Behavioral Aspects of Price Setting and Their Policy Implications

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In the textbook conception of economics, consumers use prices to determine the bundle of purchases that maximize their utility subject to the constraint that the total value of these purchases cannot exceed their income. In this paper, I consider the implications of letting consumers have somewhat different reactions to prices. First, I allow consumers to be unsophisticated when they use price information to plan their expenditures. This is a departure from the cognitive assumptions used in standard economic analysis. Second, I let consumers have emotional reactions to prices, including reactions that are motivated by concern for the welfare of others (as opposed to being driven by pure self-interest). The paper also discusses how these consumer reactions affect how firms set prices, as well as their implications for government intervention in markets.

Before turning to the psychological facets involved in understanding, setting, and regulating prices, it is worth recalling that the standard view that consumers regard prices only as incentives to guide their purchases has very little evidence on its side. Consistent with this theory, consumers prefer low prices to high prices—meaning that people do have a preference for being able to make more purchases. But this preference demonstrates only that *one* of people's desires is being able to acquire goods and says little about whether they do this well or whether they also have other objectives that guide their choices.

The additional conditions that rational utility maximization imposes on understanding consumer behavior are difficult to test, in part because consumers do not spend all their income at once. A vast empirical literature has thus devoted itself to analyzing whether people respond to incentives by entering less frequently into transactions whose terms are

more unfavorable. Unfortunately this "law of demand" is a very weak test of rational utility maximization, not only because consumer rationality does not strictly imply such a law, but also because fairly irrational consumers could still satisfy it.

There is, on the other hand, a great deal of laboratory evidence suggesting that people are not fully rational. However, no consensus exists among economists about the relevance of these lab-based observations for describing what takes place in actual market settings. Economists commonly react to evidence that consumers are sometimes not fully "rational"—particularly when this observation occurs in the laboratory—by suggesting that nonrational consumer behavior may not matter very much when describing the "real world." I am thus particularly keen on studying aspects of consumer behavior that seem to matter for the prices that firms charge or should charge. This concern leads me to focus on several aspects of price setting that do not seem easy to rationalize in the standard utility-maximizing setting. In the process, I try to link these pricing patterns to psychological studies of consumers. It is important to stress that I do not think we already have proof that nonrational behavior causes the unusual pricing patterns I discuss. Systematic thinking about the connection between consumer nonrationality and firm pricing decisions is still at a fairly early stage. Nonetheless, the two behaviors do seem to be intimately related.

The paper also spends time discussing the policy implications of the consumer nonrationalities that are suggested by the behavior of consumers and firms. This topic is somewhat perilous to approach because we lack a rigorous way of discussing social welfare considerations in the presence of the consumer nonrationalities I emphasize here. A reason to analyze policy implications in spite of this impediment is that one of the ways in which consumers react to prices is by mobilizing politically and demanding changes in legislation. These political reactions seem to be part and parcel of how consumers behave with respect to prices. One important benefit of bringing realistic psychological considerations to bear on resource allocation issues is that these considerations may explain people's behavior in the political realm as well as in the market arena. It is thus worth asking how the legislative initiatives we observe fit with the psychological reactions of consumers that I emphasize.

The paper is organized as follows. In the first section, I provide evidence garnered exclusively from consumers about how they react to prices. This evidence suggests two things that counter the standard textbook assumptions about rational utility-maximixing consumers. First, many people seem to find price information difficult to process. Second, people's emotions and moral judgments inform their responses to the prices that they observe. In this paper I emphasize that consumers feel regret when they conclude that they made mistakes in their past purchase decisions, and that they experience anger when confronted with prices they regard as unfair.

The second section focuses on three particular aspects of firms' pricing decisions. The first is the tendency of many firms to charge prices with a lump sum component and a "per unit" component well below the marginal cost of providing an additional unit. In the example of DellaVigna and Malmendier (2006), the most popular health club plans involve paying a monthly fee which allows buyers an unlimited number of visits so that the "per visit" fee is zero. What is puzzling about this practice is that health clubs' marginal cost per visit is not zero; more frequent visits do raise costs (at least for towels).

This section's second focus is that prices often end in "attractive" numbers, of which the most popular by far is the number 9. The third is the fact that prices for finished goods do not change as often as do commodity prices in futures markets. Indeed, price changes of finished goods do not just depart from the canonical model where every change in marginal cost leads to a change in price, but also depart from the predictions of models where there is an administrative cost associated with changing prices. While the modeling of this issue is still in its infancy, some of the qualitative features of price changes appear consistent with the idea that firms are setting prices to deal with nonstandard aspects of consumer behavior. Moreover, this approach has the advantage of being consistent with the fact that firms routinely cite their desire to please customers as their main reason for keeping prices relatively rigid.

In the third section, I turn my attention to policy and discuss two government policies that interfere with the freedom to set contractual terms. The first involves legislation to limit "price gouging," while the second concerns legislation to regulate mortgages for low-income people. In both

these cases, standard economic arguments would seem to point towards allowing people to write contracts as they see fit. It is thus worth understanding why people seem to wish to limit the ability to freely contract in these market settings. One reason that fits with the earlier analysis is that people are angered by the terms generated by the free operation of the price system. I then argue that, if such feelings about prices are recognized as a legitimate source of utility, laws that interfere with the freedom to set prices can result in Pareto optimal allocations.

I close the paper by showing that the feelings about prices explored in this paper provide a rationale for keeping steady-state inflation low. While more conventional analyses also reach this conclusion, I argue that the extent to which even moderate inflation is unpopular suggests that the conventional analysis of this issue is incomplete.

1. Consumer Processing of Price Information

One important question regarding consumers is whether they maximize their own utility given the many opportunities that they face. A large strand of literature in economics has focused on decisionmaking by consumers who are imperfectly informed about the alternatives that are potentially available to them. This lack of information leads to outcomes that resemble in certain ways the outcomes obtained when consumers lack the ability to fully exploit their opportunities. In both cases, an all-knowing advisor could help people reach decisions yielding consequences that they would prefer.

There are, however, two important differences between the consequences of imperfect information and the cost of those imperfect maximizations. The first is that outside observers with only moderate knowledge can tell whether an individual used her information well, and may feel differently about mistakes made due to insufficient information than mistakes attributable to imperfect maximization. The second is that after making a decision, the decisionmaker herself may learn whether she ignored some of the information she had at the time. A human activity that has received a great deal of attention from psychologists is "counterfactual thinking," where people revisit actions they have taken in the past and experience regret when they feel that they should have pursued alternate courses of action. This regret would naturally be accentuated if people determined that their past acts were not justified given the information that was then available to them.

The second important question regarding prices is whether people only have a "cognitive" reaction to them (meaning that they use the information in prices to determine their best course of action) or whether they also have an "emotional" reaction to prices. The connection between cognition and emotion (or thinking and feeling) is a complicated one but there is a great deal of evidence that the two processes are somewhat independent (see Zajonc 1984). Many researchers view emotions as discrete reactions (anger, happiness, fear, sadness, and so on) that are common across cultures and detectable in facial expressions (see Ekman 1993).

