

Fair Pricing

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Abstract

This paper explores the consequences of supposing that consumers see a firm as fair if they cannot reject the hypothesis that the firm is somewhat benevolent towards them. When consumers can reject this hypothesis, some become angry, which is costly to the firm. The desire to appear benevolent can lead firms to adopt third-degree price discrimination based on the income of different consumer classes while forswearing third-degree price discrimination based on differences in the elasticity of demand. It can also explain why prices seem to be more responsive to changes in factor costs than to changes in demand that have the same effect on marginal cost. Lastly, if consumers experience regret or disappointment when faced by increased prices, the model can explain why prices can be more rigid in response to disasters that increase demand dramatically than they are when there is a less substantial increase in demand. JEL: E3, D11, E44.

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1 Introduction

When firms are asked why they keep their prices rigid, they tend to say that they do so to avoid antagonizing their customers (Blinder et al 1988, Fabiani et al 2006). Consistent with this observation, this paper presents a model where fear of angry reactions leads firms to act as if they were altruistic. They do so because consumers react negatively if firms demonstrate that they are insufficiently benevolent towards them. As a result, firms are forced to internalize consumer emotions, and particularly the disappointment and regret that consumers feel when the price they face is higher than a price that was previously available to them. The resulting model rationalizes several observed pricing practices and seeks to explain what leads people to regard certain prices as “fair”.

The pioneering study by Kahneman, Knetsch and Thaler (1986) asked participants whether particular pricing patterns were fair or not and found remarkable consensus among its respondents.¹ An important finding of Kahneman, Knetsch and Thaler (1986) is that many respondents regard it as unfair for a firm to raise the price of an item whose demand has suddenly increased as a result of a change in the weather. By contrast, they generally regard it as fair if a firm increases its prices when the price of its inputs rise. Interestingly, these notions of fairness appear to be reflected in actual pricing practices. Firms often do increase their prices when costs rise. On the other hand, dramatic increases in demand such as those caused by hurricane alerts are often accompanied by constant prices for emergency supplies, and stores often run out.

A remarkable story of constant prices in response to a hurricane warning is reported in *The Washington Post* of September 19, 2003.² Store manager Paul Ginetti, whose store had run out of flashlights priced at \$4.97, managed to locate 1000 flashlights from an alternate manufacturer. At first he sold these for \$4.97 as well, but his supervisor raised their price to \$11.98 after learning that this was their list price. Some customers complained and Paul

¹For a recent review of the voluminous literature that extended this study, see Xia, Monroe and Cox (2004).

²The story ran under the heading “A Customer Flood for Home Depot; Va. Store Struggles To Meet Demand.”

Ginetti later obtained permission from his supervisor to lower the price of these alternate flashlights back to \$4.97. This example shows a firm that is willing to incur the administrative cost of changing prices to avoid consumer anger at an “unfair” price change. While the example may be extreme, firms that respond to calamities by raising prices do so at their peril. The L.A. Times of January 30, 1994, for example, reported that irate consumers threatened to boycott stores that raised prices after an earthquake.

The basic idea of this paper is that some consumers become angry and punish firms that demonstrate that they lack a minimal level of altruism. The fear of angering a minority of customers can be sufficient for selfish firms to act altruistically as well.³ Whether sincere or not, altruistic behavior by firms can explain two important pricing phenomena even if consumer utility functions are quite standard. The first is that groups that are generally regarded as poor (students, the elderly) often obtain goods at lower prices. By contrast, third degree price discrimination that is based on differences in elasticities of demand is frequently regarded as unfair, and is sometimes deterred by negative customer reactions. The second is that, even when prices do change, prices seem to be more responsive to changes in factor cost than to changes in demand that have the same effect on marginal cost. This last fact has been emphasized by Bils and Chang (2000), who present new evidence in its favor, as well as showing that this was a recurrent finding of the empirical price rigidity literature of the 1950s and 1960s.

With standard consumer utility functions, altruistic behavior by firms is not sufficient to explain why prices stay constant in the face of natural disasters. Altruistic behavior can explain such rigidity, however, if one accepts an aspect of consumer preferences that is increasingly well established. This is that consumers experience regret (or disappointment) when they observe a price that exceeds the one they expected. An altruistic firm would be expected to internalize this regret cost to some extent, and thereby keep its price constant even in situations where a selfish firm would raise its own price. While the idea that

³This idea also underlies Rotemberg (2005) whose focus, however, is on short term macroeconomic fluctuations and whose motivation for price rigidity is not based on regret.

consumers could turn their regret and disappointment at price changes into anger against the firms causing this price change may seem surprising, Yi and Baumgartner (2004) show that these emotions are often commingled in purchase settings. In their study of consumer emotions, they report that “A prestudy indicated that when respondents were simply asked to recall a situation in which they experienced, say, disappointment, they tended to report emotional episodes in which they felt not only disappointment but also other negative emotions, such as anger and regret, with equally high intensity.” An example of this combination of emotions was apparent after Apple lowered the price of its iPhones on September 7, 2007.⁴

One important aspect of this regret cost is that it rises as the consumers face a larger price increase. This is particularly helpful for explaining complete price rigidity in the face of a dramatic increase in demand such as those caused by natural disasters. Contrary to what happens when there is a small shift in demand, a small price increase can have a relatively modest effect on the efficiency of the allocation of resources when the demand shift is large. Large price changes do improve the allocation of resources, but involve correspondingly large regret costs. Thus, firms end up being more willing to make small price changes in response to small changes in demand (where consumers appreciate the improvement in resource allocation) than to make any price change at all when demand changes are substantial.

This logic for price rigidity can usefully be compared to earlier models of price rigidity. The simplest of these is that there is a fixed cost of changing prices, which predicts that price increases are more likely when a demand change is large than when it is small. An approach more closely related to this paper is presented in Heidhues and Köszegi (2008) who show that a form of disappointment can induce price rigidity even without altruism considerations. One difference between the two models is that consumers in Heidhues and Köszegi (2008) only suffer a loss from a price increase if they actually buy at the increased price. This fits with the idea that consumers can “avoid a loss” by not buying at a higher price than they expected. But it does not seem to fit with the idea that people experience regret because they wish they had bought earlier, since this sort of regret would remain even

⁴See “A price cut, and then anger,” The New York Times, 7 September 2007.

if consumers did not buy the good at the new higher price.

Moreover, price rigidity in Heidhues and Köszegi (2008) arises only because the firm fears that an increase in price will reduce current demand (which can occur because a reduction in current purchases eliminates any possible disappointment). In the event of a dramatic increase in demand caused by a natural emergency, this motive for keeping prices constant becomes implausible (since there is extensive rationing at existing prices). Consumer anger, by contrast, can be expected to affect both current and future purchases, so a firm may wish to avoid it by keeping a price fixed even if it knows that its limited inventories imply that its sales volume would be unaffected by a small increase in this price.

The current model of fair prices is related to the explanation given by Kahneman, Knetsch and Thaler's (1986) for when prices would be seen as fair. They argued that fairness considerations were based on a "dual entitlement." As they put it, "Transactors have an entitlement to the terms of the reference transaction and firms are entitled to their reference profit." Reference transactions often refer to those that occurred in the recent past and, similarly, reference profits are those that the firm earned in the past. The theory developed here follows their lead in giving an important role to past prices, though the current theory seeks to ground this role in disappointment and regret considerations whose importance is likely to be different in different settings.

At the same time, the current paper tries to overcome some of the difficulties faced by the dual entitlement theory. The first is that consumers surely realize that rationing is a direct consequence of constant (and therefore "fair") prices in the face of dramatic increases in demand.⁵ Rationing does, however, prevent consumers from having access to their reference transaction.

The second problem with the principle is that it seems inconsistent with many fairness judgments in the laboratory. For example, Dickson and Kalapurakal (1994) show that pur-

⁵Indeed, they seem to welcome this rationing even when explicitly confronted with its prospect: 76% of Frey and Pommerehne's (1993) respondents regarded it as fair if 100 available bottles of water were distributed among 200 thirsty hikers on a first-come first-served basis, while 73% regarded it as unfair if a higher price was used to allocate the limited supply of water.

chasers do not regard it as fair for prices to stay constant when costs fall, even though this is consistent with the principle. Keeping profits constant when factor prices increase is difficult but, even when it is possible, it requires that price increase by more than marginal cost. Bolton, Warlop and Alba (2003) show, however, that such “disproportionate” price increases are likely to be seen as unfair. In both of these cases, respondents seem to want firms to be more attentive to consumers than the principle implies. Consistent with the idea that firms need to try to raise consumer welfare if they want to be seen as fair, Huppertz, Arenson and Evans (1978) show that consumers who receive a better deal tend to see firms as treating them more fairly.

Related to this, and also to the model of this paper, Campbell (1999) emphasizes that fairness judgments depend on whether firms are seen as having benevolent intentions. She asked her respondents about the fairness of various mechanisms that a toy store could use for allocating a single doll that it found in its warehouse just before Christmas, when the doll was in short supply. While auctioning the doll to the highest bidder and keeping the proceeds was widely seen as unfair, auctioning the doll and giving the proceeds to charity was commonly regarded as fair. This can be interpreted as saying that benevolent firms are seen in a better light than ones that seek to maximize profits.

This fits not only with firms’ effort to trumpet their charitable activities but also with the frequency with which firms claim to be “committed to our consumers.” Del Monte’s web page, for example, says that “commitment to consumers” is “deeply imbedded in the Del Monte Foods culture.”⁶ Along the same lines, Johnson & Johnson advertises its 50-year old one-page “corporate credo” which begins with: “We believe our first responsibility is to the doctors, nurses and patients, to mothers and fathers and all others who use our products and services. In meeting their needs everything we do must be of high quality. We must constantly strive to reduce our costs in order to maintain reasonable prices.” Shareholders are mentioned last, and the credo ends with the words “When we operate according to these

⁶See http://www.delmonte.com/company/default.aspx?page=oc_ourhistory.

principles, the stockholders should realize a fair return.”⁷

The paper proceeds as follows. The next section introduces consumer attitudes towards firms and shows that a small number of altruism-aware consumers can keep all firms acting altruistically. Section 3 shows that this leads consumers to welcome some forms of third degree price discrimination while they condemn others. Section 4 demonstrates that, in a setting where firms do adjust their prices, cost increases raise prices by more than demand increases even if both have the same effect on marginal cost. Sudden changes in demand are considered in section 5, and this is where I study the conditions under which consumer regret is sufficient to induce firms to keep their prices rigid. The anger of consumers at price reductions that create regret among people who have bought in the past is discussed here as well. Section 6 concludes.

