FAIRNESS: EFFECT ON TEMPORARY AND EQUILIBRIUM PRICES IN POSTED-OFFER MARKETS*

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Questionnaire studies suggest that perceptions of fairness cause people to resist price increases following abrupt changes in conditions with no cost justification. This hypothesis is examined in posted-offer markets extending previous work. Consistent with the hypothesis, in the profit disclosure (fairness) treatment prices are initially below those in the cost and the no disclosure treatments. But over time prices in all treatments converge to the competitive surplus maximising equilibrium. Thus 'fairness' is interpreted as being the result of expectations that are not sustainable. Expectations adapt as the market converges to the standard competitive equilibrium prediction.

I. THE PROBLEM

I.A. *Background*

Survey studies of attitudes toward pricing in retail markets (Kahneman *et al.* 1986*a*, hereafter KKT; 1986*b*) have reported that respondents do not consider it fair for a firm to increase prices and profits when there is a short-run change in the economic environment that is not justified by a cost increase. For example, the following hypothetical circumstances are posed (KKT, p. 201): 'Question 1. 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 ___.' 82% of respondents rate this action as unfair or very unfair. What is fairness? This question is not addressed by KKT. In the light of our data, and related literature, we return to the issue of interpreting fairness in Section V.

Okun (1981, p. 170) had earlier argued that fairness considerations explain why firms operate with backlogs in periods of shortages (e.g. automobiles), and why sports tickets are often not priced to clear the market. Okun and others have argued that such instances of fair behaviour by firms constitute actions which are in their long-run profit maximising interest: the social rules of fairness define the terms of an implicit contract that is enforced by virtue of punishment of unfair price behaviour.[1] But KKT (p. 201) argue that in many

[1] Our investigation of the pricing of basketball tickets at the University of Arizona is consistent with a rational implicit contract interpretation. Historical holders of season tickets who renew each year have an entitlement to continue renewal. They pay $262 per ticket plus a required 'contribution' (tax deductible) of $100 to the Wildcat Club. New tickets (not many become available each year through release; a recent auction of entitlements for two tickets brought $13,500 in a bankruptcy settlement) are priced under several options designed to clear that market. Two of them are: (1) buy each year a loge season ticket for football for $1,400–$1,800 and get the right to a basketball ticket for $362 (including the contribution); (2) buy an entitlement with a $5,000 contribution to the Wildcat Club. Why is the $100 contribution not included in the official price of the ticket? Very simply, it gives the athletic department more budget flexibility under state spending rules. The athletic department does not price all tickets to clear the market to avoid a feared

situations people report they would follow fair policies in the absence of enforcement through punishment. Thus people report that they would leave restaurant tips (about 15%) even in cities that they did not expect to visit again.[2] Respondents also report that they expect automobile repairmen to treat tourists and regular customers alike in spite of the differing possibilities for long-term punishment strategies (KKT, pp. 212–3).

These considerations lead to the proposition that markets in which a firm makes pricing decisions that affect customers (e.g. posted prices in retail markets) will fail to clear if excess demand is not justified by increases in supplier costs (KKT, p. 213). This is because of the 'principle of dual entitlements', under which customers have a right to the terms of a reference transaction, while the firm has a right to its reference profit (Zajac, 1985, pp. 139–41). Recent posted prices can serve to define the reference transaction (KKT, pp. 201–2). But people do adapt: 'Psychological studies of adaption suggest that any stable state of affairs tends to become accepted eventually, at least in the sense that alternatives to it no longer come to mind. Terms of exchange that are initially seen as unfair may in time acquire the status of a reference transaction...they adapt their views of fairness to the norms of actual behaviour.' (KKT, p. 203). These considerations imply that the short-run price response to excess demand will be sluggish in markets in which a price increase is not justified by an increase in unit supply cost; if the excess demand persists, only new higher prices are sustainable, and people will adapt by redefining the reference transaction. The equilibrium may still be that which is predicted from economic theory. In this paper we assume that the hypothesised short-run failure of markets to clear depends upon buyers knowing that increased profits would result from the higher prices. In the absence of such information, buyers do not have a common reason for resisting the actions.

I.B. *Question 1 Responses: Market Effects*

In order to understand the responses to KKT's Question 1 better, we conducted two variations on it. First, we noticed two features of their question that seemed unusual. It used the words 'fair' and 'acceptable' within the same instrument, precluding the possibility that a situation might be judged unfair but nonetheless, acceptable. Also, questionnaires normally allow respondents

firestorm of protest from the legislature, the alumni and the community who bought their tickets years earlier in loyal support of a less popular basketball programme. Many of these individuals may feel they have earned their implicit entitlement contract, and many contribute additional money to university programmes.

