consumer subject pool) to test consumer choice between alternative retail investment products. The authors observed that when information about the products was framed in a standardised way consumers were more likely to choose the better product.

Reputation

4.17 Whenever consumers realise that they have been taken advantage of, that is, in the very same cases where learning can be effective, there is also scope for firms to create a reputation, namely a reputation for not engaging in exploitative strategies. Consumers might reward such a reputation with repeat custom and perhaps even higher WTP, for example, because they trust that they will also not be exploited in the future or because of reciprocity or, in the terminology of Bohnet and Zeckhauser (2004), as a consequence of 'betrayal aversion'. [25] Such reputation building can greatly enhance the effects of learning

4.18 In some cases firms will be able to build up a reputation on their own quite effectively, in particular when they have a large market share. For example an airline that abandons any elements of drip pricing, might gain a reputation for fair pricing or even more broadly for operating a 'fair business'. In other markets, reputation building is far more difficult to achieve for firms on their own and information sharing among consumers can greatly boost reputations and their effective destruction. A prime example for such information sharing among consumers is 'e-bay's' feedback mechanism or, in the travel industry, 'tripadvisor.com'.

Consumer education and de-biasing

4.19 A common theme in this survey is that firms can profit from consumer biases and, in cases where competition cannot mitigate these benefits, firms do not have much incentive to engage in de-biasing activities. Only if such activities would help to build a brand reputation for 'fair treatment of consumers' could consumer education form part of a successful firm strategy. However, as the analysis in Gabaix and Laibson (2006) shows clearly, there are limitations to this, in particular when sophisticated consumers are cross-subsidised by biased consumers. The problem then is that by educating a consumer the firm will not only lose

[25] 'Betrayal aversion' is a situation in which people are generally less willing to take on a risk when the source of the risk is the behaviour of another person rather than nature (or a lottery).

the extra profits it would have made from the otherwise biased consumer, it will lose this consumer completely as she would switch to another supplier who still operates a scheme of exploiting naïve consumers for the benefit of sophisticated consumers. In general, whenever sophisticated consumers benefit from the presence of biased consumers, firms will have no incentive to de-bias (see paragraphs 3.47 to 3.52).

4.20 This leaves the possibility that third parties, the press, or government agencies could engage in consumer education and, surely, such efforts cannot have adverse effects. However, there is some literature that throws doubt on the effectiveness of de-biasing and education, certainly from a cost-benefit point of view. For example effective education may not be a simple matter (see, for example, Chater, Huck, and Inderst 2010[26] or Choi, Laibson, and Madrian 2010[27]).

[26] In this study for the European Commission (also referred to in paragraph Annexe(s)4.16), observed that education only had a marginal effect on optimal choice in the retail investment product experiments.

[27] The authors observed using economic experiments that that the provision of education about alternative pension plans had only a relatively small effect on the likelihood of subjects selecting the optimal plan. As such the authors suggest that education on its own is not necessarily a pancea for mitigating consumer biases.

5 EMPRICIAL STRATEGIES

5.1 How can one identify markets that suffer from any of the discussed biases that we have surveyed?

5.2 From a policy-oriented perspective this question is of first-order importance. Interventions to prevent misallocations due to consumer behavioural biases require proof of such biases. In this chapter we briefly discuss empirical strategies to identify the presence of biases emphasising the type of data that one would need for such identification.

Firm behaviour

5.3 The most traditional approach to study market performance is supply-side oriented, and, in light of the literature surveyed here, there are several practices firms might engage in that may serve as indirect proof of biases in consumer behaviour. Specifically, employing elaborate price frames (like drip pricing) which do not change the nature of actual prices, and costly changes to price frames over time may be an indication that firms are seeking to benefit from consumer biases. Similarly, attempts at obfuscation and any kind of shrouding can serve as potential virtual proof of problems that consumers face in making sense of firms' offers. Of course this is not evidence of 'bad' behaviour, but can act as an indication of which markets we may want to investigate further (we discuss this further in the following paragraph).

5.4 There are other activities that can look similarly suspicious but might have their reason in actual consumer preferences. In particular, very ornate pricing strategies with multi-part tariffs might occur as a form of exploitation of consumer biases but might also occur to serve rational consumers with diverse needs best. Invariably, such tariffs might trigger concern but warrant deeper more detailed investigation. The same holds

for employing loss leaders[28] or engaging in other activities that are designed to influence consumers' search activity.

5.5 Overall, there are very clear limits to what the traditional supply-side oriented approach can achieve alone. In almost all cases, there are two stories one can tell when confronted with activities that arise in markets with biased consumers; this is because, these activities might also arise in markets with heterogeneous sophisticated consumers (as mentioned in the preceding paragraph with multi-part tariffs, also see DellaVigna and Malmendier's (2004) in paragraph 3.34). Exceptions are price frames that simply change the appearance of the actual price from something that is straightforward and easy to understand into something more complicated and deliberately obfuscating and shrouding. In both these cases, there is also potential scope for direct regulation of firm behaviour. For example, practices such as drip pricing could simply be outlawed without any adverse consequences.