2 The Basic Model

Preferences are closely related to those used by Rotemberg (2006) to explain ultimatum and dictator experiments. Thus, the psychological well-being of agent i is given by

$$W_i = x_i + [\lambda_i - \xi(\hat{\lambda}_j, \eta_i)]x_j, \quad (1)$$

where x_i is agent i 's “material payoff,” *i.e.* the part of his utility that is independent of the outcomes for the other agent, λ_i is the agent's altruism parameter while the variable η_i represents agent i 's anger threshold. Finally, $\hat{\lambda}$ incorporates all the information that agent i has about agent j 's altruism. Agent i expects those he interacts with to have an altruism level at least as large as η_i and gives agents the benefit of the doubt in cases where the evidence is weak. If, however, the evidence in $\hat{\lambda}_j$ allows i to reject the hypothesis that j

⁷See, for example, <http://www.jnj.com/connect/about-jnj/jnj-credo>. If customers are unaware of this credo, which they may well be, the credo's importance may lie in the fact that workers prefer to work in firms that care for their customers. The analysis of this paper would still apply in part in this case, because these workers might then lead the firm to act altruistically. It is conceivable that this firm is just “burning money” through this publicity, but too much effort is spent emphasizing the content of this message to make this interpretation plausible. According to Gates (2004), commitment to this credo led J&J to a massive recall of Tylenol after some people died by ingesting tampered Tylenol capsules in 1982. Gates (2004) notes that Perrier reacted much more slowly to the discovery of benzene in some Perrier water bottles.

has an altruism parameter at least as large as η_i with a test of size α , i becomes willing to incur costs to inflict harm on j . In other words, the function ξ thus takes a value $\bar{\xi}$ which is greater than λ_i if

$$\Pr(\lambda_j \geq \eta_i | \hat{\lambda}_j) \leq \alpha \quad (2)$$

so that agent i can reject the hypothesis that $\lambda_j \geq \eta_i$. Otherwise, the function ξ equals zero. In supposing that a person's altruism depends on that agent's expectations of another's altruism, (1) follows Levine (1998). The nonlinear reaction and the forbearance are based on Rotemberg (2006), who shows that the parameters required to explain experimental outcomes in ultimatum and dictator games with this formulation are more plausible than those that are required by earlier models.⁸

The model has two kinds of agents, consumers and firms. For simplicity, I set the λ_i of consumers equal to zero while ξ is always equal to zero for firms. Consumers for whom $\xi = \bar{\xi}$ are referred to as "angry" because anger is associated with the desire to do harm. By contrast, consumers whose $\xi = 0$ are referred to as calm.

A firm's material payoffs are given by $v(\pi)$ where π equals the firm's profits and v is an increasing and potentially concave function. The cost of producing output Q is $C(Q)$ and consumers are assumed to know the firm's marginal cost C' . There are N consumers, each of which buys either zero or one unit of the good.⁹ Consumers differ on two dimensions. The first is the value they assign to the good and the second is their attitude towards the altruism of the firms they interact with. Heterogeneity in people's attitude towards the altruism of others is important for explaining why different people react differently to the same ultimatum offers in Rotemberg (2006). In the current context, it fits with the observation that consumers differ in their assessment of the fairness of prices. Consistent with this, let a fraction $(1 - \gamma)$ of consumers be tolerant of selfish firms so that their η_i equals

⁸Levine's (1998) model, in particular, explains ultimatum outcomes with parameters that imply that a large fraction of individuals derive pleasure from harming others. This is inconsistent both with the observed generosity of players in other games and with the relative paucity of vandalism in field data.

⁹This assumption is inessential for obtaining the results concerning third degree price discrimination and those involving the effect of cost and demand on prices in the case where prices are changed. These results are shown for the case of continuous demand in Rotemberg (2005).

zero. The remaining fraction has $\eta_i = \eta > 0$. The standard case, in which consumers do not care about their suppliers' attitudes obtains when $\gamma = 0$.

Consumers also differ in their valuation θ of the good, and the analysis is simplified by supposing that the distribution of these valuations across consumers is independent of their value of η_i . Let $F(\theta)$ represent the pdf of θ for both types, with Y being equal to the maximum possible value of θ . If consumer i has a valuation θ , his material payoffs are

$$x^c = V((\theta - p)q + I), \quad (3)$$

where q represents the individual's consumption of the good (which equals zero or one), I is his income and p is the price. The function V satisfies $V' > 0$ and $V'' \leq 0$. I further assume that $|V''|$ and Y are sufficiently small that

$$V((\theta - p)q + I) \approx V(I) + V'(I)(\theta - p)q.$$

Since I let all consumers have the same income in this section, I use V' to denote their common marginal utility of income. When, below, I consider consumers whose income is identical within groups but different across groups, the inter-group differences in income are assumed to be large enough that they lead to differences in V' .

The preferences in (1) imply that a consumer's altruism towards the firm equals either zero or $-\bar{\xi}$. In the former case, the consumer maximizes his material payoff x^c so that he buys the good and sets $q = 1$ if and only if $\theta \geq p$.

In the latter case, the consumer is aware that purchasing an additional unit increases the firm's material payoff by $v'(p - C')$. This means that an angry consumer buys the good if and only if

$$V'(\theta - p)q \geq \bar{\xi}v'(p - C'). \quad (4)$$

Increases in $\bar{\xi}$ (as long as $p > C'$) or in p relative to C' , raise the right hand side and thereby require a higher θ before the consumer buys. Anger thus lowers the purchases of altruism-sensitive consumers.¹⁰

¹⁰This is consistent with the sales of French wines in the US after French-US disagreements on Iraq (see

I suppose that there are three types of firms. A fraction $1 - \delta$ of firms is selfish and has an altruism parameter of zero while a fraction δ of firms has an altruism parameter equal to $\bar{\lambda}$. Among altruistic firms, a fraction ζ is naive while the fraction $(1 - \zeta)$ is sophisticated. Both selfish and sophisticated altruistic firms realize that consumers are angry with firms whose behavior is inconsistent with minimal altruism. Naive firms, on the other hand, act as if they believe that all consumers set $\xi = 0$ regardless of p .

Because these beliefs may seem peculiar, several remarks about them are in order. First, the only naive firms in the model are in fact altruistic, so that their lack of attention to the possibility that they might be punished may be the result of knowing that they are in fact as altruistic as consumers wish them to be. Second, what is important to the model is not that there be lots of naive firms. Rather, I show below that what matters is that consumers believe that such firms exist and that they constitute at least a fraction α of all altruistic firms, where α is the size of the altruism test employed in (2). Third, the equilibrium I focus on would also exist if all firms were sophisticated and consumers knew this to be true. The role of introducing naive firms is to make the equilibrium unique.

It is useful to start the analysis of this equilibrium with the behavior of these naive firms. This development may be of independent interest because it explains why altruism matters when firms have market power. A firm that expects ξ to equal zero for all consumers expects its sales to be given by $N[1 - F(p)]$. As a function of its altruism parameter $\bar{\lambda}$, its expected welfare W^n is thus

$$W^n(\bar{\lambda}) = v\left(N[1 - F(p)]p - C\left(N[1 - F(p)]\right)\right) + \bar{\lambda}N \int_0^\infty V\left((\theta - p)q + I\right)dF(\theta). \quad (5)$$

Since consumers are not expected to be angry, q equals one if θ exceeds p . Thus, the first order condition for the maximization of $W^f(\lambda)$ can be written as

$$v'N\{1 - F(p) - F'(p - C')\} - \bar{\lambda}N[1 - F(p)]V' = 0. \quad (6)$$

Chavis and Leslie 2009) as well as with more casual evidence on the effect of consumer unhappiness. See, for example “Quick Stop in Waunakee is picketed” *Wisconsin State Journal* September 13, 2001 for the story of a consumer who responded to a gas station that raised its prices after the September 11, 2001 attack by picketing the station and thereby led the station to close.

After rearranging, the above first order condition yields

$$p \left[1 - \left(1 - \frac{\bar{\lambda}V'}{v'} \right) \frac{1 - F(p)}{pF'} \right] = C'.$$

If $\bar{\lambda}$ were equal to zero, the left hand side would be marginal revenue which would normally be equated to marginal cost. At the same time, $[1 - F(p)]/F'$ is the financial gain to consumers from the price reduction that is required to sell an additional unit. Thus this equation equates marginal cost to the sum of marginal revenue and the marginal gain to consumers from selling an additional unit, where this latter gain is weighed by the value to the firm of having an additional dollar in the pocket of consumers ($\bar{\lambda}V'$) relative to the value of having an additional dollar in its own pocket (v'). The optimal price $p^*(\bar{\lambda})$ is thus

$$p^*(\bar{\lambda}) = \frac{\epsilon}{\epsilon - 1 + \bar{\lambda}V'/v'} C' \quad \text{where} \quad \epsilon = \frac{pF'}{1 - F(p)}, \quad (7)$$

while the resulting sales are $Q^*(\bar{\lambda}) = N[1 - F(p^*(\bar{\lambda}))]$.

Thus, even small degrees of altruism have some effect on the optimal price. The reason is that, at the standard monopoly optimum, the firm is indifferent with respect to small changes in its price. Therefore, if the firm puts some weight on the consumer's utility of income, even if this weight is infinitesimal relative to the weight it puts on its own material payoffs, it will lower its price somewhat. One implication of this model is that, for a given $\bar{\lambda}$, altruistic firms with higher profits have lower prices relative to marginal cost if $v'' < 0$. The reason is that $\bar{\lambda}V'/v'$ is larger.

In the extreme case where the firm is so altruistic that it values a dollar in its consumers' pockets the same as it values a dollar in its own pocket, $\bar{\lambda}V'/v' = 1$, and the firm charges the socially efficient price C' . At this point, the firm's altruism is so strong that it would be willing to give money away to its consumers.¹¹ While it may be felt for people who are

¹¹When altruism is even stronger so that $\bar{\lambda}V' > v'$, the formula (7) implies that price equals marginal cost only when the elasticity of demand is infinite and is otherwise lower. The reason is that the firm then wishes to transfer extra resources in the form of a price below marginal cost, and is prevented from doing this only when the resulting consumption distortion is very large. This case does not seem relevant if the firm also has access to direct transfers to consumers. Its material payoffs would then be $v(\pi - \kappa)$ where κ are the transfers they make while the material payoffs of consumers are $V((\theta - p)x + I + \kappa_i)$ where κ_i are the transfers they receive. There would be no equilibrium transfers if $v' < \bar{\lambda}V'$ but the firm would be willing to give up all its wealth if this inequality were reversed. With sufficient transfers v' would then presumably become equal to $\bar{\lambda}V'$.

destitute, it is implausible to expect such a high level of altruism for typical consumers. The key point here is that firms reduce their prices out of altruism well before they hand out money to their customers. The reason is that lowering price also has the benefit of raising the firm's sales.

