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Salience in a simple transport market

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ABSTRACT

Psychologists have long since recognized that consumers have limited cognitive ability, and that this prevents them from weighing up all product attributes when making a choice. More recently, a new framework for consumer choice has been developed which takes account of this, by assuming that consumers are drawn to salient features of a product. We apply the framework of salient thinking to a simple transport market in which passengers may attach different weights to the utility of the trip (its comfort and/or duration) and the fare. We find the optimal fare structure in this market, and investigate under which conditions operators use their pricing schedule to focus passengers' attention on fare, and when they direct attention towards trip duration or comfort. Furthermore, we address the quality investments made by operators compared to a rational benchmark. Quality enhancement in this model is increasing in the unit cost of providing the service. We finally discuss the implications of the theory of consumer choice, and the competitive model for transport markets compared to the predictions of a rational model. This leads to several testable situations which could give implications for policy makers and transport firms.

1. Introduction

The liberalisation of transport markets in many industrialised countries has led to an increasing interest in the strategic interactions of transport operators. Results from fare calculation and quality provision for monopoly (e.g. Jørgensen & Pedersen, 2004; Jørgensen & Preston, 2007; Li, Lam, Wong, & Sumalee, 2012) have been extended to the oligopoly case of few providers of transport services.[1] Pedersen (1999) presents an early theoretical model, and Clark, Jørgensen, and Mathisen (2011) analyse the connections between trip length and fare under different competitive regimes for horizontally differentiated transport services. A common premise in these analyses is that the outcome of consumers' utility maximization – which belies the demand function for the transport service – is such that they trade off different goods at consistent rates (see Singh and Vives (1984) for the case of horizontally differentiated products). In a laboratory experiment, Tversky and Kahneman (1981) find that the rates at which consumers trade off time and money is context-dependent, violating the assumption common for the analysis of transport markets. Since both time (journey length) and money (fare) are important for passengers, this paper looks at how transport operators set their fares and quality level given that passengers allow relative comparisons to influence their decisions.[2]

In a famous experiment, Tversky and Kahneman (1981) find that most of their subjects are willing to drive 20 minutes to save 5$ on a 15$ item, but are not willing to drive the same amount of time to save 5$ on an item costing 125$. The postulate of rational utility maximizing consumers is thus challenged since these subjects value money less when they consider high values. A rational consumer with a utility function which is linear in money should value the 5$ saving the same, independent of the item purchased; a rational consumer with a concave utility of money would prefer to save 5$ on the higher valued item. The subjects in the experiments are influenced by relative comparisons, not just absolute ones. In the context of transport, Azar (2011) reports results from an experiment in which subjects are asked how much more fare they are willing to pay for a flight leaving at 10am as compared to 7am. Since the value of 3 hours of sleep is independent of the price of the flight, the extra willingness to pay by a rational consumer for the later flight should not depend on the fare. However, subjects are willing to

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[1] Blauwens, Baere, and Voorde (2008) suggest that few operators is the empirically relevant case for most transport markets.

[2] Azar (2007) introduces the concept of "Relative thinking theory" in which people make relative comparisons and not just absolute ones as dictated by the rational model.

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pay more for their preferred flight, the higher is the fare for that flight. The airline should then have some scope for charging a premium rate for the flight that is perceived as higher quality if passengers make relative comparisons.

Quality is a dimension that reasonably affects the demand for transport services and that will affect the fare calculations and/or the level of quality delivered by providers of services. Jørgensen and Solvoll (2018) and dell'Olio, Ibeas, and Cecin (2011) look at optimal quality provision when fares are set exogenously, and Jansson (1993), Panzar (1979) and Clark, Jørgensen, and Mathisen (2019) allow fares and quality levels to be determined endogenously.[3]

By departing from the postulate of rationality, the current analysis views quality and fare of a transport service as attributes that providers may want to stand out in some way in order to influence passengers' purchase decisions.[4] Psychologists have long since recognized that consumers have limited cognitive ability, and that this prevents them from weighing up all product attributes when making a choice.[5] McFadden (1999; p. 74) notes that "Choice behaviour can be characterized by a decision process, which is informed by perceptions and beliefs based on available information, and influenced by affect, attitudes, motives and preferences". Furthermore, the standard economic model implies that decision makers use information in an optimal manner, they have consistent and immutable preferences and the cognitive process simply involves preference maximization. In fact, McFadden (1999) accepts that decision makers can use heuristics that can fail to maximize preferences. There is some evidence that this thinking is also prevalent in the transport industry. In her report for Amadeus, Dykins (2017) looks at the consequences for airlines that customers have limited capacity for making choices, making "rational enough" decisions, noting also that upgrade service provider Seatfrog uses behavioural research on passengers to determine the value of upgrades.

Immarsat aviation, a provider of Wi-Fi systems for aircrafts, also considers the fact that passengers make choices that are based on heuristics, and not necessarily rational, explaining how this can be exploited to create value for airlines.[6] One idea reported is based upon a result from Simonson and Tversky (1992) and involves the context in which decisions are made. Subjects were asked to choose between two brands of microwave oven, A and the cheaper model B, and a more expensive version of A denoted A'. They found that the proportion choosing A increased when the choice set was {A′, A, B} compared to when the participants could just choose between A and B. Immarsat aviation applies this to an airline considering the provision and pricing of its Wi-Fi service on board. By offering three levels of service, basic at €3, medium at €7 and high at €12, a large proportion of customers will "upgrade" from basic to medium. Giving the choice between basic and high would probably result in many customers paying €3 for the Wi-Fi service. According to McFadden (1999; p. 86), "… the inconsistencies that consumers show arise because the context alters the *saliency* of available information" (italics in original).[7] It is probably no coincidence that a low-cost airline like Norwegian has three levels of Wi-Fi provision on its 737–800 models.[8] In salience theory, firms can use decoy goods to focus consumers' attention on the "correct" attribute (see Herweg, Müller, & Weinschenk, 2018).

In departing from the strict confines of rationality, one opens up the black-box of decision making. In psychology, cognitive frames create simplified models of choices, by focusing attention on a narrow content of the perceived attributes of the choice. A cognitive frame can thus create expectations about the price or quality of a good, and this can be influenced by the information momentarily on offer to the consumer (Houdek, 2016). Faced with much information, and many choices, a consumer may first decide which options to consider, and then which of these to choose. Hence, a seller must alert consumers of its product in some way before it can be chosen, i.e. it must draw the consumers' attention. In their analysis of stock purchases, Barber and Odean (2007, p. 785) state: "Attention is a scarce resource. [……] options that attract attention are more likely to be considered, hence more likely to be chosen". A good example from the transport sector is low-cost airlines promoting a no-frills service, wanting passengers to focus attention on the low fare. In the World Airline Awards for 2018, Air Asia was voted the top best low-cost airline[9]; the web page of Air Asia proclaims "You're going to love our deals. Get low fares to over 140 destinations".[10] Its Skytrax quality rating is three stars (out of a maximum five), denoting an industry average of acceptable product and service standards.[11] No low-cost airline achieves the five star quality rating; ten full-service airlines currently have this rating, eight of these are based in Asia, one in Europe and one in the Middle East. One of the current advertising slogans of Qatar Airways is "Experience a journey like never before" which is designed to draw passengers' attention to the quality of journey, not the fare. Airlines and transport operators in general can hence try to set fare and/or quality in order to influence the purchase decisions of passengers. The attribute to which a consumer's attention is drawn is referred to as "salient", and is given disproportional weight in the decision making process (Taylor & Thompson, 1982). Salience is one of the dimensions considered in the overview by Metcalfe and Dolan (2012) of how behavioral economics in general may affect research in the field of transport; this is also part of the policy of the UK Department for Transport in their "Behavioral Insights Toolkit" (DfT, 2011).