An emotion that has attracted considerable attention from economists is happiness, which some view as akin to utility.[1] Unlike happiness, which is a "positive" emotion, regret is a "negative" one. What makes regret particularly important for economics is that, as discussed below, there is substantial evidence that people engage in actions whose purpose is to reduce regret. It follows that, if utility functions are to be derived from the preferences that guide people's conscious choices, people's dislike of experiencing regret should be incorporated into these functions.

I also consider the effect of prices on engendering feelings of anger. This is a negative emotion as well, but it is less clear that people engage in purposeful action to avoid anger. Nonetheless, avoiding anger seems useful for social welfare not only because it avoids the negative emotions associated with being angry, but also because anger seems to cause other harmful externalities. It is well-established that angry people often have an impulse to hurt those with whom they are angry. It is thus common for angry people to demand policies that punish those who have angered them. Any pain inflicted by this punishment may well increase the utility of those who are angry. These punitive impulses may also serve two broader social policy goals. First, they provide incentives to reduce the incidence of anger-causing actions and thereby reduce anger. Second, they may tame the reactions of those who become angry by establishing a formal mechanism that punishes those who cause this anger.

Price Knowledge and Awareness

The first question to ask about prices is whether people know how much they are paying for things. The numerous demonstrations of the "law of demand," where total purchases for particular goods are lower when their price is higher, suggests that at least some people do respond to price incentives. But the validity of this law is consistent with the existence of large subsets of the population who are only dimly aware of the prices they pay. One vehicle for learning the extent to which people possess price information is to ask them about the prices of items with which they are supposedly familiar.

In Dickson and Sawyer (1990), interviewers were deployed inside stores so that they could approach shoppers immediately after they had selected a particular item by putting it in their shopping cart. Shoppers were then asked to recall the price of the item they had just bought. Even though no more than 30 seconds had elapsed between the time of buying the item and the time of answering this question, less than half of these subjects could recall the price perfectly. About a quarter of the respondents claimed not to know this price at all, while the rest gave estimates that differed from the true price by an average of 15 percent.

The Dickson and Sawyer (1990) analysis leaves open the possibility that people store price information in a part of memory that, while useful for decisionmaking, is not available for immediate recall. To test this result, Vanhuele and Drèze (2002) thus approached people before they entered a French hypermarket. Subjects were asked about the prices of goods whose pictures they recognized as depicting an item that they bought regularly. The fraction who could recall the price of these items accurately was significantly smaller than in the Dickson and Sawyer (1990) study. Vanhuele and Drèze (2002) also gave their respondents a series of possible prices (in random sequence) and asked them to say whether they saw these as good, bad, or normal deals. Using these responses, Vanhuele and Drèze (2002) deem about a third of their respondents to be "fairly knowledgeable" about prices. Still, about 14 percent of their respondents were so uninformed that they viewed prices 20 percent above the regular price as good deals (or prices 20 percent below the regular price as bad deals).

This hazy awareness of prices may also explain why some studies show that price endings have a surprising influence on people's purchase decisions. The most extreme example of this is reported in Schindler and Kibarian (1996) who, with the cooperation of a seller, sent mail-order catalogs with different price endings for certain items to randomly selected customers. They found that items with prices ending in 99 outsold those with a lower price ending in 88. Similarly Kalyanam and Shively (1998) show that Chiffon margarine sold more when it was priced at 59 cents than when it was priced at 53 cents. It is important to stress, though, that other studies (and other commodities within the Kalyanam and Shively 1998 study), do not show such strong benefits of ending a price with the number 9.

Consumer inattention to prices is also consistent with the evidence reported in Rotemberg (2005) that increases in the regular price of Nabisco's saltine crackers led to negligible reductions in the sales of that brand's crackers, even when competing brands had not raised their own regular prices. Such inattention is not inconsistent with the large effect of temporary special prices reported, for example, by Hendel and Nevo (2006). Special prices are heavily advertised and signposted, so consumers who generally do not pay much attention to prices may nonetheless increase their purchases considerably when they see a special. Such inattention can also be consistent with the nontrivial long-run elasticities of demand reported by Hendel and Nevo (2006), since this long-run response may involve a gradual absorption of price information by consumers.

Paying Too Much When Confronted by a Menu of Price Choices

Many services are sold in packages that differ in their profile of required payments. Examples include credit cards, cellular phone plans, service plans for appliances, vacation packages, and health club fees. Because it is possible to compute how much consumers would have paid for the services they consumed if they had picked a different package than they actually chose, it is possible to learn whether they typically choose packages that minimize their out-of-pocket costs. This is, in a way, a very weak test of rationality because different packages also provide different incentives and consumers who respond to the incentives provided by the

package that they buy ought to have a consumption pattern that would be more expensive under alternative packages. This makes the finding of DellaVigna and Malmendier (2006) that people who buy monthly passes to a health club pay significantly more per visit than they would have if they had opted to pay "per visit" all the more remarkable.

Along the same lines, Lambrecht and Skiera (2006) show a similar pattern for a sample of purchasers of Internet access. In this sample, 25 percent of the people who pay the highest fixed fee for unlimited Internet access would have paid less if they had chosen a "three-part tariff" with a lower fixed fee, a maximum amount of free usage, and a marginal per-use fee for usage exceeding this maximum free limit. Also using a sample of actual customer records, Agarwal et al. (2007) report evidence of mistakes people make in their financial transactions. One particularly dramatic instance they document involves people's usage of credit cards with low "teaser" rates on balance transfers. A catch with many of these cards is that the interest rate on new purchases is relatively high and that interest charges on purchases accrue to anyone who keeps a balance on the card. Given the availability of multiple cards, it is therefore optimal not to use these teaser rate cards for making purchases. While many people either use this optimal strategy from the beginning or learn it rapidly, others do not. Interestingly, these mistakes are more likely to occur among younger and older customers, whereas middle-aged ones are more sophisticated. Agarwal et al. (2007) consider several other instances (such as the payment of late fees on credit cards) where people pay more for financial services than is possible if using an optimal strategy and discover a similar age-related pattern of naïve and sophisticated behavior.

While the unsophisticated use of credit cards with teaser rates suggests that many consumers process price information poorly, the health club and late fee data suggest that some consumers may also suffer from overconfidence. These individuals may believe that they will attend frequently when facing low marginal prices or that they will be disciplined and pay their bills on time. In at least some of these examples (certainly in the case of late fees), consumers eventually learn when they make mistakes. At that point, consumers probably experience regret for not having made better decisions. Indeed, according to Zeelenberg and Pieters (2007): "Regret can stem from decisions to act and from decisions not to act: the more justifiable the decision, the less regret."

Regret

People have no difficulty recalling decisions that they regret. In the domain of purchases, Patrick, Lancellotti, and De Mello (2003) asked people to remember either purchases they regretted or instances where they regretted not having made a purchase. While the intensity of the purchase regrets exceeded that associated with the nonpurchase regrets, both were substantial. In both instances, respondents particularly recalled having taken actions to cope with their regret.