The rest of the section develops conditions in which the unique equilibrium involves all firms, selfish and altruistic, charging $p^*(\bar{\lambda})$. Before doing so, it is worth showing that the existence of naive firms implies that firms are generally not punished for charging this price.

Lemma 1. *Naive firms charge $p^*(\bar{\lambda})$ in equilibrium and, as long as $\eta \leq \bar{\lambda}$ and $\zeta \geq \alpha$, no firm is punished for charging this price.*

Proofs are in the Appendix.

An immediate implication of this lemma is that sophisticated altruists charge this price as well. The reason is that their objective function coincides with that of naive altruists so they would charge $p^*(\bar{\lambda})$ if they could be sure not to be punished for doing so, and Lemma 1 eliminates this fear of punishment. All that remains is to study the behavior of selfish firms. Given that the altruistic firms all charge $p^*(\bar{\lambda})$, charging a higher price leads (2) to be satisfied and the hypothesis that a firm has altruism of η is rejected. Thus, selfish firms face a stark choice between charging $p^*(\bar{\lambda})$ or angering a fraction γ of their potential customers. When they do anger them, (4) implies that their demand, and therefore their profits, are lower. In practice, this anger can be expected to persist for some time so that, in a more complete model, it would affect demand for several periods. For the moment, however, I treat it as affecting demand only in the single period under consideration. The result is

Proposition 1. *Let $\Delta(\bar{\lambda})$ be equal to the difference in profits between charging $p^*(\bar{\lambda})$ and the profits that result when firms set price to maximize profits while a fraction γ of consumers is angry. Then,*

$$\Delta(\bar{\lambda}) = \left\{ Q^*(\bar{\lambda})p^*(\bar{\lambda}) - C(Q^*(\bar{\lambda})) \right\} - \left((1 - \gamma)N[1 - F(p^*(0))]p^*(0) - C((1 - \gamma)N[1 - F(p^*(0))]) \right) \quad (8)$$

if

$$Y - p^*(\bar{\lambda}) < \frac{\bar{\xi}v'}{V'}(p^*(\bar{\lambda}) - C') \quad (9)$$

while it is given by

$$\Delta(\bar{\lambda}) = \left\{ Q^*(\bar{\lambda})p^*(\bar{\lambda}) - C(Q^*(\bar{\lambda})) \right\} - \operatorname{argmax}_p [pQ^d(p) - C(Q^d(p))] \quad (10)$$

with

$$Q^d(p) = N \left\{ (1 - \gamma)[1 - F(p)] + \gamma \left[1 - F \left(p + \frac{\bar{\xi}v'}{V'}(p - C'(Q^d)) \right) \right] \right\}$$

if (9) is violated.

Selfish firms charge $p^*(\bar{\lambda})$ if $\Delta(\bar{\lambda}) > 0$ while they charge a higher price if the inequality is reversed. Moreover, for any $\bar{\xi} > 0$, there is a $\bar{\lambda}$ low enough that $\Delta(\bar{\lambda}) > 0$.

Note that the proposition does not hinge on the fraction δ of firms that are selfish so that the number of truly altruistic firms can be arbitrarily small. The main role of altruistic firms in this model is to provide a reasonable anchor for the price that altruism-sensitive consumers expect all firms to charge. Note also that an equilibrium with the same properties would continue to exist even without naive firms because consumers would not punish firms that charged $p^*(\bar{\lambda})$ if they expected altruistic firms to do so. Altruistic firms, for their part, would happily charge this price if it did not lead to punishment. Without naive firms, however, ruling out alternate equilibria is more difficult.¹²

Proposition 1 establishes that firms can act altruistically even if they are selfish. This force is particularly strong in the extreme case where $\gamma = 1$ and $\bar{\xi}$ is high enough to satisfy (9). Then, firms sell nothing unless they act altruistically, and they naturally do so. This still leaves open the question of whether any sizeable altruistic behavior can be sustained if γ is plausibly lowered below 1.

¹²An alternative formulation that also gives rise to this unique equilibrium is to postulate that consumers punish only those firms for whom they can reject the hypothesis that the firm maximized $W^n(\bar{\lambda})$. In this alternative formulation, consumers only punish those firms that act more selfishly than a naive altruist would. This idea is pursued in Rotemberg (2008). That paper considers both the case where the firms costs are known to consumers, as in the present paper, and the case where consumers expect firms to maximize an altruistic objective function but are uncertain of the firm's costs.

I investigate this question numerically by considering a special case where θ is uniform between zero and Y while marginal cost is constant. This means that, when consumers are calm, demand is linear and equals to $N(1 - p/Y)$. Naive altruistic firms maximize

$$\left(1 - \frac{p}{Y}\right) (p - C') + \frac{\bar{\lambda}V'}{v'} \int_p^Y \frac{\theta - p}{Y} d\theta.$$

The integral representing consumer surplus equals $(Y - p)^2/2Y$. Thus, the optimal price for these firms is

$$p^* = \frac{Y(1 - \bar{\lambda}V'/v') + C'}{2 - \bar{\lambda}V'/v'}.$$

and (9) is satisfied so that angry consumers stop purchasing altogether if

$$\frac{Y - c}{2 - \bar{\lambda}V'/v'} < \bar{\xi} \frac{v'}{V'} \frac{(Y - c)(1 - \bar{\lambda}V'/v')}{2 - \bar{\lambda}V'/v'} \quad \text{or} \quad \bar{\xi} > \frac{V'}{v' - \bar{\lambda}V'}.$$

Since higher levels of $\bar{\lambda}$ yield lower equilibrium prices, the reduction in profits when one customer stops buying is smaller. As a result, a higher $\bar{\lambda}$ requires a higher $\bar{\xi}$ to keep angry consumers from buying at a price that is slightly above p^* . Since consumer's marginal utility of income V' is unlikely to be lower than that of firms' (v'), this formula implies that angry consumers stop all their purchases only if they are willing to give up more than one dollar to hurt the firm by a dollar. Still, a $\bar{\xi}$ equal to 2 should be sufficient for angry consumers to stop their purchases even for fairly high values of $\bar{\lambda}$.

Assuming (9) is indeed satisfied, selfish firms act altruistically if the expression in (8) is positive, which here requires that

$$\Delta = \frac{(Y - c)^2}{Y} \left(\frac{1 - \tilde{\lambda}}{(2 - \tilde{\lambda})^2} - \frac{1 - \gamma}{4} \right) > 0 \quad \text{where } \tilde{\lambda} = \frac{\bar{\lambda}V'}{v'}.$$

This condition is more easily satisfied as γ rises (since this means that more customers punish selfish firms). The minimum value of γ , γ^* , that leads it to be satisfied is depicted as a function of $\tilde{\lambda}$ in Figure 1. The figure shows that γ^* is a convex function of $\tilde{\lambda}$ where this convexity is due, once again, to the fact that small departures from the unconstrained optimum cause only second order losses. Thus, imitating the altruism level $\bar{\lambda}$ when this is

low imposes only minimal costs. Even with a $\tilde{\lambda}$ equal to .5, a γ of about .11 is sufficient for selfish firms to behave like altruistic ones in equilibrium.

The altruistic behavior of selfish firms in this section was derived under the assumption that consumers know marginal cost, and this is what allows them to determine whether firms are charging more than $p^*(\bar{\lambda})$. If consumers were uncertain about costs, they would still be able to test the hypothesis that the firm's altruism is insufficient. A test of size α would reject this hypothesis if the cost realization that would justify this price under the null that the firm is altruistic were so high that it would be drawn with probability less than α . Selfish firms that drew lower cost realizations would thus have some scope for charging prices that exceed the altruistic level.

While the analysis of the case with imperfect information is beyond the scope of this paper, it seems likely that consumers are better informed about cost *changes* than about cost *levels*, so that required firm altruism exerts more discipline on firms' capacity to change prices. Indeed, it is not uncommon for firms that raise their prices to attempt to explain these changes with publicly available information about costs. Similarly, determining whether price discrimination is benevolent or not, which is relevant in the next section, may be possible even with relatively weak information about the level of marginal cost.

3 Third Degree Price Discrimination

In this section, firms face two observably distinct populations indexed by i , where i equals 1 or 2. The groups can differ in their size N_i , their income I_i and their distribution of θ , $F_i(\theta)$. The income differences are large enough that they cause differences in the marginal utility of income, and I let V_i' denote the marginal utility for members of group i . Goods cannot be resold, so firms are not forced to charge the same price to both groups. In setting the

group-specific prices p_1 and p_2 , a naive altruistic firm with altruism $\bar{\lambda}$ maximizes

$$W_D^n(\bar{\lambda}) = v\left(\sum_i N_i[1 - F(p_i)]p_i - C\left(\sum_i N_i[1 - F(p_i)]\right)\right) + \bar{\lambda} \left\{ \sum_i N_i \int_{p_i}^{\infty} V(\theta - p_i + I_i) dF_i(\theta) \right\} \quad (11)$$

with respect to both p_1 and p_2 . The subscript D denotes that the firm is discriminating, and the integrals start at p_i because the firm expects consumers to purchase whenever their θ exceeds the price that they are asked to pay.

The first order conditions for this problem are the same as (6) and lead to naive optimal prices that satisfy

$$p_i^*(\bar{\lambda}) = \frac{\epsilon_i}{\epsilon_i - 1 + \bar{\lambda}v'/V_i'} C' \quad \text{where} \quad \epsilon_i = \frac{pF_i'}{1 - F_i(p_i)}. \quad (12)$$

This shows that, for a given elasticity of demand, naive altruists charge a lower price to members of group i if V_i' is higher. This reason is that altruists derive more pleasure from price reductions when these affect consumers who value income more highly.

