

Demand cross elasticity without substitutability: An experiment

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Abstract

We study a market where goods are produced under low marginal costs with a poor degree of substitutability among products. In such an environment we run a field experiment in order to explain why prices are interdependent even when preferences are independent. We compare our results to previous theoretical and laboratory experimental literature on price fairness. We find that - even in absence of interaction among subjects, price fairness/unfairness do play a major role in accepting/rejecting a deal. Subjects tend to resist more a price increase when the preferred good is not anchored to the general price increase of a given consumption bundle.

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Introduction

Fairness in transactions is now a popular theme in marketing and economic literature. Not only casual observations but also a number of papers show that fairness does play a role in characterising economic behaviour. Contributions to experimental literature are numerous (Xia-Monroe-Cox, 2004). Some references can reveal its nature. An experiment about ultimatum game (Guth-Schmittberger-Schwarz, 1982) shows that people prefer to give up some limited gain if the share of total gain is very unbalanced. Another experiment (Binmore-Shaked-Sutton, 1985) not only confirms this result but also shows that people want to reward fair allocations and punish unfair ones. In Thaler (1985), three questionnaires reveal that perception of cost influences the assessment of fair behaviour, which in turn conditions consumer choices. Other household surveys confirm the relevance of fair conduct (Kahneman-Knetsch-Thaler, 1986; Frey-Pommerehne, 1993). In particular, price increases due to cost shocks are considered more fairer than price increases due to demand shocks.

This evidence questions the robustness of standard economic theory. It seems that consumer choices are not only motivated by self interest but also by psychological attitudes towards fairness. It also appears that firms, if aware of these patterns, should adapt their commercial behaviour to them. Not surprisingly, in the last few years we have witnessed several attempts to explain these facts with analytical models.

One model (Rabin, 1993) is based on the “reciprocal behaviour” notion. Rabin assumes that people behave nicely with fair people, and vice versa. This theory can explain a large part of empirical literature. It must be noted, however, that the model can be applied to only two agent (persons, firms) games.

Kahneman-Knetsch-Thaler (1986; hereafter KKT), following the Kahneman-Tversky approach, developed what is called a “dual entitlement” theory. In short, it hinges on the idea that transactors (consumers, workers, sellers) “have an entitlement to the terms of the reference transaction, and firms are entitled to their reference profits”. Only when profits are jeopardised, firms are allowed to modify prices (or wages) in a unfavourable way for transactors. It is interesting to notice how the fair term of transaction is defined. “The measure of transaction utility depends on the price the individual pays compared to some reference price, p^* . (...) The most important factor in determining p^* is fairness.” (Thaler, 1985, p.34).

In several papers Rotenberg developed a model which can be defined as “relative altruism” (Rotenberg 2002,2003,2004). The altruistic propensity of an agent depends on the expectations of the same propensity of the other agent. In case this propensity is higher than a specific threshold, also the utility of the first agent is dependent on altruistic motivations.

While the former contributions model directly some notion of fairness, others are based on an indicator of “inequality aversion” (Bolton, 1991; Bolton-Ockenfels, 2000; Fehr-Schmidt, 1999). The idea is that utility of an agent depends not only on its

pay off but also on the relative shares of pay off for all agents. While Fehr and Schmidt include in the utility function of an agent only his own relative share, Bolton and Ockenfels also consider the shares of other agents. However, the parameter which accounts for the agent's share, in his own utility function, is higher than the parameters referred to the other agents.

All these contributions share some common elements: 1) there is a punishment for being unfair; 2) (un)fairness is detected by looking directly at some revealing facts (generally by comparing prices to cost or demand conditions); 3) the environment under investigation is often based on a "one to one" relationship, such as bargaining or monopoly pricing.

One problem arises with this line of research: how do consumers conduct the comparison which triggers the feeling of unfairness? Several benchmarks have been proposed: 1) previous prices; 2) seller's costs; 3) prices of competing goods. As we better explain in the next paragraph, all these benchmarks seem rather unfeasible. On the one hand, buyers are not generally able to analyse previous prices or cost structures of sellers. On the other hand, we don't expect to find competing products when fairness is an issue. Fairness should not play a role in oligopoly because, in this case, consumers face alternatives and therefore unfair behaviour by a firm cannot be exploited. Therefore it might be that it is only when the degree of substitutability is very low (or when a market is monopolised) that unfair behaviour (and fairness considerations) can arise.