Bordalo, Gennaioli, and Shleifer (2013) have developed a formal model of how consumers make choices when an attribute is salient to the decision, and Bordalo, Gennaioli, and Shleifer (2016) extend this to a competitive setting in which duopolists make decisions about price and product quality. It is this latter model that we utilize here to analyse competition between transport operators who attempt to draw passengers' attention to the attribute in which they have an advantage. We make a modest extension to the model by introducing an initial journey value (net of time costs) that can then be augmented by operators' quality choices. Not only do operators need to make their decisions to maximize profits given the strategic response of the rival, they must also ensure that passengers focus attention on the "correct" attribute. By reducing fare, a low-cost carrier may be able to make passengers focus on that attribute even though the rival is offering greater quality; a high quality carrier may consider lowering its price towards the rival in order that its low fare does not attract attention, focusing rather on the higher quality.[12] We investigate the consequences of this line of thinking for both the fare and the quality level, and compare with the rational

[3] Quality has many dimensions in practice such as frequency or capacity (De Borger & Van Dender, 2006) or congestion (Wan & Zhang, 2013; Wu, Yin, & Yang, 2011).

[4] Another departure from rational decision making by transport passengers has been analyzed by Avineri (2004) for decisions made under uncertainty.

[5] Gärling (1998) discusses the limitations of the rational model for modeling travel-choice decisions.

[6] See https://www.inmarsataviation.com/en/benefits/passenger-experience/connecting-with-passenger-preferences.html.

[7] Avoiding extreme options may also be familiar to customers choosing wine in a restaurant, where the most popular choice is often the second cheapest bottle (McFadden, 1999, p. 98).

[8] See https://www.norwegian.com/uk/travel-info/on-board/wifi/.

[9] See https://www.worldairlineawards.com/worlds-best-low-cost-airlines-2018/.

[10] See https://www.airasia.com/en/gb.

[11] Details of the ranking system can be found at https://skytraxratings.com/about-airline-rating.

[12] This reasoning has a link to the signaling literature which derives from Spence (1974; 1973) and asks, under what conditions, in a competitive marketplace, sellers of above-average quality products will signal this fact by taking some costly action. According to this literature, signaling costs differentials represent a competitive advantage for high-quality firms.

outcome in which salience is not a feature of decision making. We show also that the higher the initial net journey value is, the lower will be the quality augmentation chosen by the operators.

We apply a two stage model. In the first stage of competition, operators decide which level of quality to provide at a cost, and then in the second stage they set fares, taking quality as given. We show that the type of equilibrium achieved depends upon the unit cost of provision of the service and the initial level of journey utility. When unit cost is low, the equilibrium is such that quality is undersupplied relative to the rational level, and operators compete by setting low fares (fare-salient equilibrium); for high unit costs of provision, operators oversupply quality in order to make passengers focus on this attribute since the fare must be high to cover costs (quality-salient equilibrium). Knowledge about these market relationships is relevant both for the operators competing in the market and the authorities intervening the market to achieve the overall objectives.

The paper is organized as follows. Section 2 presents the framework for consumer decisions based on salient thinking developed by Bordalo et al. (2013; 2016) to a transport market. Section 3 shows how fares are determined in a simple transport market where customers are salient thinkers Investment in quality is discussed in Section 4. Section 5 extends the model to the case of continuous demand, showing that the preceding analysis is robust. Implications for transport markets are contained in Section 6, and Section 7 concludes.

2. Salient preferences

Here we adapt the model of Bordalo et al. (2016) to a transport market. There are two operators, and each provides a different version of a transport service; the service is characterized by an exogenously given journey time (t_i), and an exogenously given production cost (c_i). The value to a passenger of undertaking a journey with carrier $i = 1, 2$ is ϕ_i, and can reflect the fact that a journey gives both goal and process utility as in the literature on cognitive psychology (Gärling, Axhausen, & Brydsten, 1996). As is common in transport models, the passenger endures a generalized cost of the journey (G_i) which consists of the fare paid (P_i) and the time cost (t_i): $G_i = P_i + t_i$ (see e.g. Button, 2010). The time cost may itself depend upon factors such as trip distance, frequency, check-in procedures and other quality factors. Denote $v_i = \phi_i - t_i$ as the net value to the passenger derived from undertaking the journey with operator i. The utility of a rational passenger (R) from travelling with operator i is given by

$$U^R(v_i, P_i) = v_i - P_i. \tag{1}$$

The rational passenger is characterized by attaching the same weight to the net journey value and fare in (1), whilst a salient thinking passenger will give different weights to the components in (1) depending on whether net journey value or fare is the salient attribute. Bordalo et al. (2013; 2016) use a salience function to measure the relative importance of each element in the utility function; in essence, the characteristic that is salient is the one which is further away from a reference point since this is the one that will grab attention. It is natural to think of the average net journey value and average fare as a reference point: $\overline{v} = \frac{v_1+v_2}{2}$; $\overline{P} = \frac{P_1+P_2}{2}$. The salience function $\sigma(x, y)$ satisfies two main properties: ordering and homogeneity of degree zero. Ordering states that the salience of a characteristic is lower in a small interval than a larger one: for an interval $[x, y]$ that is contained in a larger interval $[x', y']$ we have that $\sigma(x, y) < \sigma(x', y')$. Homogeneity of degree zero implies that $\sigma(\alpha x, \alpha y) = \sigma(x, y)$ for $\alpha > 0$, which means that the salience of an attribute is independent of its unit of measurement. A salience function that satisfies ordering and homogeneity of degree zero implies also diminishing sensitivity in the sense that the same distance to the average gives lower salience at higher levels of the attribute.[13]

The salience of net journey value for operator i is given by $\sigma(v_i, \overline{v})$, and the salience of fare by $\sigma(P_i, \overline{P})$; fare (net journey value) is salient if $\sigma(P_i, \overline{P}) > (<) \sigma(v_i, \overline{v})$. Furthermore, Bordalo et al. (2016) impose symmetry on the salience function in order to give tractability in a model of competition with salient thinkers: $\sigma(a_1, \overline{a}) = \sigma(a_2, \overline{a})$, $a = \{v, p\}$. This means that any attribute is equally salient for both services. Bordalo, Gennaioli, and Shleifer (2012) give the following example of a symmetric salience function that satisfies ordering and homogeneity of degree zero: $\sigma(a, \overline{a}) = \frac{|a-\overline{a}|}{\overline{a}}$. Here salience is measured as the proportional difference from the average value of an attribute. This is illustrated in Fig. 1, which also demonstrates the ordering property.

For $\delta \in [0, 1]$, the utility of a salient thinking passenger (S) from service $i = 1, 2$ is given by

$$U^S(v_i, P_i) = \begin{cases} v_i - \delta P_i & if \quad \sigma(v_i, \overline{v}) > \sigma(P_i, \overline{P}) \\ \delta v_i - P_i & if \quad \sigma(v_i, \overline{v}) < \sigma(P_i, \overline{P}) \\ v_i - P_i & if \quad \sigma(v_i, \overline{v}) = \sigma(P_i, \overline{P}) \end{cases} \tag{2}$$

When $\delta = 1$ preferences coincide with (1), but otherwise the passenger places most weight on the attribute that he regards as salient. In the first line of equation (2), the salience function is largest for net journey value, implying that this is further from the average than operator i's fare. Hence, net journey value is salient, and passengers place more weight on this attribute in their utility function than on fare. In the second line of (2), fare is the salient attribute, and the passenger places less weight on net journey value in making a decision. The final line in (2) depicts the case in which net journey value and fare are equally salient which gives the same utility function as in (1), the rational case. In this sense, the salient thinking model encompasses the rational one, which is a special case. Passengers are all identical for model tractability.