Suppose that the distribution of altruism parameters among firms is the same as before and that a fraction γ of consumers of both types are altruism-aware, so that they become angry when their supplier demonstrates insufficient altruism. Suppose further that consumers use data on both prices to test whether the firm is sufficiently altruistic. Then, as before, naive altruistic firms are not punished for setting the prices $p_i^*(\bar{\lambda})$ even if all the other types of firms charge different prices. This leads sophisticated altruistic firms to charge these prices as well. In the case where $F_1 = F_2 = F$, and I_1 is close to I_2 , the condition $\Delta(\bar{\lambda}) > 0$ with N set to $N_1 + N_2$ and I set to I_1 remains sufficient to ensure that selfish firms also charge $p_i^*(\bar{\lambda})$. In the more general case where the difference between the F 's and the I 's is larger, the corresponding condition can be derived analogously to the one concerning Δ in the case of a single identifiable group of customers. The model thus rationalizes the existence of lower prices for groups that are generally seen as poorer, such as students and the elderly.¹³

¹³If firms acted as if they felt the same altruism for all the people on earth, they should charge less to

The elasticity of demand continues to play a role in (12), so that an altruistic firm facing two groups with different elasticities of demand would charge a higher price to the one whose demand is less elastic. However, the incentive to discriminate need not be the same for altruistic and selfish firms so that certain kinds of price discrimination can be seen as demonstrating lack of altruism.

Suppose, in particular, that the administrative structure that is needed for third degree price discrimination has a cost $K > 0$. For a naive altruist, the alternative is to set a single price and maximize

$$W_N^n(\bar{\lambda}) = v\left(\sum_i N_i[1 - F(p)]p - C\left(\sum_i N_i[1 - F(p)]\right)\right) + \bar{\lambda} \left\{ \sum_i N_i \int_p^\infty V(\theta - p + I_i) dF_i(\theta) \right\}. \quad (13)$$

One can then ask whether an increase in $\bar{\lambda}$ makes the firm more or less willing to pay the cost K to achieve the maximum of W_D^n rather than achieving only the maximum of W_N^n . The answer to this question can be obtained by taking the difference between the expression in (11) and that in (13) and differentiating while using the envelope theorem:

$$\frac{d(W_D^n - W_N^n)}{d\bar{\lambda}} = \sum_i N_i \int_{p_i}^\infty V(\theta - p_i + I_i) dF_i(\theta) - \sum_i N_i \int_p^\infty V(\theta - p + I_i) dF_i(\theta),$$

where the p_i represent the optimized discriminatory prices and p is the optimized price when the firm sets a single price for both groups. If consumer welfare is larger under a single price, an increase in $\bar{\lambda}$ thus lowers the firm's incentive to discriminate .

Notice that the analysis is related to the literature studying the social desirability of third degree price discrimination.¹⁴ In both cases, the issue turns on the extent to which consumers lose from this discrimination. There are two differences, however. The first is

customers in poor countries. Several drug companies tout the fact that they sell certain drugs at lower prices in poorer countries (see, for example, "Merck to Cut Cost Of AIDS Drug In Poorest Nations," Wall Street Journal, 23 October 2002) and, consistent with the model presented here, observers regard this as being due in part to a public relations effort. These price reductions are fairly meager overall, however. One reason for this may be that consumers care mostly about altruism towards other people who live in the same place as themselves.

¹⁴See Cowan and Vickers (2007) for a recent contribution with extensive references.

that the cost K can render discrimination undesirable even for profit maximizing firms, so the issue is whether it is more undesirable as consumer welfare is taken more intensely into account. The second is that altruistic firms do not charge the profit maximizing price, so the comparison between the discriminating and the non-discriminating outcome is not identical.

In the case of uniform distributions of θ and equal V' across the groups, so that any price discrimination is based on differences in demand elasticity, one can nonetheless establish the following

Proposition 2. *Suppose that marginal cost is constant, both groups have the same linear marginal utility of consumption V' with $V(I)$ normalized to equal zero and that $N_i = N$. Suppose further that, for group 1, θ is uniform between 0 and Y_1 while, for group 2, it is uniform between 0 and Y_2 . Then, for any $\bar{\lambda}$, consumers are better off when the naive altruistic sets a single price to maximize (13) than when it discriminates and maximizes (11).*

The result in proposition 2 is not surprising and should be quite general. Price discrimination introduces a distortion in the consumption across consumers, and is thus attractive only because it raises profits. Given a cost of setting up a discriminatory scheme, a naive altruist is then more likely to charge uniform prices than a selfish firm that does not need to fear consumer reactions. If the naive altruists choose uniform prices, the earlier argument still leads sophisticated altruists to do so as well. In this case, a firm that does set up a discriminatory scheme identifies itself as being insufficiently altruistic. One reason it may wish to do so nonetheless, is that following the lead of altruistic firms is costly not only because discrimination raises profits but also because the uniform price charged by altruistic firms is not profit maximizing.

This result rationalizes to some extent the anger expressed by consumers when they concluded that Amazon.com was tailoring its prices to individuals by using its information about these individuals' past purchases.¹⁵ This anger fits relatively well with the model because setting up this discriminatory scheme clearly involved some costs. Amazon, for its

¹⁵See "On the Web, Price Tags Blur; What You Pay Could Depend on Who You Are," *Washington Post*, September 27, 2000.

part, denied any intention to discriminate among customers who differed in their purchase patterns, and gave refunds to those who had paid more.

While the model presented above is consistent with anger at Amazon's price discrimination, other variants of this model might be able to explain the phenomenon as well. Consumers might, for example feel envious when they think someone else obtained a good for a lower price and blame firms that generate these negative emotions. This idea is broadly in the spirit of the model of Section 4, where people blame firms that cause regret. Nonetheless, the development of this idea is left for further research.

This section obviously represents only a small start in the analysis of price discrimination by firms that try to appear altruistic. The example of Amazon does suggest that firms are reluctant to use the argument that they are trying to maximize profits as a defense for the practice of charging different prices to different customers. This means that consumer perception about the fairness of different discriminatory practices is worth studying further. It appears, for example, that consumers are ambivalent about the schemes used by airlines to charge different prices to different consumers for the same segment. If one could learn which practices they find more palatable than others, one might be able to investigate whether the current model can account for these differences.

4 Changes in Factor Costs and in Planned Demand

This section considers the effects on price of changes in demand and costs that are known before the firm chooses its factor inputs and its price. I return to the case where there is a single identifiable group. Regret considerations remain absent from the analysis, and are introduced formally in the next section. Regret is particularly likely if customers expect to pay a particular price or feel that they could have bought earlier at a lower price. Regret can thus be reduced by announcing price increases in advance. Many firms do in fact carry out such pre-announcements, and the analysis here can be thought of applying to such firms. It is worth noticing that such pre-announcements are inconsistent with raising prices immediately when there is a spike in demand of the sort considered in the next section.

In this section, I let cost be affected not only by output but also by a variable ψ , where an increase in ψ raises both the total costs of producing any given amount of output and the marginal cost of producing an additional unit. Naive altruistic firms continue to maximize (5) and this can now be written as

$$W^n(\bar{\lambda}) = v\left(N[1 - F(p)]p - C(N[1 - F(p), \psi])\right) + \bar{\lambda}N \int_0^\infty V((\theta - p)q + I)dF(\theta). \quad (14)$$

The first order condition for this problem remains (6), which can be rewritten as

$$v'(\pi)N\{1 - F(p) - F'(p)(p - C_1(N[1 - F(p), \psi]))\} - \bar{\lambda}N[1 - F(p)]V' = 0, \quad (15)$$

where C_1 is the derivative of C with respect to its first argument and thus represents marginal cost. This equation allows one to solve for p as a function of ψ and N (which both affect C_1 and also affect v' when $v'' \neq 0$). One can also, of course, compute how marginal cost is affected by ψ and N once one takes into account the effect of these variables on p . The question considered in this section is whether a change in marginal cost induced by a change in ψ has a different effect on price than an equal change in marginal cost induced by N . Because C_1 depends on price also, it is actually easier to discuss the reverse problem. This is whether a given change in p that is the result of a change in ψ involves a different change in marginal cost C_1 than does the same change in p when this is due to a change in N . If v' is constant, this is not the case because (15) implies that any change in p is associated with the same change in C_1 .

If firms are worried about bankruptcy, however, one would expect them to be particularly eager to pursue additional profits when these are low while they would be freer to pursue other objectives when profits are high. This idea can be captured by considering the case where $v'' < 0$. This implies

Proposition 3. *Suppose $v'' < 0$ and consider a price increase dp . If this price increase is due exclusively to a rise in N , marginal cost must rise by more than if it is due exclusively to an increase in ψ .*

The intuition for this proposition is that increases in N raise profits while increases in ψ lower them. Thus, increases in marginal cost induced by increases in N lead firms with $v'' < 0$ to place increased weight in the income of their consumers as opposed to on their own profits. By contrast, increases in marginal cost induced by rises in ψ lower the weight that the firm places on consumer's income, so that price rises relatively more in this case.

While this result has been derived for the particular change in demand that follows from an increase in the number of customers with valuation θ , it should extend to certain increases in demand that are the result of rightward shifts in the distribution of the θ 's of existing customers. Like increases in N , such shifts would raise sales at the existing price so that they would tend to raise v' relative to V' , and thereby dampen price increases. However, such changes in the distribution of demand also tend to affect the elasticity of demand, and this has a separate effect on price.

This logic suggests that prices should be less affected by changes in opportunity costs that do not have an effect on actual costs. Indeed, a firm that has positive inventories of an input whose price goes up experiences, if anything, a rise in profits rather than a fall and it would thus be less acceptable if it increased its price. Vaidyanathan and Aggarwal (2003) provide questionnaire evidence that people do indeed perceive such price increases as less fair than price increases that are triggered by increases in costs that firms must actually pay.¹⁶

The result that prices respond more to factor prices than to increases in demand that increase marginal cost by the same amount fits with evidence presented in Bils and Chang (2000), as well as with several earlier studies which they discuss. It is not clear that this result has, by itself, implications for the way that prices respond in general equilibrium to changes in aggregate demand as opposed to changes in factor costs. As stressed for example in Rotemberg and Woodford (1991), there are important conceptual differences between changes in a firm's individual demand and changes in aggregate demand (or in the

¹⁶Consistent with this observation, Burstein, Eichenbaum and Rebelo (2005) note that a disproportionate number of the Argentinian supermarket price changes that they observed took place after stock-outs.

demand for the typical firm). Because of the complexities involved, embedding fair price considerations in general equilibrium is left for further research.

5 The Fairness of Raising Prices when Demand Rises Suddenly

I now incorporate regret and disappointment into the analysis of prices. Regret was introduced into the formal theory of decision making by Bell (1983) and, according to Connolly and Zeelenberg (2002), is “the emotion that has received the most attention from decision theorists.” The negative emotion of regret is experienced when people wish they had taken a different decision in the past.