For nonpurchase decisions, the source of regret is often that consumers passed up a good deal. Indeed, in predicting their future regret, the subjects in the Simonson (1992) study said that they expected to feel a lot of regret if they postponed purchasing a wedding present until August and ended up paying more than they would have paid in July. This effect is so strong that overall purchase satisfaction often depends on whether consumers paid more than they could have paid if they had made their purchase at a different time. Cooke, Meyvis, and Schwartz (2001) asked subjects to gauge their purchase satisfaction in situations where they are sometimes forced to buy because the experimenter tells them that they have "run out" of the product. Not surprisingly, purchase satisfaction depends (negatively) on the price paid. In addition, this satisfaction depends positively on the prices that the individual observed before making the purchase. Consumer satisfaction also declines if the individual is told that he could have paid a lower price if he had delayed his purchase. These survey responses suggest that individuals compare the outcome they actually obtained to outcomes they could have obtained. When they could have obtained better outcomes, they blame themselves and suffer a loss in utility.

While psychologists find self-reported measures of satisfaction (and regret) as indicative of people's well-being, economists may be more skeptical of the relevance of these self-reports. However, regret also matters for decisionmaking. People's desire to avoid blaming themselves for bad outcomes leads them to modify their choices. The most compelling evidence for this comes from an experimental comparison of two treatments. In one treatment, individuals do not learn what would have

happened under an alternate course of action while in the other they do. Notably in Cooke, Meyvis, and Schwartz (2001), subjects faced a sequence of offers and had to make a purchase. In one treatment, they saw no offers after they made a purchase while in the other situation they did see the offers they would have received if they had not made the purchase. In seeking to avoid regret at paying "too much," individuals are less prone to make a purchase in the treatment where they will continue to see offers after making a choice.

Regret looms large as a potential problem in situations where the price in question is an interest rate and the service people have acquired is the use of someone else's money. When the time comes to repay the loan, borrowers having repayment difficulties will typically regret having borrowed funds in the first place. This regret is likely to be particularly severe in cases where people have to give up ownership of their house. Most people are extremely attached to their home and view its loss as a major catastrophe. This should imply that people who anticipate that taking out a mortgage will lead to regret if their financial condition deteriorates should avoid borrowing against their house to finance current purchases.

One problem, though, is that all people may not be equally adept at anticipating that certain contracts have a high potential for inducing regret at a later point in time. People who are overconfident, in particular, may well enter into contracts that put their homeownership in jeopardy and eventually end up feeling a great deal of regret. At the same time, people who are capable of rationally anticipating their own regret should also be able to anticipate the regret that is likely to be felt by people who act in an overconfident manner. Insofar as people who anticipate regret feel empathy for people who do not, the regret-inducing acts of the overconfident cause utility losses to the more prudent. An indirect piece of evidence for this empathy is that people sometimes appear to be upset when they learn that other individuals have engaged in transactions that they regret. I show an example of this in the following section.

Anger and the Fairness of Prices

Regret and anger are both triggered when people learn that they are worse off than they could have been.[2] One difference between these emotions is that anger is often directed at someone else who is blamed for this misfortune. A related difference is that, as Berkowitz and Harmon-Jones (2004) put it, anger is "linked associatively with an urge to injure some target." One way of thinking about this emotion in traditional utility terms is to see angry people as individuals whose utility increases when the target of their anger is harmed.[3]

While anger may not be activated in experimental settings where, as in Cooke, Meyris, and Schwartz (2001), offers are generated by a machine, in real-world purchase settings individual sellers bear some responsibility for what happens. People can thus blame sellers as well as themselves when they are unhappy with their purchases. Yi and Baumgartner (2004) provide some evidence for this co-mingling of emotions. Their study consists of an attempt to distinguish among the various emotions triggered by making purchases. Nonetheless, 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." Similarly, when Patrick, Lancellotti, and De Mello (2003) asked people how they had coped with the purchase (or nonpurchase) decisions that they regretted, several of their respondents said that they expressed anger to someone about the problem.

There appears to be an association between feelings of anger and feelings that outcomes are unfair. Mikula, Scherer, and Athenstadt (1998) asked a large sample of respondents to recall recent situations where they had experienced one or more of these seven emotions: anger, disgust, fear, guilt, joy, sadness, and shame. They also asked their respondents whether the event that had triggered this emotion had been unfair. Unfairness was more strongly associated with anger than with any of the other emotions.

In the case of pricing, evidence of consumer anger tends to be anecdotal. In a recent dramatic episode, the September 5, 2007 reduction in the price of the Apple iPhone by $200 led to the Internet posting of many angry messages by people who had bought the phones before the price cut. Such anger at price declines after people have made a purchase (which leads people to regret their purchase) is matched by anger at price increases in cases where people did not purchase at the earlier lower price. Rotemberg (2004), in particular, reports several newspaper articles

where people became angry (and somewhat violent) in response to price increases that took place after storms or after a terrorist attack. Moreover, it is well-established that such price increases are deemed unfair by many people. Kahneman, Knetch, and Thaler (1986) asked their respondents whether after a snow storm it was fair for a hardware store to raise the price of its snow shovels from $15 to $20. Of their respondents, 82 percent viewed this price increase as either "unfair" or "very unfair" and only 18 percent saw this change as either "fair" or "acceptable." A large subsequent literature has verified this basic finding.[4]

One question that remains unsettled is why such price changes are seen as unfair. Kahneman, Knetsch, and Thaler's (1986) theory is that consumers feel that they are entitled to their "reference transaction," while firms are entitled to their "reference" level of profits. In their formulation, these reference transactions and profit levels refer to past offers made by the firm and to past profits that the firm earned. Thus, after a blizzard, the consumer is entitled to the same price charged before the storm because nothing has reduced the firm's profits at this price. By contrast, price increases that are triggered by cost increases are fair because, even though consumers lose access to their reference transactions, firms come closer to protecting their reference level of profits.

Rotemberg (2004) discusses some limitations of Kahneman, Knetsch, and Thaler's theory and provides a related and complementary theory that seeks to derive more directly the anger that consumers experience. The basic idea of Rotemberg (2004) is that consumers become angry at firms that accentuate their feelings of regret because firms that are even minimally altruistic would refrain from doing so. A minimally altruistic firm can be expected to feel a consumer's regret vicariously and would thus suffer a loss whenever it contributed to this emotion. Firms that raise their prices in circumstances where this increase heightens consumer regret considerably thus demonstrate their selfishness. The model of Rotemberg (2004) is based on the idea that consumers maintain their forbearance if they cannot reject the hypothesis that the firm is minimally altruistic. If they can reject this hypothesis, however, they become angry and seek to hurt the firm.[5]

A field experiment whose results are consistent with these basic ideas is presented in Anderson and Simester (forthcoming). They compared the purchases from a mail-order catalog sent to people who received a "test" catalog with prices that were considerably lower than earlier prices for the purchases made by individuals who received a "regular" catalog without such discounts. The post-mailing purchases of the people who received the test catalog were lower, consistent with the idea that they turned their regret at having paid "too much" into anger against the firm.[6]

Regret-based anger may also explain why firms that increase prices in response to natural disasters are particularly hated by consumers. First consider the simple example of buying a snow shovel around the time of a blizzard. An individual doing so regrets not having bought this shovel earlier and this regret is obviously accentuated if he learns that the price has been increased in response to the storm. Now consider a hurricane victim. People who are adversely affected by hurricanes inevitably feel regret at a variety of different past actions, since negative outcomes trigger counterfactual thinking and self-blame. When people in this situation encounter increased prices for hurricane-related needs, this regret is presumably accentuated since this information makes past decisions appear worse relative to past alternatives. A somewhat altruistic seller would thus abstain from accentuating such regret in this manner, and might lower his price in such circumstances (rather than merely keeping it constant).

