# Do consumers care about how prices are set?

PASCAL COURTY and MARIO PAGLIERO

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ABSTRACT *Using a survey approach, we ask consumers to reveal their preferences over pricing schemes that may differ in terms of the average price of consumption, the amount of price variation, and the probability of being rationed. We find that consumers dislike pricing schemes that vary prices more but that they are willing to trade off price variation and rationing. Surprisingly, they are not willing to trade off an increase in price variation for a decrease in expected prices. We discuss the implications of these findings for firm pricing policies.*

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*Key Words:* Consumer demand; rationing; demand fluctuation; antagonism; fairness.

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*Pascal Courty, Department of Economics, European University Institute, 50133 Firenze, Italy, e-mail: Pascal.Courty@IUE.it. Mario Pagliero, University of Turin, Department of Economics and Finance, 10134 Turin, Italy, and Collegio Carlo Alberto, e-mail: Mario.Pagliero@unito.it.*

## 1. Introduction

Although many economists agree that the introduction of pricing schemes that vary prices in response to demand shocks would solve many congestion problems, doing so may also antagonize consumers as suggested by evidence from the behavioral literature.[1] Overall, it is not clear whether consumers would prefer a pricing rule that varies prices and eliminates congestion over a pricing rule that keeps price constant but sometimes rations demand.

This paper follows a survey approach to address this issue. In our hypothetical scenarios, we consider various pricing rules that manage a given congestible resource differently in response to demand shocks. For the sake of concreteness, we select for our scenarios a beverage vending machine that may run out of cans when prices are kept constant and demand is high. This presents a natural environment where prices could be used to manage the stock more efficiently. In fact, Coca Cola has considered such a possibility and we discuss this episode in more detail later. Our basic question is the following:

> *Question 1.*
> An operator of vending machines has been selling soft drinks at 60c. When the weather is unusually hot, their vending machines typically run out of cans. The company plans to introduce a new vending machine that varies price as a function of temperature. Price would be 40c in cold weather and 80c in hot weather. On average, the price would remain the same and the vending machines will less often run out of cans. Please rate this new pricing policy as:
> (Completely Acceptable) (Acceptable) (Unacceptable) (Completely Unacceptable)

The question contrasts two pricing rules. The initial pricing rule does not vary prices. It corresponds to the way standard vending machines function. In contrast, the proposed pricing rule varies prices to smooth demand shocks. Each pricing rule is defined by three components: the average price, the amount of price variations, and the likelihood of rationing. In different versions of the questionnaires, randomly assigned to respondents, we vary these attributes. The objective of these variations is to isolate the subjects' attitudes toward the different attributes of

the pricing scheme. In particular, we want to investigate whether consumers are willing to trade off these attributes for one another. For example, if we find that consumers dislike rationing and price variation, we can ask how much reduction in rationing is necessary for consumers to accept a pricing rule that introduces a given amount of price variation.

This work contributes to the debate on why firms that face congestion problems often do not vary prices in response to changes in demand. Many factors influence a firm's decision to vary prices (Blinder et al. 1998).[2] In this work, we pursue the hypothesis pushed forward in the behavioral literature that pricing schemes that vary prices may antagonize consumers (Kahneman, Knetsch and Thaler 1986, and Frey and Pommerehne 1993, henceforth KKT and FP respectively).[3] We find that, in addition to disliking exploitative price increases, as already shown in the past survey literature, consumers also dislike pricing schemes that vary prices in the presence of demand fluctuations even if the expected price is held constant. This finding reinforces the conjecture that demand side considerations may explain why firms may be reluctant to introduce innovative pricing schemes.

We also investigate the possibility that firms could compensate consumers when they introduce price variations. Properly designed, the type of pricing schemes that have been proposed by economists to vary prices in the presence of demand fluctuations should increase overall welfare. Firms could pass some of the efficiency gain to consumers in the form of lower overall prices, reduced likelihood of rationing, or both. Our results suggest that consumers may respond only to the second incentive.

Finally, our findings may explain how firms design and present to consumers new pricing schemes that generate price variability. Our results suggest that firms should advertise the impact of variable pricing on rationing, and keep silent the impact on average price and especially on the

maximum price. We discuss toward the end of the paper how one could apply our framework and argue that our findings seem consistent with casual observations from pricing practices.

This paper is organized as follows. The next section presents in more detail our approach and discusses how it relates to the existing literature. Section 3 describes our survey design, its implementation, and the data. Section 4 presents the results and Section 5 concludes.