Evidence indicates that regret at purchasing “at the wrong time” is of sufficient concern to people that they take actions to avoid it. Simonson (1992) asked participants in his study whether they wished to purchase a good on sale in July or whether they wished to wait until August, when the product was needed. In one experimental condition, they were simply asked to pick their preferred month of purchase. In a different condition, they were told that they would be reminded of both the July and August prices at the end so they would know whether they had made a good choice. Consistent with a desire to avoid an intensified experience of regret brought on by evidence that one could have purchased earlier at a lower price, a larger fraction of subjects said they would like to purchase in July in this second condition. In response to a questionnaire, subjects also indicated that they did indeed fear regret if they waited and learned that the price had increased.

Similarly, Cooke, Meyvis and Schwartz (2001) demonstrate that subjects taking the role of consumers express regret (and are unsatisfied) if they pay high prices for a product after the product was available at a lower price earlier. Cooke, Meyvis and Schwartz (2001) also show that subjects have a different reservation price for a good depending on whether they do or do not subsequently learn the price at which it becomes available later. Since customer income is independent of the price at which the good becomes available after it has already been bought, this evidence suggests that customers suffer a direct loss in utility when they

learn that they would have been better off if they had followed an alternate course of actions.

The analysis in this section remains focuses on a single period in which a firm sells a good at a price p . The period starts, however, with two initial conditions inherited from the past. The first is the level of output Q , which is now taken to be fixed. The assumption that output is predetermined captures both the delays involved in shipping additional items to a location that has suddenly been struck by a storm and the difficulty in adding short run capacity in localized industries such as hotels. The second initial condition is a price p_o that prevailed earlier. Departures of the price p from p_o lead consumers to experience a psychological cost that depends on the extent to which they would have been better off buying at p_o .

Leaving aside regret considerations, consumer material payoffs are assumed to equal $V((\phi + \theta - p)x + I)$ where the parameter ϕ is introduced as a method for shifting demand. Only consumers for whom $p \leq \phi + \theta$ are willing to buy the good. If there are more than Q such consumers, the buyers are chosen at random among those with this willingness to pay. Thus, leaving out regret considerations, the average material payoffs of the consumers who buy the good are

$$\tilde{U}(p) = \frac{\int_{p-\phi} V(\phi + \theta - p + I) dF(\theta)}{1 - F(p - \phi)}$$

For a consumer who buys at p , the loss from buying at p rather than at p_o is $(p - p_o)$, so the regret cost for such a consumer is assumed to equal $\ell(p - p_o)$, where ℓ is an increasing function. For a consumer who does not wish to purchase the good at p (because $\phi + \theta < p$) or for one that is unable to buy at p because Q is less than demand, the loss from not having bought at p_o is $\phi + \theta - p_o$ and the regret costs are $\ell(\phi + \theta - p_o)$. Notice that the form of this cost is such that it can also be interpreted as the disappointment cost of a consumer who expected to buy at p_o and whose loss depends on the difference between his actual payoff and the one that he expected to receive. In either case, the consumer is comparing the actual outcome with the one that would have taken place at a price p_o so that this cost remains even if he is unable or unwilling to buy at present. This serves to contrast this model with Heidhues and Köszegi (2008), who suppose that consumers are averse to the psychological

loss of paying more than they expected. They suppose this loss is averted when consumers do not buy, with the result that demand falls sharply when firms set a price above the expected price.

If Q is smaller than the number of people who wish to buy the good $N(1 - F(p - \phi))$, the average regret experienced by the $N(1 - F(p - \phi)) - Q$ rationed individuals equals the average value of $\ell(\phi + \theta - p_o)$ conditional on θ being greater than or equal to $p - \phi$. Similarly, if $p > p_o$, the average regret of the $N[F(p - \phi) - F(p_o - \phi)]$ people who do not buy at p but would have bought at a price of p_o equals the average value of $\ell(\phi + \theta - p_o)$ conditional on θ being between $(p_o - \phi)$ and $(p - \phi)$. Thus, the total material payoffs of consumers including regret costs at a price of p equal

$$\begin{aligned}
\bar{U}(p, Q) &= Q\tilde{U}(p) - \left[N(1 - F(p - \phi)) - Q \right] \frac{\int_{p-\phi} \ell(\phi + \theta - p_o) dF(\theta)}{1 - F(p - \phi)} \\
&\quad - Q\ell(p - p_o) - N \left[F(p - \phi) - F(p_o - \phi) \right] \frac{\int_{p_o-\phi}^{p-\phi} \ell(\phi + \theta - p_o) dF(\theta)}{F(p - \phi) - F(p_o - \phi)} \\
&= Q \left(\tilde{U}(p) - \ell(p - p_o) + \frac{\int_{p-\phi} \ell(\phi + \theta - p_o) dF(\theta)}{1 - F(p - \phi)} \right) \\
&\quad - N \int_{p_o-\phi} \ell(\phi + \theta - p_o) dF(\theta) \tag{16}
\end{aligned}$$

In the standard case where consumers are able to buy all they want at the price p , Q is equal to $N(1 - F(p - \phi))$, and $\bar{U}(p, Q)$ equals

$$\bar{U}^*(p) = N(1 - F(p - \phi))(\tilde{U}(p) - \ell(p - p_o)) - N \int_{p_o-\phi}^{p-\phi} \ell(\phi + \theta - p_o) dF(\theta) \tag{17}$$

To gain some intuition over the tendency of firms that act altruistically to keep prices constant when prices are below market clearing levels, it is worth studying the derivative of $\bar{U}(p, Q)$ with respect to p . When the price p is below the market clearing price p^* , the quantity sold is fixed at Q and, using, (16), this derivative equals

$$\begin{aligned}
\frac{d\bar{U}(p, Q)}{dp} \frac{1}{Q} &= \frac{F'(p - \phi)}{1 - F(p - \phi)} \left\{ \tilde{U}(p) + \frac{\int_{p-\phi} \ell(\phi + \theta - p_o) dF(\theta)}{1 - F(p - \phi)} - \ell(p - p_o) \right\} \\
&\quad - \frac{\int_{p-\phi} V'(\phi + \theta - p + I) dF(\theta)}{1 - F(p - \phi)} - \ell'(p - p_o). \tag{18}
\end{aligned}$$

An important property of this equation is that the term in braces is positive. This is true not only because $\tilde{U}(p) > 0$ but also because the average value of $\ell(\phi + \theta - p_o)$ conditional on θ being greater than $(p - \phi)$ is larger than $\ell(p - p_o)$. What this means is that consumers' loss from price increases is smaller when $F'/(1 - F)$ is larger, *i.e.* when demand is more responsive to price. This responsiveness ensures that the given Q goes to people who value it more. Another benefit that is accentuated by this responsiveness is that people who stop buying the good as a result of a price increase have a lower regret cost than that of people who continue to buy it because they value it more highly.

In the case where the distribution F has finite support, one implication of this is that consumers lose more from small price increases when these occur in the wake of large increases in ϕ than when they occur in the wake of small ones. The finite support of F implies that large increases in ϕ lead the density of F at $(p - \phi)$ to be zero. Or, to put it in more economic terms, dramatic increases in demand that lead everyone to want to buy the good also reduce the sensitivity of demand to small price increases. As a result, increases in price are less palatable to consumers in this case. A firm acting altruistically should thus be less inclined to raise price by a small amount in the event of a major demand shift. This leaves the alternative of raising prices by a sufficient amount that demand responds. The problem with this alternative, of course, is that it leads to large regret costs.

I now consider a special case and show that, indeed, there are conditions under which a firm acting altruistically would refrain from any price increase at all for a large shift in ϕ whereas it would raise price in response to a smaller increase in demand.

Proposition 4. *Let V , v and ℓ be linear with slopes V' , v' and ℓ' respectively, while $V(I)$ is normalized to equal zero. Let $F(\theta)$ be uniform between 0 and Y . Suppose the firm has access to Q units at zero marginal cost. If*

$$\bar{\lambda} \frac{V' + \ell'}{2} < v' \quad (19)$$

let

$$Q \leq \frac{Y + \phi}{Y} \frac{N}{2 - \bar{\lambda}(V' + \ell')/v'} \quad (20)$$

while, otherwise, suppose only that $Q < N$.

It follows that, if (19) is satisfied, a naive altruistic firm with an altruism parameter of $\bar{\lambda}$ raises its price to the market clearing level p^* for p_o sufficiently close to p^* . ii) If (19) is violated, the firm always keeps its price equal to p_o . iii) Finally, if

$$v' < \bar{\lambda}(V' + \ell') \frac{2N\phi + (N - Q)Y}{2N\phi + 2(N - Q)Y} \quad (21)$$

one can find a p_o low enough, \bar{p}_o , such that the firm keeps its price constant at p_o for any $p_o < \bar{p}_o$.

Notice that, since the left hand side of (19) is smaller than the right hand side of (21), it is always possible to find values of v' so that both conditions hold so that naive altruists make small but not large price adjustments. Note also that incorporation of a fixed cost of changing prices would make firms unwilling to make tiny price changes. A fixed psychological cost might exist if, for example, customers are better at recognizing that the current price exceeds a previous price than they are at remembering the exact value of an earlier price. They would then experience some regret whenever the price was increased, though the size of this regret would start rising with price only at the point where they become confident that the earlier price was substantially lower than the current one. In any event, I have neglected such fixed costs to draw a sharp distinction between the predictions of this model and that a model with fixed administrative costs of changing prices.

While the analysis above applies directly only to naive altruists, sophisticated altruists follow the same behavior because they know that consumers will remain calm. When altruistic firms prefer to keep prices constant at p_o , consumers view constant prices as fair. They thus see an allocation with rationing (using either a first-come-first serve rule or any other rule that allocates scarce goods randomly) as more fair than one with market clearing prices. The reason is not that they ignore the costs of rationing, it is just that the regret costs from having to pay the market clearing prices loom larger.

It remains to study the conditions under which selfish firms imitate these altruistic firms. Some simple sufficient conditions for selfish firms to either imitate altruistic ones or deviate

are given by the following proposition.

Proposition 5. *Suppose v , V , ℓ and θ satisfy the conditions of Proposition 4. For any fixed ϕ , one can find sufficiently high values of γ and $\bar{\xi}$ so that selfish firms charge p_o when altruistic firms do so. Conversely, for fixed $\gamma < 1$ and $\bar{\xi}$, selfish firms deviate from charging p_o if ϕ is sufficiently large.*

The proposition shows that there are values of γ such that selfish firms do not deviate from p_o for certain levels of ϕ , but do deviate for larger levels of ϕ . After major emergencies it is not uncommon to observe some firms raising their prices dramatically while others keep their prices fixed.¹⁷ The model can explain this diversity if one grants that some firms are truly altruistic. The altruistic firms keep their prices constant while the selfish ones do not. Or, as a headline in the September 2004 issue of the *Deseret Morning News*, put it, “Disasters reveal the stuff we’re truly made of.”