In this paper, extending the KKT model, we focus the problem of the reference price, an essential ingredient of every theory of fairness: our intuition is that the best candidate for playing this role is the price of similar but not substitutable products. There is some evidence which allows us to infer that consumers do pay attention to these sorts of prices, when evaluating the product they intend to buy, and that firms behave accordingly. If so, a model embodying fairness considerations can rest on a solid base.

Consider, for example, the music CD market. In an environment like this we expect that prices of goods belonging to the same category do show high cross-section variability. With low marginal costs (and high overhead costs), prices should mainly reflect different demands for musicians and low demand substitutability must cause prices to diverge quite substantially. Surprisingly enough we find a convergence of prices through some common values. Prices of recently launched CDs of two artists, with very unequal popularity (so to let us expect different demand elasticity), are almost the same. This pattern is not confined to the music CD market. Ticket prices of football matches of clubs belonging to the same league (but located in different cities) are very similar, independent of the number of their local

viewers (and supporters)¹. More generally we find the same price pattern for films, CDs, DVDs, standardized software, live concerts and sport events. We wonder whether fairness considerations can explain this fact. This paper prompted by the intuition that the price of a good (e.g. the last CD by Elton John) can be used as a reference point to base fairness consideration for a similar but not substitutable good (e.g. the last CD by Bruce Springsteen). So these two goods must show a high degree of price similarity not because they are substitutable but because their prices are reciprocally used as a benchmark for assessing fairness behaviour in pricing.

A quite similar intuition motivated a recent paper (Anderson-Simester, 2006) which deals with prices of clothes which are not substitutable because of different sizes. According to the field experiment reported in that paper, demand of a cloth is influenced by the price of clothes for different sizes. The authors find that this effect is due to unfairness considerations, effect which seems much stronger in reducing consumer demand than the genuine effect of a price increase.

In the second part of the paper we present a field experiment whose aim is to test our a priori beliefs. The experiment refers.....

The preliminary results are encouraging.....

Demand cross elasticity without substitution

As explained in the first chapter of all microeconomics textbooks, demand cross elasticity depends on product substitutability: demand of good “1” increases as the price of good “2” increases, because some consumers of good “2” shift to good “1”. They show this pattern in so far that consumers consider the two goods interchangeable. Our intuition is that you can observe demand cross elasticities even if the respective goods are not substitutable and there is no shift in consumption between goods in the case of relative price changes. The reason for this must be traced back to the fairness feelings of consumers.

This insight could be framed in terms of the *Transaction utility theory* (Kanheman-Tversky, 1979; Thaler,1985; Kahneman-Knetsch-Thaler, 1986). According to this theory the total utility accruing from a transaction is the sum of two components: acquisition utility and transaction utility. That is:

Total utility of good “z” = acquisition utility + transaction utility

acquisition utility = $v ({}_zP^o - {}_zP) \cong$ consumer surplus

¹ A recent investigation of the Italian Antitrust Authority revealed that football clubs monitor prices charged by clubs based in other cities, a behaviour which seems at odds with the lack of substitutability among clubs based in different cities.

transaction utility= $v(-{}_zP: -{}_zP^*)$

where:

${}_zP^o = \text{value equivalent of } z$;

${}_zp = \text{price of } z$;

${}_zP^* = \text{reference price}$

The first component is the utility taken into consideration by the traditional theory and it is based on the value derived by consuming the good (less the price paid for buying it). The second component (transaction utility) concerns fairness behaviour and depends on a comparison between the price paid by the consumer and some reference price.

We feel that this reference price could be based on prices of similar but not substitutable goods: ${}_zP^* = g(P_{-1})$. This is not common in the literature. Generally, reference price has been associated to: 1) former prices; 2) seller's costs; 3) prices of substitutable goods.