## 2. Literature Review and Survey Scenarios

*Literature*

The focus of this work is on the possibility to vary price, in response to changes in demand, with the objective to reduce congestion.[4] This choice is motivated by the finding that consumers feel more strongly toward price variability caused by demand than by supply fluctuations. Several survey studies have asked respondents to express how they feel toward price increases triggered by demand shocks. The typical finding is that about two thirds or more of the respondents find such practices unfair. For example, a question from KKT (p.729) is: "A hardware store has been selling snow shovels for $15. The morning after a large snowstorm, the store raises the price to $20. Please rate this action as: (Completely Fair) (Acceptable) (Unfair) (Very Unfair)." In their sample, 82 percent responded 'unfair'. FP report similar conclusions: "The random survey reveals that pricing, at least in the context of an excess demand situation, is considered unfair by almost four out of five respondents" (p. 296). (See also Dickson and Kalapurakal 1994, and Piron and Fernandez 1995).

Our approach differs from this literature in two ways. First, previous consumer surveys almost always report consumer fairness or acceptability perception to price *increases* in response to a positive demand shock.[5] In this work, we are not interested in consumer attitude toward a single price increase but in their attitude toward *pricing rules*. A pricing rule describes how prices change during positive demand shock events, as considered in the previous literature, but

also negative demand shocks events where prices may decrease. For example, a pricing rule could describe how the price vary over different periods of time (e.g. hour-of-the-day peak pricing), or, as we do in our questionnaire, how the price depends on observable weather shocks. In our application, a pricing rule is characterized by a distribution of prices, that specifies how prices vary as demand fluctuates, and by a likelihood of rationing. We focus on this information alone because it is sufficient to compute the expected consumption utility under standard demand theory as we argue soon. Behavioral economics has demonstrated that consumers may also care about other dimensions of the pricing rule such as framing and reference point. In the core of our study, we hold constant these other considerations and vary only the distribution of price (mean and variability) and the chance of rationing.

Second, past survey research has focused on consumer attitude toward the exploitative feature of price increases that are meant to deal with positive demand shocks. Such price changes transfer surplus from consumers to producers. We also consider pricing rules that clear markets, but in contrast with previous literature, we consider non-exploitative pricing rules, in the sense that there is no monetary transfer from consumers (as a group) to the producer, with respect to a rule that keeps prices constant. In our reference question, we hold the level of price constant across fixed pricing and variable pricing, as an attempt to control for exploitation. We then present variations of the basic question to investigate if it is possible to offer monetary compensation when price variation increases.

*Hypothesis*

To motivate our approach, we present in the appendix a simple benchmark model, that builds up upon Oi's argument (1972), to shows that consumers behaving according to rational theory would benefit from the introduction of price variability. Focusing on a specific demand environment, the model demonstrates that a risk neutral representative consumer unambiguously

benefits from the introduction of congestion pricing. Although we recognize that the model is not completely general, its purpose is to help formulate questions for which one can draw clear cut predictions under rational theory.[6]

Briefly summarized, the representative consumer has random utility, and has to select, before the realization of her utility shock, a pricing rule which will later be used to price and allocate a fixed resource. The model shows that the consumer always prefers pricing schemes that vary prices in response to demand shocks, as long as the expected price does not increase. The intuition is simply that under variable pricing the consumer may re-optimize, and possibly change her consumption decision, after observing the realized price. Since the indirect utility function is convex in price, the consumer likes price variation. The model shows that this will also hold in an equilibrium model where prices are used to clear markets. Even though consumers have to pay more in the states of the world where all consumers value consumption more, they still prefer, from an ex-ante point of view, the rule that allocates the resource to those consumers who value it the most.

An alternative theoretical benchmark corresponds to Kahneman and Tversky (1979) model of loss aversion.[7] To illustrate the point, we leave aside rationing considerations and assume that consumers consider a pricing policy that holds prices constant as the reference pricing rule. Under loss aversion, consumers dislike a pricing rule that is equally likely to increase or decrease the reference price by a given amount. Under extreme loss aversion, interpreted as a situation where consumers do not value the gains from lower prices, consumers dislike any pricing rule that sometimes increase prices even if prices almost always decrease.

We design our questions to match the environment presented in the benchmark model presented in the appendix and such that a hypothetical respondent who would behave according to rational choice theory would be in favor of variable pricing. If we find that some of the

consumers, or a majority of them, find variable pricing unacceptable, then we can conclude that there exist other motives that may influence consumer decisions.

To summarize our predictions, let A represent the acceptability of a pricing rule. Holding everything else constant, this function may depend on the average level of price, p, the variability in price, $\sigma$, and the probability of rationing $\pi$,

$$A(p,\sigma,\pi).$$

According to both behavioral theory and rational choice theory we expect that acceptability should decrease under both an increase in average price or in rationing probability. The two theories differ when one considers an increase in price variability. According to rational choice, one would expect acceptability to increase with price variability while according to behavioral one should expect the opposite.

Summary of Predictions

| | Rational Choice | Behavioral Theory |
|---|---|---|
| $dA/dp$ | - | - |
| $dA/d\pi$ | - | - |
| $dA/d\sigma$ | + | - |

We recognize that this framework is very stylized. The tri-dimensional decomposition of a pricing rule into $(p,\sigma,\pi)$ greatly simplifies the investigation of whether consumers have preferences over the rules that govern how prices are set. In practice, consumer may have more complex preferences and may care about additional attributes to the ones we have considered here. The approach pursued here is a first stab at the problem that allows us to investigate some important trade-offs and also to discriminate between two central theories.

