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Anger and Regulation

Rafael Di Tella

Harvard Business School, Boston, MA 02163, USA
rditella@hbs.edu

Juan Dubra

University of Montevideo, 11600 Montevideo, Uruguay
dubraj@um.edu.uy

Abstract

We study a model in which agents experience anger when they see a firm that has displayed insufficient concern for the welfare of its clients (i.e., altruism) making high profits. Regulation can increase welfare, for example, through fines (even with no changes in prices). Besides the standard channel (i.e., efficiency), regulation affects welfare through two other channels. (i) Regulation calms down existing consumers, because a reduction in the profits of an unkind firm increases total welfare by reducing consumer anger. (ii) Individuals who were out of the market when they were angry in the unregulated market decide to purchase once the firm is regulated.

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I. Introduction

Governments routinely regulate markets, particularly those where there is a tendency towards little competition. One possible explanation is that such regulation improves efficiency. Indeed, economists have developed normative theories of regulation, explaining how social welfare increases when such regulation adopts a particular form. For example, forcing a monopoly to increase output might be desirable because, in a monopoly equilibrium, the cost to the firm of an extra unit is less than the value given to it by the consumer (see Pigou, 1938; Baron and Myerson, 1982; Laffont and Tirole, 1993; *inter alia*).

In many settings, however, efficiency is not the only – or the most important – human motivation. In ultimatum games, for example, consumers are often willing to walk away from a profitable deal that they feel takes advantage of them. Thus, an important challenge is to develop a normative theory of regulation that incorporates a more complete description of human motivation.[1] Although most existing models do not focus on such emotions and the populist dynamics to which they often give rise to, they are central in our paper because we emphasize the role of emotions in the motivation of consumers (as distinct from a material motive). Thus, we assume that a consumer's experience and decisions can be understood by studying total utility, constructed as the sum of a material pay-off and an emotional pay-off. Psychologists and some economists have gathered evidence on several emotions that are candidates to be part of the second term. Consumer anger is one emotion that appears to be particularly relevant for the setting we seek to describe, whereby a monopoly might abuse its market position and set exploitation prices.

Anger appears to have been central in several historic episodes whereby some form of regulation or punishment of business was put into place, although economists typically dismiss them as populist incidents, perhaps because they often involve indignation at actions that might be broader than price increases. Di Tella and MacCulloch (2009) have shown empirically that a measure of "average anger" in society rises when businessmen are perceived to be corrupt, but that such angry reaction falls when there is heavy regulation of business. The purpose of our paper is to develop a model where we can understand the causes of these populist forces and how regulation might help contain them. Evidence gathered by psychologists points to several characteristics of angry emotional reactions. For example, anger is correlated with the belief that redress is still possible, with the belief that remedy requires (perhaps indirectly) the intervention of the self, and with the belief that others – as opposed to the situation, or the self – were responsible for the negative event (e.g., Smith and Ellsworth, 1985; Lazarus, 1991; Lerner and Tiedens, 2006). Small and Lerner (2008) have found that individuals induced to feel anger choose to provide less welfare assistance than those induced to feel other emotions, while Bodenhausen *et al.* (1994) have found them to engage in more stereotyping. Less of this research has concerned itself with emotional reactions following price increases, although Tyran and Engelmann (2005) were able to generate experimental evidence on boycotts following increases in prices in the laboratory.

[1] Actual regulation often mentions fairness. For example, Article 82 on competition policy in the European Community treaty prohibits abuse by "directly or indirectly imposing unfair purchase or selling prices or other unfair trading conditions". Several authors have argued that economics has difficulties in providing a comprehensive theory of regulation (descriptive or normative). See, for example, Zajac (1995), who discusses alternative definitions of fairness applied to regulation, including how the tension between fairness and efficiency has shaped public policy in several areas (beyond the regulation of public utilities), as well as Posner (2002), who focuses on the difficulties in defining the concept of transaction cost.

We study a model where an individual's experience as a client of a monopolistic firm improves when the price paid falls and the profits of those firms perceived as unkind go down.[2] The first of these two terms – the material pay-off – is standard in economics, while the second term – the emotional pay-off – captures the demand for fairness that has been analyzed in several well-known models in economics (e.g., Rabin, 1993; Fehr and Schmidt, 1999; Falk and Fischbacher, 2006; *inter alia*).[3] In particular, we follow Levine (1998) and Rotemberg (2008) and assume that an individual's kindness towards others depends on their estimation of how kind others have been in relationships with them.[4] This allows these authors to have agents who are spiteful towards those who are perceived to have behaved unkindly to the decision-maker, a feature that plays a key role in our theory of regulation of monopolists. Note that this specification naturally leads to a signaling game, because an individual's action can reveal how altruistic he/she is. Thus, it is not necessary to have a large fraction of truly altruistic firms in order for the equilibrium to be heavily influenced by altruism. Finally, part of the attraction of applying these preferences to the demand for regulation is that it might help to explain not only the amount of regulation, but also some instances of redistributive regulation (such as when fines are applied by populist governments) and of inefficient regulation (i.e., types of regulation might not be optimal from a standard economic efficiency perspective).[5]

[2] Anecdotal evidence suggests that anger often arises at the announcements of high profits by firms that are under scrutiny. See, for example, "Railtrack profits spark anger", reported on BBC News online, Thursday, November 4, 1999, http://news.bbc.co.uk/2/hi/business/504329.stm (accessed Tuesday, October 28, 2008).

[3] Jolls *et al.* (1998) have provided an early discussion of how law and economics might incorporate agents that have bounded rationality and bounded self-interest. See also the contributions by Sunstein (2000) as well as the observations by Posner (1998).

[4] Although there are differences (Levine's preferences are linear) in our context, they lead to similar implications. One reason for this is that, although in Rotemberg the individual is angry or not whereas in Levine anger is continuous, the trade-offs in Levine are linear, so the optimal amounts of regulation (or of punishment) are corner solutions: the individual wants either no punishment or as large a punishment as possible. Rotemberg (2008) explains how the minimal altruism preference relations he defines explain a wide range of behavior in ultimatum and dictator games.

[5] Another instance where anger might be the driver of regulation is the rise of political pressure on CEO pay following the 2008–2009 financial crisis. A report in the *Financial Times* explains "Gordon Brown, the prime minister, has said he would use the government's banking aid package to clamp down on compensation, adding 'the days of big bonuses are over'." Then, it describes how the actions of the Financial Services Authority reflected this heightened pressure. For example, it states "The letter does not have the status of mandatory guidance, but the FSA has said it would increase the regulatory capital requirements for banks that do not sufficiently link pay with risk." See the article "Banks urged to rein in bonuses", in the *Financial Times*, Monday, October 13, 2008. With respect to the forms of

We develop a model of price competition along the lines of Salop (1979), but where consumers react with anger when they conclude that the firm has shown low levels of altruism towards them. Given the strength of consumer reactions to high prices by monopolistic competitors, there is a signaling game where it often pays for firms to act as if they were kind. This leads to a set of pooling equilibria, where prices are relatively low and consumers are not angry. One could question whether there is any reason for including anger in a model. After all, one may think that the anger at price increases, as reported above, is just the reflection of a lower utility achieved at the new price level. Moreover, the evidence gathered by psychologists on the anger cited above does not really focus on price changes and somewhat abstract entities, such as firms. However, in a recent paper, Anderson and Simester (2010) have presented convincing evidence on this issue, using two large field experiments to study how customers react if they buy a product and later observe the same retailer selling it for less. They have found that customers react by making fewer subsequent purchases from the firm, an effect that is particularly large for the firm's most valuable customers (i.e., those whose prior purchases were most recent and at the highest prices). Although it is not hard to produce a model in which a standard utility and some asymmetric information story could predict such a response by consumers, it seems more natural to include what we know about the psychology of consumers into the decision-making aspect of the model, as we do.