With preferences given by (1) and two transport alternatives, a rational passenger will choose to travel with operator 1 if $v_1 - P_1 > v_2 - P_2$. Suppose that operator 1 has higher quality and a higher fare than 2, then this condition is $\frac{v_1-v_2}{P_1-P_2} > 1$. The more expensive service is chosen if

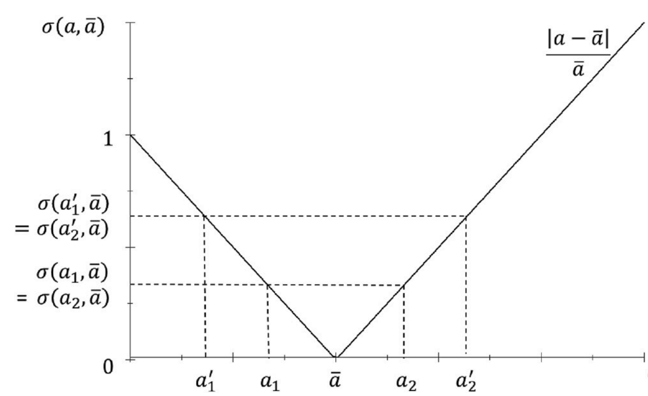

Fig. 1. The salience function.

[13] The salience function is a mathematical representation of the Weber-Fechner law (see Nielsen, Sebald, & Sørensen, 2018). Weber's principle states that the perception of the difference in magnitudes of two stimuli is measured by the ratio of the large one to the small. Fechnerian sensitivity implies that changes in stimuli are perceived with diminishing sensitivity. See Ellis and Masatlioglu (2019) for an axiomatization of the salience function.

the difference in net journey value outweighs the mark-up in fare. This comparison will not be affected by a common change in the net journey values, or fares. Suppose that the building of a new bridge, or better facilities for check-in and security control at airports, reduces journey time for each operator so that the new net journey value is increased by the same amount for each operator, then the difference $v_1 - v_2$ is unaffected as is demand. Similarly, demand is not changed if both fares increase or decrease by the same amount.

Suppose now that passengers are salient thinkers and their preferences are given by (2). If $\frac{v_1 - v_2}{P_1 - P_2} > \frac{1}{\delta}$, then the difference in quality is high compared to the price mark up and the salient thinker prefers service 1. Similarly, if $\delta > \frac{v_1 - v_2}{P_1 - P_2}$, then the salient passenger prefers service 2. In both of these cases, the choices of the rational passenger and the salient thinking one coincide. For intermediate values, $\delta < \frac{v_1 - v_2}{P_1 - P_2} < \frac{1}{\delta}$, then the choice made by the salient thinker depends upon which attribute that is salient, and the choice may diverge from the rational passenger. Bordalo et al. (2013) show that homogeneity of the salience function implies that the salience of attributes is determined by the ratio of the net journey quality to fare ratio. In our case above, net journey value (fare) is salient if $\frac{v_1}{P_1} > (<) \frac{v_2}{P_2}$; the passenger chooses the service that has the highest net journey value to fare. In stark contrast to the rational case above, a common fare change or change in net journey value can lead consumers to shift demand from one service to the other. Suppose for example that the government imposes a seat levy of L on all airlines, increasing both fares to $\widetilde{P}_i = P_i + L$. It was established above that this does not affect the decision of a rational passenger. However, this common fare increase can change the salience ranking across attributes, which will cause a demand shift in a salient thinking passenger. Suppose initially that fare is salient, i.e. $\frac{v_2}{P_2} > \frac{v_1}{P_1}$; after the introduction of a common seat levy, quality will be salient if $\frac{v_1}{\widetilde{P}_1} > \frac{v_2}{\widetilde{P}_2}$ which can occur if $L > \frac{v_2 P_1 - v_1 P_2}{v_1 - v_2}$. A large enough fare increase makes passengers less sensitive to this attribute by diminishing sensitivity, and a salient thinking passenger can shift demand to the more expensive, high quality service even though both have experienced the same rise in fare. A shift in demand can also result from a common reduction in journey time mentioned above. Dertwinkel-Kalt, Kökler, Lange, and Wenzel (2016) test this property from salience theory in a laboratory setting, finding strong support for the phenomenon.

A further implication of the Bordalo et al. (2013) theory of consumer choice is that expanding the choice set may change the salience ranking. Ariely (2008) presented MBA students with two types of subscription for The Economist magazine: 1. A web subscription for $59 and 2. A print and web subscription for $125. Faced with these options, 32% chose option 2. Then a third option was introduced: 3. Print subscription for $125. This is clearly a dominated offer, and should not change the choices of rational decision makers. However, faced with three options, 84% now chose option 2. Option 3 is a decoy product which plays no role in rational decision making, but which can be used to change consumers' saliency ranking in the theory of Bordalo et al. (2013) since it changes the reference point from which salience is measured.[14] An airline will often offer an economy ticket, a more expensive premium package, and an economy plus ticket close in price to the premium package. In choosing between the economy and premium package, the large fare difference may catch the attention of passengers. Adding the intermediate option can make the passenger focus less on price, and more on the high quality of the premium deal, making it seem like a good option compared with the slightly cheaper economy plus ticket. Another manifestation of this is the compromise effect first discussed by Simonson (1989). The case of airline internet provision mentioned in the Introduction is an example of this; faced with basic and premium coverage, many passengers may resort to the cheap option. Adding an intermediate option may be seen by consumers as a compromise, making them willing to pay more for higher quality, even though they still do not choose the most expensive option.

We now consider how salient thinking passengers affect competition between transport operators.

3. Competitive fare setting

Transport operators compete by setting fares, given passengers' perceived utility represented by (2) and the cost of providing the services. Suppose that a train operator and a bus company compete to take passengers between two towns, and that the journey time is shorter by train (i.e. a larger net journey value for the passenger from train transport). Hence, one can surmise that the train company will want to set its fare quite close to the bus company in order to highlight the difference in net journey value from the two transport modes. The bus company, on the other hand will try to set its price a good deal lower than the train fare in order to distract the consumers' attention from the difference in net journey value. Intuitively, each operator wants their favoured attribute to grab the attention of the passengers.

To translate the preferences of passengers in (2) to a demand function, we assume that total demand is given by measure one. Since all passengers are identical, they will choose the mode of transport that gives them the most utility in (2). Demand for operator i's service will depend upon net journey values and fares also of the rival j: $d_i(v_i, P_i, v_j, P_j)$, with $d_j = 1 - d_i$ and $i \neq j = 1, 2$. Suppose that $U^S(v_i, P_i) = U^S(v_j, P_j)$ and that $P_i > c_i,\ P_j = c_j$. Then operator i is the only operator that can reduce its fare, and still make a profit, and an infinitesimal reduction in i's fare will allow it to capture the whole market: $d_i = 1,\ d_j = 0$.

Given the demand function, each operator sets its fare in order to maximize profit given by $\pi_i = d_i(P_i - c_i)$. As in Bordalo et al. (2016), it is instructive to start with the rational case ($\delta = 1$) as a benchmark, before going on to analyse the role of salient thinking. Suppose that operator 1 gives the consumer the weakly largest net journey value ($v_1 \geq v_2$) at a weakly higher cost ($c_1 \geq c_2$), and furthermore that $v_1 - c_1 > v_2 - c_2$ so that operator 1 creates the largest surplus. Then this operator can always undercut the fare of the rival in order to capture the whole market; hence, operator 2 can do no better than setting its fare equal to its production cost, earning a profit of zero. Operator 1 will then set its own fare in order to ensure that a rational consumer is just indifferent between the two services[15]: $v_1 - P_1 = v_2 - c_2$ which gives $P_1 = c_2 + (v_1 - v_2)$. Operator 1 sets its fare at a premium above the fare of 2 with the premium given by the utility difference between the two services. Operator 1 serves the whole market in equilibrium, making a positive profit of $\pi_1 = (v_1 - c_1) - (v_2 - c_2)$. In the case that $v_1 - c_1 < v_2 - c_2$, then it is operator 2 that provides the largest surplus (in spite of the fact that operator 1 gives weakly most net journey value). Then $P_1 = c_1$, $P_2 = c_1 - (v_1 - v_2)$, $\pi_1 = 0$, $\pi_2 = (v_2 - c_2) - (v_1 - c_1)$. Here, operator 2 prices below the cost of the rival, capturing the whole market. Finally, when both operators produce the same surplus, we have the standard Bertrand case under symmetry where each can do no better than set fare equal to own production cost, serving half the market each, and making zero profits.