*Real and Perceived Exploitation*

The past survey literature has not made the distinction between a change in expected price and a change in price variability as we do in this paper. In the snow shovel question presented earlier, for example, both the level of price and the amount of price variations increase when the store increases prices in the event of a snowstorm. Our approach allows us to disentangle consumer attitude toward these two dimensions of a pricing policy.

We distinguish two different concepts of exploitation. *Real exploitation* occurs when a change in pricing rule increases the level of price p holding the other two dimensions ($\sigma$,$\pi$) constant. We label this type of price variation 'real exploitation' because there is a monetary transfer from the consumer to the producer. *Perceived exploitation* occurs if the change in pricing rule increases the level of price variation $\sigma$ holding the other two dimensions (p,$\pi$) constant. Under such a change, there is no monetary loss in expectation for a consumer who does not change her consumption plan, and possibly an increase in surplus if the consumer does so. Still, this change in the pricing rule could be perceived as exploitative because the resulting pattern observed by the consumer is that prices increase when demand increases. Such an interpretation is consistent with KKT, who argue that consumers demonstrate an 'opposition to exploitation of shortages'.

*Scenarios*

Following Okun (1981) and past survey literature, we select an hypothetical scenario from a customer market.[8] Our scenario is drafted after the experience of Coca-Cola with responsive pricing. The company began testing in 1999 a vending machine with a temperature sensor and computer chip to determine when to automatically raise prices for its drinks in hot weather, a variable known to affect demand. Coca-Cola's chairman and chief executive Douglas Ivester argued that the technology would cater to the basic law of supply and demand, as consumers' desire for cold drinks increases in hot weather and each machine has a fixed capacity. When the

news became public, however, many were shocked by the proposal. Pepsi was quick to state that it was not considering a similar innovation. A public relation fiasco followed "causing Coke to promptly deny that it would ever have a vending machine do any such thing." (Washington Post, 27 September 2000, p. A1). Given that the scheme was never rolled out, it is not clear whether the consumer backlash was due to the fact that consumers expected that Coca Cola would use the new scheme in an exploitative way (real exploitation or increase in p), or whether consumers were hostile to the idea that price could vary per se (perceived exploitation or increase in $\sigma$). In our survey questions, we are careful to control for these two dimensions of exploitation by always giving detailed information on changes in the entire distribution of prices.

**3. Survey and Data**

We consider four main questions describing different scenarios. In each question we start by describing a reference situation, in which there is rationing if prices do not vary. As mentioned in the introduction, this initial situation corresponds to the way most vending machines function. We contrast this reference situation with four alternative scenarios where prices vary depending on demand realizations.

Question 1 is reported above. Questions 2-4 introduce simple variations to this basic question. In addition, we also consider a question equivalent to the snow shovel question in KKT, but framed in the context of our scenario (Question 5). This last question will be used to establish that our survey design is consistent with previous survey literature.

*Data*

The survey was conducted on first year students in business economics at the University of Turin on 21 and 22 March 2006. A one-page survey form was given to each student at the beginning (or the end) of the first lecture of the Basic Microeconomics course.[9] Each questionnaire contained one of the four main questions. In addition, 20 percent of the

questionnaires included Question 5. Question 5 was matched with equal frequency with each of the four main questions. When two questions were included, two different versions of the questionnaire presented the questions in different order. This survey structure balances the need to maximize the number of responses to each question and the need to minimize the number of questions in each survey to avoid the possibility of interaction between questions.

Each questionnaire included a series of questions regarding individual characteristics such as gender, educational achievement of the mother and father, occupation of mother and father, family income, political preferences covering the whole spectrum from very conservative to very liberal. In addition, we asked whether subjects had taken economics courses before, as some students may have been retaking the course because they failed or were asked to do so because they were transferred from other universities with different curricula. Descriptive statistics are presented in Table 1.

[Table 1 about here]

A total of 519 students from 3 different groups participated in the experiment. Each student was randomly assigned one version of the survey. Some questionnaires were not fully filled, while only a few were not correctly filled (e.g. a double preference was given instead of one as required). Overall, 448 questionnaires (75 percent) were completely and correctly filled.

Our survey design is broadly similar to that of KKT and FP. The structure of the questions, for example, is the same. A basic scenario is used as a reference and it is compared to an alternative scenario in which a hypothetical firm varies prices following demand shocks. The amount of price variability introduced in these scenarios is also comparable. Similarly, as in KKT and FP, subjects are asked to choose among 4 alternative acceptability levels.