The main result of the paper is that when competition decreases and the number of firms falls, the set of prices for which a pooling equilibrium can be sustained is smaller. That is, as competition decreases, consumers are more likely to experience anger, leading to higher welfare losses. In this context, regulation might increase welfare through three different channels. First, there is the standard channel, whereby a reduction in monopoly price leads to the production of units that cost less than their value to consumers. Second, regulation placates existing consumers – a reduction in the profits of a firm viewed as excessively selfish increases total welfare by reducing consumer anger. Finally, there is a third (mixed) channel arising because individuals who were out of the market when they were excessively angry in the unregulated market decide to purchase once the firm is regulated, thus reducing the standard distortions described in the first channel. Note that one of the most visible ways that regulation affects firm profits is

regulation, we note that previous work has tried to explain variations over time. For example, increases in market size play a key role in the explanations given by in Glaeser and Shleifer (2003) as to why private litigation is substituted by *ex ante* regulation during the progressive era. Previous work has also tried to clarify why the particular forms observed differ from what economists would expect. For example, Rotemberg (2003) has been able to explain the choice of commercial policy (tariff versus quotas) using altruistic preferences.

by regulating prices, but the mechanism also allows fines (when their imposition is credible) to play a similar role. Our theory connects the public's appreciation of firms with the extent of competition, noting that positive appraisals of big monopolies would be harder to maintain. This connection is emphasized in the body of literature on the history of public relations of large American corporations (e.g., Marchand, 1998).

Closest to our paper are two studies of the determination of prices when consumers' utility functions display psychologically realistic features. The first study is by Heidhues and Kőszegi (2008), who study the role of competition when consumers are loss averse and discuss the emergence of focal points and price rigidity. The second study is by Rotemberg (2005), who assumes a similar set of preferences as we do (consumers become angry when firms display insufficient levels of altruism), developing a new model with price rigidity and applying it to the analysis of monetary policy. Our model, which extends their analysis of realistic preferences to the context of regulation, is related to theories of exploitation by big firms. Marxist theories emphasize how capitalist institutions (including private ownership of the means of production and an accomplice state) lead workers/consumers to pay surplus value (see Brewer, 1987; *inter alia*). In our theory, consumers have a simple approach to deciding when such exploitation takes place (they measure firm altruism), and are neither alienated nor passive (they become angry). The problem with monopoly in our model is that consumers cannot go to other firms when firms misbehave, and because of this, firms are more likely to do so.

Interestingly, our approach to regulation and emotions is connected to capture theory. The Chicago and Virginia schools argue that regulations are the product of interest group activity (see Buchanan, 1968; Stigler, 1971; Peltzman, 1976; Djankov *et al.*, 2002; *inter alia*). The basic idea is that regulations are correlated with profits across industries and that this could reflect the interaction of groups in society, with different costs and benefits of organizing to obtain favorable regulations. Indeed, noting that "the Civil Aeronautics Board has not allowed a single new trunk line to be launched since it was created in 1938", and other examples where the regulatory actions appear to benefit firms, Stigler (1971) has concluded that the most plausible explanation is the firm's demand for protection and regulation. Such demand for regulation on the part of firms and other interest groups has occupied most positive theories of regulation.[6] Whereas the public could, in principle, be treated as an interest group, as in the generalizations

[6] Given the empirical failure of standard (normative) models of regulation, capture theory has developed models where the objectives of the agencies that implement regulation have been changed (i.e., there is, to some extent, democratic failure). We take a different approach and study normative models with non-standard preferences (of course, it is possible to develop positive models with both non-standard preferences and agencies that do not seek

of the theory (e.g., Becker, 1983; Baron, 1994; Grossman and Helpman, 1994; *inter alia*), the emphasis there is on material pay-offs and the public typically ends up with a low influence on the final outcome, given the tendency for free riding in voting in models with agents who only care about material pay-offs.[7]

In Section II we introduce the basic model, while in Section III we characterize the equilibrium in oligopoly. The main result is derived, showing that the set of pooling prices is smaller when there are fewer firms, so that anger is more likely as competition decreases. In Section IV, we study the welfare gains from regulation. Given that regulation has often been discussed in situations of monopoly, we analyze the monopoly equilibrium and describe three channels through which regulation might increase consumer welfare. We conclude in Section V.

II. The Model

We only depart from the standard Salop model by assuming that consumers have a reciprocity component in their utility function: they become angry at firms that they consider to be selfish. In order to do this, we must also incorporate into the Salop model two types of firms: selfish firms (the standard firms in the Salop model) and altruistic firms, who care about the welfare of the consumer.

There are n consumers, each characterized by a parameter x, which is interpreted, as in Salop (1979), as either a preferred variety or a location parameter. For each consumer, his location is drawn from a uniform distribution on the circle of circumference 1. There are $1/b$ evenly distributed firms along the circle, where b is a measure of concentration in the industry.

to maximize the public's welfare). Note that, given the empirical failure of classic normative models of regulations, it is less clear that a model with behavioral features provides less scientific discipline than a model where the agencies are assumed to be captured period after period. Wittman (1989) has provided an interesting discussion on the exaggeration of democratic failure in regulatory theories. For a model where public-spirited bureaucrats and public accountability are not enough to induce efficiency, see Leaver (2009).

[7] Rotemberg (2009) has shown how altruistic preferences are helpful in explaining turnout by voters who expect to be pivotal with very low probability. Note that Stigler himself has referred to the public's demand for regulation, but it seems that he believed it could not be modeled. When explaining the existence of regulations that harm social welfare, he has stated "the second view is that the political process defies rational explanation: 'politics' is an imponderable, a constantly and unpredictably shifting mixture of forces of the most diverse nature, comprehending acts of great moral virtue (the emancipation of slaves) and of the most vulgar venality (the congressman feathering his own nest)." Our theory of regulation focuses on fairness (and anger) and is thus capable of explaining the type of regulatory phenomena about which Stigler is concerned.

Firms are of one of two types, altruistic or selfish, and the prior probability that a firm is altruistic is q. Firm i chooses a price p_i, and has a cost c, so when demand for its product is D_i, its profits are $(p_i - c)D_i$. If the firm is selfish, then this is the firm's objective (its utility). If the firm is altruistic, its utility is profits plus a term that depends on the utility of the consumer. The altruistic firm has a cost of α if consumer utility is lower than a certain threshold τ. In order to keep things tractable, we set τ to be the utility a consumer would obtain in a Salop equilibrium in a market with $(1/b) + r$ firms. However, this parameter τ could be any other quantity (i.e., it could come from adaptation, learning, etc.). We interpret the parameter r as a measure of how $r$estrictive our assumption is that firms are altruistic. For $r = 0$, our assumption has no effect, because in a market with $1/b$ firms, in a Salop model, consumers obtain a certain equilibrium utility; suppose we call this utility τ. Because consumers already attain this equilibrium utility, altruistic firms behave like selfish firms, and the introduction of altruism and reciprocity play no role. For large r, altruistic firms bear the utility cost α for a large set of prices, because the target utility τ is large. In an earlier version of the paper we considered τ to be exogenous, and we obtained the same qualitative results.

Each consumer wants to buy (at most) one unit of the good, for which he obtains a gross surplus of s (gross of price and transport costs). If he has to travel a distance x, and pay a price of p_i, the net surplus is $s - tx - p_i$ (i.e., there is a transport cost of t per unit of distance traveled). In addition, the consumer derives $\lambda_c(\widehat{\lambda_f})(\pi + p - c)$ from consuming, where p is the price he is paying to the firm, c is the firm's marginal cost, and π is the profit the firm obtains from other customers. The individual's reciprocity is denoted as λ_c, which is assumed to depend on its estimate of the firm's altruism, $\widehat{\lambda_f}$. The individual's reciprocity is assumed to be non-negative when he thinks he is interacting with a kind firm, which is a firm that is altruistic towards consumers (i.e., it experiences an increase in utility when its customers are happier). Also, an individual's reciprocity is assumed to be negative when he concludes that the firm he is dealing with is unkind (i.e., not altruistic). In what follows, $\lambda_c(\widehat{\lambda_f})$ is either a fixed number $-\lambda < 0$ or 0, depending on whether the consumer has rejected the fact that the firm is altruistic, or not.

We normalize $t = 1$ (so all other parameters are just normalized by t) and we assume that the number of consumers is $n = 1$; both assumptions are without loss of generality. Also, we suppose $s \leq c + 1$, which ensures that in a monopoly not all consumers are served, and $s \geq c + (3/4)$, which ensures that in an oligopoly the market is covered (because, otherwise, an oligopoly behaves just like a group of local monopolies). We assume that the proportion of altruistic firms in the market is such that based solely on his prior, the individual does not reject the fact that the firm he is facing is altruistic. That is, if the individual is faced with a random firm, and has no information on which to update his prior, he does not become angry at the firm.

Finally, we assume that $\sqrt{\alpha} > (5b/4)(br/br + 1)$. For fixed α, this means that r is not too large (i.e., the target level of utility τ is not too restrictive); for fixed r, this means that the utility cost of the firm cannot be too small. Note that the assumption is automatically satisfied if there is competition (small b).