Consistent with the rest of the paper, this proposition considers the case where the only punishment for firms that show themselves to be insufficiently altruistic takes place in the current period. More plausibly, angry consumers also reduce their future purchases. In this case, there would be conditions under which selfish firms would refrain from raising their price above p_o even when doing so allows them to sell their entire available output Q . Still, for sufficiently high ϕ , the profits from raising the price should outweigh even these lost future profits.

The attitudes of people after these emergencies also fit broadly with the model. People generally decry price increases in emergencies and push for laws that prevent “price-gouging.” This is consistent with the model’s assumption that people are upset by departures from minimally altruistic behavior, and that they are particularly incensed when firms that act selfishly benefit as a result.

¹⁷The article “Hotels treated guests like family,” *St. Petersburg Times*, August 18, 2004 describes a hotel that kept its price constant after a Florida hurricane and even added free amenities while the article “West Palm Days Inn Settles Storm Gouging Suit,” *Tampa Tribune*, October 4, 2004 describes a hotel that dramatically raised prices in the same circumstances.

One implication of this analysis is that price increases should be seen as more unfair when they lead to more regret. This means that consumers ought to be more tolerant of price increases of perishable goods, since a price increase for a perishable good should lead to less self-reproach for not having bought the good earlier. The model thus implies that perishable good prices ought to be more volatile, though this implication is shared with models where the existence of inventories allows firms to smooth prices. Bils and Klenow (2004) show that perishable goods do in fact have particularly variable prices, though they attribute this to the lack of diversity in the inputs of these products.

The analytical development of this section has stressed the regret and anger that is associated with price increases when demand rises suddenly. These emotions are felt by people who failed to purchase the product earlier. For people who have bought the product at an earlier price p_o , regret is experienced when they become aware that the price has fallen. If they know p , the regret function ℓ differs from the one above and $\ell(x) = 0$ if $x \geq 0$ while $\ell'(y) \leq 0$ if $y < 0$. This means that anger at firms that cause regret is now triggered by price reductions. The capacity of consumers that have bought a good in the past to be upset at price reductions was recently demonstrated by the outcry that followed Apple's September 5, 2007 \$200 reduction in the price of its iPhone. The resulting volume of complaints led Apple to offer a rebate to people who had bought the phone earlier.

Anderson and Simester (2009) provide dramatic evidence that customers who observe a price below the one that they have paid in the past are left with lasting scars. They analyze the mail order purchases of consumers from a catalog that offers distinct products, each of which tends to be purchased only once. Some of these customers were sent a test catalog with larger discounts on certain items. Customers who received this test catalog and who had previously purchased one of the discounted goods reduced their purchases from this firm in comparison to both the customers who did not receive the test catalog and also relative to the customers who received the test catalog but had not bought the currently discounted goods before. This is consistent with the central idea in this paper that firms that lead their consumers to regret their past behavior engender animosity that, in turn, brings about a

reduction in purchases.

It is important to stress that the theory does not imply that all price changes are equally problematic, and this could be the basis of further tests. People particularly dislike the price increases that lead them to regret their past actions, like not having brought enough water for a hiking trip (as in Frey and Pommerehne (1993) where hikers regard water price increases as unfair) or not having planned appropriately for a hurricane. In contrast, people who wish to attend popular sporting and cultural events have less scope to regret their past decisions when they are confronted with increased hotel room prices. People seeking hotel rooms for other reasons at the same time do have cause for such regrets, but they presumably represent only a minority of visitors during episodes like the Cannes Film Festival or the Super Bowl. Consistent with this, questionnaire evidence indicates that people regard it as much less unfair to raise prices in these circumstances.

I gave a group of 82 participants in an experiment two vignettes. In the first, they were told, "After a hurricane wreaks havoc in a town, many homeowners need a place to stay and many seek lodging at nearby motels. Several of these motels have doubled their room rates from around \$50 to around \$100 per night." In the second, they were told "After a town is chosen to host the Super Bowl, many people try to get rooms at nearby motels for the nights surrounding the game. Several of these motels have raised their room rates from about \$50 to about \$100 per night." After reading each of these vignettes, participants were asked to say whether they saw the price increase as "fair," "acceptable," "unfair," or "very unfair." In the hurricane case, 75.5% saw the price increase as either unfair or very unfair, while only 9.8% did so in the Super Bowl case. Using a chi-squared test, this difference in proportions is statistically significant with a significance level smaller than .01%.

This is hardly a sharp test of the predictions of the theory, since there are other differences between disasters and popular events. It does suggest, however, that the fairness of price increases after sudden increases in demand depends on more than the sizes of the price and demand increases (or the entitlements emphasized by Kahneman, Knetsch and Thaler 1986). Further study of whether regret can account for these differences seems worthwhile.

6 Conclusions

The perception that prices are unfair sometimes elicits strong consumer reactions. Consumers have, on occasion, challenged price discrimination, denounced price increases, and objected to price reductions. This paper has sought to provide a theory that explains how such distinct pricing patterns can be viewed as unfair. The aim of this theory is to predict when consumers will be angered by prices. This would be useful because this anger generally leads to change. In particular, firms often react by backtracking and trying to appease consumers. Examples of this are Amazon's abandonments of its experiment of using past consumer purchases to set prices and Apple's rebate to past iPhone customers. In addition, consumer anger can lead to changes in legislation. For example, laws outlawing price-gouging were passed in several states after damaging storms led some firms to raise their prices.

Because consumer anger is clearly detrimental to firms, firms can be expected to take steps to avoid it. In the likely case where anger prevention strategies are costly to the firm, many firms may be behaving in such a manner that consumers are just one short step away from anger. If this is so, the understanding of consumer anger becomes much more central to economic analysis. Anger would then matter for prices even when consumers appear calm; indeed it could be a central force in determining prices at all times.

In the model presented here, consumers' potential anger is always relevant to firms, even if the number of consumers that react with fury at demonstrations of selfishness is relatively small. One potential attraction of the theory is that it is very tightly parameterized so that it should be possible to reject it. One area where such testing might prove feasible is in price discrimination. In many industries, price discrimination across different types of consumers is accomplished by using different "models" of the same product, with some "stripped down" models carrying a lower price than "full featured" ones. Consumers often tolerate this, though they appear to be unaware that, in some cases, "stripped down" models are no cheaper to produce than "high end" ones (because, as discussed in Deneckere and McAfee (1996), the latter have to be crimped to deteriorate their performance). This consumer

ignorance may well facilitate price discrimination in situations where this would be impossible with full information. One obvious question that may shed light on the model's validity is how quickly consumers become angry with this practice as they learn about the lack of cost advantages of "stripped down" models. Notice that, depending on the marginal utility of income of the consumers that buy the different models and depending on the difference in actual performance, the disclosure of small cost differences may not lead to anger. For example, consumers may be happy to let richer customers pay more for a product that is only slightly better, if they expect that poorer customers would have to pay a higher price in the absence of model proliferation.

On the other hand, Anderson and Simester (2008) report a case where consumer resistance prevented a firm from charging more for clothes in larger sizes, which did actually cost more to manufacture. They show that the people buying clothes of size 4X in a catalog were particularly unwilling to purchase when the price of these clothes was higher than those for sizes XL–3X.¹⁸ By sending out various test catalogs, they learned that this was not an effect of the level of prices but an effect of price differences, suggesting that such differences were seen as unfair. While the model of this paper would have to be adapted to this setting, it seems possible that the difference in price was painful to 4X customers as a reminder of their body size, and that they blamed the seller for bringing these feelings to the fore.

One aspect that is likely to complicate the testing of the model is that the perceived fairness of a price depends on numerous aspects of consumers that are not usually measured in economic analysis. In addition to depending on consumers' expectations regarding firms' costs, fairness judgments depend on the extent to which prices trigger regret and disappointment. This need not make the theory less testable, since people seem quite willing to talk about these emotions to researchers (Simonson 1992, Cooke, Mevys and Schwartz 2001, Yi and Baumgartner 2004). Still, it may mean that testing the theory will be facilitated by the use of such self-reports of mental states.

¹⁸The majority of American clothing is sold in sizes S (small), M (medium) and L (large), which are smaller than XL (extra large). Size 1X is one size larger than XL, and 2X, 3X, 4X and 5X are larger still.

Appendix:

Proof of Lemma 1 : That this is the equilibrium price of naive firms follows from the analysis above. For consumers, the only information in $\hat{\lambda}$ is the price they observe, and they know that naive altruists charge this price. Thus, the probability on the left hand side of (2) is the probability of observing the price $p^*(\bar{\lambda})$ in the case where the firm is truly altruistic. This probability is equal to one if all altruistic firms charge $p^*(\bar{\lambda})$ whereas it equals ζ if sophisticated altruistic firms charge a different price. Given that $\zeta \geq \alpha$, the inequality (2) is violated at this price in either case. \square

Proof of Proposition 1: Condition (9) implies that angry consumers with the highest possible valuation (Y) do not buy the good even if its price is only imperceptibly above $p^*(\bar{\lambda})$. Thus, a selfish firm that charges more than $p^*(\bar{\lambda})$ loses a fraction γ of its customers. Its objective function is then identical to (5) with $\bar{\lambda}$ set to equal zero and N replaced by $(1 - \gamma)N$. Its optimum price is thus the standard monopoly optimum $p^*(0) = \epsilon C' / (\epsilon - 1)$ with sales of $(1 - \gamma)N(1 - F(p^*(0)))$. The expression in (8) gives the difference in profits between charging $p^*(\bar{\lambda})$ and charging $p^*(0)$. When this is positive, $v(\pi)$ is higher if the firm charges $p^*(\bar{\lambda})$ than when it identifies itself as selfish and charges $p^*(0)$. When it is negative, the firm charges $p^*(0)$, which is higher.

When (9) is violated, the sales of a firm that identifies itself as selfish fall somewhat less because angry consumers satisfying (4) still buy the good. Total sales are then given by $Q^d(p)$. Equation (10) then gives the difference between the profits from charging $p^*(\bar{\lambda})$ and those from maximizing profits when demand is given by $Q^d(p)$. If this is positive, $v(\pi)$ is larger for selfish firms that charge $p^*(\bar{\lambda})$, so all selfish firms charge this price once again. When this is negative, selfish firms charge the profit maximizing price, which is higher.