With the assumptions made on the salience function, net journey value or fare will be salient for both transport services, and Bordalo et al. (2016) show that utility is salient if[16]

$$\frac{v_1}{v_2} > \frac{P_1}{P_2} \tag{3}$$

Here, the net journey value provided by each operator is furthest away from the reference point, so that this is the attribute that stands

[14] Herwig et al. (2018) give a good account of the mechanism here.

[15] By an argument similar to that of Bertrand competition, operator 1 sets its fare infinitesimally under this level to capture the whole market.

[16] This is easily verified by using the symmetric salience function introduced earlier.

out. Suppose that $v_1 > v_2,\ P_1 > P_2$, so that the operator providing the highest net journey value also sets the highest fare. If operator 1 then reduces its fare sufficiently, price becomes less salient, and attention is drawn to the high net journey value of its own service. On the other hand, if 2 reduces its fare, then this makes fare more salient and passengers' attention is more likely to be drawn to the high fare charged by 1. Hence, each operator can use the fare-setting decision to draw attention to the attribute on which its scores most favourably with passengers. Bordalo et al. (2016) call this an "attention externality".

Suppose then that passengers gain greater net journey value from travelling with operator 1: $v_1 > v_2$, and that operator 2 has set a fare of P_2. The pricing problem for 1 is to set as high a fare as possible given the constraints that passengers regard net journey value as salient (inequality (5) below) and prefer the service of operator 1 (inequality (4) below). Using equation (2), the problem is written

$$\max P_1 - c_1$$

s.t.

$$v_1 - \delta P_1 \geq v_2 - \delta P_2 \tag{4}$$

$$\frac{v_1}{P_1} \geq \frac{v_2}{P_2}. \tag{5}$$

Fig. 2 represents the choice problem, in which the lower envelope of constraints (4) and (5) determines the fare of operator 1 given that it covers cost. When 2 sets its fare at $P_2^{'}$ then constraint (5) binds, and setting a fare above $P_1^{'}$ would mean that net journey value would no longer be salient. When 2 sets its fare at $P_2^{''}$ then it is (4) that binds, and setting a price above $P_1^{''}$ would mean that passengers would prefer the service of the rival 2. The dashed line in the figure shows how fare would be set with fully rational passengers. Note that the high provider of net journey value often sets a fare with salient customers above the one that would be set in the rational case; only if P_2 is set very low, would the fare decision of operator 1 be below the rational level indicated by the dashed line in Fig. 2.

For operator 2 that gives the lowest net journey value, the fare-setting decision is designed in order to make price the salient feature:

$$\max P_2 - c_2$$

s.t.

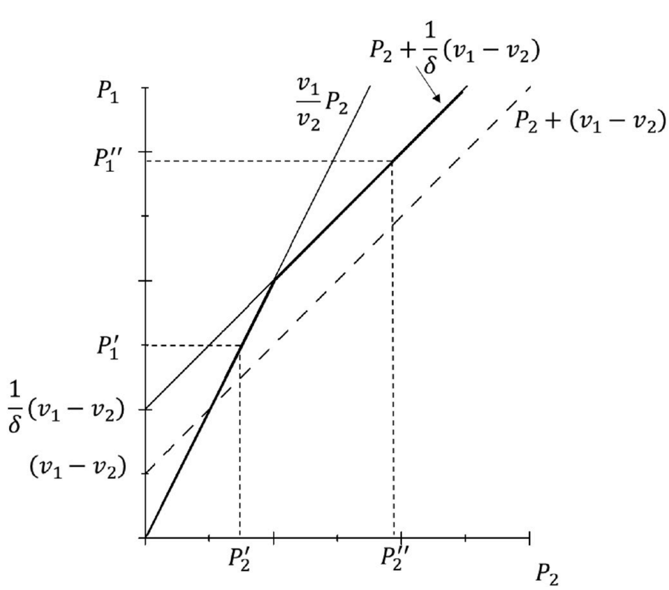

Fig. 2. Optimal fare response of operator 1, ensuring that net journey value is salient.

$$\delta v_2 - P_2 \geq \delta v_1 - P_1 \tag{6}$$

$$\frac{v_2}{P_2} \geq \frac{v_1}{P_1}. \tag{7}$$

The constraint in (7) ensures that passengers regard price as the salient feature, and given this, (6) implies that they gain more utility from this service than that of the rival.

Which attribute is salient depends upon the net journey value to cost ratio of the services. When $\frac{v_1}{c_1} > \frac{v_2}{c_2}$, then the higher net journey value of operator 1 is salient since it can set a sufficiently low fare to make this the case. Operator 2 cannot follow this low fare without making a loss, making it a non-optimal choice. On the other hand, $\frac{v_1}{c_1} < \frac{v_2}{c_2}$ implies that operator 2 – providing lower net journey value – can set a fare sufficiently low to make the fare attribute salient, and this cannot be matched by operator 1 without making a loss. It is convenient to allow salience to fully determine the decision of the passengers, and Bordalo et al. (2016) assume that

$$\frac{1}{\delta}(c_1 - c_2) > v_1 - v_2 > \delta(c_1 - c_2). \tag{8}$$

Assuming (8) means that when net journey value is salient, equation (4) is automatically fulfilled, and that when fare is salient then (6) is fulfilled. With this, the equilibrium of stage 2 (the fare-setting stage) can be stated directly:

Proposition 1. (Bordalo et al., 2016).

With (8) satisfied, and for any parameter values $\delta \in [0,1]$, and $v_1 \geq v_2$, $c_1 \geq c_2$, the following fares are optimal:

(i) *if $\frac{v_1}{c_1} > \frac{v_2}{c_2}$, fares are $P_1 = \min\left\{v_1\frac{c_2}{v_2},\ c_2 + \frac{1}{\delta}(v_1 - v_2)\right\}$, $P_2 = c_2$. Net journey value is salient, demand is $d_1 = 1$, and operator 1 makes positive profits.*

(ii) *if $\frac{v_1}{c_1} < \frac{v_2}{c_2}$, fares are $P_1 = c_1$, $P_2 = \min\left\{v_2\frac{c_1}{v_1},\ c_1 - \delta(v_1 - v_2)\right\}$. Fare is salient, demand is $d_2 = 1$, and operator 2 makes positive profits.*

(iii) *if $\frac{v_1}{c_1} = \frac{v_2}{c_2}$, fares are $P_1 = c_1$, $P_2 = c_2$. Net journey value and fare are equally salient, demand is $d_i = 1$, if $v_i - c_i > v_j - c_j$ and $d_1 = d_2 = \frac{1}{2}$ if $v_1 - c_1 = v_2 - c_2$. Both operators make zero profits.*

The operator that manages to make the attribute salient in which it has an advantage captures the whole market here. Operator 1 with the higher net journey value wants to make this the salient feature of passengers' choices, and prices the service accordingly. Operator 2 provides a lower net journey value, and wants fare to be salient for passengers. Which attribute is salient depends upon the cost per unit net journey value ratios of the two services since $\frac{c_j}{v_j} > \frac{c_i}{v_i}$ implies that operator i can set the fare in order to make its advantage salient. In part (i) of Proposition 1, this is the case for operator 1. To find the optimal fare for 1, we can refer to Fig. 2, setting $P_2 = c_2$, and then reading off the optimal fare from the locus indicated in bold.