5.6 However, as our survey has shown there are several other variants of markets with behaviourally biased consumers and these require alternative empirical strategies – strategies that examine directly the demand side. In the following paragraphs we will enlist these strategies and explain their scope for application as well as their data needs.

Observe consumer choice and (market) prices

5.7 Price dispersion can easily be detected in market data and is, as we have seen, indicative of search costs (see for example paragraphs 3.17 and 3.60). Such markets can be problematic regardless of where the search costs stem from, simply because standard intuition about the welfare effects of lowering barriers to entry can go wrong.

5.8 Without further data it will generally be impossible to learn anything about the source of high search costs. High search costs may stem from high economic opportunity costs (maybe we are examining a market for

[28] Loss leaders are products sold at cost or below cost to generate other profitable sales.

a good in high demand among highly paid individuals) but could also stem from consumer ignorance.

5.9 A slightly different case arises when consumers are observed to purchase goods at an excessive price when the same supplier also offers a cheaper variant. Essentially, this is DellaVigna and Malmendier's strategy in their analysis of gym memberships (see paragraph 3.31). Given their actual gym usage, many consumers would ex post have been better off opting for pay-as-you-go schemes rather than memberships.

Observe consumer choice and consideration set

5.10 Perhaps the most direct strategy to prove biased decision making, or to be more precise, errors in decision making, is to compare the consumer's actual choice with his consideration set, that is, with all alternatives that the consumer had under consideration when making his purchase. This strategy is most promising for the class of markets where consumers suffer from misjudgement of price and quality. If the consumer chooses a product that is strictly, and objectively, dominated by another product in her choice set, this cannot be due to preference but must be a consequence of misjudgement.

5.11 While this is the clearest type of proof, data on consideration sets might be hard to obtain. Typically, consideration sets cannot be easily observed as one would have to track the entire search process of a consumer. Moreover, consumers who are prone to making mistakes when comparing prices are unlikely to have perfect recall of the goods they have considered prior to a purchase so asking consumers to report their consideration set appears not the most promising strategy either. An exception to this rule could be tracking consumers search on the internet. In principle, cookies and other traces of a consumer's search history could contain the desired data. Studies that track consumers' internet purchases might, thus, be the most fruitful avenue for empirical work that aims at comparing choices to other considered alternatives.

5.12 Economic experiments are also a useful method for observing consumer choice. Controlled economic experiments can isolate errors in decision-making from a pre-determined set of choices and pay-offs.

Ask the consumer after purchase

5.13 This is the first strategy considered here that essentially rests on survey methods rather than choice data. It comes, thus, with the usual caveats concerning the reliability of questionnaires. But for several of the consumer biases considered here this appears to be the most efficient empirical strategy.

5.14 Specifically, in all cases of misperception of desired quantities consumers should be able to tell later that they initially believed their demand would be greater or smaller and that, when they made their purchase (or signed up for their contract), they made a mistake.

5.15 It is exactly this ability of consumers' to realise that they originally misperceived their demand that also enables (conscious) consumer learning.

5.16 Presumably, the strategy of simply asking consumers after the fact is a little less promising in cases of misperceptions of the type of good desired, simply because it is harder for the consumer to learn that she actually made a mistake. A biased product that boosts extremely good characteristics in a dimension where less would not do harm, the consumer might never find out that this dimension is actually not so important. Likewise reference points may not be effectively identified through this method as the consumer (in the absence of information provision, see paragraph 4.15, and 5.19 below) may not know a reference point has influenced their choice. Again, in this case, controlled economic experiments could be used to reveal misperceptions.

5.17 This is different for cases of vertical quality differences (misjudgement of quality). Consumers who purchased a low-quality product will report disappointment when they expected higher quality.

5.18 Finally, we can consider the case of misjudgement of prices. Again, it is more questionable that consumers will recall that they could have paid a lower price when they actually 'forgot' the low price during the purchasing process. However, it is plausible that consumers might report confusion and/or uncertainty experienced during the search process which could be indicative of a real problem, but, of course, no proof. Supporting proof could be elicited through the use of controlled economic experimentation.

Elicit the consumer's WTP before the purchase

5.19 So far, none of the discussed empirical strategies appears useful to prove the role and effect of reference points in markets. This is perhaps not so surprising as reference point effects are a matter of preference similar to preferences for certain (maybe odd) type of products. However, as shifting reference points can shift consumers' WTP there is an obvious procedure the empirical economist can employ. He can ask the consumer before she starts her search process about her WTP and compare it later to actually paid prices. If actual prices paid are higher than initial WTP, this would be indicative of reference point effects in the mode of Zhou, that is, reference points that are formed during the search process (see paragraph 3.15).