Although the details of the scenarios described in our questions differ from KKT and FP, we choose a consumption good (soft drink) very similar to that of FP (bottle of water). For such goods, demand is stochastic (for example because of weather conditions) but costs of production tend to remain stable over time. These are also the salient characteristics of the demand for snow shovels (KKT), for which weather conditions may unexpectedly increase consumers' demand.[10]

*Consistence with KKT*

In Question 5 the initial price is maintained for low demand periods while the vending machine charges a higher price when demand is high. This combines both an increase in variability and in average price:

> *Question 5. Only price increases*
> An operator of vending machines has been selling soft drinks at 60c. The company plans to introduce a new vending machine that varies price as a function of temperature. The price will increase to 80c when the weather is particularly hot. Please rate this new pricing policy as:
> (Completely Acceptable) (Acceptable) (Unacceptable) (Completely Unacceptable)

As in KKT, there is no reference to the existence of a rationing problem in high demand periods before the introduction of price variability. Similarly, there is no reference to the reduction in rationing that may be generated by price variations. About three respondents out of four find this unacceptable (either "completely unacceptable" or "unacceptable"), which is consistent with answers in KKT (Question 1 p. 729) and FP (Question 1 and 2 p. 298). This suggests that there is no obvious reason to think that our subjects' attitude toward price variability is systematically different from that of subjects taking part in previous experiments.

**4. Results**

Table 2 reports the survey results. Question 1, which was presented in the introduction, is used as a benchmark to compare other scenarios. The focus is not on the level of acceptability but on the difference in acceptability level across questions. Differences in acceptability can be clearly seen comparing rows in Table 2. We compare questions 2, 3 and 4 with question 1. We

start by discussing differences in unconditional means and we show later that the results are robust after controlling for demographic characteristics.

[Table 2 about here]

*Rationing ($dA/d\pi$)*

Question 2 varies rationing $dA/d\pi$. We manipulate Question 1 by not making any reference to the reduction in rationing resulting from price variability. We simply omit the text "and the vending machines will less often run out of cans".

> *Question 2. No reference to the decrease in rationing*
> An operator of vending machine has been selling soft drinks at 60c. When the weather is unusually hot, their vending machines typically run out of cans. The company plans to introduce a new vending machine that varies price as a function of temperature. Price would be 40c in cold weather and 80c in hot weather. On average, prices would remain the same. Please rate this new pricing policy as:

(Completely Acceptable) (Acceptable) (Unacceptable) (Completely Unacceptable)

Ignoring the advantage of price variability in terms of lower probability of rationing reduces the acceptability by 10 percentage points, from 38% to 28% and the difference is statistically significant. Consumers have a positive attitude toward reduction in rationing. This is consistent with both rational choice and behavioral predictions. An implication is that omitting the impact of variable pricing on rationing, as was typically the case in past survey studies, tends to bias answers toward a negative attitude toward variable pricing.

*Price Variability ($dA/d\sigma$)*

Question 3 investigates the main issue of consumer attitude toward change in price variability, $dA/d\sigma$. While in Question 1 price can increase or decrease by 33%, in Question 2 price increases or decreases by 50%, from the initial 60Cent to either 90Cent or 30Cent, depending on weather conditions.

*Question 3. High price variability*
An operator of vending machine has been selling soft drinks at 60c. When the weather is unusually hot, their vending machines typically run out of cans. The company plans to introduce a new vending machine that varies price as a function of temperature. Price would be 30c in cold weather and 90c in hot weather. On average, the price would remain the same and the vending machines will less often run out of cans. Please rate this new pricing policy as:
(Completely Acceptable) (Acceptable) (Unacceptable) (Completely Unacceptable)

Increasing the price range by 50% decreases the acceptability of the pricing policy by 15 percentage points, from 38% to 23% and the difference is statistically significant. Consumers are hostile toward price variations. This finding is in contradiction with rational choice theory.

*Average Price (dA/dp)*

Question 4 considers the possibility that consumers care about the average price holding constant the price variability (dA/dp). We substitute for the sentence "On average, prices would remain the same" in Question 1 with the sentence "On average, prices would decrease to 45Cent".

*Question 4. Low average price*
An operator of vending machine has been selling soft drinks at 60c. When the weather is unusually hot, their vending machines typically run out of cans. The company plans to introduce a new vending machine that varies price as a function of temperature. Price would be 40c in cold weather and 80c in hot weather. On average, prices would decrease to 45c and the vending machines will less often run out of cans under this new policy. Please rate this new pricing policy as:
(Completely Acceptable) (Acceptable) (Unacceptable) (Completely Unacceptable)

Decreasing the average price by 25%, from 60Cent to 45Cent, leaves the acceptability substantially unchanged from 38% to 37% and the difference is not statistically significant. This result is surprising.