When $\bar{\lambda} = 0$, $p^*(\bar{\lambda})$ is the optimal price for selfish firms as well. It follows that $\Delta(0) > 0$ if $\bar{\xi} > 0$. To see this, consider first the case where (9) is satisfied for this $\bar{\xi}$ and $\bar{\lambda} = 0$. The relevant condition is then (8). This is positive because $Q^*(\bar{\lambda})$ is equal to $(1 - \gamma)N[1 - F(p^*(0))]$ and $\gamma > 0$. In the case where (9) is violated for this $\bar{\xi}$ and $\bar{\lambda} = 0$, $\Delta(0)$ is given by (10). The definition of $Q^d(p)$ implies that increases in ξ (starting from zero) lower this demand for any

given p and therefore lower the term in square brackets in (10). Since this term would equal the term in braces if $\bar{\xi}$ were equal to zero, $\Delta(0) > 0$ once again.

As $\bar{\lambda}$ is increased, $p^*(\bar{\lambda})$ falls and the term in braces in the two equations defining $\Delta(\bar{\lambda})$ fall continuously. The rest of the equations defining $\Delta(\bar{\lambda})$ are unaffected by changes in $\bar{\lambda}$. Thus for any $\bar{\xi} > 0$, one can find a $\bar{\lambda} > 0$ such that $\Delta(\bar{\lambda}) > 0$. \square

Proof of Proposition 2: With linear V and $V(I)$ normalized to equal zero while θ is uniform between 0 and Y_i for group i , $W_N^n(\bar{\lambda})$ is

$$W_N^n(\bar{\lambda}) = v \left(N(p - c) \left[2 - \frac{p}{Y_1} - \frac{p}{Y_2} \right] \right) + \bar{\lambda} N V' \left\{ \frac{(Y_1 - p)^2}{2Y_1} + \frac{(Y_2 - p)^2}{2Y_2} \right\}$$

Where the term in braces gives consumer surplus under uniform pricing. After dividing by N , the first order condition for this problem is

$$\left(2 - \frac{(Y_1 + Y_2)p}{Y_1 Y_2} \right) \left(1 - \frac{\bar{\lambda} V'}{v'} \right) - \frac{Y_1 + Y_2}{Y_1 Y_2} (p - c) = 0,$$

so the optimal price satisfies

$$p_N = \frac{c}{2 - \tilde{\lambda}} + \frac{2Y_1 Y_2 (1 - \tilde{\lambda})}{(2 - \tilde{\lambda})(Y_1 + Y_2)},$$

where $\tilde{\lambda}$ equals $\bar{\lambda} V'/v'$ once again. Consider first consumer surplus in market 1, $(Y_1 - p_N)^2/2Y_1$. This is

$$\begin{aligned} & \frac{1}{2Y_1} \left(Y_1 - \frac{2(1 - \tilde{\lambda})Y_1 Y_2}{(1 - \tilde{\lambda})(Y_1 + Y_2)} - \frac{c}{2 - \tilde{\lambda}} \right)^2 \\ &= \frac{1}{2Y_1} \left(\frac{Y_1 - c}{2 - \tilde{\lambda}} + \frac{Y_1(1 - \tilde{\lambda})(Y_1 + Y_2) - 2Y_1 Y_2(1 - \tilde{\lambda})}{(2 - \tilde{\lambda})(Y_1 + Y_2)} \right)^2 \\ &= \frac{1}{2Y_1} \left(\frac{Y_1 - c}{2 - \tilde{\lambda}} + \frac{Y_1(1 - \tilde{\lambda})(Y_1 - Y_2)}{(2 - \tilde{\lambda})(Y_1 + Y_2)} \right)^2. \end{aligned}$$

By contrast, the single market analysis with uniform θ implies that the discriminating firm charges $p_i = [(1 - \tilde{\lambda})Y_i + c]/(2 - \tilde{\lambda})$ in market i yielding a consumer welfare in this market of $(1/2Y_i)[(Y_i - c)/(2 - \tilde{\lambda})]^2$. Thus, total consumer welfare is larger with a uniform

price if

$$\begin{aligned} & \frac{1}{2Y_1} \left(\frac{Y_1 - c}{2 - \tilde{\lambda}} + \frac{Y_1(1 - \tilde{\lambda})(Y_1 - Y_2)}{(2 - \tilde{\lambda})(Y_1 + Y_2)} \right)^2 - \frac{1}{2Y_1} \left(\frac{Y_1 - c}{2 - \tilde{\lambda}} \right)^2 \\ & + \frac{1}{2Y_2} \left(\frac{Y_2 - c}{2 - \tilde{\lambda}} + \frac{Y_2(1 - \tilde{\lambda})(Y_2 - Y_1)}{(2 - \tilde{\lambda})(Y_1 + Y_2)} \right)^2 - \frac{1}{2Y_2} \left(\frac{Y_2 - c}{2 - \tilde{\lambda}} \right)^2 > 0 \end{aligned}$$

or, multiplying by Y_1Y_2 if

$$\frac{(Y_1 + Y_2)(1 - \tilde{\lambda})^2(Y_1 - Y_2)^2}{2(1 - \tilde{\lambda})^2(Y_1 + Y_2)^2} + \frac{2(1 - \tilde{\lambda})[(Y_1 - c)(Y_1 - Y_2) + (Y_2 - c)(Y_2 - Y_1)]}{(2 - \tilde{\lambda})^2(Y_1 + Y_2)} > 0.$$

This is satisfied because the left hand side of this inequality equals

$$\frac{(1 - \tilde{\lambda})^2(Y_1 - Y_2)^2}{2(2 - \tilde{\lambda})^2(Y_1 + Y_2)} + \frac{2(1 - \tilde{\lambda})(Y_1^2 - 2Y_1Y_2 + Y_2^2)}{(2 - \tilde{\lambda})^2(Y_1 + Y_2)},$$

which is positive. □

Proof of Proposition 3: Profits π are given by $N(1 - F)p - C$ so that the change in profits $d\pi$ is

$$d\pi = NR_\pi dp + (1 - F)(p - C_1)dN - C_2 d\psi \quad R_\pi \equiv 1 - F(p) - F'(p - C_1), \quad (22)$$

where C_2 represents the (positive) derivative of C with respect to its second argument. The first order condition (15) implies that $R_\pi > 0$.

Now let NR_p represent the derivative of the left hand side of (15) with respect to p . The second order conditions imply that (15) falls when p rises so that R_p is negative. Differentiating (15) after dividing by N while using the above expression for $d\pi$, we have

$$R_p dp + v'' R_\pi [(1 - F)(p - C_1)dN - C_2 d\psi] + v' F' [(1 - F)C_{11}dN + C_{12}d\psi] = 0, \quad (23)$$

where C_{ij} represents the second derivative of C with respect to i th and j th argument of C . Since marginal cost is increasing in output and ψ , both C_{11} and C_{12} are positive.

First, set $d\psi$ to zero and interpret (23) as giving the change in N that rationalizes a particular dp . Note that an increase in p can only be due to an increase in N (as opposed to

a decrease) if $[v'F'C_{11}(1-F) + v''R_\pi(p-C_1)] > 0$. The resulting change in marginal cost is

$$\begin{aligned} dC_1 &= -C_{11}NF'dp + C_{11}(1-F)dN \\ &= \left(-C_{11}NF' - R_p \left\{ \frac{C_{11}}{v'F'C_{11} + v''R_\pi(p-C_1)} \right\} \right) dp. \end{aligned} \quad (24)$$

Now, set dN to zero and interpret (23) as giving the change in ψ that is needed to obtain a particular dp . The change in marginal cost induced by this is

$$\begin{aligned} dC_1 &= -C_{11}NF'dp + C_{12}d\psi \\ &= \left(-C_{11}NF' - R_p \left\{ \frac{C_{12}}{v'F'C_{12} - v''R_\pi C_2} \right\} \right) dp. \end{aligned} \quad (25)$$

Dividing the denominator of the expression in brackets in (24) by C_{11} in the case where $[v'F'C_{11}(1-F) + v''R_\pi(p-C_1)] > 0$ yields a larger expression than dividing the denominator of the expression in brackets in (25) by C_{12} . Since R_p is negative, the expression multiplying dp on the RHS of (24) is larger than the corresponding expression in (25). \square

Proof of Proposition 4 I first establish that a naive altruistic firm would not want to charge a price above the one that clears the market with Q units being sold. Later, I study whether it would be willing to charge a lower price. The market clearing price p^* ensures that demand $N(Y + \phi - p^*)/Y$ is equal to Q . This price is thus given by

$$p^* = \phi + Y \frac{N - Q}{N} \quad (26)$$

If the firm charged a higher price, consumers would no longer be rationed so that their welfare would be given by (17) and a naive altruistic firm would have a welfare of

$$\begin{aligned} v(p[1 - F(p - \phi)]) + \bar{\lambda}\bar{U}^*(p) &= \frac{N}{Y} \left(v'(Y + \phi - p)p + \bar{\lambda} \left[(V' + \ell') \frac{(Y + \phi - p)^2}{2} \right. \right. \\ &\quad \left. \left. - \ell' \frac{(Y + \phi - p_o)^2}{2} \right] \right) \end{aligned}$$

where the equality is obtained by using the linearity of v , V , ℓ and the uniform distribution of θ . The derivative of this welfare with respect to price is

$$(Y + \phi)(v' - \bar{\lambda}(V' + \ell')) - (2v' - \bar{\lambda}(V' - \ell'))p$$

which equals

$$-(\phi + Y)v' + (2v' - \bar{\lambda}(V' - \ell'))YQ/N.$$

at the market clearing price p^* . A naive altruistic firm does not want to charge more than p^* if this expression is negative. When (19) is satisfied, (20) ensures that it is indeed negative while, when (19) is violated, the expression is negative for any positive Q .

Having established that the firm does not want to sell less than Q , a firm that acts as if had an altruism of $\bar{\lambda}$ charges the price smaller than or equal to p^* that maximizes

$$W^n(\bar{\lambda}, p, Q) = v'Qp + \bar{\lambda}\bar{U}(p) \quad (27)$$

Using the properties of V , ℓ and θ in (16), $\bar{U}(p)$ is now

$$\frac{\bar{U}(p)}{Q} = (V' + \ell')\frac{Y + \phi - p}{2} - \left\{ \frac{N}{Q} \int_{p_o - \phi} \ell(\phi + \theta - p_o) dF(\theta) \right\} \quad (28)$$

when $p \geq \phi$, while it is given by

$$\frac{\bar{U}(p)}{Q} = (V' + \ell') \left(\phi - p + \frac{Y}{2} \right) - \left\{ \frac{N}{Q} \int_{p_o - \phi} \ell(\phi + \theta - p_o) dF(\theta) \right\} \quad (29)$$

when $p \leq \phi$. In these equations, the term in braces is left undeveloped because it is independent of p .