In practice, price-setters do not all respond in the same way to natural disasters. As I discuss further below, some firms raise their prices to such an extent that they then become accused of violating legislation that forbids "price gouging." Others, by contrast, improve the terms that they offer purchasers. After Hurricane Charley struck Florida in 2004, some hotels lowered their rates, allowed pets to stay in rooms in which they were usually not permitted, and gave free food to hungry guests.[7] This diversity of reactions suggests that suppliers vary in their altruism. In normal times, this variety may be hidden because relatively selfish suppliers gain little by charging more than their more altruistic brethren. After a natural disaster, however, the benefits of charging a profit-maximizing price may be quite substantial. Thus, the extent to which firms are genuinely altruistic stands revealed. As suggested by the title of a story that ran in September 2004 in the *Deseret Morning News,* "Disasters reveal the stuff we're truly made of."[8]

Consistent with Rotemberg's (2004) model, the set of people who become angry at firms who raise prices is not limited to those individuals that actually end up paying more. Indeed, the loaded expression "price gouging," which is widely used in this context, suggests that many people view these price increases as an affront to decency. In a *Miami Herald* editorial published shortly after a hurricane, Associate Editor Martha Musgrove gives further expression to her anger and says "I'd like to punch out those price-gouging creeps."[9]

2. Price-Setting Anomalies

All You Can Eat

It is fairly common for firms to offer price schedules where customers pay a fixed fee that does not depend on their level of consumption and, in exchange, face a zero per unit cost. What makes this pattern of prices surprising is that it occurs in settings where, as in the health club example of DellaVigna and Malmendier (2004, 2006), marginal cost is strictly positive. This outcome seems problematic in that it seems to provide inefficient incentives to consume more than what is socially optimal.[10] It also implies that people who plan to consume relatively little are subsidizing those who plan to consume a great deal. A firm's embrace of this adverse selection is peculiar because one would expect those who plan to consume a great deal to have a larger willingness to pay.

In discussing the pricing of health club memberships, DellaVigna and Malmendier (2004) suggest a sophisticated efficiency rationale for this pattern of prices. They suppose that health club visits are "investment goods" that reduce utility on the day that they take place and increase utility only in the future. They further suppose that individuals discount the future hyperbolically. This means that, looking just three periods ahead for simplicity, individuals at t care about $u_t + \beta\delta u_{t+1} + \beta\delta^2 u_{t+2}$ where u_t is the level of utility at t while β and δ are parameters that lie strictly between 0 and 1. When these individuals stand at u_t, an increase by one unit of utility at $t + 2$ is worth a sacrifice of δ units of utility at $t + 1$. In the health club example, DellaVigna and Malmendier (2004) suppose that the benefits at $t + 2$ of a visit are larger than the sum of the disutility of the visit at $t + 1$ and the social marginal cost of the visit at $t + 1$.

Because this individual has time-inconsistent (and "present-biased") preferences, he maximizes $u_{t+1} + \beta\delta u_{t+2}$ at $t + 1$. A unit of extra utility at $t + 2$ is now worth only the sacrifice of $\beta\delta$ units of utility at $t + 1$. As a result, the individual may no longer be willing to incur the personal disutility of a visit to the health club plus its social marginal cost even if he sees the same increase in u_{t+2} from this visit. From the perspective of the period t "self," it makes sense to trick the period $t + 1$ self into going to the health club by artificially facing the period $t + 1$ self with a low price for the visit. The contract with a zero price thus acts as a commitment device that leads people to do things that they would wish to do at t but are unwilling to do at $t + 1$.

In the health club case, the assumptions of DellaVigna and Malmendier (2004) are reasonable, though many health club users seem to enjoy their visits rather than regard them as a burden. There are, however, other examples of firms charging a zero marginal price for costly services where these assumptions seem less natural. Club Med, for example, also charges a fixed fee for a period of time and charges nothing for many activities, meals, and drinks. If people had the "present-biased" preferences discussed above, they would overconsume food and drink at $t + 1$ (when they are on vacation) relative to their desires at t (when they are booking the vacation). With these preferences, the period t self would like to impose artificially high prices for these activities at period $t + 1$. Nonetheless, just as in the health club case, people seem to like the "all you can eat" aspect of Club Med pricing. This "all-inclusive" preference is also prominent in car rental contracts—whereas marginal (mileage) charges used to be common, their relevance has waned over time.

The ubiquitous practice of charging zero for additional units of consumption suggests the desirability of a more general explanation than the one provided above. Two explanations readily suggest themselves. The first, which is mentioned by DellaVigna and Malmendier (2006) as well, is that people are overconfident about their tendency to use particular services. Instances where services at priced at zero marginal price lead lots of consumers to feel that they will benefit disproportionately from buying the service, even if they know that the average consumer does not really benefit from this type of pricing scheme.

The second explanation is that people dislike facing tradeoffs between paying a price and consuming; rather, they prefer to avoid having to make recurring "purchasing decisions" by making one decision at the outset. Consistent with this observation, Prelec and Loewenstein (1998) show survey evidence that, for a variety of goods including health clubs and meals during cruises, more people prefer to pay such a fixed fee than a "per-use" fee even if the total cost and usage is the same. This explanation still leaves open the question of why metering is so distasteful. Prelec and Loewenstein (1998) provide an explanation based on mental accounts. Another possibility is that charging a single fixed fee reduces people's cognitive load by cutting down on both the need to carry out calculations regarding whether an additional purchase is worthwhile and regarding whether a particular purchase (or mile driven, in the case of a rental car) will lead to future regret for having paid too much. In the health club example, a customer might worry that she will face a regret-prone decision on those occasions where she only has limited time available for a visit to the health club. In the example of vacation packages, a customer might worry that staying at a hotel where the price of the room does not include meals will lead to regret about the chosen hotel when a meal purchased there proves to be expensive. This concern might be particularly acute if the hotel is in a remote location, which is common for Club Med properties.

It might be thought that a consumer who pays a fixed fee may be subject to some kind of regret if he ends up using the service relatively little. One advantage of the fixed fee, however, is that the consumer is unlikely to know how much his actual pattern of visits would have cost under a per-use payment scheme (because he is unlikely to recall either the amount he has used the service or the per-use charge under alternative contracts). By contrast, a customer using a per-use contract runs the risk of regretting his marginal transaction and is much more likely to be aware of its price.[11]

While there is still no consensus on what determines whether a price is fair, a zero marginal price presumably also lowers the computational burden needed to decide whether a price is fair or not. There may thus be a connection between people's desire for fair prices (and their extreme displeasure at being confronted with unfair ones) and their desire to enter into agreements that cut marginal prices to zero.

Price Endings

Consistent with consumers' preferences for purchasing goods whose price ends with a 9, firms use this price ending extensively. Twedt (1965) and Levy et al. (2007) use quite different samples and both studies find that over half the prices they observe end in the digit 9. One explanation for this behavior is that consumers absorb price information from left to right and recall only the first few significant digits. If this were true, one might expect consumers to be more confused when a price ends with several 9s, so that prices ending with several 9s would be particularly common.