[Table 3 about here]

*Linear probability model*

The results are robust after controlling for demographic characteristics. Table 3 reports the results of a linear probability model. In column 1, the constant term can be interpreted as the average acceptability of question 1 and the other estimated coefficients as the impact of manipulating the survey questions. Column 2 provides the same results controlling for gender, parents' education, family income and political preferences. The constant can be interpreted as the acceptability of the basic scenario for a male subject, with both parents with less than high school education, family income between 32,000 and 53,000 and neither left nor right wing political preferences. Only the coefficients corresponding to questions 2, 3 and 5 are negative and statistically significant. We omit from the Table the coefficients on the demographic characteristics because they do not affect the acceptability of the pricing schemes.[11] We test and cannot reject the equality of acceptability levels for Question 3, 4, and 5. Table 4 reports these tests.

[Table 4 about here]

*Summary*

Two clusters of pricing schemes emerge. Consumers are indifferent between scenarios 1 and 4 and between scenarios 2, 3, and 5, and strictly prefer the first group to the second. Tables 2-4 suggest the following inference on consumer preferences:

(a) Consumers value a decrease in rationing $dA/d\pi<0$.

(b) Consumers dislike an increase in price variation $dA/d\sigma<0$.

(c) Consumers do not care about average price $dA/dp=0$.

There is a trade off between rationing and price variability but no trade off between average price and these two dimensions. The evidence that $dA/d\sigma<0$ is inconsistent with rational

choice and consistent with behavioral theory. The other two findings do not permit to distinguish the two theories. The finding that $dA/d\pi<0$ is consistent with both behavioral theory and rational choice. The finding that $dA/dp=0$ is inconsistent with both theories.

*Implications for Pricing Practices*

In practice, firms use a wide range of pricing schemes to deal with congestion problems. Some firms greatly vary prices (e.g. airlines) while others rarely do so (e.g. movie theatres). At first glance, it may be difficult to make sense of the wide variety of variations in pricing practices both within and across industries. Our results provide a starting point and a framework to discuss these issues. Two examples illustrate how this could be done.

To start, one may consider an industry where firms typically vary prices, and study how firms communicate their pricing policies, assuming that such information influences consumer willingness to buy.[12] In particular, one would expect that firms should advertise reductions in rationing but should not mention the existence of price variability. Mentioning the feature that the average price remains constant or decreases may have little impact on consumer attitudes. Consider the airline industry, where price variability is typically large (Borenstein and Rose, 1994).[13] Firms generally advertise the lowest price for advance booking and do not reveal the entire fare structure. In addition, they do not mention the average price close to departure date, which can be 5 to 10 times higher than the lowest price (McAfee and Velde 2006).[14]

In the airline industry, rationing takes the form of overbooking. There is no rationing in full fare refundable tickets, but firms sometimes have to overbook economy tickets to make space for full fare consumers who show up at the last minute, and also to optimize capacity utilization. European low cost airlines do not sell refundable tickets and therefore generally do not overbook (ELFAA, 2004).[15] Interestingly, those airlines that do not overbook emphasize this feature in their websites and in advertising campaigns while those that do overbook mention it

only in the contract's small print.[16] To summarize, the observations that airlines typically advertise the lowest price, keep silent the entire distribution of fare and in particular the fares for last minute bookings, and that some low cost airlines advertise the absence of overbooking, are broadly consistent with our results.

Secondly, one can pursue an event study approach and investigate why the introduction of variable pricing sometimes fails. As mentioned earlier, it is difficult to draw definite conclusions in the Coke failed experiment. Consider instead Deutsche Bahn's introduction in 2002 of revenue management principles to long distance train travel. The new system abandoned the principle of fixed fare per kilometre, and introduced advance purchase discounts (40% for one week advance booking), as well as cancellation fees (Seidel et al. 2004). Interestingly, Deutsche Bahn launched this change at a time when it was not making profits and when there was congestion at peak hours. Seidel et al. review 407 articles from the press and conclude that consumers perceived that the system was designed to increase average price rather than to deal with congestion.[17] Consumers rejected the scheme and Deutsche Bahn had to terminate its main features. Interestingly, fairness concerns is one of the most often cited reason for this failure. Our framework would suggest that acceptability would have increased if Deutshe Bahn had emphasized the lowest prices and the impact of the system on rationing.

We recognize that these two case studies are very specific. But the point was to illustrate the practical relevance of our framework to (a) discuss how successful schemes that vary prices are presented to consumers and (b) understand why consumers sometimes reject new schemes that vary prices. Finally, one could use our framework to discuss variations in firm practices across industries, a topic that is beyond the scope of this study.

## 5. Conclusions

The main objective of this paper was descriptive. Our survey results documents whether consumers are averse to price variations that are meant to smooth demand fluctuations, and if so, whether they are willing to trade-off price variations for a reduction in the likelihood of rationing or for lower expected prices. We find that (a) consumers are averse to price variation (they dislike pricing schemes that vary prices more), (b) they are willing to trade off price variation and rationing, but (c) they are not willing to trade off price variation for lower expected prices.

A secondary objective of this paper is to interpret these findings in light of two conflicting theories of how consumer should respond to price variations. In the context of our scenario, we would expect that a consumer behaving according to rational choice would prefer the introduction of price variation as long as the level of price does not increase. The first finding rejects this prediction and seems consistent with the behavioural hypothesis that consumers are antagonized by price variations.