5.20 While this sounds like a fool-proof method (in particular when one has access to incentive compatible elicitation mechanisms such as a Vickrey auction or the random price mechanism of Becker, de Groot, and Marshak[29]) there is one potential caveat - if the researcher asks the consumer, say, outside a shop she is about to enter, about her WTP for some product, this could very well alter the consumer's behaviour as it could make her more aware of her original WTP and, hence, reduce the likelihood of reference point shifts and changes in WTP.

[29] The Vickery auction and the Becker, deGroot and Marshak mechanism are methods which are designed to elicit truthful willingness to pay. People tend to under report their true valuation for goods when they know that the goods are allocated based on these valuations.

Other survey methods and ethnographic studies

5.21 We are left with a situation where we have for almost all of the biases that we considered at least one or two potential avenues to examine them empirically. The exception to this is inertia where we have no empirical avenues to examine its' driver, that is, the question whether inertia is rational or not. If a consumer does not search or does not switch the fundamental reason might always be real cost, whether monetary or psychological, and non-searching, non-switching consumers might well be aware that they forgo better deals. It is just that they have concluded it does not pay for them to engage in more intensive search.

5.22 In such cases of inertia, the empiricist has probably the hardest task. He needs to understand the true sources of inertia and make a judgement call on whether these sources can reasonably be rationalised. Obtaining proof requires then in-depths surveys or even ethnographic studies.

6 CONCLUSION

6.1 One key conclusion we want to emphasis at the outset is that we feel that the literature surveyed here deserves to be taken seriously. It has become evident that the literature is now more than just a collection of intellectually interesting curiosities. The literature can be grouped into relevant areas of consumer choice and shows substantial consistency and robustness within each area.

6.2 The most striking result of the literature so far is that increasing competition through fostering entry of more firms may not on its own always improve outcomes for consumers. Indeed competition may not help when there are at least some consumers who do not search properly or have difficulties judging quality and prices (see Figure 4.1 and paragraphs 4.2 to 4.8). In the presence of such consumers it is no longer clear that firms necessarily have an incentive to compete by offering better deals. Rather, they can focus on exploiting biased consumers who are very likely to purchase from them regardless of price and quality. These effects can be made worse through firms' deliberate attempts to make price comparisons and search harder (through complex pricing, shrouding, etc) and obscure product quality. The incentives to engage in such activities become more intense when there are more competitors. In these situations complementary policies such as learning, provision of information and standardisation of information and frames can help (Figure 4.1, and paragraphs 4.9 to 4.20).

6.3 On the other hand, competition tends to work as standard intuition suggests if biases simply distort consumers' demand without affecting their desire to search for the best deals in light of their demand (Figure 4.1 and paragraphs 4.2 to 4.8). While competition is unable to eradicate the allocative inefficiencies that arise in response to these distortions, entry from more firms can never harm consumers and will mostly make them strictly better off.

6.4 Related to this main result is the finding that in the presence of behaviourally biased consumers markets cannot always be expected to self correct. Sometimes gains from exploiting a certain bias may be

partially competed away through very attractive prices for another product to attract consumers in the first place (depending on the extent of competition). Such 'waterbed effects' always depend, however, on the fine detail of the market and cannot be taken for granted.

6.5 We also find that firms may sometimes have little incentive to educate consumers. This is particularly severe if educated or sophisticated consumers benefit from the pricing offered by those firms who do not engage in consumer education (see for example paragraph 3.59 and the search models). However, where learning will eventually eradicate consumer biases, firms may have a clear incentive to establish a reputation for 'fair behaviour' early on (see for example paragraph 3.111).

6.6 The extent to which behavioural effects matter in real markets is, as of the time we are writing this survey, largely unknown. While there is substantial evidence for firms employing strategies that basically only make sense when consumers are biased in one way or other, there is little direct evidence on how consumer choice deviates from full rationality. In view of these deviations' potential importance for market outcomes, more empirical work is, we believe, urgently called for.

A REFERENCES

Akerlof, G. (1970) 'The market for lemons, quality uncertainty and the market mechanism', *Quarterly Journal of Economics*, 83(3), 488 – 500.

Armstrong, M. and Vickers, J. (2001): 'Competitive Price Discrimination,' *RAND Journal of Economics*, 32(4), 579-605.

Armstrong, M., Vickers, J. and Zhou, J. (2009): 'Prominence and consumer search', *RAND Journal of Economics*, 40, 209–233.