Interestingly, Schindler and Kirby (1997) show that firms are less likely to charge a price ending in a zero rather than a slightly lower price ending in 9 if the latter leads the price to end in several nines. In other words, prices ending in zero where reductions by one unit would lead a digit that is three positions to the left of the last digit to fall (as in the case of 2000) are particularly rare relative to prices ending in 9. This suggests that firms find it particularly difficult to resist lowering a price by one unit when this affects a relatively important leftmost digit. This strategy seems particularly well designed to take advantage of consumers that only react to the first few digits.

Levy et al. (2007) connect the behavior of price endings with the behavior of price changes. They show that prices ending in 9 are less likely to be changed than prices ending in other digits while, at the same time, the typical size of price changes is larger for prices ending in 9. It thus follows that firms are less attached to 9 endings so that 9 endings are "more sticky." Still, and perhaps surprisingly, the distribution of price endings has not converged to a degenerate distribution, as other numerical price endings continue to be used for many products. Since not all price changes are multiples of 10, this means that some products go from having a price ending in 9 to a price ending with another digit. The conditions under which this occurs are deserving of further study. I now discuss price changes more generally.

The Amplitude and Timing of Price Changes

Commodities that trade in open exchanges have prices that vary frequently, often from transaction to transaction. Since essentially every

industrial good contains some commodities that are traded on these exchanges, the marginal cost of producing these goods varies as well. Nonetheless, final goods prices are rather rigid relative to the prices of raw commodities. The standard reason given for this rigidity is that there are administrative costs associated with publicizing new prices and with modifying the equipment that ensures that consumers pay a different amount for the units that they buy.[12] In this subsection, I first discuss a variety of empirical regularities that cast doubt on the idea that, by themselves, administrative costs of this type can explain the price rigidity we observe. I then turn to a more tentative treatment of why the consumer nonrationalities discussed above may help explain the pattern of price rigidity that we observe.

When the administrative costs of changing prices are independent of the size of price changes, Sheshinski and Weiss (1977) as well as Golosov and Lucas (2007) show that there is a "band of inaction," meaning a range in which firms will not change prices. In other words, firms will keep their price constant if it falls between an upper and a lower threshold price. In the case covered by Sheshinski and Weiss (1977), there is constant inflation, and the two thresholds s and S are fixed. When inflation erodes the firm's real price to the point that it equals s, the firm raises its real price to S—only to see the real price being eroded again. Golosov and Lucas (2007) consider a more complicated setting where firms are also subject to idiosyncratic shocks. Nonetheless, the basic logic of the Sheshinski and Weiss (1977) analysis carries through, with the firm raising its price by a discrete amount whenever history has left the firm with a price that is too low.

If the firm is setting its price optimally, two things must be true about this band of inaction. The first is that, during the period in which the firm expects its price to be constant, the expected discounted value of the change in profits from raising the price slightly must be zero. The second is that profits after the adjustment must exceed profits before the adjustment by the adjustment cost's time value of money. The reason is that the firm can always delay adjustment for a short while and thereby save the time value of money on its adjustment cost, and must thus be compensated for this by an increase in profits when it does eventually adjust its price.

As shown in Sheshinski and Weiss (1977), this finding implies that an increase in inflation must necessarily lead to an increase in the size of price increases $S - s$. To see this, consider a firm that keeps its band of inaction constant after inflation rises. An increase in inflation then implies that the firm reaches prices near the lower bound s more quickly than before. Since profits increase with prices when the price is relatively low, this means that the present discounted value of the benefits of raising the price become positive when inflation rises. This tends to push up S, the price after adjustment. Since S is always larger than the profit-maximizing price, profits at SR fall when S is increased. Finally, since the level of profits before adjustment needs to stay in the same relation to the profits after adjustment, the price before adjustment must decline. So S rises and s falls, and $S - s$ unambiguously rises.

Rotemberg (2004) demonstrates that, for plausible parameter values, inflation's effect on the size of price increases is quite substantial. In particular, it is much larger than the actual increase in the size of price increases one observes when comparing low to high inflation periods. One of the most striking and robust facts reported by researchers who have studied price adjustment in both low and high inflation periods is that the size of price increases barely rises even if inflation rises substantially. This finding is present in Cecchetti (1986), in Lach and Tsiddon (1992), in Goette, Minsch, and Tyran (2005), in Gagnon (2007), and in Wulfsberg (2009). The Gagnon (2007) study of Mexican data and the Wulfsberg (2009) study of Norwegian data are particularly notable because each one shows that the typical size of price increases actually rose (instead of falling) after inflation dropped in the 1990s and the 1980s, respectively. This inability of a model with administrative costs associated with changing prices to account for changes in the size of price increases seems like a substantial drawback.

An equally serious drawback was pointed out by Carlton (1986) and Kashyap (1995). They both showed that the minimum size of price increases for the goods that they studied was extremely small. This minimum increase is extremely important in models with administrative costs because it must equal $S - s$ and is small only if administrative costs are unimportant. Thus, a finding of small price increases suggests that the costs of increasing prices must be trivial, at least for some goods.

I have talked so far about models that include the administrative costs of changing prices because these models have the proper "micro-foundations" in that they derive price rigidity from an appealing and simple underlying friction. In applied macroeconomics, it is actually more common to simply assume that each firm has a constant probability of changing its price in each time period.[13] This assumption is due to Calvo (1983), and leads the aggregate price level to behave as if firms faced costs to change prices that are quadratic the size of the price change, as in Rotemberg (1982). Taken literally, the Rotemberg (1982) model implies that each firm changes its prices by a small amount each period, which is counter to the evidence. Unfortunately, when taken literally, the Calvo (1983) model is also inconsistent with firm-level evidence.[14] As shown by Gagnon (2007), Nakamura and Steinsson (2008), and Wulfsberg (2009), the fraction of firms changing their prices is not at all constant. Rather, the fraction of firms raising prices increases with inflation while the fraction of firms reducing prices is not closely related to inflation—so that the overall fraction of firms changing prices is procyclical.

If the administrative costs of changing prices were the main impediment of price flexibility, firms would presumably give this as their reason for keeping prices constant. This issue can be checked by interviewing firm managers who set prices, and several studies including Blinder et al. (1988) and Fabiani et al. (2005) have done so. In these studies, managers do not seem to put much weight on administrative costs when asked to explain why they keep their prices constant for extended periods of time. What managers cite as the main reason for price rigidity, instead, is that not changing prices avoids antagonizing their customers.

One issue that remains unsettled is whether a model where price rigidity is due to concerns about inciting negative customer reactions can account for these two features of price changes discussed earlier. One interesting model of this sort is provided by Heidhues and Kőszegi (2008). They focus on consumers who become unwilling to buy a good if the price exceeds the price that they expected to prevail. Consumers react in this manner because they are averse to the loss associated with paying too much. The result is that firms face a very elastic demand for their product at the price that consumers expect to pay. This model has several attractive features, including that it represents a relatively small departure from standard economic models. Another benefit is that, while firms are not reacting directly to the anger that consumers feel, the model is quite consistent with consumers being very upset when they encounter a price that does not match their expectations—since such a price increase leads them to lose something relative to their expectations. What is less clear is whether this model is consistent with the fact that many regular price changes seem to be associated with insignificant changes in purchases or whether it can explain the patterns of price changes discussed above.