[2] Although tipping in such situations has been described by KKT as due to a 'fairness' ethic, it is important to realise that it is based on a widely accepted expectation that tipping is an exchange – a payment for service. The IRS considers tips an exchange, and taxes the employer's estimate as income. The powerful expectations that drive tipping is clear in the following incident involving one of us (Smith): Ten people go to a Mexican restaurant at the end of a conference day. No tip was left in the belief that with groups of six or more an automatic 15% gratuity was included. The waiter follows the payer into the parking lot and demands to know what was wrong with the service? It was fine. But you left no tip. Wasn't a tip included in the bill? No. Forthwith he is given $20. Upon reporting this experience in various seminar presentations, other such incidents of outraged waiters (blocking the exit door) and taxi drivers (hurling coins at a fleeing customer) are brought forward. Clearly, there is a strong mutual expectation that service requires a reward, which is recognised and taxed by the state. This is so whether or not an exchange will be repeated.

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to register 'no opinion'. Consequently, in our first variation of Question 1, everything was the same as in KKT except that we removed the word 'fair', asking our respondents to please rate the store's action as: Completely Acceptable (29·7%) Acceptable (32·4%) No Opinion (5·4%) Unacceptable (27·0%) Completely Unacceptable (5·4%). For $N = 37$, our results are shown in the parentheses. We get 32·4% who rate the action as Unacceptable or Completely Unacceptable. We use these results as a subject control for introducing a treatment change. Using a different sample of respondents from the same pool of undergraduates, our second variation of Question 1 posed the same situation, but added the sentence: 'The store does this to prevent a stockout for its regular customers since another store has raised its price to $20.' Changes in the economic environment have implied consequences in the behaviour of markets; our purpose was to express the sort of market consequence that might reasonably follow such a change.[3] The issue here is whether the store's response to market competition could serve to justify its action (in addition to KKT's postulate that people will accept a price increase, relative to a reference transaction, if it arises from an excess demand that is cost-justified). Our results for $N = 41$ are: Completely Acceptable (34·1%) Acceptable (39·0%) No Opinion (7·3%) Unacceptable (19·5%) Completely Unacceptable (0%). With a market justification the percentage in the last two categories falls from 32·4 to 19·5%.

These data suggest the need for reward motivated experiments, in a posted-offer market setting, to explore further the KKT hypothesis that subjects might trade off self-interested behaviour against concerns of fairness.

I.C. *Previous Experiments*

Kachelmeier *et al.* (1991*a*, hereafter KLS) report laboratory experiments designed to measure the effect of the above fairness considerations on actual price responses and convergence behaviour in experimental markets using *buyer* posted bid pricing. In their environment, five buyers and five sellers trade for ten periods under stationary value/cost conditions. Buyers independently post bid prices, and sellers respond with individual sales by accepting bids. Then a change is introduced for a new ten-period sequence. In the first sequence, sellers are subject to a 50% profit tax such that, at the competitive equilibrium price and volume, the sellers' share of total surplus is exactly 50%. But in the second sequence of 10 trading periods, the sellers' 50% profit tax is replaced by a 20% sales tax on each seller's revenue. The effect of this sales tax is to raise the previous marginal cost supply schedule, $MC(q)$, to $1·25\ MC(q)$. This increases the competitive equilibrium price, lowers the volume, and increases the sellers'

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[3] When markets fail to clear at below-equilibrium prices, both buyers and sellers are hurt by the resulting stock-out approach to rationing. Some buyers, who would be submarginal at the equilibrium, can profitably buy at the disequilibrium price; this displaces intra marginal buyers for whom purchase is more profitable, with consequent losses of buyer profit (surplus). In particular, if we postulate KKT's local stores, one 'unfair' consequence of not raising price is that some units are sold to crossover buyers who thereby displace sales to neighbourhood customers. If the store refuses to sell to strangers (besides being actionable in court), it is vulnerable to the charge that this is unfair to anyone who drove out of her way to buy at lowest cost. Given a change from the reference baseline, all alternative policies are 'unfair' to some subset of buyers.