Now consider the case where $\phi \leq p_o < p \leq p^*$ so the firm sells Q at both p_o and p . Equations (27) and (28) imply that

$$W^n(\bar{\lambda}, p) - W^n(\bar{\lambda}, p_o) = [v' - \frac{\bar{\lambda}}{2}(V' + \ell')]Q(p - p_o).$$

This is positive if (19) is satisfied. Thus, condition (19) implies that the firm raises its price from p_o to p , and hence to p^* whenever $p_o \geq \phi$. This establishes i) for any $p_o \geq \phi$. It also implies that, when p_o is below ϕ , the firm does not set a price between ϕ and p^* .

If $p_o < p < \phi$, (29) implies that

$$W^n(\bar{\lambda}, p) - W^n(\bar{\lambda}, p_o) = [v' - \bar{\lambda}(V' + \ell')]Q(p - p_o)$$

and this is negative when (21) is satisfied. Thus (21) implies that, when $p_o < \phi$, the firm does not choose a price between p_o and ϕ . Since we also established that it does not choose

a price strictly between ϕ and p^* , iii) just requires that there exist a p_o (lower than ϕ) that the firm prefers to p^* in this case. Using (28) and (29), the firm prefers p_o if the following expression is positive:

$$\begin{aligned} \frac{W^n(\bar{\lambda}, p_o) - W^n(\bar{\lambda}, p^*)}{Q} &= v'(p_o - p^*) + \bar{\lambda}(V' + \ell') \left(\frac{\phi + p^*}{2} - p_o \right) \\ &= \left\{ \bar{\lambda}(V' + \ell') \left[\phi + \frac{N - Q}{2N} Y \right] - v' \left[\phi + \frac{N - Q}{N} Y \right] \right\} + [v' - \bar{\lambda}(V' + \ell')] p_o \end{aligned}$$

where the second equality follows from (26). Condition (21) implies that the term multiplying p_o is negative so that a positive p_o can be found to ensure that $W^n(\bar{\lambda}, p_o) - W^n(\bar{\lambda}, p^*)$ is positive if the term in braces is positive. This is true when (21) is satisfied. Note, lastly, that if (19) is violated, (21) is violated as well so the firm prefers p_o to any other price. \square

Proof of Proposition 5 If a firm deviates from charging p_o when all altruistic firms charge this price, it identifies itself as selfish. This means, using (4) that a fraction γ of customers is willing to buy the good at a price slightly higher than p_o only if their individual θ satisfies

$$\theta + \phi \geq \left(1 + \frac{\bar{\xi} v'}{V'} \right) p_o, \quad (30)$$

where I have made use of the fact that marginal cost is zero. This implies that no angry customers buy the good at any price above p_o if

$$\phi + Y < \left(1 + \frac{\bar{\xi} v'}{V'} \right) p_o, \quad (31)$$

which is satisfied for $\bar{\xi}$ sufficiently high. If γ is sufficiently high, we also have

$$\frac{N(1 - \gamma)(\phi + Y)^2}{4Y} < Q p_o, \quad (32)$$

and I now show that this condition together with (31) is sufficient for a selfish firm to charge p_o . The left hand side of (32) is the maximum level of profits for a firm with infinite capacity at zero marginal cost facing the demand $N(1 - \gamma)(\phi + Y - p)/Y$, which is the demand that remains at a price above p_o if (31) is satisfied. If these profits are lower than the profits from going along with p_o , so are the profits that are constrained by the quantity Q .

I now focus on conditions that guarantee that the firm deviates from p_o . First, for $\phi > p_o(1 + \bar{\xi}v'/V')$ sufficiently large (30) is satisfied even when $\theta = 0$. Thus, when ϕ satisfies this condition, the firm's demand at p_o exceeds Q , and it can increase its profits above p_oQ by raising its price slightly. In fact, a sufficiently high ϕ leads the firm to deviate even if $\bar{\xi}$ is infinite so that angry consumers never buy. To see this, focus on the case where $N(1 - \gamma)$ is less than Q so that a deviating firm must sell less than Q . Still, all these consumers are willing to pay ϕ and the profits from charging this price $N(1 - \gamma)\phi$ exceed p_oQ for sufficiently high ϕ . \square

7 References

- Anderson, Eric T. and Duncan I. Simester (2008). "Does Demand Fall When Customers Perceive That Prices Are Unfair: The Case Of Premium Pricing for Large Sizes." *Marketing Science*,
- Anderson, Eric T. and Duncan I. Simester (2009). "Price Stickiness and Customer Antagonism." Working paper, MIT, *Quarterly Journal of Economics*, forthcoming.
- Bell, David E.(1983). "Risk Premiums for Decision Regret." *Management Science*, 29, 1156–66.
- Bils, Mark and Yongsung Chang (2000). "Understanding the Response of Prices to Cost and Demand Factors." *Carnegie-Rochester Series on Public Policy*, 52, 33–77.
- Bils, Mark and Peter J. Klenow (2004). "Some evidence on the importance of sticky prices." *Journal of Political Economy*, 112, 947–86.
- Blinder, Alan S., Elie R.D. Canetti, David E. Lebow and Jeremy B. Rudd (1988). *Asking about prices: a new approach to understanding price stickiness*. Russell Sage Foundation.
- Bolton, Lisa E., Luk Warlop and Josep W. Alba (2003). "Consumer Perception of Price (Un)Fairness." *Journal of Consumer Research*, 29, 474–91.
- Burstein, Ariel, Martin Eichenbaum and Sergio Rebelo (2005). "Large Devaluations and the Real Exchange Rate." *Journal of Political Economy*, 113, 742–84.
- Campbell, Margaret C. (1999). "Perceptions of Price Unfairness: Antecedents and Con-

- sequences.” *Journal of Marketing Research*, 36, 187–99.
- Cecchetti, Stephen G. (1986). “The Frequency of price Adjustment, A Study of Newsstand Prices of Magazines.” *Journal of Econometrics*, 31, 255–74.
- Chavis, Larry and Phillip Leslie (2009). “Consumer Boycotts: The Impact of the Iraq War on French Wine Sales in the U.S.” *Quantitative Marketing and Economics*, 7, 37–67.
- Connolly, Terry and Marcel Zeelenberg (2002). “Regret in decision making.” *Current Directions in Psychological Science*, 11, 212–6.
- Cooke, Alan D. J., Tom Meyvis and Alan Schwartz (2001). “Avoiding future regret in purchase-timing decisions.” *Journal of Consumer Research*, 27, 447–59.
- Cowan, Simon and John Vickers (2007). “Output and welfare effects in the classic monopoly price discrimination problem.” Working paper, University of Oxford.
- Deneckere, Raymond J. and R. Preston McAfee (1996). “Damaged Goods.” *Journal of Economics & Management Strategy*, 5, 149–74.
- Dickson, Peter R. and Rosemary Kalapurakal (1994). “The use and perceived fairness of price-setting rules in the bulk electricity market.” *Journal of Economic Psychology*, 15, 427–448.
- Fabiani, Silvia, Martine Druant, Ignacio Hernando, Claudia Kwapil, Bettina Landau, Claire Loupias, Fernando Martins, Thomas Mathä, Roberto Sabbatini, Harald Stahl and Ad Stockman (2006). “What firms’ surveys tell us about price-setting behavior in the Euro area.” *International Journal of Central Banking*, 2, 3–48.
- Fehr, Ernst and Klaus M. Schmidt (1999). “A Theory of Fairness, Competition and Cooperation.” *Quarterly Journal of Economics*, 114, 817–68.
- Frey, Bruno S. and Werner W. Pommerehne (1993). “On the fairness of pricing - An empirical survey among the general population.” *Journal of Economic Behavior and Organization*, 20, 295–307.
- Gates, Jacquelyn B. (2004). “The Ethics Commitment Process: Sustainability Through Value-Based Ethics.” *Business and Society Review*, 109, 493–505.
- Heidhues, Paul and Botond Köszegi (2008). “Competition and Price Variation When Consumers Are Loss Averse.” *American Economic Review*, 98, 1245–68.
- Huppertz, John W., Sidney J. Arenson and Richard H. Evans (1978). “An application of

- equity theory to buyer-seller exchange situations.” *Journal of Marketing Research*, 15, 250–60.
- Kahneman, Daniel, Jack Knetsch and Richard Thaler (1986). “Fairness as a Constraint on Profit: Seeking Entitlements in the Market.” *American Economic Review*, 76, 728–41.
- Levine, David K. (1998). “Modeling Altruism and Spitefulness in Experiments.” *Review of Economic Dynamics*, 1, 593–622.
- Maxwell, Sarah (1995). “What makes a price increase seem ‘fair’?” *Pricing Strategy & Practice*, 3, 21–27.
- Monroe, Kent B. and Angela Y. Lee (1999). “Remembering versus Knowing: Issues in Buyers’ Processing of Price Information.” *Academy of Marketing Science Journal*, 27, 207–25.
- Olmstead, Alan L. and Paul Rhode (1985). “Rationing without Government: The West Coast Gas Famine of 1920.” *American Economic Review*, 75, 1044–55.
- Rotemberg, Julio J. (2005). “Customer Anger at Price Increases, Changes in the Frequency of Price Adjustment and Monetary Policy.” *Journal of Monetary Economics*, 52, 829–852.
- Rotemberg, Julio J. (2008). “Minimally Acceptable Altruism and the Ultimatum Game.” *Journal of Economic Behavior and Organization*, 66, 457–76.
- Rotemberg, Julio J. and Michael Woodford (1991). “Markups and the Business Cycle.” *NBER Macroeconomics Annual*, 63–129.
- Sheshinski, Eytan and Yoram Weiss (1977). “Inflation and Costs of Price Adjustment.” *Review of Economic Studies*, 44, 287–303.
- Simonson, Itamar (1992). “The Influence of Anticipating Regret and Responsibility on Purchase Decisions.” *Journal of Consumer Research*, 19, 105–118.
- Xia, Lan, Kent B. Monroe and Jennifer L. Cox (2004). “The Price is Unfair! A Conceptual Framework of Price Fairness Perceptions.” *Journal of Marketing*, 68, 1–15.
- Vaidyanathan, Rajiv and Praveen Aggarwal (2003). “Who Is the Fairest of Them All? An Attributional Approach to Price Fairness Perceptions.” *Journal of Business Research*, 56, 453–63.
- Yi, Sunghwan, and Hans Baumgartner (2004). “Coping With Negative Emotions in

Purchase-Related Situations.” *Journal of Consumer Psychology*, 14, 303-317.

Figure 1: Value of γ that keeps selfish firms imitating firms with altruism λ