It is also not clear whether this pattern can be explained with models where consumers get upset if the firm acts selfishly, as in Rotemberg (2004, 2005). Rotemberg (2004) shows that one can at least explain the weakness of the relationship between the size of price increases and inflation under reasonable assumptions about consumer regret. A consumer facing a price that was recently increased regrets not having bought the good before its price was raised. It is therefore plausible to suppose that these "regret costs" are larger when price increases are larger. Firms that want to appear altruistic should then avoid large price increases because these induce a great deal of regret on the part of consumers. More importantly, such firms should not substantially raise the size of their price increases when inflation is higher. The reason is, in part, that a higher rate of inflation implies that regret rises by more when a firm postpones its price increase by one unit of time (since the resulting price increase will have to be larger). Postponing price increases thus becomes less attractive to a firm that wishes to be seen as acting altruistically. Since this effect is larger when inflation is larger, it has a larger dampening effect on the size of price increases when inflation is higher.

This still leaves the question of whether a model of this type can explain the fact that so many price increases are small. One possibility, suggested by Rotemberg (2005) is that there are occasions in which firms become aware that small price increases would be particularly acceptable to customers. Given the simultaneous objectives of raising prices and preventing customer anger, firms may raise their prices by a small amount on these occasions. Whether this mechanism can explain the frequency of small price increases deserves continuing theoretical and empirical research.

3. High-Low Pricing

An obvious question raised by the reluctance of firms to change their regular prices is why so many retailers adopt a "high-low" strategy where goods are routinely put on special sale below their "regular" price level, rather than adopting an everyday low pricing (EDLP) strategy. EDLP economizes on transaction (and menu) costs and some stores, Walmart in particular, are supposedly successful with EDLP.[15]

One factor that may contribute to the profitability of the high-low strategy is that people derive a great deal of personal satisfaction from purchasing what they consider to be bargains (see Darke and Dahl 2003 for evidence on this). Still, according to Hoch, Drèze, and Purk (1994), only about a quarter of the revenue generated by stores using a high-low pricing strategy consists of items that are being promoted. To study the costs and benefits of the high-low strategy, Hoch, Drèze, and Purk (1994) ran an extensive experiment using different stores in the Dominick's supermarket chain. Some of these stores increased their regular prices to pursue a high-low strategy while others lowered their prices to pursue an aggressive EDLP strategy. The latter strategy was less profitable in the Hoch, Drèze, and Purk (1994) data because the reduction in prices had only a modest effect on demand. The 10 percent reduction in EDLP prices relative to those of the control stores only raised unit volume (in the category in which prices were reduced) by 3 percent.

Perhaps the most important overall conclusion of this study is that high-low stores manage to sell a considerable volume of goods at nonpromotional prices so that EDLP is quite costly. This raises the obvious question of why customers do not regard the existence of high "regular" prices as unfair. While this question remains unsettled, two observations are in order. The first is that, as argued by Rotemberg (2004), regret may be kept relatively low by price specials whose duration is short and spelled out in advance. The reason is that because these specials are temporary, people who become aware of the special take advantage of it. By the same token, people who do not become aware of the special see only a relatively stable "regular" price and therefore they do not know that there is a specific opportunity that they failed to take advantage of.

A second aspect of special prices is that the people who disproportionately take advantage of them are "price sensitive" shoppers. Insofar as people who pay higher prices perceive price sensitive shoppers as valuing money (or income) more highly, they may feel that an altruistic firm would indeed wish to offer such individuals a better deal. Thus, specials, at least in the form that they take in modern supermarkets, may be seen as less unfair than other forms of unstable prices. As an illustration of these differences, Haws and Bearden (2006) report that fairness perceptions depend on the amount of time that elapses between the purchases of consumers who pay different prices. People regard it as particularly unfair if another consumer obtains a lower price within an hour of their own purchase, while price differences separated by a month are less likely to be seen as unfair. At the very least, this fact shows that firms with rigid prices are less likely to upset their customers by behaving in ways that they regard as unfair.

4. Government Price Policies

The previous analysis suggests three behavioral elements of prices that are relevant for public policy. First, people appear to be confused by certain aspects of pricing, so they may well make mistakes in their choices. Second, they see certain pricing practices as unfair and they react to these with anger. Some firms act so as to avert this anger but others do not, so this consumer anger is observed. Lastly, people who are not directly affected by a particular price do sometimes share the anger of those who are, presumably because they empathize with their sense of being treated unfairly. Unfortunately, these considerations mean that policy analysis is more difficult than in the usual case where people are rational decision-makers who care only about their own bundles of consumption. Indeed, relatively little is known in general about how policy should be conducted if people make mistakes, experience regret both directly and vicariously, or get upset at people whose behavior exacerbates regret.

I illustrate the complexities of the resulting welfare analysis by considering two policies that are currently under discussion in the United States. Both involve interference with the right to set prices freely, both already

have the force of law behind them, and there appears to be widespread support for expanding the scope of these laws. The first of these policies forbids firms from raising prices in emergencies while the second limits the contractual terms that can be offered when people take out mortgages to purchase their primary residences.

In standard economic models, these interventions lead to Pareto suboptimal allocations so everyone's welfare can be increased by freeing prices and making lump sum transfers. As I discuss below, the presence of regret, anger, and empathy make it harder to increase everyone's welfare in this manner. The analysis also reveals who gains and who loses from these policies and thus makes clear why it is possible for these policies to be supported by a majority of the population. By doing so, the analysis may also shed light on the elements of these policies that people see as particularly desirable, and this might help improve their design.

This section ends by discussing monetary policy and inflation. Because the analysis of inflation when people have the concerns that are explored in this paper is still in its infancy, this portion is mostly conjectural. Still, the psychological issues stressed in this paper may help explain why inflation is so widely disliked.

Anti–Price Gouging Legislation

As of September 2005, 28 U.S. states had laws against "price gouging." These statutes outlawed certain price increases during periods in which government authorities declared a state of emergency or during periods of "market disruption." The details of these laws differed, with some states treating offenses as criminal violations subject to jail while others treated them as civil offenses subject only to fines. The existing laws often exempted price increases based on cost and outlawed only "excessive" or "unconscionable" price increases. Connecticut, Oklahoma, and West Virginia each forbade price increases in excess of 10 percent of the price in the pre-emergency period, though they differed in the range of products that were covered by this requirement. In 2006 and 2007 there was also an effort to impose federal anti-gouging legislation specifically targeted at oil products.