share of total profit. Each of three different information treatment conditions is replicated three times with different subjects (90 subjects total): (1) seller marginal cost information is disclosed to all subjects; (2) the sellers' share of aggregate profit (surplus) is disclosed to all subjects; (3) no marginal cost or profit information is disclosed. With profit disclosure, buyers are fully informed that, compared with the previous ten reference transactions periods, the change to a sales tax regime has shifted net surplus from buyers to sellers. With marginal cost disclosure, buyers are informed that prices must increase to cover the new seller costs. Consequently, profit disclosure focuses on the KKT principle that sellers are only entitled to their previous reference profit (it is 'unfair' for sellers to profit from the tax), while marginal cost disclosure reinforces the principle that any price increase is justified by a unit cost increase. The treatment with no marginal cost or profit disclosure provides experimental control. The prediction hypotheses, based on KKT, are as follows (KLS, p. 697).

H1 : The initial price response to a change from an income to a sales tax will
be greater under marginal cost disclosure than under profit disclosure.

Convergence over time relative to baseline control experiments will be

H2: faster under marginal cost disclosure;

H3: slower under profit disclosure.

KLS report statistical support for all three hypotheses.[4] Our results below for posted-offer pricing are completely consistent with those of KLS, except for some minor deviations in the efficiency results, which we discuss in Section III.

I.D. *Extension: Posted Bid versus Posted Offer*

The institution used by KLS is posted bid pricing. 'The trading rule allowed only buyers to propose prices.' (KLS, p. 700). This was defended on the grounds of 'intentional experimental artificiality'. That is, since fairness directly concerns the perceptions and response of buyers, this device enables direct measurement of that response in terms of posted buying prices.

In this note we propose to examine the robustness of the KLS results using the familiar retail institution in which sellers post prices to buyers. This institution is quite clearly the one that KKT have in mind in their consumer market examples (although they do discuss labour markets in which wage bids are made by firms). To wit: 'For example, 68 percent of respondents said they would switch their patronage to a drugstore five minutes further away if the one closer to them raised its prices when a competitor was temporarily forced to close...Retailers will have a substantial incentive to behave fairly if a large number of customers are prepared...to avoid doing business with an unfair firm' (KKT, p. 212). Thus, customers will withhold demand from an unfair firm, and, anticipating this, the firm will have an incentive to price fairly. In the experiments reported below, in which sellers independently post prices to the buyers, we can study not only buyer demand withholding behaviour, but

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[4] In a related study, Kachelmeier *et al.* (1991 *b*) examine fairness using the double oral auction trading rules with a different experimental design and perspective. The basic result, however, a tendency for the fairness effect to dissipate over time, is the same. In this paper we use the design reported in KLS (1991 *a*).

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also the sellers' indirect attitudes towards 'fairness' as expressed in the prices they post to buyers. Of course, if sellers post lower prices under profit disclosure, we cannot know whether it is because they are being 'fair' or because they are simply responding rationally to avoid expected punishment by buyers.

We employ the Novanet (Plato) posted offer mechanism described by Ketcham *et al.* (1984), with the modification that in the experiments reported below, sellers could not see each other's prices after independently posting them in each period. This has the effect of reducing the ability of sellers to undercut each other's prices; i.e. by this procedure one expects to observe a purer and perhaps more persistent individual 'fairness' response, thereby giving the KKT theory its best shot in the experimental market context. This is not to deny that markets may be more competitive when sellers observe each other's prices. Rather, our point is that the reported experiments control for this, and, if the effect of fairness disappears, then under this interpretation we have a stronger result. The effect of publicising price information can always be studied using the experiments herein as a comparison control.