Discussion of the Modeling Assumptions

A standard criticism of preferences that incorporate psychologically realistic features is that they are, in some unspecified sense, ad hoc. We note that the preferences we use are not new, because they are exactly those described by Levine (1998) and Rotemberg (2008), whose functional forms yield identical predictions in this context. The discontinuities in choice observed when Rotemberg's agents reject the hypothesis that they face an agent that is not minimally altruistic can also be observed when preferences are linear (as in Levine's model) because agents choose corner solutions.[8] More importantly, the authors argue that the preferences they postulate can explain – better than competing theories or functional forms – the experimental results of ultimatum and dictator games; we refer the reader to their discussion of the evidence. This is important, because these experiments are one of the main reasons why economists have incorporated reciprocity and altruism in utility functions. Therefore, if we want to study the role of reciprocity and altruism, it seems reasonable to request that we choose preferences that can account for the observed experimental data.

The key features of these preferences, for our purposes, are as follows: (i) consumers can become angry; (ii) this anger is triggered by the behavior of the firm; (iii) angry consumers dislike firms making a profit (and a consumer is angrier when he contributes to those profits). Four features of these preferences can be emphasized. First, although both departures (for firms and consumers) from standard preferences take specific functional forms, the reader should bear in mind that extensions of the Salop model have been rare, and that it is not possible to obtain closed-form solutions if general utility functions are postulated. Second, regarding the preferences of the consumer, they have been contrasted with laboratory data, and they perform better than competing alternatives; moreover, the preferences of

[8] We note that this formulation, like Rotemberg's, is not consistent with expected utility, because $\lambda_c(\cdot)$ is a non-linear function of the probabilities. See Gilboa and Schmeidler (1989) for another deviation from expected utility with non-linearities, and see Dubra *et al.* (2004) for a departure due to incompleteness.

Levine and Rotemberg have similar consequences in our model, which constitutes a robustness check for our specification. Third, regarding the preferences of the firm (a discrete utility loss for the altruistic firm if consumers do not achieve a certain utility level), we have considered an alternative specification in which the utility loss of the firm is linear in consumer utility and the same qualitative results emerged (albeit in a more cumbersome manner). Finally, one could take issue with the existence of altruistic firms; we stress that the proportion of altruistic firms plays no role in separating equilibria generally, and even a small proportion of such firms has an effect on the emergence of pooling equilibria. As evidence of this effect, Roe and Wu (2009) have shown that selfish players mimic the actions of altruistic players in a finitely repeated labor-market setting with unenforceable worker effort. Reputation appears to be important: selfish and altruistic types act differently when previous individual actions cannot be tracked (see also Page *et al.*, 2005; Fischbcher and Gachter, 2006).

Another aspect of our formulation is that we assume that there is a finite number of consumers who care about the total profits of the firm. Suppose, instead, we had assumed, as in the standard formulation, a continuum of consumers. In this case, the consumer's purchases would not affect the firms profits, and consumer anger would play no role whatsoever in the model. Here, we are bound by the preferences of Rotemberg and Levine, who have postulated that the reciprocity component of the consumer's utility depends on the total resources of the other party, and not on how much the consumer contributes to those resources. An alternative interpretation of the model in this paper is that there is a continuum of individuals, and that when they are angry, they have a cost of purchasing from the firm, regardless of their effect on the firm's profits. That is, our model is identical to a model in which there is a continuum of individuals, and their utility is such that if they purchase from a selfish firm, their utility decreases by $\lambda(p - c)$, regardless of whether this affects the firm's profits.

Finally, a comment about the size of λ is in order. The size of λ does not need to change when the size of the firm changes (i.e., it does not need to change with the application of the model to different situations). To illustrate why this might (incorrectly) seem to be the case, note that because the size of $\lambda(\pi + p - c)$ increases in π, it would seem that consumers would be willing to punish a large firm more than a small firm (or that, for different applications, the size of λ would have to change to match the real behavior of consumers). This is not the case, because when comparing the utility of buying from one selfish firm or from an alternative firm, even if the consumer buys from the alternative firm, he will still be angry at the selfish firm he is not purchasing from.[9] For concreteness, suppose that the selfish firm is at a distance x, charges a price p, and has profits (arising from other consumers) of π, and suppose that the alternative firm is located at a distance $b - x$, and charges a price p^{a}. The consumer will buy from the alternative firm if

$$s - p - x - \lambda(\pi + p - c) \leq s - p^{\mathrm{a}} - (b - x) - \lambda\pi$$
$$\Leftrightarrow s - p - x - \lambda(p - c) \leq s - p^{\mathrm{a}} - (b - x),$$

so, in the purchasing decision, the profits π vanish from the comparison. The above equation also highlights the equivalence between our model and the one with a continuum of consumers, in which a consumer is angry at a firm if and only if he purchases from the firm (if he does not buy, he is not angry).

Equilibrium

We analyze a signaling game, in which firms choose a price that signals their type. An equilibrium in this setting is a triplet $[a(p, x; \mu), p(\theta); \mu(p)]$, where:

- $a(\cdot)$ is an acquisition decision strategy (the same for all consumers; we are looking at symmetric equilibria) as a function of price, tastes x (or distance), and beliefs μ (of whether the firm is altruistic or not) into $\{0, 1\}$, where $a = 1$ means buy and $a = 0$ means do not buy;
- $p(\cdot)$ is a function that maps types into prices (one price for each type; the same function for all firms);
- $\mu(\cdot)$ is a function that maps prices into $[0, 1]$, such that $\mu(p)$ is a number that represents the probability that the consumer assigns to the firm being altruistic;
- a is optimal given x, p, and μ, p is optimal given a (and other firms playing p), and μ is consistent (it is derived from the Bayes rule whenever possible).

We focus on equilibria (pooling or separating) where beliefs are of the sort "I reject the firm is altruistic if and only if its price p is such that $p > \overline{p}$", where $\overline{p}$ is the equilibrium pooling price, or the equilibrium price

[9] For simplicity, we only allow firms to signal their type through their choice of prices. However, one interpretation of the large amounts of money spent in public relations is that they are an attempt to signal a kind type by other (presumably cheaper) means than lowering prices; see, for example, Boyd (2000), Metzler (2001), and the discussion by Patel *et al.* (2005). A particular form of public relations that is consistent with our approach is to try to humanize corporations.

of the altruistic firm in a separating equilibrium (i.e., $\overline{p} = p(\theta_a)$ for θ_a the altruistic type).[10]

Equilibrium Selection

We are agnostic as to what equilibrium will be selected. We discuss mainly pooling equilibria in the case of oligopoly, and separating in the case of monopoly, but this is not because we believe these are the natural things to happen. Rather, it is because we have the following narrative in mind. In a certain industry, before the rise of regulation, there was no anger at firms. Then, at some point, the industry became monopolized, anger arose, and with it came regulation.

The way to interpret this chain of events in the context of this model is the following. If there was no anger, and then it appeared, it must mean that firms were pooling before the rise of anger, and that in the monopolized setting, the equilibrium was a separating one. Hence, we have our informal equilibrium selection. Some of our results below indicate that this story is plausible, because the set of pooling equilibrium prices decreases with concentration.

III. Anger and Competition in Oligopoly

The following theorem presents the characterization of pooling equilibria in an oligopoly.

Theorem 1. *A price p^{o} is part of a pooling equilibrium in an oligopoly with $1/b$ firms if and only if*

$$\frac{1}{4}\frac{4-br}{br+1} \geq \frac{p^{o}-c}{b} \geq 1+2\lambda-2\sqrt{\lambda(1+\lambda)}. \tag{1}$$

In a pooling equilibrium, consumers always attain their target level of utility, τ.

Proof: All proofs are in the Appendix.

We obtain as a corollary the standard Salop equilibrium, when $r = \lambda = 0$.

[10] We are ruling out, for example, equilibria in which the consumer rejects that the firm is altruistic if the firm charges a price $p < \overline{p}$ (i.e., the consumer comes to believe the firm is selfish even if it is charging a price below the target price). In standard signaling models, beliefs like these might still be part of an equilibrium, because in equilibrium one does not observe prices $p < \overline{p}$, and so the consistency condition (i.e., beliefs are derived from the Bayes rule) places no constraints on beliefs.