States with anti-gouging legislation tended to make it easy for consumers to lodge complaints. During the hurricane emergencies of 2004–2006,

the Florida Attorney General dealt with about 13,000 such complaints. Many of these were resolved quickly and there were only 81 formal investigations, which resulted in 17 lawsuits. Several of these lawsuits resulted in businesses paying restitution and fines.[16] For example, the West Palm Days Inn, which charged guests up to $144 in spite of having a nearby billboard advertising rooms for $49.99, agreed to pay $70,000. This was supposed to pay for the investigation, with $10,000 set aside to compensate hotel guests, and the rest being directed to the Florida Hurricane Relief Fund.[17] Similarly, a Honda dealer that sold electric generators in Long Island for 67 percent above the normal price after a 1985 hurricane was ordered to give refunds to its customers and was fined $5,000.[18]

Anti–price gouging laws were billed by their supporters as protecting consumers. In introducing federal anti-gouging legislation, Senator Joseph Lieberman (Democrat, Connecticut) said: "This law is necessary because there is really nothing available to protect consumers and businesses from being gouged."[19] The idea that price controls "protect" consumers seems incompatible with standard economic models. In a competitive market, prices below the market-clearing level lead to an inefficient allocation of scarce goods among consumers who value them differently and yield an insufficient incentive to bring more goods to the market. So consumers as a whole are clearly hurt. It should be noted, however, that these deleterious effects may be relatively modest if prices are temporarily held near their pre-emergency level for a short time. The reason is that the people buying critical goods during emergencies may all need them a great deal so the problem of inefficient allocation across consumers may be small. Similarly, the pre-emergency price may still maintain a reasonable incentive to bring goods to the affected area.

Nonetheless, there is little doubt that some inefficiency arises during the period where price increases are capped, raising the political economy question of why such caps have political support. This is an important question because it casts doubt on the idea that people's full reaction to prices is captured by the standard economic model in which selfish consumers react rationally to prices as signals of scarcity. If people were purely selfish, this political mobilization should be championed by its direct beneficiaries. But who are the beneficiaries here? The affected firms lose money so they should organize against these laws and, according

to the view that firms find it easier to organize than consumers, they should win and keep such legislation at bay. Some consumers do benefit by paying lower prices, but others lose by being rationed. Thus, if the traditional model of consumer preferences is valid, it is not entirely clear whether consumers as a whole could expect to gain from this legislation. Even assuming that consumers come out ahead, it would seem that the traditional model has no explanation for why consumers organize to keep prices low in this particular case, rather than organizing to lower prices in more normal times.[20]

One possibility is that policymakers and the public at large are confused about how markets operate. This interpretation is unappealing because economists have written a large number of popular media accounts on the topic, begging the question of why the standard economic arguments have been so unpersuasive in the past. Since these arguments do not seem overly complicated, an inability to comprehend them would seem to bode poorly for people's capacity to make rational decisions.

A rather different possibility is that people understand the economic arguments full well but that they do not find them convincing. Some evidence for this can be found in the *Miami Herald* of September 1, 1992 where Martin Hoffman gave the standard economic arguments against anti–price gouging legislation and Associate Editor Martha Musgrove forcefully rejected them. From this and the earlier discussion of consumer reactions to price increases, we can conclude two things. First, people who faced price increases during emergencies were upset, with their utility loss exceeding the financial burden of having to pay a higher price. Second, some people who were not directly affected by the price increase were also furious at the gougers who raised their prices during the emergency.

These two factors reduce the social benefits from letting prices rise after an emergency. Indeed, the existence of regret and anger make it difficult to achieve Pareto improvements from the outcome with anti-gouging legislation even if transfers are allowed. Without transfers, individual losses from the abandonment of anti-gouging legislation are larger still.

To see this, consider a setting where we would normally expect such legislation to be Pareto suboptimal. Suppose that a law of this type forces a firm to charge a price p for a hotel room that ends up being occupied by a person to whom it is worth $x > p$. Moreover, suppose that there are two additional people to whom the room is worth $y > x$ and that they are both rationed. Suppose, further that an additional room could have been obtained at a cost y so that a price of y would have led both the people who value the room more highly to have obtained lodging.

In the conventional analysis, we reach a Pareto improvement by charging y for the two rooms and giving the person to whom it is worth x a transfer slightly larger than $x - p$. To find the people willing to pay y, this improvement requires that the price y be charged for the rooms. But, as soon as y is charged, everyone who sees the higher price (all three potentially customers) suffer the nonpecuniary losses that are triggered by the difference between y and p. Let these losses equal ℓ. This can be thought of as the costs of regretting not having bought the good earlier at p. Alternatively, one can imagine that the reference price p is particularly salient in a natural disaster with people feeling relatively acute pain when they spend more for a hotel room than they would have in normal times.

Those observing the situation, meanwhile, are upset if the hotel owner is receiving y rather than p. We could relieve the observers of some of their anger by charging y but giving the hotel owner only p and using the remaining proceeds for charity. This fits with Campbell's (1999) demonstration that the auctioning of a desirable Barbie doll during the Christmas shopping season is more acceptable if the proceeds go to charity. But this remedy would not be sufficient to induce the hotel owner to bring the second room to the market. For that, we would have to pay her y, at least for the second room.

Leaving aside the problem of anger at the hotel owner, we can only make all customers as well off as they were with the anti-gouging law if we give all three of them ℓ. Once we do that, the money left over after the two room occupants pay y may not be sufficient to compensate for the cost of the extra room y, plus the price the hotel room initially commanded, p, plus the gain to the initial room occupant $x - p$. In other words, $y - 3\ell$ may be less than x. The impediment to reaching a Pareto improvement (even in the presence of transfers) is that the process of identifying the person who is willing to pay the most imposes direct costs to other consumers. Without transfers, of course, simply raising the price

is not a Pareto improvement, since there is at least one customer who is worse off if $x > p$.

In this example, one could argue that the two rationed customers benefit from freeing prices and that, since the hotel owner also gains, a majority of the agents is better off. Even if people who value the good at y are better off because the regret costs ℓ are relatively low, a majority could still favor anti-gouging legislation. This would occur if there existed a large number of people who purchased the room at both the old and the new price since each of these would lose ℓ in addition to the price difference. It would also occur if the anger induced by the hotel owner that raised prices is counted sufficiently in social welfare.

"Suitability" Criteria for Mortgages

According to Persky (2007), the idea that emergencies should lead lenders with other-regarding preferences to make loans at zero interest was central to the medieval prohibition against usury. Persky (2007) quotes a 1572 text by Thomas Wilson saying: "lend to your poore neighbors in time of their great need" and "[lending] shoulde be …free, simple, and for charityes sake …without anye thinge at all more than the principall." Persky (2007) further suggests that charging positive interest only became socially acceptable as firms gained productive opportunities that made it easy for them to repay such loans. The debate over limits on interest rates continues to this day. My focus here, however, is on a very specific set of regulations concerning loans, namely limitations on contracts that allow people to borrow using their principal residence as collateral.

In the United States, the bulk of the federal regulations concerning extension of credit to consumers involves the disclosure requirements imposed by the 1968 Truth in Lending Act and its subsequent revisions. An important and interesting exception to this emphasis on information is provided by the 1994 Home Ownership and Equity Protection Act (HOEPA), which sets limits on the contractual terms of "high cost" mortgages. Mortgages that are classified as high cost either on the basis of high interest rates or high up-front fees are not allowed to contain penalties if the borrower pays down the principal before it is due nor are they allowed to have the principal grow over time (meaning have negative amortization).[21] In addition, lenders who offer such loans are not allowed to engage in a "pattern or practice of extending credit . . . to a consumer based on the consumer's collateral without regard to the consumer's repayment ability."[22] In this section, I analyze whether the psychological considerations stressed in this paper rationalize restrictions of this type.

The "endowment effect" of Kahneman, Knetsch, and Thaler (1990) leads people to demand a higher price to part with an object they already have than they are willing to pay to acquire the same object. This attachment to objects that one owns suggests that people who lose their house through foreclosure suffer enormous pain. Moreover, the desire to help people in these circumstances suggests that this pain elicits empathy from others.