II. EXPERIMENTAL DESIGN

Essentially, we use the same experimental design as in KLS. The information disclosure treatments are identical as described above in Section I. Our supply and demand environment, also identical with that of KLS, is shown in Fig. 1
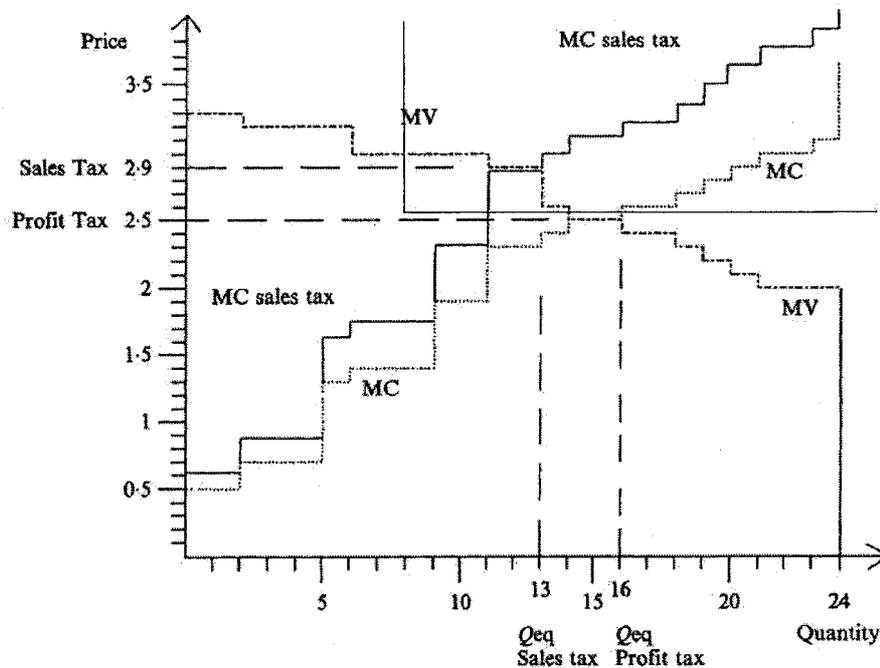

Fig. 1. Supply and demand environment. ———, MC sales tax; ·······, MC profit tax; –·––·–, marginal values.

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regime in part two. Our design and procedures differed from KLS only in the following respects.

(1) We used six buyers and six sellers, rather than five each. (This was to accommodate a second independent follow-on experiment that required twelve subjects.)

(2) Each of the three treatment conditions, parts one and two, were replicated four times instead of three times (144 subjects total).

(3) Two control experiments were run for twelve price/purchase periods in part one; the others for ten periods. Two profit disclosure experiments were run for twenty periods in part two; the others for ten periods. The two longer profit disclosure experiments allowed us to determine if any equilibrating tendencies continued after the first ten periods.

(4) Between parts one and two of their experiments KLS scheduled a break allowing buyers and sellers to be separated (ostensibly to pay them privately) and given the required separate instructions for the part two, sales tax (no disclosure), regime. We did not do this, but elected simply to pass out different instruction forms to buyers from those to sellers in the control experiment; since everyone received paper, this disguised the different treatment of sellers. The instructions to buyers simply informed them that their redemption values in part two were the same as in part one, while it was explained to sellers that starting in the next period they would pay a sales tax rather than a profits tax. Table 1 contains a summary of all handouts for the different information

Table 1

Handouts for Experiments

	Control experiment		Marg. cost disclosure*		Profit disclosure	
	B	S	B	S	B	S
1st part of experiment						
How a buyer calculates profit	A1	A1	A1	A1	A1	A1
How a seller calculates profit	A2	A2	A2	A2	A2	A2
Explanation and graph of profit tax					A3	A3
Form: expected price, actual price, sellers' share of profits					4	4
2nd part of experiment						
Notice: nothing changed†	B1					
Notice: new instructions		B2				
MC disclosure			B3	B3		
Explanation and graph of sales tax					B4	B4
Form: expected price, actual price, sellers' share of profits					4	4

B, Buyers; S, sellers.
* Same as control experiment (no disclosure) in 1st part of experiment.
† Buyers were informed that their values are the same as in part 1.

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treatments which can be compared with the KLS procedures (pp. 691–703, 715–6).[5] Subjects earned non-trivial amounts of money. Payoffs for the experiments, which lasted usually between 2 and 2½ hours, ranged from $8.75 to $62.50, averaging about $26 ($3,700 in total). These payoffs substantially exceeded our subjects' usual opportunity costs. For a survey of papers that have evaluated the importance of monetary rewards, see Smith and Walker (1993).

III. HYPOTHESES AND EXPERIMENTAL RESULTS

H1. In period one, part two, the first period of trading under the sales tax regime, the KKT fairness argument will yield prices ordered as follows:

Prices (marginal cost disclosure) > Prices (no disclosure) > Prices (profit disclosure).

H2. By period ten, part two, the prices under the various treatment conditions will be indistinguishable.

H3. Under the profit disclosure treatment, the two experiments that continue for twenty periods in part two will show convergence to the competitive equilibrium.