Multiplying equation (1) by b, we find that the admissible set of equilibrium margins, $p^{\mathrm{o}} - c$, is given by

$$\frac{b}{4}\frac{4 - br}{br + 1} \geq p^{\mathrm{o}} - c \geq b\left[1 + 2\lambda - 2\sqrt{\lambda(1+\lambda)}\right]. \tag{2}$$

The expression on the right is a line with slope less than 1. The expression on the left is concave, with slope 1 at $b = 0$, and is increasing in b, as long as $br < \sqrt{5} - 1$. For reasonable values of b and r, this constraint is not binding (so that the expression on the left is increasing in b). This is so, because for the largest value of b (when the constraint is tighter), which is $b = 1/2$, we obtain $r < 2(\sqrt{5} - 1) = 2.4721$. That is, as long as we choose $r \leq 2$, the expression on the left will not be binding. Here, $r \leq 2$ means that when the firm calculates the target value of utility τ, it does not use as a benchmark an industry that is a lot more competitive than the current one; the comparison is with the utility in an industry with $(1/b) + r$ firms.

As a consequence, we have the following important result. As competition decreases (enough), the set of prices for which there is a pooling equilibrium shrinks. However, because pooling equilibria have no anger, and separating equilibria do (in expected terms, there will be some selfish firms), when pooling equilibria disappear, anger appears.

Proposition 1. *Suppose br and λ are such that*

$$\frac{4 - b^2r^2 - 2br}{4(br+1)^2} < 1 + 2\lambda - 2\sqrt{\lambda(1+\lambda)}.$$

There exists a critical b^{c} such that if $b \geq b^{\mathrm{c}}$, any decrease in competition (any increase in concentration from b to $b' > b$) leads to a smaller set of pooling equilibrium prices. The critical b^{c} is increasing in λ and decreasing in r.

The following key points emerge from Theorem 1 and from Proposition 1 and its proof.

(i) For small values of b, the signaling features of the model dominate, making the equilibrium set of prices larger as b grows. In particular, for very small b, competition (even with signaling) ensures that the equilibrium price will be very close to c. As b grows and competition decreases, the signaling aspects of the model (which, as usual, tend to increase the set of equilibria) determine that the set of equilibrium prices grows.

(ii) For larger values of b, the altruistic motive dominates, and the equilibrium set of prices shrinks in b (as the industry becomes more concentrated).

(iii) The threshold or cut-off is decreasing in r. When the altruistic motive is important (when r is large, so our assumption about altruistic firms is restrictive), the equilibrium set of prices decreases for a larger range of b.

(iv) The threshold is increasing in λ. The reason for this comparative statics is the following. As λ falls, the behavior of consumers becomes less responsive to anger. Then, selfish firms are less willing to pool with altruistic firms because consumers will not punish them much if they find out that a firm is selfish.[11]

The following result illustrates another straightforward feature of the model. When, for some exogenous reason, consumers become captive of one particular firm, anger is more likely. When the elasticity of demand decreases, local monopolies have an incentive to increase prices. The temptation might be large enough that an anger-triggering price increase might be profitable. The motivation for this result is the scenario of "raising prices in a snow storm", considered in the classic paper on fairness by Kahneman *et al.* (1986).[12] We model this increase in captivity by changing the transport cost of consumers going to rivals, while keeping rival's prices fixed.[13]

Proposition 2. *Assume that for a given parameter configuration, there is a pooling equilibrium with a price of* p^{o}. *If the cost of transportation to firms* $i-1$ *or* $i+1$ *increases from* 1 *to* $t>1$, *but the cost of getting to firm* i *remains constant, the firm's incentives to increase price increase. There is a threshold* t^{*} *such that if* $t \geq t^{*}$ *firm* i *raises its price and consumers become angry.*

This result assumes that consumers continue to make inferences based on the equilibrium prior to the shock. Although we could argue that a new equilibrium (one with fewer firms) should be the benchmark, we believe that keeping the old equilibrium beliefs is also plausible. In addition, note

[11] Note that this suggests that this particular social emotion has an instrumental value for the economy. Consumer anger incentivizes the opportunistic firms to engage in self-regulation. On the functional role of emotions, see Coricelli and Rustichini (2010) and Dessi and Zhao (2011).

[12] They ask: "A hardware store has been selling snow shovels for $15. The morning after a large snowstorm, the store raises the price to $20. Please rate this action as: Completely Fair, Acceptable, Unfair or Very Unfair." Almost 82 percent of respondents considered it unfair for the hardware store to take advantage of the short-run increase in demand associated with a blizzard.

[13] This keeps the number of competitors constant for the firm being analyzed. An equivalent way of modeling this is to assume that the two neighbors of the firm being analyzed move farther away, as if there had been a decrease in the number of firms.

that the case of fewer firms also leads to more anger, as established by Proposition 1.

Reference Utility and the Disciplined Approach

Models concerned with reference points (including fairness models) must decide how to model the reference point in a way that is appealing (non-arbitrary) and consistent with the evidence. It is also helpful if it is straightforward to track the proposed deviation from standard economic models. For example, Heidhues and Kőszegi (2008) have used the disciplined approach introduced by Kőszegi and Rabin (2006), basing the reference-dependent preferences on classical models of intrinsic utility taken straight from Salop (1979). Importantly, they have endogenized the reference point as a lagged rational expectation, in such a way that if there is no loss aversion, then their theory reduces to that of Salop. Likewise, we base our model on Salop (1979) and endogenize the target level of utility as the utility that can be obtained in a reasonably competitive model with selfish firms. When there is no anger (at insufficiently altruistic firms), our model reduces to that of Salop.

IV. Regulation and Welfare

We now analyze the welfare gains from regulation in a monopoly setting. We do this in order to simplify the exposition and the contrast with the gains from regulation in the standard model. Note that both pooling and separating equilibria are possible (in principle) in a monopoly. Anger will only arise in a separating equilibrium, so this is the main focus in this section. For reference, we note that the analysis of the pooling equilibrium in a monopoly is straightforward.

The reader might wonder about the validity of a Becker-type argument of the kind "if selfish firms make higher profits, won't altruistic firms be wiped out of the market in the long run?". Although the analysis of such a claim is worthwhile, it is beyond the scope of this paper. However, two related arguments against the evolutionary advantage of selfish firms must be made. Selfish entrepreneurs can make higher bids than altruistic entrepreneurs if the rights to run a monopoly are auctioned (because they make higher profits). Nevertheless, depending on the price offered by altruistic firms in a potential auction, it could be optimal for selfish firms to pool with the altruistic firms, and to avoid consumer anger in the monopoly game that ensues. (In this equilibrium, there must be relatively few firms participating, so that a lottery over the firms tied with the highest bids is still more profitable than offering one more cent, winning the auction, but angering consumers.) In addition, one must bear in mind that it is not true, in general, that only selfish firms will survive in the long run. The question of whether a firm that cares only about its profits will beat the competition (if the competition has different preferences) has been analyzed in the context of Cournot oligopoly for several variations of the standard preferences (e.g., Vickers, 1984; Fershtman and Judd, 1987). Note that we do not assume that altruism is widespread, but instead allow for a very small proportion of truly altruistic firms. We explain how this can result in a set of beliefs and expectations that gives rise to an equilibrium where profit maximizing behavior is not present.

Separating Equilibrium in a Monopoly

We now study the welfare effects of regulating a monopoly. To do so, we must first characterize the separating equilibria when there is only one firm. The type of equilibrium we focus on is one in which the belief is "do not reject that the firm is altruistic iff $p \leq \overline{p}$" for some price $\overline{p}$. Our results do not depend on this assumption, which is quite natural in this context. Two cases can arise: for the altruistic firm, the consumer's utility is either above or below the threshold.

If the consumer's utility is below the threshold for the price of the altruistic firm in some equilibrium, then both firms face the same incentives, and that cannot be a separating equilibrium (not a strict one, at least).[14] The same is true if the consumer's utility is above the threshold for both prices. Therefore, we only focus on separating equilibria in which the high price yields a utility below the threshold, and the low price yields a utility above the threshold. That is, in the equilibria we analyze, we have $p_{\mathrm{a}} \leq p^{\tau}$, where p_{a} is the price of the altruistic firm in equilibrium, and p^{τ} is the highest price that gives consumers their target utility when they are not angry. If the consumer is to attain a utility of τ, we must have p^{τ} defined by

$$U = 2\int_0^{s-p^{\tau}} (s - p^{\tau} - x)\,\mathrm{d}x = (s - p^{\tau})^2 = \tau \Leftrightarrow p^{\tau} = s - \sqrt{\tau}. \qquad (3)$$

We now give necessary and sufficient conditions for a pair of prices $(p_{\mathrm{s}}, p_{\mathrm{a}})$ – one for the selfish firm and one for the altruistic firm – to be part of a separating equilibrium. To do so, first note that in a separating equilibrium the consumer knows when the firm is selfish, and the monopolist must maximize $(p - c)D$, where $D = 2x$ for x such that

$$s - p - x - \lambda(p - c) = 0 \Leftrightarrow x = s - p(1 + \lambda) + \lambda c. \qquad (4)$$

[14] The firm charging the high price would make more profits out of the larger price, but fewer from the punishment, than the firm charging the low price. The two effects would net out.