Ausubel, L. (1991): 'The failure of competition in the credit card market', *American Economic Review*, 81(1), 50-81.

Banks, J. and Oldfield, Z. (2007): 'Understanding Pensions: Cognitive Function, Numerical Ability and Retirement Saving', *Fiscal Studies*, 28: 143–170.

Baye, Michael R., Rupert Gatti, Paul Kattuman, and John Morgan (2006): 'Did the Euro Foster Online Price Competition? Evidence from an International Price Comparison Site', *Economic Inquiry*, 44(2), 265-279.

Becker, G.M., Degroth, M.H., Marashak, J. (1964): 'Measuring Utility by a Single-Response Sequential Method', *Behavioral Science*, 9(2).

Bernheim (2009): 'Behavioural Welfare Economics', *Journal of European Economic Association*, 7(2-3), 267-319.

Bertrand, M., D. Karlan, S. Mullainathan, E. Shafir, and J. Zinman (2009): 'What's Advertising Content Worth? Evidence from a Consumer Credit Marketing Field Experiment,' *Quarterly Journal of Economics*, forthcoming.

Bohnet.I, Hamgart.H, Huck.S and Tyran. J-R (2005): 'Learning Trust', *Journal of the European Economics Association*, 3(2-3), 322-329.

Bohnet.I, and Zeckhauser, R,(2004). 'Trust, Risk and Betrayal.' Journal of Economic Behaviour and Organisation 55.4 (2004): 467-484.

Burks, S., Carpenter, J., Gotte, L., and Rustichini, A.: (2008) 'Cognitive skills explain economic preferences, strategic behaviour and job attachment,' Discussion paper 3609, IZA.

Carlin, B. (2009): 'Strategic price complexity in retail financial markets,' *Journal of Financial Economics*, 91 (3), 278-287.

Chen, Y., G. Iyer, and A. Pazgal (2010): 'Limited Memory, Categorisation, and Competition,' *Marketing Science*, 29(4), 650-670.

Chioveanu, I., and J. Zhou (2009): 'Price Competition with Consumer Confusion,' mimeo, UCL.

Choi, J., D. Laibson, and B. Madarian (2008): 'Why Does the Law of One Price Fail? An Experiment on Index Mutual Funds,' mimeo, Yale and Harvard.

DellaVigna, S. and U. Malmedier (2004): 'Contract Design and Self-Control: Theory and Evidence,' *Quarterly Journal Economics*, 119(2), 353-402.

DellaVigna, S. and U. Malmendier (2006): 'Paying not to go to the Gym,' *American Economic Review*, 96(3), 694-719.

Dow, J. (1992): 'Search Decisions with Limited Memory,' *Review of Economic Studies*, 58, 1-14.

DG SANCO (2010): Consumer Decision-making in retail Investment Services: A behavioural Perspective, a report by N.Chater, R.Inderst and S.Huck.

Dulleck.U, Kershbamer.R, and Sutter.M (2010): 'The Economics of Credence Goods: On the Role of Liability, Verifiability, Reputation and Competition,' forthcoming in *American Economic Review*.

Eliaz, K. and R. Spiegler (2010): 'Consideration Sets and Competitive marketing,' forthcoming in *Review of Economic studies*.

Eliaz, K. and R. Spiegler, (2006): 'Contracting with Diversely Naive Agents,' *Review of Economic Studies*, 73(3), 689-714.

Ellison, G. (2005): 'A Model of Add-On Pricing,' *Quarterly Journal of Economics*, 120(2), 585-637.

Ellison, G. and S. Ellison (2009) , 'Search, Obfuscation, and Price Elasticities on the Internet,' *Econometrica*, 77(2), 427-452.

Ellison, G., and A. Wolitzky (2008): 'A Search Cost Model of Obfuscation,' mimeo, MIT.

Gabaix, X., and D. Laibson (2006): 'Shrouded Attributes, Consumer Myopia, and Information Suppression in Competitive Markets,' *Quarterly Journal of Economics*, 121(2), 505-540.

Grubb, M. (2009): 'Selling to Overconfident Consumers,' *American Economic Review*, 99(5), 1770-1807.

Hann and Moraga-Gonzalez (2009): 'Advertising for Attention in a Consumer Search Model', forthcoming in *Economic Journal*.

Heidhues, P. and B. Koszegi (2008): 'Competition and Price Variation When Consumers are Loss Averse,' *American Economic Review*, 98(4), 1245-1268.

Heidhues, P. and B. Koszegi (2010): 'Exploiting Naivete about Self-Control in the Credit Market,' forthcoming in *American Economic Review*.