As a description of price competition in a transport market, this model is not particularly satisfactory since it predicts that only one operator will serve the market except in the unlikely case depicted in Proposition 1 (iii). In this sense, the model can be deemed similar to the Bertrand model of competition with homogeneous products; this could be the outcome of strictly regulated markets where operators compete to become the only one given a traffic license by the authorities. On the other hand, the model draws attention to the fact that operators think strategically in terms of which attribute of a service it wishes to emphasize. As Fig. 2 indicates, this will usually tend to increase the fare choice of a provider of high net journey value when passengers place sufficient weight on this attribute. This prediction may be sensible for a transport market. The simplicity of the price competition model also allows *interesting predictions involving quality choices made by operators as elaborated on in the next section.*[17]

4. Introducing quality of transport services

4.1. Augmenting journey quality

In a transport market, the net value of a journey to a passenger can be affected by different dimensions of journey quality that influence the inconvenience of making the trip. These may relate to comfort or safety, or can involve speedy check-in procedures or free food or beverages. Let us denote the quality augmented net value of a journey with operator i by $V_i = v_i + q_i$ where $q_i \geq 0$ is journey quality, coming at a cost of $k_i(q_i)$, which is an increasing convex function with $k_i(0) = 0$. Hence the total cost of providing service i consists of the unit cost and quality cost: $C_i = c_i + k_i(q_i)$. With these cost and journey utility definitions, assuming that (8) holds for (V_i, C_i), then the result from the fare-setting subgame is still given by Proposition 1; here (v_i, c_i) are replaced by (V_i, C_i). Suppose that we are initially in a situation in which $\frac{V_1}{C_1} = \frac{V_2}{C_2}$ so that Proposition 1 (iii) indicates that both services are priced at cost and neither operator makes a positive profit. If operator 1 can increase quality proportionately more than this increases cost so that $\frac{V_1}{C_1}$ increases, then Proposition 1 (i) indicates that net journey value (now given by the quality augmented measure V_i) becomes salient and operator 2 can do no better than price at cost, whilst operator 1 now makes a positive profit. In such a situation, operator 1 has an incentive to increase the quality of its service. On the other hand, if the increase in quality costs proportionately more than the increase in net journey value, then $\frac{V_1}{C_1}$ will fall and Proposition 1 (ii) shows that fare will now be salient and the lower quality provider will set fare in order to exploit this, drawing attention to the high fare of service 1. Operator 2 will earn positive profits in this case. It should be clear that each operator faces this dilemma when determining the optimal level of quality. We now look at how quality choices are made, first by symmetric operators, and then for the case of asymmetry.

4.2. Symmetric operators

Suppose that we introduce a stage at which the operators set their quality simultaneously at stage 1 and then at stage 2 set fares. To determine the level of quality chosen by the operators, consider first the symmetric, rational case in which $v_1 = v_2 = v$, $c_1 = c_2 = c$, $k_1(q) = k_2(q) = k(q)$, $\delta = 1$. Bordalo et al. (2016) show in this case that the operators set quality at the rationally optimal level, q^*, in order to maximize surplus $v + q - c - k(q)$, implying $k'(q^*) = 1$, with fares set at cost $P_1 = P_2 = c + k(q^*)$, sharing the market equally. This is a standard result in which the quality chosen is determined purely by the condition that the marginal cost of a quality increase is equal to the increment in utility. Chosen quality is hence independent of the unit cost c and the initial net journey value v.

Retaining the case of symmetry, but now assuming salient thinkers ($\delta < 1$), we can consider the incentives to raise quality. As discussed above, from a symmetric situation, it can be profitable for an operator to increase quality if this increases $\frac{V_i}{C_i}$, making net journey value the salient attribute. The derivative of this with respect to quality is

$$\frac{\partial}{\partial q_i}\left(\frac{v + q_i}{c + k(q_i)}\right) = \frac{c + k(q_i) - (v + q_i)k'(q_i)}{(c + k(q_i))^2} \tag{9}$$

It is immediate that (9) is increasing if

$$\frac{c + k(q_i)}{v + q_i} > k'(q_i). \tag{10}$$

The left-hand-side of (10) is the average cost per unit of net journey value, whilst the right-hand side is the marginal cost of quality. If (10) holds at the rational equilibrium ($q_i = q^*$), then an operator may find it profitable to increase quality from this point as long as average cost is larger than marginal cost. This implies that a deviation from first-best quality may be optimal, and quality can be oversupplied. Intuitively, an increase in quality adds little to cost, so that fare will not increase much. Salient thinkers will focus on the quality increase allowing this operator to capture the market. If, on the other hand, the inequality in (10) is reversed at the rational equilibrium then it can be profitable to reduce quality from the first-best level. Such a reduction leads to a large cost saving, so that the fall in quality can be outweighed by a large drop in fare. Salient thinkers focus on fare, and quality is undersupplied in relation to the first-best outcome.

The fact that passengers are salient thinkers implies that operators will have an incentive to deviate from the quality level that would be chosen when passengers are rational. The temptation to exploit the salient thinking of the passengers lies in the fact that adjusting quality changes the net journey value-to-cost ratio. When we reach a point at which changing quality no longer affects this ratio, the temptation disappears and we have an equilibrium level of quality. This occurs when (10) becomes an equality, so that the average cost per unit of net journey value equals the marginal cost of quality provision, i.e. for $\widehat{q}$ where

$$\frac{c + k(\widehat{q})}{v + \widehat{q}} = k'(\widehat{q}). \tag{11}$$

Equation (11) defines the optimal quality as $\widehat{q}(c, v)$. There is a clear deviation in the optimal quality when passengers are salient thinkers as compared to the rational case since quality now depends upon both the unit cost of the service and the initial net value from undertaking a journey, v; the rational quality choice simply solves $k'(q^*) = 1$ as noted previously. Note that the optimal level of quality defined in (11) is that which minimizes the average cost per unit of quality augmented net journey value ($\frac{v+q}{c+k(q)}$), giving operators a simple rule for optimal quality determination. From (11) one can calculate the following comparative static effects:

$$\frac{\partial \widehat{q}}{\partial c} = \frac{1}{(v + \widehat{q})k''(\widehat{q})} > 0; \quad \frac{\partial \widehat{q}}{\partial v} = \frac{-k'(\widehat{q})}{(v + \widehat{q})k''(\widehat{q})} < 0. \tag{12}$$

The higher the unit cost of the service, the more quality that is supplied by the operators, who want passengers to focus on this attribute rather than the high fare necessitated by high costs. Hence, airlines will offer visible add-ons such as seating with extra leg room, food and beverages, free wi-fi, priority boarding etc. Services that have a low unit cost will have a low level of quality since operators in this case want passengers to focus on the low fare. When the net value of a journey without quality add-ons is already high – in our case due to a short journey time – operators will not invest in so much quality since they want the low price of the short journey to be salient. Long journeys, with low net journey value, will have a higher quality service in order to improve the standing of the services with salient thinking passengers.

There is a maximal quality level, above which $\widehat{q}(c, v)$ will no longer be the optimal choice for operators; they will not wish to increase quality above the level that maximizes the total surplus when quality is salient. This level is such that $(v + q) - \delta(c + k(q))$ is maximized; denote this by $\overline{q}$ where $k'(\overline{q}) = \frac{1}{\delta}$. In addition, quality will not be supplied below the level $\underline{q}$ that maximizes total surplus when price is salient $\delta(v + q) - (c + k(q))$, i.e. where $k'(\underline{q}) = \delta$.

4.2.1. An example

Suppose that the cost of quality is given by the specification $k(q) =$

[17] Section 5 also presents a version of the model with continuous demand so that both operators may coexist in the market.

$\frac{Kq^2}{2}$ where $K > 0$ is constant. Then we can use Bordalo et al. (2016),[18] to work out the symmetric level of quality provision with salient thinkers as

$$q^S = \begin{cases} \frac{1}{\delta K} & \text{if} \quad c > \bar{c} \equiv \frac{1}{2K\delta^2} + \frac{v}{\delta} \\ \sqrt{\frac{Kv + 2c}{K}} - v & \text{if} \quad c \in [\underline{c}, \bar{c}] \\ \frac{\delta}{K} & \text{if} \quad \frac{\delta^2}{2K} + \delta v \equiv \underline{c} > c \end{cases} \tag{13}$$

where the bounds ensure that $\bar{q} > q^* > \underline{q}$. The symmetric choice of quality when facing salient thinking passengers is illustrated in Fig. 3. In this symmetric equilibrium, both operators set fares at cost $P_1 = P_2 = c + k(q^S)$, and share the market equally.