The weighted mean contract price (each posted price is weighted by volume) for the four experiments in each information condition is shown plotted across all periods in both parts of the experiments in Fig. 2. In part 2 there is initially
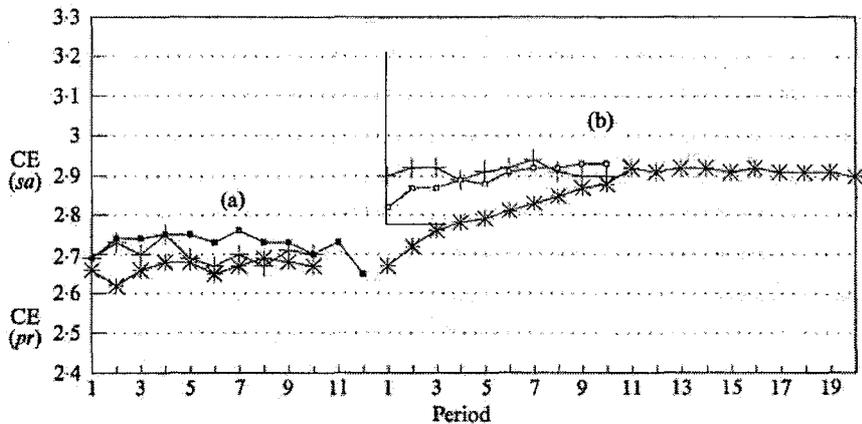

Fig. 2. Mean contract prices: profit tax and sales tax. (a) ■, *prc*; +, *prm*; ✻, *prp*; (b) □, *sac*; +, *sam*; ✻, *sap*. The experiments have two stages. With (i) profit tax (*pr*); (ii) sales tax (*sa*). (*c*), control; (*m*), MC; (*p*), profit disclosure.

(period one) a clear separation of mean observed prices in accordance with H1. Under marginal cost disclosure prices jump immediately to the new equilibrium, while under profit disclosure they do not change from their previous 'reference transaction' level. By period 10 the mean price under all

[5] All forms and supplemental instructional handouts are available by writing to the authors (Smith).

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Table 2

Buyer Withholding by Treatment

Withholding	Control	MC disclosure	Profit disclosure	Sum
Profit tax	—	1	4	5
Sales tax	2	2	23*	27

* 22 of these cases were in experiment *sa4p* and involved three buyers.

three information conditions has converged to near the new competitive equilibrium price ($2.90). Finally, the two experiments that were extended for twenty periods in part two stabilise at slightly above the competitive equilibrium price in periods 11–20.

We test H1 and H2 using the nonparametric Jonckeere test that the samples (mean contract prices), of size $m_i(= 4)$, are from an *a priori* ordering of $n(= 3)$ distributions against the null alternative that the samples come from the same distribution. The Jonckeere test is a generalisation of the one-tailed Wilcoxon test. For H1 we reject the null hypothesis with a test statistic $J_1(3, 4) = 2\cdot34$ (p = 0·01). For H2 we are unable to reject the null hypothesis, $J_2(3, 4) = -0\cdot439$ (p = 0·33).

In the profit tax regime (part 1, periods 1 to 10–12, Fig. 2), although prices in all treatment conditions hover above the competitive equilibrium, prices are lowest under profit disclosure. The three series come together, however, by period ten. Consequently, even in the baseline series, with no reference transaction, initially we observe lower prices under profit disclosure. Profit disclosure blunts the profit-seeking behaviour of sellers relative to the other experiments. But the effect of profit disclosure is even more striking under the sales tax regime, given the previous reference transactions in the baseline. The tendency of the 'profit disclosure' price path to be below that of the 'marginal cost' and 'no disclosure' treatments is evident, but the control and marginal cost disclosure price paths are indistinguishable after the first three periods in part 2.