Before examining these referencing rules, a general warning must be given. The literature on fairness is mainly driven by experimental analysis and has paid a tribute, probably overdue, to psychology. In evaluating all the different aspects of buyer-seller relationship, this literature does not look very parsimonious, as in a laboratory you can control the effects of a variety of causes. One consequence of this attitude is that the discussion about what should be considered a plausible reference, out of the different alternatives, has been substantially neglected. But when we want to make this analysis fully operative, a more consistent and realistic approach on the underlying assumption is requested.

Former prices – One obvious way to trace back a reference price is to look at previous prices of the same good. Experimental studies (Briesh-Krishnamurti-Mazumdar-Raj,1997) as well as analytical contributions (KKT,1986, Rotemberg, 2004) seem to confirm this opinion. In particular, Rotemberg approach makes use of this reference as consumer's angry reactions are triggered by learning “ something that makes them wish they had carried out a different set of transaction at an earlier time”. So the reference to previous prices is the starting point of his analysis. The fact that price changes are not easily interpreted by consumers does not affect his approach substantially as it is aimed to show the rationale for sticky pricing. According to this approach consumers are generally hostile to price increases, as they do not understand the underlying rationale.

On the contrary other approaches explaining the role of fairness in economic behaviour need to assume that consumers are able to make some inference on the causes of price changes. That is particularly true for the “dual entitlement theory “ by KKT, which states that only price changes which are not justified by costs increases

can trigger consumer reaction. Using this model, past prices perform very poorly. For example, Bolton-Warlop and Alba (2003) present laboratory experiments which show that consumers cannot distinguish the reasons for price increases and are puzzled by inflation. Therefore past prices are practically unsuitable for most of the theories on fairness.

Sellers' costs - As just mentioned, the “dual entitlement theory” by KKT need the assumption that consumers are knowledgeable of the price structure of sellers. If unaware, they are not able to make any inference on firm profitability. Thaler clarifies the point by arguing that the reference price is based on costs (Thaler,1985, p.34). Also Okun, who is generally credited for having originated the literature on fairness, noticed that only price increases which are not justified by cost increases are eligible for causing fairness consideration. An observation which implies that consumers use costs as a point of reference for evaluating prices. It is worth noting that these theories are generally used as an explanation for price mark up, interpreted as a way to limit unfairness reactions.

However costs are unsuitable for playing any referencing role. Consumers do not have access to cost information and cannot extrapolate correct conclusions from the little data they have (Bolton-Warlop and Alba, 2003). This point seems rather conclusive. But we can add a further argument. Very often, overhead costs prevail over variable costs and price structure should be settled by firms according to the strength of the several components of demand. In this case there is no satisfactory way for consumers to relate unfair concerns to the cost structure of the seller.

Prices of substitutable goods – Several contributions exploring the impact of the perception of prices of substitutable goods on marketing strategies² have been mentioned in the discussion about the role played by fairness (Xia *et al.*,2004; Anderson *et al.*,2006). When products look alike, it has been argued, price comparisons are easy to accomplish and consumers can ascertain the presence of unfair behaviour. We cannot share this opinion and we are inclined to think rather the opposite, that prices of substitutable goods cannot be considered a benchmark for unfair behaviour. Inevitably unfairness is associated with the lack of alternatives³: if prices of substitutable goods are lower than the one under evaluation, consumers do not feel spoiled, they simply chose the lower priced alternative, at least in the long run. (...) Therefore, if we use prices of competing good as a benchmark we are forced to confine the relevance of fairness feeling to (very) short term disequilibrium phenomena.

Our main contribution is to consider, as a point of reference, the price of similar but not substitutable goods. You might believe that these prices are very rare.

² Briesch *et al* (1997), Alba *et al.* (1994), Urbany *et al.* (1988), Dholakia *et al.*(2005).

³ In the Rotenberg model unfairness feeling can coexists with alternatives because it arises out of a confrontation between a present transaction and an hypothetical one which could have occurred at an earlier time. But in this case confrontation is carried out with previous prices.

Quite the opposite. We observe many environments characterised by products which look similar but are not substitutable. An obvious reference is to markets of very differentiated products: CDs, DVDs, and books are good examples.