As the operators and their services are identical in this equilibrium, operators price at cost and share the market equally. Several features of the equilibrium are noteworthy, however. As noted above, there is a positive relationship between unit operating costs and the provision of quality for some cost levels. Two low cost operators who compete against each other (e.g. Ryanair and Easy Jet) will hence provide low quality; low costs lead to low fares and fare becomes salient, so that the low quality draws attention to the low fare. If the competitors have higher unit costs (e.g. British Airways and Lufthansa), then they will offer quality upgrades to passengers in order to draw attention away from the fact that they must charge a high fare to cover operating costs.

In Fig. 3, note that the upper bounds for the quality choice do not depend on the initial net journey value v, and that the level of quality in the first-best rational case is constant for all values of unit cost c. The choice of quality between the upper and lower bounds is dependent on initial net journey value, however, and two examples are drawn in Fig. 3 for $v = v_0$ and $v = v_0 + \Delta$, $\Delta > 0$. In both cases, quality is an increasing function of the unit cost, and we can see that for high enough levels of c, quality is oversupplied in relation to first-best, and for sufficiently low levels of unit cost it is undersupplied; for initial net journey value v_0, $c > (<) \hat{c}(v_0)$ implies oversupply (undersupply) of quality in relation to the rational equilibrium. Fig. 3 also illustrates the point made above that quality is decreasing in the initial net journey value since $\hat{q}(c, v_0 + \Delta)$ lies below $\hat{q}(c, v_0)$. As initial net journey value increases, it is also the case that the range of unit costs increases for which quality is undersupplied

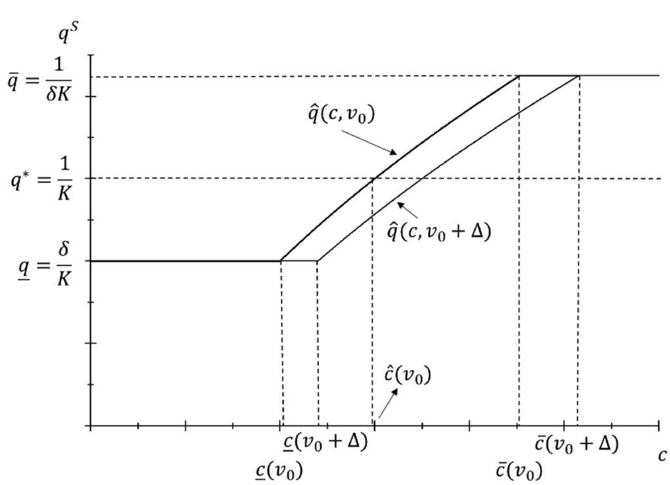

Fig. 3. Optimal choice of quality in the symmetric case.

in relation to first-best. This follows since $\hat{q}(c, v_0 + \Delta)$ lies to the right of $\hat{q}(c, v_0)$, so that unit costs between the two curves face undersupply of quality with the higher initial net journey value, whilst they lead to oversupply when initial journey value is lower. Note also that the degree to which the salient passengers overweigh the salient attribute (δ) affects only the upper and lower bounds for quality, not the optimally provided level for the operators. The larger is this parameter, the smaller the spread of quality around the rational, first-best level. Hence, transport operators do not need to know the exact degree of "irrationality" of its passengers in making its optimal quality choice, given that this is within the upper and lower bounds.

4.3. Implications for policymakers

Suppose that a transport regulator wishes to implement a minimum level of quality, and based on the usual calculation, ignorant of the fact that passengers weight net journey value and fare differently, he then sets the rational solution q^* as the minimum desired quality level. Fig. 3 makes clear, however, that this is not optimal for operators for many levels of unit cost when one takes account of the fact that passengers in the market are salient thinkers. When initial net journey value is v_0, operators with a cost below $\hat{c}(v_0)$ must increase quality above the optimal level; this could be interpreted as a penalty to efficient running of the service, since high cost operators (above $\hat{c}(v_0)$) will not be affected by the minimum quality standard. Fig. 3 also illustrates what can happen if the regulator decides to give a subsidy to the running of the service, effectively reducing the unit cost c. Where quality is provided at the lower bound, this will have no effect on the level of quality supplied. Otherwise, the subsidy will lead to (weakly) lower levels of quality. When the unit cost is lower, fare becomes more salient, and quality falls in order to draw attention to the lower fare. On the other hand, implementing regulation that increases the unit cost (such as an extra congestion tax on busses, or landing fee on aircraft), will lead to weakly more quality being offered by the operators. Fares must increase due to the cost rise, making quality augmented net journey value more salient. Quality provision increases to draw attention to this attribute and away from the higher fare.

When the marginal cost of providing quality decreases, then the rational, first-best level of quality increases. This is also true for the case of salient thinking passengers. Using the parameterized example in (13), a decrease in K will cause a larger increase in quality provided when passengers are salient thinkers compared to the rational case when $c > \tilde{c} \equiv \frac{1+\sqrt{K^2v^2+1}}{K}$; it can readily be established that this level of unit cost is higher than that at which $q^* = \hat{q}(c,v)$, illustrated as $\hat{c}(v_0)$ in Fig. 3 for initial net journey value v_0. Hence, the increase in quality with salient thinking passengers is larger than in the rational case as long at quality is sufficiently overprovided before the reduction in the marginal cost of quality.

4.4. Asymmetric cost of quality provision

From the symmetric equilibrium that underlies (13), it is possible to ask what would happen if one of the operators – say 1 – has a lower cost of providing quality than the rival. Suppose that the cost of providing quality for operator 1 is now $k_1(q_1) = \frac{K_1 q_1^2}{2}$, $K_1 < K$. Bordalo et al. (2016) show that in the new equilibrium that operator 2 can do no better than retaining the level of quality established in (13). Operator 1 will always be able to capture the whole market now since it can provide the same level of quality as the rival at a lower cost, which in turn means that it can charge a lower fare and service all customers. Given the assumption that operator 2 with high cost does not change its quality level, Fig. 4 illustrates the quality choice of operator 1. The high cost operator earns zero in this equilibrium, and cannot do better by choosing another level of quality, rendering the quality in (13) a best response, and indicated by

[18] Proposition 2 and Corollary 1 in Bordalo et al. (2016).

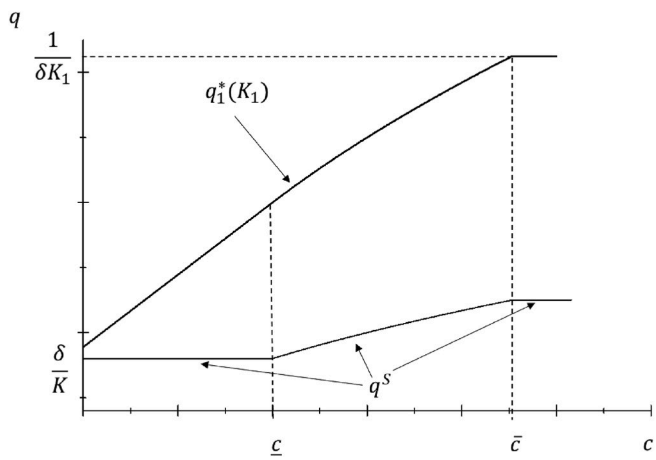

Fig. 4. Effect on quality of a cost reduction for operator 1.

q^S in Fig. 4.