Of course, it must also be the case that $x \leq 1/2$ (otherwise, $D = 1$). In order for x to be less than 1/2, we must have $p \geq [s + c\lambda - (1/2)/(\lambda + 1)]$ (in the standard case, with $\lambda = 0$, this just means that the individual located at $x = 1/2$ has negative net surplus from buying the good).

Hence, profits for the selfish monopolist are

$$(p - c)2[s - p(1+\lambda) + \lambda c] \Rightarrow p = \frac{c(1 + 2\lambda) + s}{2(1 + \lambda)} \Leftrightarrow \pi^{s} = \frac{(c - s)^2}{2(1 + \lambda)}. \quad (5)$$

Note that consumer anger has two different effects on demand. First, it reduces demand (see equation (4)): $\mathrm{d}D/\mathrm{d}\lambda = 2(c - p) < 0$. The second effect is less direct and involves the effect on the incentives of the firm (i.e., the effects on marginal revenue). In this setting, price as a function of quantity Q is

$$Q = D = 2[s - p(1 + \lambda) + \lambda c] \Leftrightarrow p = \frac{2s - Q + 2c\lambda}{2(1 + \lambda)},$$

which implies that marginal revenue is

$$pQ = \frac{(2s - Q + 2c\lambda)}{2(1 + \lambda)} Q \Rightarrow MgR = \frac{s - Q + c\lambda}{\lambda + 1}.$$

Note that in the standard model (with $\lambda = 0$), if marginal revenue equals marginal cost, this implies that $Q^* = s - c$. Because λ increases (from 0), the effect on marginal revenue is given by $\mathrm{d}MgR/\mathrm{d}\lambda = (Q - Q^*)/(\lambda + 1)^2$, which is negative for $Q < Q^*$ and positive for $Q > Q^*$. Hence, for $Q < Q^*$, the monopolist facing angry consumers has a smaller incentive to increase Q. (The quantity demanded is more sensitive to price, so increasing the quantity on the margin requires a bigger drop in price than when λ was 0.) Similarly, for $Q > Q^*$, the monopolist facing angry consumers has a smaller incentive to decrease Q. However, because the sign of $MgR - c$ is the same as before the change in λ, the optimal quantity is the same as in the standard model:

$$Q^{\lambda} = 2\,[s - p^{\mathrm{m}}(1+\lambda) + \lambda c] = 2\left[s - \frac{c(1 + 2\lambda) + s}{2(1 + \lambda)}(1 + \lambda) + \lambda c\right] = s - c.$$

Lemma 1. *In a separating equilibrium, the only possible price for the selfish firm is the price that maximizes profits when consumers are angry:*

$$p_{\mathrm{s}} = \frac{c(1 + 2\lambda) + s}{2(1 + \lambda)} \Leftrightarrow \pi_{\mathrm{s}} = \frac{(c - s)^2}{2(1 + \lambda)}. \quad (6)$$

We now find the range of prices for the altruistic firm that can be part of a separating equilibrium.

Lemma 2. *In a separating equilibrium, the price p_{a} of the altruistic firm must satisfy*

$$\frac{s+c}{2}-\frac{s-c}{2}\sqrt{\frac{\lambda}{\lambda+1}}\geq p_{\mathrm{a}}\geq\frac{s+c}{2}-\frac{1}{2}\sqrt{\frac{\lambda}{\lambda+1}(c-s)^2+2\alpha}. \qquad (7)$$

Moreover, any price in that range can be sustained as a separating equilibrium, as long as it gives consumers their target level of utility.

For an equilibrium with $p_{\mathrm{a}}\leq p^{\tau}$ to exist, we must have

$$p^{\tau}\geq\frac{s+c}{2}-\frac{1}{2}\sqrt{\frac{\lambda}{\lambda+1}(c-s)^2+2\alpha},$$

otherwise the range is empty. If we continue with the assumption that τ is consumer utility in an oligopoly with $(1/b)+r$ firms, so that $\tau=s-c-\{5/[4(1/b+r)]\}$, the condition for the existence of a separating equilibrium becomes (from equation (3))

$$p^{\tau}=s-\sqrt{s-c-\frac{5}{4(1/b+r)}}\geq\frac{s+c}{2}-\frac{1}{2}\sqrt{\frac{\lambda}{\lambda+1}(c-s)^2+2\alpha}.$$

Regulation

In Lemmas 1 and 2, we have characterized the set of separating equilibria in a monopoly. We now turn to regulation.

Recall that we have assumed $s\leq c+1$, which is the condition for the market not to be fully served by a monopoly. We compare two types of regulatory policies: mandated prices for the firms, and subsidies.

Consider a situation where there is a separating equilibrium and the firm is perceived to be selfish (a possible example is the US railroads at the time of the Sherman Act). What is total welfare? Using p_{s} from equation (5), consumer utility is

$$2\int_0^{s-p-\lambda(p-c)}[s-p-\lambda(p-c)-x]\,\mathrm{d}x|_{p=p_{\mathrm{s}}}=\frac{(s-c)^2}{4}.$$

Note that consumer welfare is exactly the same as in the case where the consumer's utility is standard: the expression of consumer welfare is independent of λ. The reason for this is that, while for each price fewer consumers would purchase, because anger diminishes the incentives to purchase, the monopolist lowers his price so that exactly the same number of consumers as before do purchase:

$$\frac{D}{2} = s - \lambda(p_s - c) - p_s = s - \lambda\left[\frac{c(1+2\lambda)+s}{2(1+\lambda)} - c\right] - \frac{c(1+2\lambda)+s}{2(1+\lambda)}$$
$$= \frac{s-c}{2}.$$

In order for the marginal consumer to be the same (with $\lambda > 0$ or $\lambda = 0$), the price decrease must exactly offset anger; indeed, an increase in λ decreases price p_s as

$$\frac{dp_s}{d\lambda} = \frac{c-s}{2(\lambda+1)^2} < 0.$$

Because transportation cost (or taste) x is additive, the effect on every other consumer is exactly the same as with the marginal consumer, and therefore total utility is the same.

In brief, the reason for the price decrease is that demand becomes more elastic when λ grows. This lower optimal price leads to a decrease (relative to the standard case) of the welfare of the firm:

$$(p-c)D|_{p=p^s} = (p-c)2\left[s - \lambda(p-c) - p\right]|_{p=p_s} = \frac{(s-c)^2}{2(1+\lambda)}.$$

We now calculate the welfare in six cases. These are the standard and anger models, crossed with three policies: laissez-faire, regulated price $p = c$, and a subsidy, under which $p = c$ and the monopolist receives $p_s - c$ per unit from the government, as a compensation for the lower price to consumers. For these calculations, we assume that even for $p = c$, not all consumers are served.

In the standard model, as has been argued, the firm maximizes $(p-c)$ $2(s-p)$, charges an optimal price of $p^* = (c+s)/2$ and obtains profits of $\pi^* = [(c-s)^2]/2$. The rest of the cases are given in Table 1. Consumer welfare is given in Table 2.

Note that in the anger model, the consumer cares not only about how much he pays, but also about how much the firm receives. In calculating the subsidy, we assume that the firm receives p_s, which is the price in the absence of regulation. Interestingly, consumer welfare is the same in the absence of regulation. Not only that, the consumer who is indifferent between buying and not buying is also the same individual. The price reduction, which the monopolist must make in the anger model, leaves the welfare of each consumer intact. The total welfare in all scenarios is given in Table 3.

Because consumer welfare is the same both with and without anger, and the profits of the monopolist are lower with anger, the total welfare in the economy is lower in the anger model.