In Table 2 we report the frequency with which demand is withheld (underrevealed) by buyers. This frequency is determined by counting the number of instances in which each buyer fails to buy at a price equal to or below his/her redemption value. Although the incidence of withholding, in the profit disclosure treatment, is far greater in the sales tax regime (23) than in the profit tax regime (4), 22 cases were in one experiment! Furthermore, that experiment yielded mean prices below that of two other experiments. This observed withholding was an uncontrolled 'treatment' variable. It is important to note that the mean posted prices in that experiment were *not higher* than in the other experiments with sales tax. On the contrary, in all periods they were *lower* than in two other experiments and in the first period after the tax change they were the lowest of all. For the detailed price path see Fig. 3; the experiment in which the withholding occurred is *sa4p*. It would appear that the tendency of sellers to post lower prices earlier but not later in the sequence of
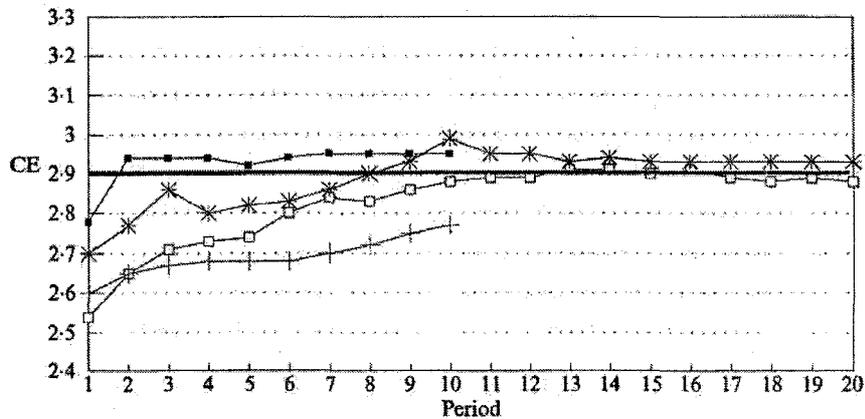
Fig. 3. Mean posted prices: sales tax, profit disclosure. ■, $sa1p$; +, $sa2p$; ✳, $sa3p$; □, $sa4p$.

trading periods was the result either of seller 'fairness' behaviour or anticipation of strategic buyer withholding, not a response to buyer withholding.

Withholding did not significantly affect efficiencies, mainly because often (though not always) only marginal units were withheld. However, there is one efficiency difference between our experiments and KLS. KLS state as one of their hypotheses that 'Profit information will lead to lower volume and lower market efficiency than in either the cost-disclosure or no-disclosure markets' (KLS, p. 698) and report support for this hypothesis. Our data do not support this hypothesis. In only two periods (6 and 10) is the average efficiency and the trading volume in the profit disclosure experiments the lowest of all treatments. Similarly, we observe lower efficiency and trading volume in the marginal cost disclosure treatment than do KLS. Minor differences are to be expected since the microstructure of the institutions (rules) of trade are different. But overall the results reported by KLS are robust with respect to the change to posted-offer pricing.

IV. DISCUSSION

Economists and econometricians have long allowed that nonmonetary and non-economic factors influence behaviour, although the standard rational model has always been more prominent. The exceptions are implicit in concepts of external economies in consumption. Recent work (e.g. KKT) has shown how survey evidence can be used to study systematically, and categorise, a wide variety of behaviours that may deviate from the narrow interpretation of rational self-interested models of equilibrium behaviour.

In this paper we have studied the effect of alternative information disclosures on the prices posted by sellers subsequent to an exogenous increase in seller marginal costs (a sales tax). If, as argued by KKT, buyers are more receptive to price increases that appear to be cost justified than to price increases that increase profits above reference transaction levels, then, recognising this, sellers will post lower prices under profit disclosure than under marginal cost disclosure. Over time, however, this discrepancy need not persist, since KKT

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argue that actual (equilibrium) behaviour may allow the establishment of a new reference transaction that does not violate social norms of fair behaviour. Our results support this argument. Consequently, the prediction is supported that equilibrium outcomes will reflect the rational behaviour of standard economic models, although the transition path to the new equilibrium is affected by such 'fairness' considerations. Our results also support the value of survey data in uncovering potential anomalies, which can then be tested in the context of motivated decisions to see if the findings survive in actual behaviour.

According to the *New York Times* (Lohr, 1992), Hurricane Andrew, striking South Florida on 24 August 1992, provided a fine example of how the KKT 'fairness' considerations are needed to modify economic theory. 'What happened in the plywood market here after the storm is a classical example of fairness constraints at work...The big companies (Home Depot, Georgia Pacific and Louisiana-Pacific) performed far differently (increasing the price only about half as much as the "market") than the price-gougers selling ice, water and lumber from the back of pickup trucks at wildly inflated prices in the first week after the hurricane hit. Classic economic theory, of course, defends these...' (Lohr, 1992, p. C2). Actually what classical theory does is to explain, not defend, the competitive market operated out of the back of pickup trucks. In a competitive market, those who would attempt to charge low prices would stock out more quickly, and thus are under pressure to raise prices, given the limited supplies; otherwise arbitrage profits will be collected by third parties. Modern economics, in the form of reputation theory, also explains the actions of the large firms who have much greater control over their market. Their national sources of supply enable them, through transfers, to replenish stocks more quickly, price less aggressively, and build a long term reputation for not 'price gouging' (with free advertising, courtesy of the *New York Times* article), but simultaneously reap supra normal profits (they did raise prices, if only half as much as the competitive fringe). But one does not need a utilitarian fairness ethic to explain the repeated game (versus one-shot) nature of the long-run outlook of the large supplies. Similarly, optimisation theory predicts that if buyers believe that they can conserve their resources by complaining about price gouging being unfair, then they will do it. The long-term result (hidden from the average consumer) may actually build the market power of the large firms, reduce competition, and decrease welfare: all in the good name of 'fairness'. Would a rose by any other name smell as sweet?