A final objective is to discuss the implications of our findings for the debate on why firms rarely vary prices to deal with congestion problems. Accordingly, we presented consumers with a real world situation, similar to the Coca Cola experiment, where more innovative pricing schemes could be implemented. The results suggest that consumers are averse to a scheme that sometimes increases prices above a reference level even if it also sometimes decreases prices. Our findings also suggest that the most effective way to get consumers to accept a pricing scheme that varies prices is to emphasize, assuming that such announcement influence consumers' willingness to buy, its positive impact on rationing and to conceal events when prices are high. These observations seem consistent with casual observations from industries where prices do vary.

## Appendix: Efficiency Argument for Varying Prices

We review the economic argument based on the efficiency logic, advocating the use of variable pricing. Our goal is to identify situations where rational choice theory predicts that consumers should always prefer a pricing rule that varies prices.

Assume there are N states of the world. State n=1..N occurs with probability $\pi_n$ such that $\Sigma_n\pi_n=1$. A state could represent a day of the week or a month of the year if demand is seasonal and in that case $\pi_n$ should be interpreted as the fraction of time that state n occurs. Alternatively, demand could depend on underlying stochastic states of nature (e.g. the weather in the Coke example). There is a unit continuum of consumers who consume at most one unit and they do so if their willingness to pay is greater than the price. In state n, consumers' willingness to pay are random and i.i.d. with distribution $F_n(v)$ and we assume that $F_n$ are continuous functions with full support on $[0,\infty]$. Each consumer learns her willingness to pay only once the state is realized. This implies that the aggregate distribution of willingness to pay in state n is $F_n(v)$.

There is a fixed capacity Q<1 such that all consumers cannot consume. The marginal cost of serving an additional consumer is zero up to Q and infinite onwards. This stylized representation of situations where capacity is set in advance and is inflexible in the short run is consistent with our survey scenarios.

Consider first the case where the price does not vary. Assume the price is set at p. Sales in state n are equal to

$$q_n(p)=\text{Min}(1-F_n(p),Q).$$

In the event $1-F_n(p)>Q$ there is rationing. Assuming random rationing, the probability of being served in state n is

$$r_n(p)=\text{Min}(1,Q/(1-F_n(p))$$

and the overall chance of being served is $\Sigma_n\pi_n r_n$. In the event $1-F_n(p)<Q$, some of the capacity is not used. Consumers evaluate a pricing rule ex-ante, that is, before they have learned their realized valuation.[18] We assume that consumers are risk neutral.[19] A consumer's expected utility is

$$EU = \sum_n \pi_n r_n(p) \int_p^\infty (v-p) dF_n(v)$$

and the expected cost of consumption is $\Sigma_n\pi_n r_n(p)p$.

Consider next variable pricing. The price in state n is $p_n$. We call a pricing rule a set of $p_n$ for n=1..N. Sales in state n are $q_n=\text{Min}(1-F_n(p_n),Q)$. As a benchmark case, we first consider the efficient pricing rule that eliminates rationing and unused capacity. The price in state n is

$$p^*_n=F_n^{-1}(1-Q).$$

This set of prices clears the market and achieves the efficient outcome. To compare intermediate pricing rules (between fixed pricing and efficient pricing) we use the following definition.

**Definition**: Pricing rule $p_n$ varies prices more than $p'_n$ if (a) for any n such that $1-F_n(p'_n)>Q$, $p^*_n \geq p_n \geq p'_n$ and (b) for any n such that $q_n(p'_n)<Q$, $p^*_n \leq p_n \leq p'_n$, with at least an inequality (between $p_n$ and $p'_n$) strict in one state.

We can answer the question of whether consumers would be willing to adopt a pricing rule that vary prices in the sense defined above.

**Proposition**: Consumers strictly prefer a pricing rule that varies prices more as long as the expected cost of consumption does not increase.

**Proof**: Define $EU(\{p_n\}_{1..N})$ the expected utility under pricing rule $\{p_n, n=1..N\}$

$$EU(\{p_n\}_{1..N}) = \sum_n \pi_n r_n(p_n) \int_{p_n}^{\infty} (v - p_n) dF_n(v)$$

We have,

$$EU(\{p_n\}_{1..N}) - EU(\{p'_n\}_{1..N}) = \sum_n \pi_n \left( r_n(p_n) \int_{p_n}^{\infty} (v - p_n) dF_n(v) - r_n(p'_n) \int_{p'_n}^{\infty} (v - p'_n) dF_n(v) \right)$$

$$\geq \sum_{ns.t.r_n(p_n)=1} \pi_n \int_{p_n}^{p'_n} v dF_n(v) + \sum_{ns.t.r_n(p_n)<1} \pi_n \left( \int_{p_n}^{\infty} \frac{v}{1 - F_n(p_n)} dF_n(v) - \int_{p'_n}^{\infty} \frac{v}{1 - F_n(p'_n)} dF_n(v) \right)$$