We can reformulate KKT theory, using this sort of reference point. Consider the following utility function:

$$U = u(\mathbf{x}, \beta) + w + f(P_y, \gamma)$$

$$\text{s.t. } \mathbf{P}_x * \mathbf{x} + w = Y$$

Where: β = parameter which measures the degree of substitutability between goods
 γ = parameter which measures the strength of fairness considerations
 \mathbf{p}_x = price vector of goods x_1, \dots, x_n
 P_y = reference price
 \mathbf{x} = vector of quantities of products (x_1, \dots, x_n)
 Y = income
 w = all goods different from \mathbf{x} (price normalised at $P_w=1$)

The last part of this utility function deals with fairness and depends on the price chosen as a benchmark and the parameter γ , which measures the strength of fairness considerations. The degree of substitutability between products is measured by parameter β . Notice that in this utility function the product, whose price is chosen as a benchmark, does not belong to the consumer goods set: therefore products are only allowed to have mutually exclusive substitution or fairness effects.

A system of demand function can be derived from U function. In order to obtain a linear demand system (for two goods), we employ a slightly modified version of the Bowley utility function for the representative consumer.

$$U(x_1, x_2, P_y) = [a(x_1 + x_2) - \frac{1}{2} b (x_1^2 + 2 \beta x_1 x_2 + x_2^2) + f] + [\gamma P_y (x_1 + x_2)]$$

$$\text{s.t. } p_1 x_1 + p_2 x_2 + f = Y$$

The second part of the equation is the term added for taking into consideration fairness feeling by consumers. In essence, it says that the utility of consuming x_1 or x_2 changes in proportion (γ) to the reference price (P_y). From this utility function we can derive the following system of linear demands:

$$x_1 = c_0 - c_1 P_{x1} + c_2 P_{x2} + c_3 P_y$$

$$x_2 = c_0 - c_1 P_{x1} + c_2 P_{x2} + c_3 P_y$$

Where: $c_0 = a(1 - \beta)/b(1 - \beta^2)$
 $c_1 = 1/b(1 - \beta^2)$
 $c_2 = \beta/b(1 - \beta^2)$
 $c_3 = \gamma(1 - \beta)/b(1 - \beta^2)$

This demand system looks familiar. But the interpretation of the coefficient (c_3) for the reference price (P_y) is different from the standard one. Generally, a coefficient of the price of a product, in the demand equation of another, implies some degree of substitutability between the two. In this case, the coefficient depends on the parameter γ , which accounts for the fairness feeling. It also depends on the degree of “closeness” (β) between the goods x_1 and x_2 : the more they are substitutable, the less is the role played by fairness considerations.

Therefore demand cross elasticity could arise not only from the first component of the total utility function (acquisition utility), as maintained by the traditional theory, but also from the presence in the second component (transaction utility) of prices of similar goods. If this intuition is correct we must observe, in some cases, demand cross elasticity without a shift from one product to another. We also expect that price changes of some goods do exert some influence on demand of another product even if they are not substitutable with it. In conclusion, the line of research presented in this paper can be considered a new critique to the Independence of Irrelevant Alternatives assumption.

Musical CD market

The musical CD market is a suitable candidate for experimenting the validity of our hypothesis. It is highly differentiated as consumers show strong preferences toward some musicians and are relatively uninterested in others. One characteristic of this market, which has relevant consequences on the way we ran our field experiment, must be stressed. Due to piracy reserve price for music can be very low, in particular for the sort of participants (university students) to this experiment.

CD are priced according their vintage, as new records have an higher price. However, once maturity has been kept in account, CDs show a quite remarkable price homogeneity, despite they are an highly differentiated. Recently launched CD's are generally priced at the same price in each national market. We also notice a relative homogeneity in pricing among older CDs. The only relevant price differentiation in the sector rests on discounts regarding temporary sales.

The recourse to the same price level can be explained by two competing theories: 1) firms cannot calculate the precise demand elasticity of each CD and therefore apply some general price rule; 2) reference pricing, that is all prices of CDs belonging to a specific category are considered by consumers a sort of a benchmark for the single price of any CD belonging to the same category. This would force firms to apply the same price, as they don't want to antagonise patrons.

The first theory is credited with wide acceptance. When a firm sells a number of CDs, even a rough estimation of individual demands might be impractical. So the recourse to some conventional sort of homogeneous pricing becomes the only viable alternative.