Huck, S, Luenser, G, and Tyran, J-R (2006): 'Competition Fosters Trust,' *ELSE Working Paper* 235

Huck,S, Luenser, G, and Tyran, J-R (2007): 'Pricing Trust,' *ELSE Working Paper* 257

Huck.S and Tyran,J-R (2007): 'Reciprocity, social ties, and competition in markets for experience goods', *Journal of Socio-Economics*, 2007, 36, 191-203

Kahneman and Tversky (1979): 'Prospect theory and analysis of chopice under risk' *Econometrica*, 47(2), 263 – 292.

Kahneman, and Tversky (2000): *Choices, Values, and Frames*, Cambridge University Press.

Kalayci, K. (2010): 'Price Complexity and Buyer Confusion in Posted Offer Markets,' mimeo.

Kalayci, K. and J. Potters (2010): 'Buyer Confusion and Market Prices,' forthcoming in *International Journal of Industrial Organization*.

Karle, H. and M. Peitz (2009): 'Pricing and Information Disclosure in Markets with Loss-Averse Consumers', mimeo.

Karle, H. and M. Peitz (2010): 'Consumer Loss Aversion and the Intensity of Competition', mimeo.

Keser, Claudia (1993): 'Some Results of Experimental Duopoly Markets with Demand Inertia,' *Journal of Industrial Economics,* 41, 133-151.

Klemperer, P. (1987): 'Markets with Consumer Switching Costs,' *Quarterly Journal of Economics*, 102, 375-394.

Laibson, D. (1997): Golden Eggs and Hyperbolic Discounting ', *Quarterly Journal of Economics*, 112(2), 443 – 447.

List, J. (2003): 'Does Market Experience Eliminate Market Anomalies?' *Quarterly Journal of Economics*, 118(1), 41-71.

Miravete, E. (2003): 'Choosing the Wrong Calling Plan? Ignorance and Learning,' *American Economic Review*, 93(1), 297-310

OFT (2010) The Impact of price frames, a study by London Economics, Charlotte Duke, Steffen Huck and Brian Wallace.

OFT (2011) Consumer Contracts Economics Framework.

Perloff, J. and S. Salop (1985): 'Equilibrium with Product Differentiation,' *Review of Economic Studies*, 52(1), 107-120.

Piccione, M., and R. Spiegler (2009): 'Price Competition with Limited Comparability,' mimeo, LSE and UCL.

Rochet, J. and Stole, L. (2002): 'Nonlinear Pricing with Random Participation,' *Review of Economic Studies*, 69(1), 277-311.

Rothschild and Stiglitz (1976): 'Equilibrium in Competitive Insurance Markets: An Essay on the Economics of Imperfect Information', *Quarterly Journal of Economics,* 90(4), 629-649.

Rosenthal .R. (1980) A Model in which an Increase in the Number of Sellers Leads to a Higher Price, *Econometrica*, 48(6),1575-1579.

Rubinstein and Salant (2008): '(A,f): Choices with Frames,' *Review of Economic Studies*, 75, 1287-1296.

Rubinstein and Salant (2008): '(A,f): Choices with Frames,' *Review of Economic Studies*, 75, 1287-1296.

Salop, S, and Stiglitz, J(1977): 'Bargains and Ripoffs: A Model of Monopolistically Competitive Price Dispersion,' *Review of Economic Studies,* 44, 493-510.

Sandroni, A. and F. Squintani (2007): 'Overconfidence, Insurance, and Paternalism,' *American Economic Review*, 97(5), 1994-2004.

Scitovsky, T. (1950): 'Ignorance as a Source of Oligopoly Power,' *American Economic Review*, 40(2), 48-53.

Selten, R (1965): 'Spieltheoretische Behandlung eines Oligopolmodells mit Nachfragetragheit,' *Zeitschrift fur die gesamte Staatswissenschaft,* 121, 301-324 and 667-689.

Smallwood, D. and J. Conlisk (1979): 'Product Quality in Markets where Consumers are Imperfectly Informed,' *Quarterly Journal of Economics*, 93(1), 1-23.

Spence, M. (1977): 'Consumer Misperception, Product Failure and Producer Liability' *Review of Economic Studies*, 44(3), 561-572

Spiegler,R. (2010): '*Bounded Rationality and Industrial Organisation'*, Oxford Economic Press.

Spiegler, R. (2006a): 'The Market for Quacks,' *Review of Economic Studies*, 73(4), 1113-1131.

Spiegler, R. (2006b): 'Competition over Agents with Boundedly Rational Expectations,' *Theoretical Economics*, 1(2), 207-231.

Stahl, D. (1989) 'Oligopolistic Pricing with Sequential Consumer Search' *The American Economic Review,* 79(4), 700-712.

Tversky and Kahneman (1991): Loss Aversion in Riskless Choice: A Reference-Dependent Model, *Quarterly Journal of Economics,* Vol. 106(4), 1039-1061

Tversky and Kahneman (1981): 'The Framing of Decisions and the Psychology of Choice,' *Science*, 211, 453-458.