V. WHAT IS FAIRNESS?

The answer, we think, is likely to depend on the particular context in which the term is used. In the context that we study here the results are not consistent with the idea that 'fairness' considerations belong in the utility function, as an externality in consumption that alters in a sustainable way the equilibrium behaviour predicted by the standard own utility maximising model.[6]

[6] To illustrate, suppose that there are two commodities, X and Z, and that the utility function for each buyer has the form $u(x, z \,|\, \pi/\pi_0) = z + ax + (b/2)\, x^2 - \alpha x[(\pi/\pi_0) - 1]$ with income constraint, $I = z + px$, where p is the price of X in units of Z. Note that, with the parameter $\alpha > 0$, an externality (π/π_0) appears in the

We suggest that 'fairness' in our context is best characterised as affecting agent expectations, not their utility functions. Thus, buyers expecting (feeling they have a right to) fair treatment believe that price increases resulting from external cost increases should not produce higher profits for sellers. Sellers, accepting this norm of fair treatment, or fearing retaliation, do not attempt initially to 'extract' higher profit. These expectations yield no change in prices, initially, but such prices are unsustainable as an equilibrium; i.e. there is excess demand. In the absence of a utility from being 'fair' sellers gradually do what comes naturally: they raise prices and find rewards in higher profits. If sellers received utilitarian value from 'fairness' they would be satisfied with lower profit by accepting the profit-fairness trade-off. If buyers received utilitarian value from 'fairness' their final equilibrium demand levels would not be predicted from the model that maximises their monetary reward. By this interpretation, what alters over time are the expectations of both buyers and sellers as to what is acceptable or 'fair'. This also explains why fairness dominates the questionnaire responses of subjects. Their answers are based upon their expectations, not on the unanticipated and unanticipatable adjustments that can occur in the dynamics of actual market or experimental market behaviour. This is because no one (except the experimenter in a market experiment) can anticipate the new equilibrium and its possible effect on transient expectations of what is fair.[7]

Also, questionnaire data summarise average, not marginal, opinion, and we know from hundreds of controlled laboratory experiments that competitive outcomes and efficiency are driven by marginal analysis (sometimes called the marginal traders hypothesis). Thus, in markets like the one in Fig. 1, average MV and average MC, are irrelevant to determining the equilibrium, where $MV(Q_e) \geqslant MC(Q_e)$. The marginal trader hypothesis explains why the Iowa Presidential stock market is a much more accurate predictor of the popular

utility function, where π_0 is the profit of each seller in a reference (initial) situation, and π is the corresponding profit in a new situation. If buyers each maximise u subject to their income constraint, this leads to the demand equation: $p = a - bx - \alpha[(\pi/\pi_0) - 1]$. If each seller has quadratic increasing total costs, the profit function ($y =$ output) can be written, $\pi = py - (1/2\beta) y^2$, which at a maximum yields the supply function, $y = \beta p$.

Initially, let $a = a_0$, and $\pi = \pi_0$. Then $x_0 = y_0$ (demand equals supply) implies $p = p_0 = a_0 - b\beta p_0$ and $p_0 = a_0/(1+b\beta); \pi_0 = (\beta/2) p_0^2$. Now let demand increase with $a = a_1 > a_0$. Then $x_1 = y_1$ implies the new equilibrium, $p = p_1 = a_1 - b\beta p_1 - \alpha[(\pi_1/\pi_0) - 1]$, with $(\pi_1/\pi_0) = p_1^2/p_0^2$. Clearly, if $\alpha > 0$, the externality equilibrium, $x_1 = y_1$, is distinct from that which would prevail, where $x_1^* = y_1^*$, based on the absence of the externality ($\alpha = 0$).