The new level of quality provided by operator 1 is shown by $q_1^*(K_1)$ where

$$q_1^*(K_1)=\begin{cases}\dfrac{1}{\delta K_1} & if \quad c>\bar{c}\\ \dfrac{K}{K_1}q^S & if \quad c\in[\underline{c},\bar{c}]\\ \dfrac{2Kc+\delta^2}{2K_1(vK+\delta)} & if \quad \underline{c}>c \text{ and } K_1<\dfrac{\delta K}{2(vK+\delta)};\ \dfrac{\delta}{K} \text{ otherwise}\end{cases} \tag{14}$$

Whilst it is clearly the case that the lower cost operator will provide more quality for sufficiently high unit cost of provision ($c\geq\underline{c}$), this is not necessarily true for $c<\underline{c}$. The first two lines in (14) make clear that quality increases for very high and intermediate levels of the unit cost, and for these intermediate levels, quality of 1 is a fixed multiple of that of the higher cost rival. For these intermediate unit cost levels, the quality provided by 1 is an increasing concave function of unit cost. For low levels of the unit cost, the third line in (14) indicates that the quality provided by 1 is a linear function of c. This lies wholly above $q^S=\frac{\delta}{K}$ if

$$K_1<\frac{\delta K}{2(vK+\delta)} \tag{15}$$

as indicated by the third line in (14). In other words, if the new marginal cost of quality for operator 1 is sufficiently small then $q_1^*(K_1)>q^S$ for all levels of the unit cost. The more efficient provider of quality increases quality enough to make net journey value the salient attribute for passengers, and the low cost means that this does not involve a large price hike. This is the situation depicted in Fig. 4. When (15) is not fulfilled, and the marginal cost reduction is modest, then the lower cost provider of quality keeps the same level of quality as before ($\frac{\delta}{K}$), as indicated at the end of line three of (14). Each operator sets its fare at $P_1 = P_2 = c+k\left(\frac{\delta}{K}\right)$, i.e. the same price as before the cost decrease. Since operator 1 has lower cost, it can set its fare slightly below this level so that it serves the whole market, making a positive profit.

These results stand in stark contrast to those that occur if passengers are fully rational ($\delta=1$). In this case, the quality provided by the operators would maximize surplus so that $q_1^*(\delta=1)=\frac{1}{K_1}>q_2^*(\delta=1)=\frac{1}{K}$ with quadratic costs of quality provision. Hence, operator 2 keeps quality at the same level, whilst that of 1 is increased. The level of quality does not depend on the initial net journey value or the unit cost of the service. Assuming that passengers are salient thinkers gives a link between the provision of quality, the unit cost of service provision, and the initial net journey value.

5. Continuous demand

As noted previously, the fare-setting model is not completely satisfactory for modelling a transport market since it precludes the coexistence of both operators; one operator would – according to the model – usually evolve to be a monopoly. This was a feature of the standard Bertrand pricing model for homogeneous products that was changed by assuming continuous demand for horizontally differentiated products (Singh & Vives, 1984). Similarly, Bordalo et al. (2016) show that their model can be adapted to a continuous demand framework.[19] Rather than assuming that products are different, they introduce the notion that different consumers can have different perceptions of salience, i.e. some may focus more on quality differences than others. Formally, the heterogeneity in salience perception is modelled stochastically, where the difference in randomness between consumers is distributed as a logistic function.[20] This gives rise to a version of the multinomial logit demand function first introduced by McFadden (1973). Bordalo et al. (2016) show that the market of size one will be divided by operators depending upon the ratios of fares $\left(r_P=\frac{P_1}{P_2}\right)$ and quality augmented net journey values $\left(r_V=\frac{V_1}{V_2}\right)$:

$$D_1=\frac{1}{1+e^{\frac{1}{\beta}Z(r_P-r_V)}},\quad D_2=\frac{1}{1+e^{-\frac{1}{\beta}Z(r_P-r_V)}} \tag{16}$$

where $Z=\frac{2}{(r_V+1)(r_P+1)}$, and $\beta>0$ is the scale parameter of the distribution underlying the randomness in salience. It is straightforward to verify that operator 1 has the larger demand for its service if net journey value is salient ($r_V>r_P$). When $\frac{1}{\beta}$ is low then the difference in the ratio of fares and net journey values (i.e. salience) plays little role in passengers' choice of service; when $\frac{1}{\beta}$ is large, then deviations from equal salience has a large effect on demand, giving scope to the operators to adjust their net journey value-to-fare ratios in order to capture a larger share of the market. At the fare-setting stage, each operator maximizes profit $D_i(P_i-C_i),\ i=1,\ 2$ for a fixed level of quality. As in the previous section, we simplify to the symmetric case in order to analyse the optimal choice of quality for the operators. The decision facing operator 1 is then to choose fare to maximize profit which gives the following first-order condition

$$\frac{2}{\beta}\frac{(P_1-C_1)}{P_2}\frac{e^{\frac{1}{\beta}Z(r_P-r_V)}}{(r_P+1)^2}D_1=1. \tag{17}$$

Evaluating this at a symmetric situation gives the optimal fare as

$$P=C\,\frac{1/\beta}{1/\beta-4}. \tag{18}$$

The solution requires of course $\frac{1}{\beta}>4$ so that passengers are sufficiently sensitive to differences in the net journey value-to-fare ratio. If they are infinitely sensitive to these differences ($\beta\rightarrow0$), then the fare is equal to cost as in the Bertrand model. Turning to the quality determination stage, (18) can be rewritten to depend upon the quality chosen since $C=c+k(q)$ so that

$$P(q)=(c+k(q))\,\frac{1/\beta}{1/\beta-4}. \tag{19}$$

With quality choices q_i, we can write $r_P=\frac{c+k(q_1)}{c+k(q_2)}$, $r_V=\frac{v+q_1}{v+q_2}$ and operator

[19] This is demonstrated in the online appendix accompanying their paper.

[20] The random component of salience is modelled as a Gumbel distribution, and the difference between two random variables distributed accordingly has a logistic distribution.

1 chooses quality to maximize

$$D_1(P(q_1) - c - k(q_1)). \tag{20}$$

Differentiating (20) with respect to q_1, and evaluating the first order condition at a symmetric situation ($r_P = r_V = 1$, $D_1 = D_2 = \frac{1}{2}$, $q_1 = q_2 = q^*$) gives the optimal quality as

$$k^{'}(q^*) = \frac{1}{1-\beta} \frac{c + k(q^*)}{v + q^*}. \tag{21}$$

This result echoes that found previously in equation (11). Indeed, when passengers are infinitely sensitive to differences in the net journey value and fare ratios ($\beta \to 0$), then (11) and (21) are identical. Taking the case of quadratic quality costs, as β increases towards one, the curve depicted in Fig. 3 moves up, and more quality will be provided for each level of unit cost. As in the previous section, quality provision is increasing in the unit cost, in contrast to the rational case in which it is constant. Hence, the case with continuous demand depicts qualitatively the same situation as before, but now both operators serve the market (with identical market shares in the symmetric case).

6. Implications for transport markets

As acknowledged by Metcalfe and Dolan (2012), transport economists have started to consider behavioural analysis as an framework for passenger decision making. Saliency theory is one possibility that we have expanded on, and which has for example been suggested as one way of informing decisions in the design of taxes (Schenk, 2011), or to improve dietary choices by directing attention towards the healthiness of foods (Hare, Malmaud, & Rangel, 2011). Policymakers in transport markets have directed attention to behavioural analysis (Department for Transport, 2011), and several travel-related companies (e.g. Amadeus and Seatfrog) consider the possibility that passengers make decisions based on heuristics rather than as the result of complex rational utility maximization. The implications of saliency theory for transport markets follow from i) the predictions emanating from the preference structure and ii) operators' fare and quality choices based on salient preferences.

In Section 2, we noted that a salient thinking passenger will make choices according to the value of the net journey value to fare ratio. If this is higher for the high quality operator then the highest quality service is chosen; if the low quality operator has the higher net journey value to fare ratio, then the passenger chooses the cheapest service. A salient thinking passenger will tend to make extreme choices (highest quality or lowest price, depending on which attribute is salient). One possible test of whether passengers are salient thinkers would be to compare competing services by calculating their net journey value to fare ratios, expecting those with the largest values to have a large market share. The framework in Section 2 can also be used by a single operator who is considering different ticket categories. A train operator with a monopoly on a service might attempt to differentiate between consumer groups with respect to fare and net journey value combinations. Adrian (2019) shows, however, that the operator would be less prone to treating consumer groups differently when they are salient thinkers as compared to the rational version of price discrimination.