Varian, Hal R. (1980): 'A Model of Sales,' *American Economic Review* 70, 651-659.

Wilson, C. (2010): 'Ordered Search and Equilibrium Obfuscation,' *International Journal of Industrial Organisation*, 28(5), 496-506.

Zhou, J. (2008): 'Advertising, Misperceived Preferences, and Product Design,' mimeo, UCL.

Zhou, J. (2008): 'Reference Dependence and Market Competition,' forthcoming in *Journal of Economics & Management Strategy*.

Zhou, J. (2010): 'Multiproduct Search,' mimeo, UCL.

B SIMPLE MODELS

1 Box: A simple model where consumers overestimate future demand

Consider a simple market where consumers purchase according to their perceived demand $x^d = \lambda - p$ (with $\lambda > 1$) while their actual demand at time of consumption is $x^c = 1 - p$. Suppose there is a monopolist operating in this market who faces constant marginal costs of c and no fixed costs. Suppose further the monopolist employs a linear pricing scheme (he can obviously do better with two-part tariffs but for expositional reasons let us simply examine the linear pricing case).

To make the case more poignant let us also assume that the consumer will "only take delivery" of the actually demanded items. This assumption is most appealing in the case of services where additional units (minutes on a phone plan, hours in a gym) are simply not requested. But one could also imagine that, if disposal is costly, consumers would prefer to cancel part of an order for physical items if they find out they don't need the entire quantity.

The monopolist then sells $\lambda - p$ units but produces only $1 - p$ units such that the profit function is

$$\Pi(p) = p \underbrace{(\lambda - p)}_{\text{misperceived demand}} - c \underbrace{(1 - p)}_{\text{actual demand}}.$$

The first-order condition of the profit maximization problem gives

$$p^m = \frac{\lambda + c}{2}.$$

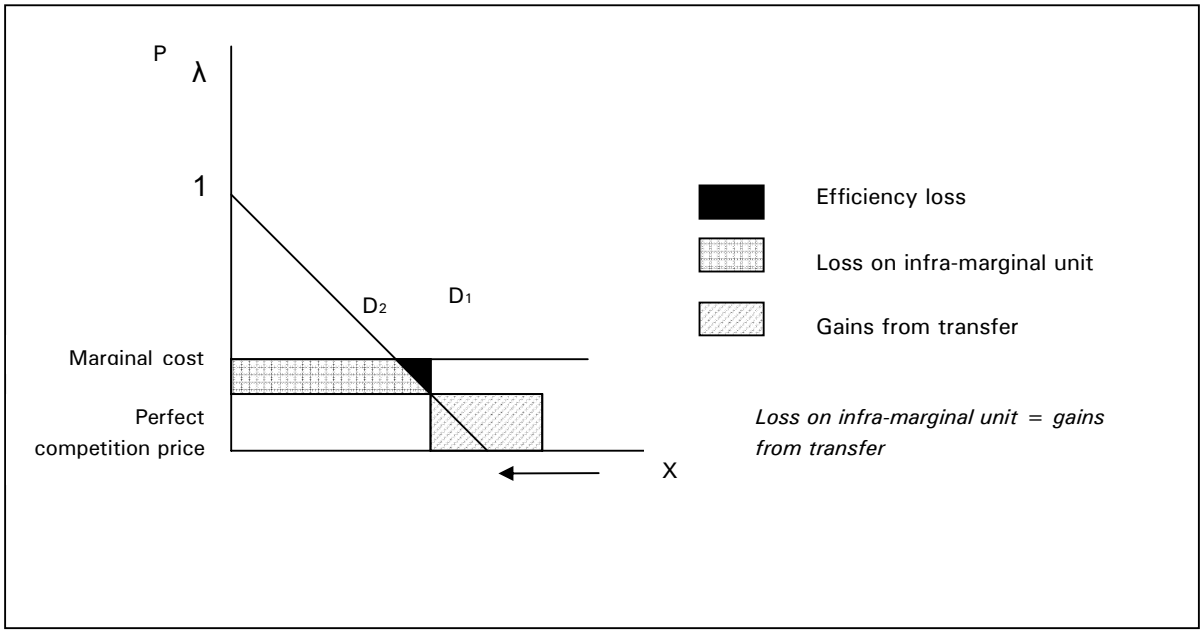
The price is increasing in costs and the degree of overestimation. Consumers will purchase the amount $x^d = \frac{1}{2}(\lambda - c)$ but consume only $x^c = \frac{1}{2}(2 - \lambda - c)$. The price paid on the difference $p^m(x^d - x^c) = \frac{1}{2}(\lambda + c)(\lambda - 1)$ is a pure transfer from consumers to the monopolist.