The price and quantity levels to which our experimental data converge over time correspond to the situation in this example in which $\alpha = 0$; i.e. the results in part 2 of the experiment are predicted from the standard own-maximising model of utility.

[7] Our expectations interpretation of fairness is consistent with the results of Hoffman et al. (1993) in their ultimatum and dictator game experiments, although here the results are stronger because there are six (not one) bargainers on each side of the market. Also see Binmore et al. (1992) who report Nash bargaining experiments in which the median subject optimises in the long run in accordance with the theory using trial-and-error adjustment processes. 'However, the subjects seem to see no contradiction between such optimizing and "fair" behaviour, since the median subject reports as fair pretty much what actually happens towards the end of the games he or she played. These results are consistent with a view that regards behaviour as being shaped by social norms in the minds of the subjects, but which sees the social norms themselves being determined by evolutionary considerations of which the subjects are only dimly aware.' (Binmore et al. 1992, p. 34). This is consistent with KKT, and the adaptive results in the psychology literature, and with the results reported in this paper.

vote than opinion polls, although the participants prove to have, on average, all the standard opinion biases established by political science and sociological studies (Forsythe *et al.* 1992).

Fehr *et al.* (1993) provide a different context in which the word 'fairness' is associated with deviations from self-interested behaviour. First movers (buyers) compete by announcing buying prices (anonymously by telephone through an experimenter) to sellers who can accept but not make counter offers. Sellers then choose a 'quality' or effort level for the good they produce; given any accepted price it is in the sellers' interest to choose low effort, but in the buyer/seller joint interest to choose high. Buyers do best individually with a low price, if sellers choose high effort, but the dominant strategy of sellers is to choose low. Cooperative play requires buyers to buy at a high price and to trust sellers to reciprocate with a high effort. In this two-stage market game the gains from exchange are maximised by cooperative ('fair') behaviour not by competitive action in the self interest. The market study reported here is the opposite: the gains from exchange are maximised by competition, and reduced by 'fair' behaviour (unless there is utilitarian compensation from 'fairness').

The Fehr *et al.* (1993) experimental data across pairs and periods shows a statistically and economically significant positive relationship between price and quality. The results are especially interesting since the pairings by the market are not constant through time so that reciprocity is diffuse.

It is not clear, however, in what sense these results are 'explained' by a (utilitarian?) 'fairness' ethic, as against a mutual expectation/recognition by all parties that individual rewards will deteriorate across time if there is not reciprocity: better quality for better prices, for better quality, etc. Parallel results have been reported by Berg *et al.* (1994) in the single play of a two-stage dictator game run under double blind conditions (see Hoffman *et al.* 1993: subjects' pairings are anonymous with respect to each other and the experimenter, who cannot know who made what decision). In Stage I, subjects in room A choose how much of their $10 endowment to send to an anonymous counterpart in room B. Each dollar sent will be tripled (common knowledge) before it reaches the counterpart, who, in Stage II, chooses how much of this tripled amount to pay back to the person in room B. The dominant strategy for subjects in room A is to keep all the money, because it is a dominant strategy for any money received in room B to be retained. The average amount sent is $5.16 with an average payback of $4.66. In a second 'social norm' treatment all subjects are given a common history: the outcomes from all plays in the first treatment. The average sent is now $5.36 with a payback of $6.46.

Berg *et al.* (1994) do not suggest that their results are due to 'fairness'. As they describe it, they are studying trust and reciprocity. Subjects in room A can substantially leverage their endowments by 'investment' in amounts sent to room B. But this requires trust and an expectation of reciprocity. They are studying mechanisms of social exchange, and how the social norms that support such exchange can emerge from historical experience. These mechanisms allow gains from exchange to be captured in situations where traditional economic analysis would suggest market failure. Such mechanisms are metarational, and

materially extend the rational choice paradigm to include the evolution of institutions that promote gains from exchange in situations that are not incentive compatible.

We think the results of our paper and those of Fehr *et al.* (1993), and of Berg *et al.* (1994), contribute to a unified understanding of anomalous behaviour usually attributed to 'fairness'. Although the contexts differ in the three studies, the anomalous results are not explained satisfactorily by a utilitarian fairness ethic, but by expectations that are not sustainable, in our study, or by trust coupled with expectations of reciprocity, in the other two studies. The common outcome across the three studies is for subjects to approach the efficient maximisation of the social monetary gains from exchange.

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