Saliency theory explains two phenomena that are at odds with rational preferences, as noted in Section 2. First, a common change in fare or net journey value will not affect the choice decision of a rational passenger. However, such a change can affect the saliency ranking of the attributes, leading to a shift in demand from one service to another. A further test of the theory would then be to examine the responses of passengers on competing services before and after common changes to the services. The introduction of a (sufficiently large) seat surcharge on airlines will be expected to increase demand of higher quality services relative to low, according to the theory.[21] This demand shift phenomenon is interesting from a policy point of view, since one may consider that a common surcharge imposed on transport operators will not change the nature of competition between them since passengers rationally calculate that the fare differential is unchanged. However, the change may disproportionally harm providers of low net journey value due to the demand-shifting effect; their competitive response – according to the model in Section 3 – could then be to cut fares in order to again make this the salient attribute for customers.[22] Similarly, competition between services may be affected by the provision of a common infrastructure (a new train track, or new bridge for bus traffic) which reduces journey time equally for the services. This general increase in net journey value makes this attribute less salient, and could lead to passengers switching to the lowest fare alternative.

Consider now passengers' reaction to a policy that affects one of the providers in the market. Suppose that a pollution tax is imposed on a diesel bus that serves a route between towns A and B, but this is not imposed on an electric tram service. To the extent that the tax increases fare, a rational response would be for some passengers to substitute to the relatively cheaper service. A salient thinker will not necessarily change decision, however, if the salient attribute is the same before and after the tax; the competitive response of the operator can contribute to this.

Net journey value can be affected by the operators (through quality enhancements for example), by infrastructure providers, or by policy decisions of the transport authority. The novelty in the salient thinking approach is that the decision of the operators to augment quality will depend on the unit cost of providing the service. This is a testable implication of the theory – high cost operators should invest more in quality provision than low cost (British Airways vs Ryanair). According to the theory, operators would tend to reduce quality investments the higher the initial net journey value. If an airport provides check-in and security facilities that save passengers' journey time, the salient response of airlines would be to reduce investments in the quality of the service. Reducing the landing fees of an airline, making the cost of providing the service lower, will tend to increase quality investments by the airline. In both cases, the quality optimal choice will not be affected if passengers are purely rational.

7. Conclusion

Consumers have limited cognitive ability to take account all facets of a decision, and substantial experimental evidence suggests that we make relative comparisons that are context-specific rather than just absolute ones that underlie the rational utility model. This gives rise to the possibility that an attribute of a product may stand out by being further away from a reference point than others. This attribute is then salient in the decision of consumers, and receives more weight in the utility function than rationality would dictate. This gives producers the scope to adjust the attributes of their products in order to capture a larger share of the market, by making the attribute in which it has an advantage salient for consumers.

We have adapted a model of choice under salient thinking to a simple transport market consisting of two operators who provide services that can differ in terms of quality and fare. Initial net journey value can depend upon the goal and process utility of the trip as well as its duration; this basic journey has a fixed unit cost to provide. The net value of a journey can be enhanced by the providers' investing in costly quality

[21] Finding evidence of this provides indirect support for the theory, without of course establishing that passengers are salient thinkers.

[22] A complicating effect here is that the pass-on rate (the degree to which firms pass on changes in taxes to passengers) depends on market structure (see e.g. Jørgensen & Santos, 2014).

improvements. When consumers are rational, they put equal weight on fare and quality in their utility function, and the optimal amount of quality to supply maximizes total surplus. This gives an optimal quality enhancement that is constant, and does not vary with the unit cost of journey provision. When passengers are salient thinkers, then the ratio of the operators' provided net journey value to journey cost is an important variable. When the net journey value provided by operator *i* is greater than operator *j*, and *i* has the higher value/cost ratio, then this operator can set its fare low enough such that this attribute does not stand out between the operators; passengers are thus drawn to the higher quality of operator *i*. Operator *j* may be tempted to lower fare in order to draw attention back to the higher fare of the rival, but cannot do so without making a loss due to the asymmetry in value/cost ratio. Such considerations are not present in traditional models of fare setting, but are an important consideration when passengers are drawn to salient attributes of a transport service. We have demonstrated in the discussion around Fig. 2 that fares will generally be higher when passengers are salient thinkers; the exception is for journeys with low unit costs, where the temptation to make price salient leads to hard competition.

Similar implications follow from the quality decision made by operators. Enhancements of quality that increase the net journey value/cost ratio of a service put the operator in a position to price in order to draw attention to its superior quality as suggested above. An operator can secure an increase in the net journey value/cost ratio if the average cost of a quality improvement is greater than the marginal cost; such operators are candidates to increase quality in order to make this a salient attribute for passengers. The simple case of symmetric operators is instructive for comparing the salient thinking model to the rational one. We show that the type of equilibrium achieved depends upon the unit cost of provision of the service. When this is low the equilibrium is such that quality is undersupplied relative to the rational level, and operators compete by setting low fares (fare-salient equilibrium); for high unit costs of provision, operators oversupply quality in order to make passengers focus on this attribute since the fare must be high to cover costs (quality-salient equilibrium). This is consistent with the case of airlines discussed in the introduction. Low-cost airlines that compete against each other will supply a low level of quality enhancement in order to make passengers focus on price. Full-service airlines that compete against each other have high costs of journey provision and cannot hence charge a low fare. Their response is to enhance quality to make this the feature on which passengers focus, oversupplying quality in relation to the level required by rational passengers. Quality enhancements by airlines are often very visible such as speedy check-in, fast security pass through, free food and drink on board, more leg room, luxurious cabin etc. A simple condition is revealed by the model for determining the optimal level of quality enhancement, since it is the level that minimizes the average cost per unit of quality augmented net journey value. The symmetric model also suggests that the amount of quality enhancement is decreasing in the initial level of the net journey value; operators that provide a journey that already gives passengers a high net value will not invest as much in quality as operators that provide a lower initial net journey value.

When one operator has a cost advantage in providing quality enhancements, it will set a high level of quality in order to induce a quality-salient equilibrium. In our initial formulation of the model this leads to the operator with higher cost of quality being driven out of the market. This is akin to the traditional model of Bertrand price competition with heterogeneous firms which could be the market solution when operators compete for sole rights in regulated markets. As such, the predictions of the model may not be deemed relevant for deregulated transport markets in which we observe co-existence of quite different operators (low-cost airlines and full-service airlines compete on the same routes for example). The basic model may then be more suited to looking at competition between similar operators. Following Bordalo et al. (2016), we considered a version of the model that admits continuous demand, allowing for the coexistence of heterogeneous operators in the same market. The conclusions here are in line with the simple model. The more sensitive passengers are to differences in the net journey value/fare ratio, the closer the quality level from the simple model we come.

Central questions in evaluating the analysis in this paper is to what degree passengers are actually salient thinkers, and to what extent transport providers take this into account in their fare-setting and quality decisions. Suppose that a bus and a ferry serve the same stretch A to B, with the journey time being lower with the ferry, but at a higher fare. If the ferry operator offers a VIP room at a surcharge for some customers with free coffee and sandwiches, then traditionally economists would regard this as a form of price discrimination. An alternative explanation could be that the ferry operator is trying to detract attention from the high fare by enhancing quality for those passengers who may be salient thinkers, and choose the ferry because the quality attribute stands out. Other considerations is whether passengers have differences in the preferences for salience. Some passengers might avoid the ferry completely because they do not want to travel by sea or are afraid of bad weather. Possible avenues for future research are then to investigate empirically whether passengers are salient thinkers, and to analyse to which extent transport service providers take this into account in their strategic interactions.

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