The monopolist's profit is $\frac{1}{4}(\lambda + c)^2 - c$, the consumer rent is $\frac{1}{8}(\lambda - c)^2 - \frac{1}{2}(\lambda^2 - 1)$, and the dead weight loss is $\frac{1}{8}(\lambda - c)^2$ which is increasing in λ.

Compared to the standard case where consumers predict their demand correctly we find that monopolist makes an extra profit of $\frac{1}{2}c(\lambda - 1) + \frac{1}{4}(\lambda^2 - 1)$; the consumer's rent falls by $\frac{c}{4}(\lambda - 1) + \frac{3}{8}(\lambda^2 - 1)$; and the dead weight loss increases by $\frac{1}{8}(\lambda^2 - 1) - \frac{c}{4}(\lambda - 1)$.

Can perfect competition eliminate these inefficiencies? Figure 4.1 illustrates that it cannot. If price were equal to marginal cost, firms would still make a profit resulting from the pure transfer that consumers pay for unused units. This profit will only be competed away for prices below marginal cost such that the loss on the inframarginal units, $(c - p^*)(1 - p^*)$ equals the profit from the sold but never supplied units $p^*(\lambda - 1)$, which determines the perfect competition price $p^* = \frac{1}{2}\left(\lambda + c - \sqrt{(\lambda + c)^2 - 4c}\right)$. There is now an efficiency loss due to overproduction equal to $\frac{1}{2}(c - p^*)^2$.

Box 1 Figure: Overestimation of future demand



2 Box: A simple model where consumers underestimate future demand

Consider the same model as from Box 1, but now with $1 > \lambda > c$. When actual demand is realized consumers will purchase the additional units. As a consequence the monopolist who employs linear pricing can sell twice to the consumer and his profit function becomes

$$\Pi(p_1, p_2) = p_1 \underbrace{(\lambda - p_1)}_{\text{initial misperceived demand}} + p_2 \underbrace{(1 - p_2 - (\lambda - p_1))}_{\text{additional demand}} - c \underbrace{(1 - p_2)}_{\text{actual demand}}.$$

The first-order conditions of the profit maximization problem are

$$\lambda - 2p_1 + p_2 = 0$$

and

$$1 - 2p_2 - (\lambda - p_1) + c = 0.$$

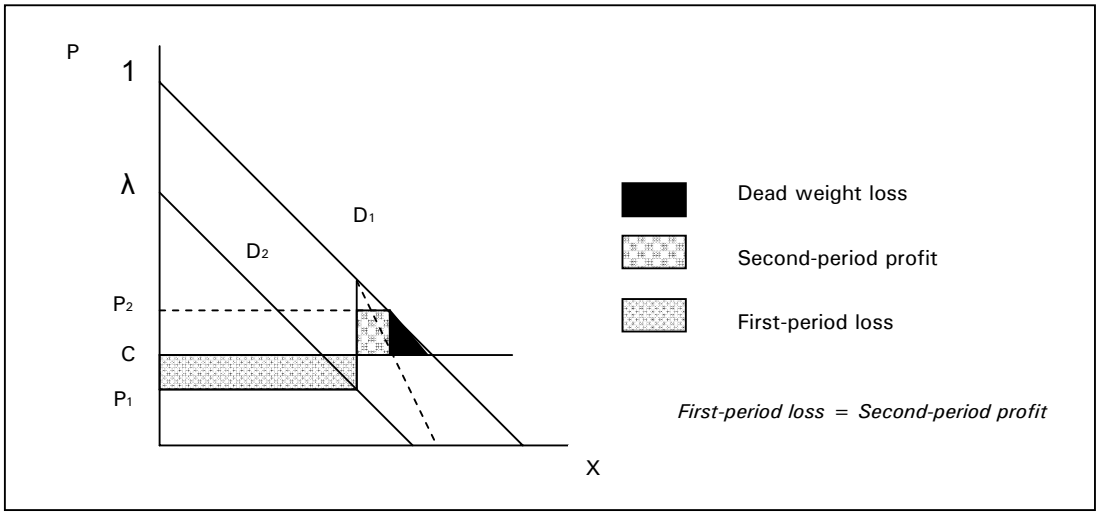
So the monopolist charges $p_1 = \frac{1}{3}(1 + c + \lambda)$ in the first period and $p_2 = \frac{1}{3}(2 + 2c - \lambda)$ in the second period.

Two observations: (i) $p_1 > p_2$ whenever $2\lambda > 1 + c$. So whether the firm charges a higher price in the first period or not depends on the magnitude of underestimation. (ii) Even if $\lambda \to 1$ (i.e., if there is almostt no underestimation), $p_1 \neq p_2$. This is because this toy model allows the firm to price discriminate intertemporally and consumers are assumed to be myopic (i.e., they do not anticipate that the firm will offer a lower price in the second period).