Table 1. *Firm's profits in standard and anger models*

Policy	Profits
Standard model	
Laissez-faire	$\frac{(c-s)^2}{2}$
Regulated price	0
Subsidy	$(p^* - c)2(s-c) = (c-s)^2$
Anger model	
Laissez-faire	$\frac{(s-c)^2}{2(1+\lambda)}$
Regulated price	0
Subsidy	$(p^{\mathrm{s}} - c)2[s + \lambda(c - p^{\mathrm{s}}) - c] = \frac{(\lambda+2)(c-s)^2}{2(\lambda+1)^2}$

Table 2. *Consumer welfare in standard and anger models*

Policy	Consumer welfare
Standard model	
Laissez-faire	$2\int_0^{s-(c+s/2)} \left(s - \frac{c+s}{2} - x\right) \mathrm{d}x = \frac{(c-s)^2}{4}$
Regulated price	$2\int_0^{s-c} (s-c-x)\,\mathrm{d}x = (c-s)^2$
Subsidy	$2\int_0^{s-c} (s-c-x)\,\mathrm{d}x = (c-s)^2$
Anger model	
Laissez-faire	$2\int_0^{s+\lambda(c-p_{\mathrm{s}})-p_{\mathrm{s}}} [s + \lambda(c-p_{\mathrm{s}}) - p_{\mathrm{s}} - x]\ \mathrm{d}x = \frac{(c-s)^2}{4}$
Regulated price	$2\int_0^{s+\lambda(c-c)-c} [s + \lambda(c-c) - c - x] = (c-s)^2$
Subsidy	$2\int_0^{s+\lambda(c-p_{\mathrm{s}})-c} [s + \lambda(c-p_{\mathrm{s}}) - c - x] = \frac{(\lambda+2)^2(c-s)^2}{4(\lambda+1)^2}$

Table 4 shows the gains to regulation: total welfare after regulation, minus total welfare before regulation. An obvious point that we have not yet addressed is to ask where the money for subsidies comes from. How is it counted in total welfare? We address this issue shortly.

In both the standard and anger models, the government subsidy equals the firm's profit: $T_{\mathrm{A}} = [(\lambda+2)(c-s)^2]/[2(\lambda+1)^2]$ and $T_{\mathrm{S}} = (c-s)^2$ denote the transfer in the anger and standard cases, respectively. It is easy to check that the subsidy is always larger in the standard case; however, as we now show, it is not the extra subsidy in the standard case that make

Table 3. *Total welfare in standard and anger models*

Policy	Total welfare
Standard model	
Laissez-faire	$\frac{(c-s)^2}{4}+\frac{(c-s)^2}{2}=\frac{3(c-s)^2}{4}$
Regulated price	$(c-s)^2+0$
Subsidy	$(c-s)^2+(c-s)^2=2(c-s)^2$
Anger model	
Laissez-faire	$\frac{(c-s)^2}{4}+\frac{(s-c)^2}{2(1+\lambda)}=\frac{(\lambda+3)(c-s)^2}{4(\lambda+1)}$
Regulated price	$(c-s)^2+0$
Subsidy	$\frac{(\lambda+2)^2(c-s)^2}{4(\lambda+1)^2}+\frac{(\lambda+2)(c-s)^2}{2(\lambda+1)^2}=\frac{(c-s)^2(\lambda^2+6\lambda+8)}{4(\lambda+1)^2}$

Table 4. *Benefits of interventions in standard and anger models*

Policy	Benefits
Standard model	
Regulated price	$(c-s)^2-\frac{3(c-s)^2}{4}=\frac{(c-s)^2}{4}$
Subsidy	$2(c-s)^2-\frac{3(c-s)^2}{4}=\frac{5(c-s)^2}{4}$
Anger model	
Regulated price	$(c-s)^2-\frac{(\lambda+3)(c-s)^2}{4(\lambda+1)}=\frac{(c-s)^2(3\lambda+1)}{4(\lambda+1)}$
Subsidy	$\frac{(c-s)^2(\lambda^2+6\lambda+8)}{4(\lambda+1)^2}-\frac{(\lambda+3)(c-s)^2}{4(\lambda+1)}=\frac{(c-s)^2(2\lambda+5)}{4(\lambda+1)^2}$

subsidies less attractive in the anger model. Let $\Delta_{\text{St.}}^{S-R}$ be the difference in welfare between subsidies and regulation in the standard model (i.e., how much more do subsidies increase welfare); similarly, let $\Delta_{\text{Ang.}}^{S-R}$ be the difference in welfare between subsidies and regulation in the anger model. We find that

$$\Delta_{\text{St.}}^{S-R}-\Delta_{\text{Ang.}}^{S-R}=(c-s)^2-\frac{(c-s)^2(4-3\lambda^2-2\lambda)}{4(\lambda+1)^2}=\frac{1}{4}\frac{\lambda(c-s)^2(7\lambda+10)}{(\lambda+1)^2}$$

$$>(c-s)^2-\frac{(\lambda+2)(c-s)^2}{2(\lambda+1)^2}=T_{\text{S}}-T_{\text{A}}.$$

Hence, imagine that because of the costs of raising the money (or the political economy costs), the regulator is indifferent between the two policies when he believes the economy to be a standard economy. If he were to learn that consumer preferences include the anger term that we study in this paper, he would favor regulation without subsidies.

Although subsidies are less attractive than in the standard model, good old-fashioned price setting (the policy we have called regulation) by the regulator is better in the model with anger:

$$\frac{(c-s)^2(3\lambda+1)}{4(\lambda+1)} - \frac{(c-s)^2}{4} = \frac{1}{2}\frac{\lambda}{\lambda+1}(c-s)^2 > 0.$$

Three Channels in the Regulation of Monopoly

To summarize, there are three channels through which regulation can potentially increase welfare in our model where consumers react with anger at prices they consider to be unfair.

(i) There is a standard channel whereby a reduction in price from above marginal costs increases total welfare by allowing a good of cost c to be produced and transferred to a consumer who values it at s.
(ii) For each consumer, who was purchasing and was angry, a reduction in price increases total welfare by reducing his anger (because the firm is making lower profits).
(iii) Finally, any channel that reduces anger (whether it reduces price or not) induces people who were out of the market to start buying the good, and that also increases total welfare. Imagine, for example, a policy that kept the price fixed, but expropriated the profits from the firm. In that case, in the standard model, welfare would be unchanged. In the current model, welfare increases for two reasons. First, each consumer who was previously purchasing is happier. Second, some consumers who were not purchasing will now become customers.

Figure 1 depicts the three channels described above, which go beyond the standard Kaldor–Hicks potential efficiency gains.[15] Consider a regulator who induces a change in the price from the monopoly price p_{M} to p_{R}. Assume he does so in two (imaginary) steps. First, he reduces the price paid by the consumer, while keeping the price received by the monopoly at p_{M}. In the second (imaginary) stage, the regulator reduces the price received by the monopoly from p_{M} to p_{R}. The locus AA’ depicts demand when the price paid by the consumer varies, but the price received by

[15] Trivially, these are Kaldor–Hicks gains when consumers maximize an objective that has a fairness component. An interesting extension of our model is to consider the possibility of an emotional cost to those that are the target of anger, because firms might want to be popular with consumers (particularly when the owner has to live in the same community as consumers) and regulation introduces other welfare terms.

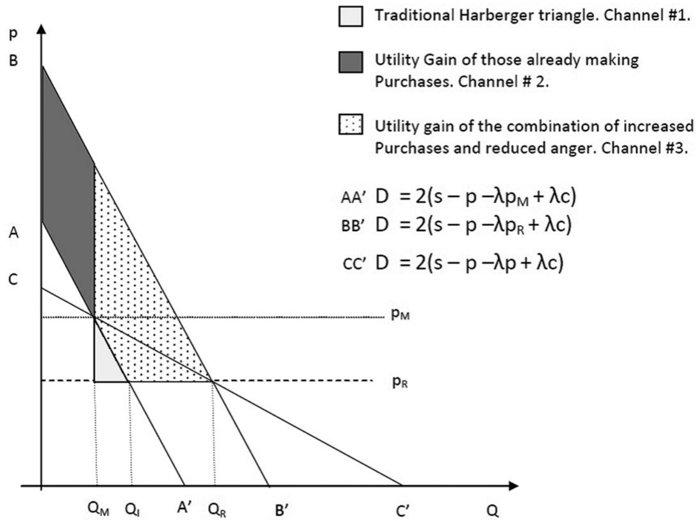

Fig. 1. Three channels through which a reduction in price from the monopoly price p_M to the regulated price p_R increases welfare

the firm is fixed at p_M, $D = 2(s - p - \lambda p_M + \lambda c)$. In this case, when the price paid by the consumer is changed by the regulator to p_R, the demand function is fixed, and the quantity demanded changes to the intermediate amount $Q_I = 2(s - p_R + \lambda p_M + \lambda c)$. At that stage, welfare has increased only through the first channel, the traditional Harberger triangle (shown by light gray in Figure 1). Then, when the regulator changes the price received by the firm, the new demand curve is the locus BB', $D = 2(s - p - \lambda p_R + \lambda c)$. Consumers who were already purchasing Q_M units will increase their welfare as a result of reduced anger; this is the dark gray area in Figure 1, which corresponds to the second channel. Finally, the change in the price received by the monopoly induces additional purchases of $Q_R - Q_I$ from individuals for whom the reduction in anger makes the purchases worthwhile. These new sales generate additional welfare through the first (traditional) channel, because units are being exchanged that cost less than what consumers value them. This combination is the third channel (shown by the dotted trapezoid in Figure 1). The demand function, when the price changes are not broken down into the two imaginary steps, is given by $D = 2(s - p - \lambda p + \lambda c)$ and is locus CC' in Figure 1.