(references to menu costs)

By the way, this explanation has been recalled often by music companies. However, as it can explain their behaviour when niche CD's are concerned, this explanation is not convincing when we try to interpret the pricing of top seller CD's. In this case the specific calculation of individual demand and the choice of an appropriate price should be a better maximizing price strategy.

The design of the experiment

We ran a field experiment on musical CD market. In particular the experiment throws some light on the behaviour of students (attending a BA course at the Siena University) shopping for a musical CD. Only students who had acquired one CD in the previous twelve months were considered eligible for participating to the experiment. The experiment is based on consumption behaviour referred to a list of 20 CDs. CDs of the list are recent hits, all priced at the same market price (€ 18 is the price charged by an internet seller).

The experiment was designed in the following way:

- 1) Preliminary stage - We asked participants to choose between € 3 in cash or a discount bonus of € 9 for buying one CD from a list of 20 hits. Only students who opted for the bonus were allowed to continue the experiment. The aim of this preliminary stage was to exclude students with a very low reservation price for CDs belonging to the list.
- 2) First stage – We asked students to reveal their first and secondary choices of CD at different levels of discount. We started by asking all participants which CD they would like to buy with an initial discount of € 9 (compared to the internet price). Then we asked if they wanted to buy other CDs at the same discounted price. We progressively increased the discount (up to € 11) and checked their reactions. The aim of this stage was to force each participant to reveal his first choice and all his secondary choices.
- 3) Second stage – We started this stage by modifying the original list of CDs. For each participant the list was then composed by his first choice and all the CDs he did not show any interest in (we can call these “irrelevant CDs”). That is, we eliminated all secondary choices from the original list. We then divided all participants in two groups. We offered one group the possibility of buying one CD from the modified list at the following prices: € 13 (which corresponds

to a € 5 discount) for the first choice and € 9 (which corresponds to the original € 9 discount) for each of the irrelevant alternatives. We offered the second group the possibility of buying one CD from the modified list for the same price of € 13 (irrespective if it is the first choice or one of the irrelevant alternatives). Students which decided not to buy any CD were compensated with € 1. The aim of this stage was to check if the price of irrelevant alternatives influenced the decision to buy the preferred CD.

All students, irrespective if they choose cash or CD in the final stage, receive € 3 for having participated in the experiment.

Problems in the experiment setting:

- 1) Due to low income and piracy, students do not buy many CDs and generally have a very low reservation price for recorded music. We handled this problem, first, by excluding, at a preliminary stage, all students preferring a small amount of money (€ 3) to a substantial (€ 9) discount on one of the CDs from our list. We also offered a very low sum of money as an alternative to the discount on music proposed in the last stage of the experiment.
- 2) Because the experiment is dependent on the reactions of two samples subject to different price structures, it is important that the two samples are not distorted. We dealt with the problem by paying attention to the following variables: a) number of CDs bought by each participant in the previous year; b) number of second choices elicited during the first stage of the experiment.

Result of a preliminary experiment

Last 26 of May 2006 we run the described experiment employing a sample of 25 students. Seven of them abandoned the experiment at the early stage (having decided to accept € 3 in cash). The result of the experiment can be described by contrasting the percentage of CD buyers (of the first choice) in the two sub-samples:

- 1) Group facing the same price (for the first option and for the irrelevant alternatives): 86 per cent.
- 2) Group facing two different price for the best option (€ 13) and for the irrelevant alternatives (€ 9): 50 per cent.

As expected, nobody wanted to buy what he considered an irrelevant CD, even when it was offered at a better price.

This result is encouraging and it seems to confirm the initial intuition. The experiment shows that fairness considerations play a role in the demand pattern of

consumers. Similarly to Anderson-Simester (2006) the fairness effect seems more relevant than the standard effect of a price increase. Lacking the fairness effect (when also prices of irrelevant alternatives increase) the demand shrinks by 14 per cent. The fairness effect – according to the results of this experiment when only the price of first best option increases – decreases the demand by an additional 36 per cent: more than twice the standard effect!

Of course the number of students is very low and this result can be due to chance. We now plan to run a second round of the experiment employing additional 80/100 students.