Consumers purchase a total quantity of $\frac{1}{3}(1+\lambda-2c)$ for which they pay $\frac{1}{3}(1-\lambda+\lambda^2-c^2)$. The monopolist's profit is $\frac{1}{3}(1 - c + c^2 - \lambda + \lambda^2 - c\lambda)$. The dead weight loss is $\frac{1}{18}(2 - c - \lambda)^2$. Thus, total efficiency can be higher if consumers underestimate their demand because the monopolist can sell larger quantities. But the dead weight loss is decreasing in λ, that is, the more accurate consumers predict their demand, the smaller is the efficiency loss (with a discontinuity at $\lambda = 1$ where suddenly the monopolist loses the ability to sell twice because consumers lose their naivity).

Does competition eliminate the inefficiencies due to underestimating demand? If we consider the case where firms commit to price profiles (p_1, p_2) and consumers commit to one supplier for both periods (which is now like a contract), the answer is no. In the fully competitive equilibrium firms will choose $p_1 < c$ and then offer the monopoly price with respect to the consumer's residual demand in the second period such that the first-period loss will just be covered by the second-period gain (see Figure 4.2). The consumer will consider this a very attractive deal as she will deem the high second-period price p_2 irrelevant (think of that as a fee for not paying back your credit card debt on time). Therefore, the allocation distortion will not vanish even in the perfect competition case.

Box 2 Figure: Underestimation of future demand



3 Box: A very simple search market

Consider a search market with a continuum of consumers of mass 1. There are two types of consumers. Those who search and are, hence, fully informed of market prices and those who are ignorant and do not search at all (perhaps because they erroneously believe in the law of one price). The former have mass q, the latter $1-q$.

There are two firms who can either charge a low price p or a high price P. The high price is indeed so high that the informed consumers prefer not to buy at all when there is no cheaper option. In that case, if both firms charge P, each firm will simply sell to half of the ignorant consumers. If both firms charge the low price p, they will share all consumers equally. If they charge different prices, the low-price firm will attract all informed consumers and half of the ignorant consumers and the high-price firm just half of all ignorant consumers. There are no costs of production. This generates the following 2×2 game.

	H	L
H	$\frac{(1-q)P}{2}, \frac{(1-q)P}{2}$	$\frac{(1-q)P}{2}, \frac{(1+q)p}{2}$
L	$\frac{(1+q)p}{2}, \frac{(1-q)P}{2}$	$\frac{p}{2}, \frac{p}{2}$

It is easy to see that for $\frac{1}{1-q} < \frac{P}{p} < \frac{1+q}{1-q}$ this game has no symmetric pure-strategy equilibrium. If the other firm charges a low price, it pays to avoid cut-throat competition and sell only to ignorants at the high price. On the other hand, if the other firm charges a high price, it is profitable to capture all informed consumers through the lower price. Hence, there will be price dispersion either in the form of asymmetric pure-strategy equilibria in which one firm earns $\frac{(1+q)p}{2}$ and the other earns $\frac{(1-q)P}{2}$, or in the form of mixed-strategy equilibria in which each firm earns an expected profit $\frac{(1-q)P}{2}$.[1] (Notice that under the previous condition firms earn (weakly) higher profits in the asymmetric pure-strategy equilibria.)

[1] In the mixed-strategy equilibrium, each firm charges the high price with a probability $\frac{1-q}{q}\frac{p}{P} - \frac{1}{q} \in (0,1)$.

4 Box: Competition with price framing

Consider again a market with a continuum of consumers of mass 1 that is served by two firms who can charge a low price p or a high price P. Additionally, firms can choose between two different price frames A and B. There are two types of consumers. Those who can effectively compare prices even in different frames and those who will choose at random when faced with two different frames. The former have mass q, the latter $1-q$. (But all consumers are able to compare prices correctly if the two firms use the same frame.) As in Box 3, we assume that the high price is too high for the standard consumers while those consumers who struggle with price comparisons are willing to pay it.

Let us consider the case where firms first choose price frames and then engage in price competition. If they choose identical frames, they face in the price-setting stage the following 2×2 game.

	H	L
H	$0, 0$	$0, p$
L	$p, 0$	$\frac{p}{2}, \frac{p}{2}$

This price subgame has a unique equilibrium where each firm charges the low price p and earns $\frac{p}{2}$. However, if firms choose different price frames, the price-setting game becomes identical to the one examined in Box 3 and both firms are strictly better off in the equilibria played in that game (given the condition specified in Box 3).

Consequently, all subgame perfect equilibria will involve some form of price frame dispersion, either via asymmetric pure-strategy equilibria or in mixed-strategy equilibria, and price dispersion.