The first term is positive since $p'_n > p_n$. Consider any element in the second term's sum indexed by n. We have $p'_n < p_n$

$$\int_{p_n}^{\infty} \frac{F_n(p_n) - F_n(p'_n)}{(1 - F_n(p_n))(1 - F_n(p'_n))} v dF_n(v) - \int_{p'_n}^{p_n} \frac{v}{1 - F_n(p'_n)} dF_n(v)$$

$$> p_n \int_{p_n}^{\infty} \frac{F_n(p_n) - F_n(p'_n)}{(1 - F_n(p_n))(1 - F_n(p'_n))} dF_n(v) - p_n \int_{p'_n}^{p_n} \frac{1}{1 - F_n(p'_n)} dF_n(v)$$

$$= p_n \left( \frac{F_n(p_n) - F_n(p'_n)}{1 - F_n(p'_n)} - \frac{F_n(p_n) - F_n(p'_n)}{1 - F_n(p'_n)} \right) = 0.$$

Therefore $EU(\{p_n\}_{1..N}) > EU(\{p'_n\}_{1..N})$ . QED

The proposition holds even if consumers have to pay a fix cost to find out about the price (e.g. travel cost) since consumers would have to pay the fixed cost independently of the level of price variation. Under variable pricing, consumers may end up paying the fixed cost more often for nothing, but they are still better off doing so in expectation.

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**Notes**

[1] Vickrey (1971) pushed forward the concept of variable pricing (see Borenstein et al (2002) for recent proposals). Kahneman et al. (1986) were one of the first to present consumer evidence of consumer antagonism. See also Carlton (1986) and Rotemberg (2004).

[2] Considerations include technological constraints, implementation and billing cost, complexity of communicating how these schemes works, political reasons, redistribution reasons, to name just a few.

[3] See as well surveys of revenue managers (Hall and Hitch 1939, Blinder et al. 1998, and Zbaracki et al. 2004) which are consistent with the antagonism hypothesis. See Xia et al. (2004) for a review of the marketing literature.

[4] Prices also vary to price discriminate, and this rationale is sometimes indistinguishable from congestion management. We exclude situations where prices vary only to price discriminate without any impact on congestion management.

[5] Although such price changes may allocate the scarce resource more efficiently, it is almost obvious that, in the absence of transfers, most consumers would not benefit. Only those consumers with very high valuation for the

good may value the decrease in the probability of being rationed more than the monetary loss due to the increase in price.

[6] With heterogeneous consumers, for example, congestion pricing may redistribute surplus across consumers and some consumers may be worse off.

[7] Alternatively, one could assume that consumers are risk averse. We do not pursue this hypothesis because the financial amounts at stake are very small in our case study.

[8] In customer markets, suppliers are perceived as making their own pricing decisions, have some monopoly power, and have repeat business with consumers.

[9] The Italian version of our survey forms, actually used to collect data, is available upon request.

[10] Our survey design slightly differs from KKT and FP in some details. KKT asked a variable number of questions (but less than 5) while FP asked each respondent to fill 4 types of questionnaires with 4 or 5 questions each. As argued earlier, asking one or two questions reduces the possibility of interactions between questions. The method we use to collect the data also differs from KKT and FP. KKT survey was conducted by telephone on a sample of residents in two Canadian metropolitan areas. FP survey was sent by mail to a sample of households in Zurich and Berlin (550 households in total). That being said, the number of subjects providing usable answers in our survey is broadly similar to that of FP (in their sample, between 452 and 148 households provided usable answers, depending on the question). KKT do not report the overall number of subjects interviewed, but the number of answers to their main questions is comparable to ours.

[11] The interaction of political preferences and income levels with our different pricing schemes does not significantly affect the acceptability level. The results of non-linear probability models are not significantly different and are not reported.

[12] This implicitly assumes that firms can 'fool' consumers because a rational consumer should care about the actual distribution of prices not about what the firm announces.

[13] Fares are typically determined by the amount of time customers book in advance and the number of seats already booked on the flight (see McAfee and Velde (2006) for a review of revenue (or yield) management).

[14] A survey of the top 10 European airlines by number of passengers in 2005, shows that none advertises its fare structure although several advertise the lowest price for a given route.

[15] "Low Fare Airlines generally do not engage in overbooking (because their fares are nonrefundable)... traditional airlines, who offer flexible fares for business passengers, will continue to profit from this practice" (p.32).

[16] Among the top 10 European airlines by number of passengers in 2005, 9 airlines acknowledge overbooking in their small print, while Ryanair, which is the largest low cost airline in Europe, advertises in its charter that 'Ryanair is possibly the only airline in Europe that does not overbook its flights' (http://www.ryanair.com/site/EN/about.php?sec=charter). Another low cost airline, Vueling, which does not figure in the above ranking, advertises in its statement of philosophy that 'No overbooking. We are the only Spanish airline with who you are sure to get your seat once it has been booked.' http://www.vueling.com/EN/vueling/acerca_02a.php.