Second experiment

1st stage

We start from a very low price structure; then gradually we increase prices up to the point in which nobody buys CD's

2nd stage :

We decrease the price of first choice and prices of irrelevant alternative (1st sample) and (2nd sample) we increase the price of irrelevant alternatives and decrease the one of the first choice

By doing that we are able to control the effect of the increase of the price of irrelevant alternatives on the demand of a good.

Final remarks

The proposed analysis can cast a new light on some antitrust cases where suspects aroused of collusive behaviour among producers of very differentiated goods or of goods (or services) belonging to different markets. In these cases standard theory lacks of convincing explanations because collusion is generally interpreted as a way to “control” demand externalities among substitutable products. So collusion among producers of not substitutable goods is something which could not exist. But if the proposed theory is true, then an agreement among this sort of producers (aimed to minimize fairness effect through common price increases) could be profit enhancing.

Our analysis also requires a reconsideration of how an antitrust relevant market is defined. It has been definitely clarified some time ago (Boyer, 1979) that in order to delineate an antitrust market we must take in consideration all those products which will be profitably included in a collusive agreement. The SSNIP test,

introduced in the US Merger Guidelines (and used almost everywhere) to delineate a market, is based on the same intuition. If a cartel can only include substitutable products, then an antitrust market must be only composed by substitutable products. But if we can provide a rationale for a cartel to include not-substitutable products, it follows that an antitrust market cannot rest only on the notion of substitutability.

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Dettagli sull'esperimento:
A pag 11 parli di Secondo esperimento

Second experiment

1st stage

We start from a very low price structure; then gradually we increase prices up to the point in which nobody buys CD's

VUOI DIRE CHE NON DOBBIAMO PIU' USARE IL SISTEMA DEI BUONI E CHIEDERE DIRETTAMENTE LA DISPONIBILITA' A PAGARE?

IN TAL CASO DOVREMMO DARE UNA CASSA INIZIALE

2nd stage :

We decrease the price of first choice and prices of irrelevant alternative (1st sample) and (2nd sample) we increase the price of irrelevant alternatives and decrease the one of the first choice

STESSO PROBLEMA DELLA FASE UNO

CON IL METODO USATO NEL PRIMO ESPERIMENTO ABBIAMO OTTENUTO CHE

- 3) Group facing the same price (for the first option and for the irrelevant alternatives): 86 per cent.
- 4) Group facing two different price for the best option (€ 13) and for the irrelevant alternatives (€ 9): 50 per cent.

E' QUINDI ABBASTANZA CHIARO CHE UNA DIFFERENZIAZIONE DI PREZZO PER PRODOTTI COSI' TANTO DIFFERENZIATI (IN ASSENZA , DA PARTE DEL VENDITORE, DI CONOSCENZA DEI PREZZI DI RISERVA DEI SINGOLI CONSUMATORI PER OGNI SINGOLO CD) DIMINUISCE GLI ACQUISTI DEI CONSUMATORI (perché AUMENTA LA UNFAIRNESS PERCEPITA)

RIMANE IL PROBLEMA DI DEFINIRE I NUOVI CONFINE DELL'INSIEME DI SCELTA (LE PARTITE DI B, C1, C2, O ALTRO, LE PARTITE DI BASKET? LA MUSICA CLASSICA RISPETTO AL ROCK, ecc.)

PROBLEMA GENERALE:

Noi diciamo che l'insieme che i consumatori considerano per la scelta è più grande (per via dell'effetto fairness) dell'insieme dato dai soli beni per i quali esiste una elasticità incrociata.

Probabilmente questo insieme "di considerazione" è un insieme chiuso e cioè non tutte le alternative irrilevanti vengono prese in considerazione, senno' avremmo l'impossibilità di definire quale sia il nuovo e più ampio mercato rilevante.

Il tentativo di separare individui con preferenze "concentrate" (vedono solo la Lazio o ascoltano solo Renato Zero) dagli individui con preferenze distribuite (vedono la Roma, la Nazionale e qualcos'altro, ascoltano Rolling e Beatles, ecc.) andava proprio nella direzione di definire meglio la misura dell'effetto fairness nei due diversi casi.