V. Conclusions

We present a model where the need to regulate a firm arises because consumers sometimes have adverse emotional reactions to high prices. The root assumption is that consumers become angry when they think that a firm is charging abusive or exploitative prices. We model this by assuming that consumers experience utility from consumption at low prices (a standard material pay-off) and disutility from observing high profits in the hands of firms that have displayed low levels of altruism towards their clients (an emotional pay-off). In the context of a simple monopolistic competition model along the lines of Salop (1979), this implies that firms experience large drops in demand when their activities (e.g., price selections) irritate consumers. We show that market equilibrium in these circumstances displays a series of interesting properties. For example, the client of a firm who discovers that the owner is (say) a criminal experiences a utility loss (while no such loss is present in standard economic models). Moreover, in some circumstances, even with a very low proportion of truly altruistic firms, most firms in the market charge a low price in order to appear to be kind.

The main result of the paper is that, in a reasonable set of circumstances, anger is more likely as the number of firms falls and competition decreases.[16] This happens because a feature of the equilibrium is that, as the number of firms in the market drops, switching to a firm that has not raised prices becomes more costly to the consumer, and the threat to punish unkind firms by not purchasing from them becomes less credible. This leads to price increases by firms, which in turn lead to anger. This phenomenon introduces a new potential justification for regulation: by reducing the profits of firms revealed to be unkind, the anger of captive consumers (and of the public that is witness to the abuse) falls and consumer welfare is increased. This is consistent with the widespread wish to regulate utilities (such as water and sewage), even though it is clear that high prices bring about small reductions in consumption.

The second contribution of the paper is to illustrate these gains from regulation in the context of monopoly. There are three channels: regulation helps through the standard channel (increasing output when it is valuable), through a purely emotional channel (captive consumers are less angry when unkind firms earn less in profits), and through a mixed channel (individuals who were out of the market, because they were too angry in the

[16] Some economists have debated whether corporate social responsibility involves more than just making profits (e.g., Friedman, 1970; Rose-Ackerman, 2002; Calveras *et al.*, 2007; *inter alia*). A key question is whether competition will curtail unethical behavior (see Shleifer, 2004). Our model emphasizes beliefs and introduces a demand for ethical behavior (defined as one that reveals a high concern for the well-being of others). It shows that intense competition between firms (which allows consumers to easily switch) gives consumers a weapon to punish firms that do not behave as demanded. Thus, competition is associated with more ethical behavior.

Fig. 2. An advert in the campaign by Bell Telephone System to humanize the corporation

unregulated market, decide to purchase, and this reduces the standard distortions described in the first channel). The anger mechanism emphasized here suggests that firms will invest resources in public relations in an attempt to appear kind, or by advertising campaigns that emphasize the founder's philanthropy and identity (in contrast to an anonymous set of shareholders; see Figure 2).[17]

Fairness has been the focus of a growing body of literature in economics. Our paper's contribution is to lay out a simple framework to discuss how such considerations might help us to better understand the benefits of regulating monopolies. Specifically, we show how anger and competition are connected and how the anger/fairness objective modifies the simple Kaldor–Hicks criteria (based only on efficiency considerations), yielding three channels through which monopolies affect welfare. The framework can also be applied to help explain the choice between different regulatory approaches, such as antitrust versus regulatory agencies or between regulatory instruments, such as fines versus price regulation.

Appendix

Proof of Theorem 1: Necessity

First, we show that p^{o} must satisfy equation (1). Suppose p^{o} is part of a pooling equilibrium, which yields profits of $(p^{\mathrm{o}} - c)b$ to the firm, and suppose that the firm is considering a decrease in the price. If the firm lowers its price, consumers will not be angry. In this case, demand is given by the sum of all (unit) demands of consumers who are closer to the deviating firm than the two consumers (one to each side) who are indifferent:[18]

$$s - p - x = s - p^{\mathrm{o}} - (b - x) \Leftrightarrow D = 2x = p^{\mathrm{o}} - p + b.$$

Profits and the optimal price in the deviation are then

$$\pi = (p - c)(p^{\mathrm{o}} - p + b) \Rightarrow p^{\mathrm{d}} = \frac{p^{\mathrm{o}} + b + c}{2}.$$

[17] See Marchand (1998) who has studied the role of corporate imagery in the creation of the idea that corporations have a soul. He states: "The crisis of legitimacy that major American corporations began to face in the 1890s had everything to do with their size, with the startling disparities of scale." (Marchand, 1998, p. 3). Indeed, it is possible to argue that there is a parallel between our paper's focus on the concept of commercial legitimacy and the concept of state legitimacy in political science.

[18] Recall that we have assumed that there are n consumers, and we have normalized $n = 1$. We have argued that this is not the same as the assumption that there is a continuum of mass 1 of consumers. Still, when calculating demand, and elsewhere, the intuitions for the results will be conveyed as if we had assumed the continuum version, because it is easier to explain equations in that way. For example, in this case, the explanation with one consumer would be the following. "In that case, demand is given by the probability that the consumer is located closer to the deviating firm than the locations that would leave him indifferent between purchasing from the deviating firm and its neighbors."

For the firm not to want to deviate from p^{o}, it must be the case that this optimal price is larger than p^{o}, or equivalently

$$b + c \geq p^{\mathrm{o}}. \tag{A1}$$

In other words, if the oligopoly price is too large, the firms are better off lowering their price, and the consumers will not punish them (by being angry). In the calculation of this upper bound on p^{o}, we have not considered whether consumers are obtaining their target level of utility either because this plays no role (if, after the deviation, consumers are still not achieving their target level), or because the deviation is even more profitable for the firm.

We now derive a second, tighter, upper bound on p^{o}. Consumer utility (in a pooling equilibrium with $1/b'$ firms and a price p) is the number of firms, $1/b'$ times the total utility of consumers served by each firm (the 2 in equation (A2) is because each firms serves consumers to both sides):[19]

$$\frac{2}{b'} \int_0^{b'/2} (s - p - x)\,\mathrm{d}x = s - p - \frac{b'}{4}. \tag{A2}$$

This utility is larger than τ if and only if

$$s - p^{\mathrm{o}} - \frac{b}{4} \geq \tau \Leftrightarrow s - \tau - \frac{b}{4} \geq p^{\mathrm{o}}.$$

Given our assumption that τ is the utility in a Salop equilibrium with $(1/b) + r$ firms, we can see (from a derivation similar to that leading to equation (A1)) that the equilibrium price is $[1/(1/b + r)] + c$, so that the target level is given by equation (A2) with $b' = 1/(1/b + r)$ and this price level: $\tau = s - c - [5/4(1/b + r)]$. In order for the equilibrium price in a market with $1/b$ firms to guarantee a utility of τ, we need

$$s - p^{\mathrm{o}} - \frac{b}{4} \geq s - c - \frac{5}{4(1/b + r)} \Leftrightarrow c + \frac{5}{4(1/b + r)} - \frac{b}{4} \geq p^{\mathrm{o}}$$
$$\Leftrightarrow \frac{1}{4}\frac{4 - br}{br + 1} \geq \frac{p^{\mathrm{o}} - c}{b}.$$

[19] Here, the definition of what utility to consider (for consumers) is not obvious. Why consider the total utility of all consumers? Perhaps firm 1 is behaving really badly and slaughtering its consumers, but still total utility is large in the market, and so firm 1 experiences no utility cost of having a high price. In equilibrium, this will make no difference (if firm 1 is treating its consumers badly, all firms are doing the same), but it does matter in a deviation. In the set of questions we analyze in this paper, this makes no difference. However, in general, it would seem more psychologically plausible that the firm cares about how it treats its consumers, and not about average utility in the market (including the welfare of other firms' consumers).