[17] In the executive summary, the report states that 'People felt treated unfairly due to pricing according to demand elasticities and cancellation fees. The infringement of the public's perception of fairness played probably and important role that the system was not accepted by the public.'

[18] Clearly, a pricing rule also has ex-post distributional consequences. For example, not all consumers will be identical ex-post under variable pricing. Those consumers who end up consuming in a state of the world when the price is high may be worse off ex-post. If these consumers had known their realized valuation ex-ante, when they were asked to decide which pricing rule to adopt, they would have not been in favor of variable pricing. To eliminate the possible ambiguity that may arise with ex-ante versus ex-post considerations, we select scenarios where it is clear from the question that consumer should consider the choice of adoption of variable pricing from an ex-ante point of view. Using the notation of the model, we design our scenarios so that it is reasonable that consumers do not know where they are likely to end up on the distributions $F_n$, when they are asked to choose between pricing rules.

[19] This is reasonable in the applications we have in mind, because the price of the goods under consideration is typically very small relative to consumer income.

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Table 1. Descriptive statistics

| | A. Educational Attainment | | | |
|---|---|---|---|---|
| | **Less than high school** | **High school** | **College degree** | **Postgraduate degree** |
| **Mother** | .33 | .51 | .15 | .01 |
| **Father** | .33 | .45 | .19 | .02 |

| | B. Occupation | | |
|---|---|---|---|
| | **Self Employed** | **Employee** | **Other** |
| **Mother** | .19 | .52 | .29 |
| **Father** | .34 | .50 | .16 |

| | C. Family Income | | | | |
|---|---|---|---|---|---|
| | **Less than 16,000€** | **Between 16,000€ and 32,000€** | **Between 32,000 and 53,000€** | **Between 53,000 and 80,000€** | **Above 80,000€** |
| | .07 | .29 | .33 | .17 | .14 |

| | D. Political preferences | | | | |
|---|---|---|---|---|---|
| | **Very right wing** | **Somewhat right wing** | **Centre** | **Somewhat left wing** | **Very left wing** |
| | .13 | .30 | .19 | .31 | .07 |

Note: The table reports the fraction of subjects by educational attainment and occupation of their parents, family income and political preferences.

Table 2. Acceptability of pricing policy changes

| | **Acceptable** | **Unacceptable** | **N** |
|---|---|---|---|
| Question 1. Basic question | 0.38 | 0.62 | 87 |
| Question 2. No reference to the decrease in rationing | 0.28 | 0.72 | 93 |
| Question 3. High price variability | 0.23 | 0.77 | 106 |
| Question 4. Low average price | 0.37 | 0.63 | 89 |
| Question 5. Only price increases | 0.25 | 0.75 | 73 |

Note: The table reports the fraction of subjects describing each pricing policy as acceptable (either "completely acceptable" or "acceptable") or unacceptable (either "completely unacceptable" or "unacceptable"). N is the number of observations for each question.

Table 3. The acceptability of policy changes (linear probability model).

| | (1) | (2) |
|---|---|---|
| Question 2. No reference to the decrease in rationing | -0.100 | -0.123 |
| | (0.068) | (0.072)* |
| Question 3. High price variability | -0.153 | -0.156 |
| | (0.066)** | (0.068)** |
| Question 4. Low average price | -0.009 | -0.009 |
| | (0.069) | (0.072) |
| Question 5. Only price increases | -0.133 | -0.142 |
| | (0.072)* | (0.076)* |
| Group 2 | | -0.068 |
| | | (0.058) |
| Group 3 | | 0.003 |
| | | (0.054) |
| Constant | 0.38 | 0.374 |
| | (0.049)** | (0.126)** |
| $R^2$ | 0.02 | 0.05 |

Note: The dependent variable is the acceptability of the pricing policy (equal to 1 if the policy change was considered acceptable or completely acceptable, zero otherwise). In column 2, we also control for gender, parents' educational attainment, family income and political preferences. The number of observations is 448. Standard errors in parentheses. * significant at 10%; ** significant at 5%.

Table 4. Test of equality of acceptability levels across questions.

| $H_0$ | | |
|---|---|---|
| Question 5 - Question 3 = 0 | F( 1, 421) = 0.04 | Prob > F = 0.85 |
| Question 5 - Question 2 = 0 | F( 1, 421) = 0.07 | Prob > F = 0.79 |
| Question 5 - Question 4 = 0 | F( 1, 421) = 3.21 | Prob > F = 0.07 |
| Question 3 - Question 2 = 0 | F( 1, 421) = 0.24 | Prob > F = 0.63 |
| Question 2 - Question 4 = 0 | F( 1, 421) = 2.56 | Prob > F = 0.11 |

Note: The table reports the test of equality of the coefficients reported in Table 4 for Question 2, 3, 4 and 5.