Because the left-hand side of this last inequality is less than 1, we see that this is indeed a tighter bound on p^o than that given in equation (A1).

In order to see that this is an upper bound on the equilibrium prices, we now show that if the equilibrium price p^o was such that $b + c \geq p^o > c + (b/4)[(4 - br)/(br + 1)]$, an altruistic firm would choose to lower its price, yielding a contradiction. The equilibrium utility of an altruistic firm in this case is $U^*(p^o) = (p^o - c)b - \alpha$. If the firm lowered its price to $p = c + (b/4)[(4 - br)/(br + 1)]$ demand would be $p^o - p + b$ and utility would be

$$U^d(p^o) = (p - c)(p^o - p + b) = \frac{b}{4}\frac{4 - br}{br + 1}\left(p^o - c + \frac{5b}{4}\frac{br}{br + 1}\right).$$

Because the coefficient on p^o is less than b, $U^*(p^o) - U^d(p^o)$ is increasing in p^o. We now show that for the largest p^o in the range, $p = b + c$, we have $U^*(b + c) < U^d(b + c)$, implying that an altruistic firm would deviate for any $p^o \leq b + c$. By assumption, $\sqrt{\alpha} > (5b/4)(br/br + 1)$, so that

$$\alpha > \left(\frac{5b}{4}\frac{br}{br + 1}\right)^2 \Rightarrow U^*(b + c) = b^2 - \alpha < b^2 - \left(\frac{5b}{4}\frac{br}{br + 1}\right)^2$$
$$= \frac{b^2}{16}\frac{(4 - br)(9br + 4)}{(br + 1)^2} = U^d(b + c).$$

We now establish the lower bound on the equilibrium prices. Suppose p^o is part of a pooling equilibrium, which yields profits of $(p^o - c)b$ to the firm, and suppose that the firm raises its price to p. Consumers become angry and the individual who is indifferent is that located at x, given by $s - p - x - \lambda(p - c) = s - p^o - (b - x)$. So, demand and profits are

$$D = p^o - (1 + \lambda)p + b + \lambda c \Rightarrow \pi = (p - c)[p^o - (1 + \lambda)p + b + \lambda c].$$

For the firm not to want to deviate and charge the optimal price

$$p = \frac{p^o + b + c(1 + 2\lambda)}{2(\lambda + 1)} \Rightarrow \pi^* = \frac{(p^o - c + b)^2}{4(1 + \lambda)}, \tag{A3}$$

it must be the case that profits in the equilibrium are larger than these deviation profits.[20] Formally,

$$(p^o - c)b \geq \frac{(p^o - c + b)^2}{4(1 + \lambda)} \Rightarrow \frac{p^o - c}{b} \geq 1 + 2\lambda - 2\sqrt{\lambda(1 + \lambda)}.$$

[20] It could happen that the firm considers raising its price and discovers that the optimal price in the deviation with angry consumers is lower than p^o (this happens if p^o is larger than the optimal price, given in equation (A3)). If this happens, the firm is better off not raising its price. Hence, our assumption that the optimal price in a deviation is achieved with angry consumers is justified.

Sufficiency is trivial. Pick any price p^o in the set, and set the belief of the consumers to be "the firm is selfish with probability 1 if $p > p^o$ and 0 otherwise". It is easy to check that the case of all firms setting a price of p^o is an equilibrium.

Proof of Proposition 1

Let $f(b) = (b/4)[(4 - br)/(br + 1)]$, and note that $f'(b) = (4 - b^2r^2 - 2br)/4(br + 1)^2$ is such that $f'(0) = 1$, $f''(b) < 0$ and, by assumption of the proposition, for some $b \leq 1/2$, $f'(b) < 1 + 2\lambda - 2\sqrt{\lambda(1 + \lambda)} < 1$. Therefore, there exists a unique b^c such that $f'(b^c) = 1 + 2\lambda - 2\sqrt{\lambda(1 + \lambda)}$.

From equation (2), the set of pooling equilibrium prices decreases in b whenever $f(b) - b[1 + 2\lambda - 2\sqrt{\lambda(1 + \lambda)}]$ decreases, and this expression is decreasing for all $b > b^c$.

From the definition of b^c, we have

$$\frac{4 - b^{c2}r^2 - 2b^c r}{4(b^c r + 1)^2} = 1 + 2\lambda - 2\sqrt{\lambda(1 + \lambda)}.$$

Because the right-hand side is decreasing in λ and the left-hand side is decreasing in b, b^c is increasing in λ. Also, an increase in r must be matched by a decrease in b^c.

Proof of Proposition 2

When the cost of getting to firms $i - 1$ and $i + 1$ increases to t, the demand faced by firm i (after an increase in price) and its profits are

$$D = 2\frac{p^o - p + \lambda(c - p) + bt}{t + 1} \qquad \pi = (p - c)2\frac{p^o - p + \lambda(c - p) + bt}{t + 1},$$

and the optimal price and profit are

$$p = \frac{c + p^o + 2c\lambda + bt}{2\lambda + 2} \Rightarrow \pi = \frac{(p^o - c + bt)^2}{2(\lambda + 1)(1 + t)}.$$

For large enough t, these profits exceed the oligopoly profit, and the firm raises its price, causing anger.

Proof of Lemma 1

Suppose p_s is not as in equation (6). Because p_s is a (separating) equilibrium price, consumers will know that the firm is selfish and will therefore be angry. Hence, playing p_s must be better than playing any price p for which consumers have rejected that the firm is altruistic: $(p_s - c)2[s - p_s(1+\lambda) + \lambda c] \geq (p - c)2[s - p(1+\lambda) + \lambda c]$. However, the right-hand side has a unique maximizer given by equation (6), so we obtain a contradiction.

Proof of Lemma 2: Necessity

In order for the altruistic firm not to want to deviate (upwards) and charge its optimal price (the optimal price is the same as for the selfish firm), we must have

$$2(p_a - c)(s - p_a) \geq \frac{(c-s)^2}{2(1+\lambda)} - \alpha \Rightarrow p_a \geq \frac{s+c}{2} - \frac{1}{2}\sqrt{\frac{\lambda}{\lambda+1}(c-s)^2 + 2\alpha}.$$

Similarly, the selfish firm must want to charge its equilibrium price, and not the maximum price for which consumers are not angry, $\overline{p}$. To connect this relationship with an upper bound on p_a, note that we must have $p_a = \min\{\overline{p}, p^\tau\}$. This is for the following reasons. First, it is because we must have $p_a \leq \min\{\overline{p}, p^\tau\}$ for beliefs to be consistent, and for consumers to obtain their target utility. Second, if we had $p_a < \min\{\overline{p}, p^\tau\}$, the altruistic firm could increase its price towards its optimal price (without anger) $(c+s)/2$. Because $\overline{p}$ must be less than the price of the selfish monopolist, $[c(1+2\lambda)+s]/2(1+\lambda)$, we obtain

$$\frac{c+s}{2} > \frac{c(1+2\lambda)+s}{2(1+\lambda)} > \overline{p} \geq \min\{\overline{p}, p^\tau\} > p_a,$$

and such a price increase would strictly increase its profits without lowering consumer utility below τ.

For the selfish firm not to want to deviate to $\overline{p}$, we must have

$$2(\overline{p} - c)(s - \overline{p}) \leq \frac{(c-s)^2}{2(1+\lambda)} \Rightarrow p_a \leq \overline{p} \leq \frac{c+s}{2} - \frac{s-c}{2}\sqrt{\frac{\lambda}{\lambda+1}},$$

and this establishes the upper bound for p_a.

Proof of Lemma 2: Sufficiency

It is straightforward to check that for any $p_a \leq p^\tau$, and p_a in the range defined by equation (7), there is an equilibrium with $\overline{p} = p_a$. This condition defines μ as

$$\mu(p) = \begin{cases} 1 & p \leq \overline{p} \\ 0 & p > \overline{p} \end{cases}.$$

Given this, the selfish firm optimally charges p_{s} as in equation (6), the altruistic firm optimally charges $p_{\mathrm{a}} = \overline{p}$, beliefs are consistent, and the consumers' acquisition decisions are optimal, given their beliefs and tastes.

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