The recent escalation of subprime mortgage defaults in the United States begs the question of how so many individuals reached the point where they stood such a high probability of losing something that is so valuable to them. One obvious possibility that is consistent with the cognitive difficulties discussed earlier is that overconfident individuals may have been particularly prone to enter into such contracts. A related possibility is that this population of borrowers proved easy to manipulate by brokers who posed as their friends. For purposes of discussion, consider a very stark case where, for one reason or another, some people make such mistakes.

Let there be only two periods (labeled 0 and 1) and a person I will call A who believes that he derives total expected utility $\bar{u}_0 + \beta\bar{u}_1$ if he does not borrow. Thus, $\bar{u}_0$ and $\bar{u}_1$ denote his baseline levels of expected utility and β denotes his discount rate. Let us suppose that A is offered a loan backed by his principal residence and that this individual believes that accepting this loan will lead to levels of expected utility $\hat{u}_0$ and $\hat{u}_1$ in the two periods. This person thus accepts the loan if he believes that $(\hat{u}_0 + \beta\hat{u}_1)$ exceeds $(\bar{u}_0 + \beta\bar{u}_1)$. Indeed, if one took a revealed preference viewpoint, one would conclude that $(\hat{u}_0 + \beta\hat{u}_1) \geq (\bar{u}_0 + \beta\bar{u}_1)$ from the observation that A took the loan.

Now consider an observer (possibly an econometrician armed with data and a model, possibly a friend) who agrees with the assessments $\bar{u}_0$, $\bar{u}_1$, and $\hat{u}_0$ so that she has no quarrel with the baseline levels of utility or the extra time zero utility from consuming the proceeds from the

loan. The observer believes, however, that expected utility at time 1 with the loan equals $\tilde{u}_1 < \hat{u}_1$. In other words, she believes that there is a good probability that the individual will lose his house, experience regret and be extremely unhappy. If $(\overline{u}_0 + \beta\overline{u}_1) < (\hat{u}_1 + \beta\tilde{u}_1)$, this observer believes that *A* is better off not borrowing.

Now consider an ideal mortgage limitation that prevents *A*, and only *A*, from taking on this loan. The conventional analysis gives credence to the utility function that is consistent with *A's* actions, and thus sees this prohibition as inefficient because it makes both *A* and the lender worse off. One might, instead, use either the utility function of the observer or, equivalently, a social planner's expectation of the true long-run utility of *A*.[23] This point of view is somewhat problematic because there is at least one moment in time where *A* believes that this prohibition makes him worse off, though there may well be other times (particularly in period 1) where *A* is in fact better off.[24]

Even if one is willing to evaluate *A's* welfare using *A's* assessment of utility, the existence of empathy can still make the outcome with the loan prohibition Pareto optimal. Suppose, in particular, that observers have a utility function that puts a weight of λ on *their* perception of the utility of potential borrowers. In other words, observers "put themselves in *A's* shoes" but use their own assessments of utility when they do so. Then each loan received by people with the characteristics of *A* is costly to these outside observers if $(\overline{u}_0 + \beta\overline{u}_1) > (\hat{u}_0 + \beta\tilde{u}_1)$. These costs are experienced mostly in period 1 but observers already anticipate them as of period 0. To obtain a Pareto improvement from the outcome reached with the prohibition, it is thus necessary to compensate observers at some point for these losses. Even if *A* and the lender feel that they are better off when the loan is allowed, their subjective gains may not be sufficient to compensate these observers for their vicarious losses.

There also may exist outside observers that are upset by the behavior of the lenders that loan to *A*. The widespread use of the pejorative term "predatory lending,"[25] already suggests that many people regard certain lending practices as morally reprehensible. The activist organization ACORN (the Association of Community Organization for Reform Now) has gone further and adopted the chant "predatory lenders, criminal offenders."[26]

While the evidence that people dislike "predatory lending" seems strong, different people (not all of whom may be equally opposed to the same lending practices) use the term quite differently. In 2000, the Department of Housing and Urban Development and the U.S. Treasury Department published a report called "Curbing Predatory Home Mortgage Lending," where this concept was defined in terms of specific practices. These included the use of high fees of which borrowers were unaware, frequent refinancing so as to collect fees repeatedly, as well as other forms of fraud. The report also objected to loans that were made without attention to the borrower's ability to repay, where such loans could only be profitable if the home was eventually foreclosed.[27] While agreeing that predatory lending is based on fraud, the California Association of Mortgage Brokers defines predatory lending as "intentionally placing consumers in loan products with significantly worse terms and/or higher costs than loans offered to similarly qualified consumers in the region."[28] Lastly, and most closely related to the discussion above, mortgagenewsdaily.com defines loans as predatory if they do not benefit the borrower.[29]

This last definition has the advantage of fitting with the idea that customers demand a minimal level of altruism from firms. A lender that benefits marginally from providing a loan whose borrower can be expected to lose a great deal of utility might well be seen as not having this minimal required altruism. Because transactions in mortgage lending markets are not repeated very frequently, the anger of past customers is not very effective at keeping lenders in check (particularly in comparison with the effect of potential anger on suppliers of food items that are purchased regularly). It is thus not surprising that anger at lenders spills over into the policy arena.

Whether this interpretation of the source of consumer anger is warranted or not, it is hard to dismiss the importance this anger has for policy analysis. Angry individuals get utility from the punishment inflicted on those that make them angry. So, one could argue that a law that criminalizes behavior that induces anger has a direct positive effect on the ex post utility of angry individuals. More importantly, the elimination of anger-inducing behavior seems useful for social cohesion. In the absence of well-defined social welfare functions that incorporate this concern,

one might wish to treat anger as a loss that can be triggered by contracts among third parties, and thus as a kind of externality.

Even if one accepts both that overt proofs of limited altruism cause anger, as in Rotemberg (2007), and that lending terms that are seen by outside observers as harming borrowers are viewed as signs of insufficient altruism,[30] there is still the question of which practices should be forbidden. One advantage of limiting prepayment penalties and negative amortization is that these features of mortgages may be ones that unsophisticated borrowers do not understand at the time they sign these contracts. Particularly for mortgages with "teaser rates," borrowers may not realize that the existence of prepayment penalties will prevent them from refinancing cheaply once the period of low rates expires. Similarly, borrowers of negative amortization mortgages may be lulled into complacency by the affordability of monthly payments without noticing that their main payments lie in the future. Thus, the elimination of these practices may prevent borrowers from signing contracts that ultimately cost them their house.

On the other hand, these limitations also make borrowing more difficult for some individuals whose risk of default is low. Prepayment penalties, for example, should reduce interest rates and make mortgages more affordable at first, with this benefit to the borrower being offset by a reduction in the likelihood of refinancing when interest rates drop. Negative amortization mortgages, meanwhile, may well be very useful for borrowers that expect their income to rise over time. Rather than forbidding practices that might be advantageous to borrowers, it would seem more desirable to target only those loans that are likely to end in tears of regret and anger. In the case of housing loans, the pain is likely to be particularly acute for those whose loan ends in foreclosure.

One policy that therefore appears to be somewhat desirable is to require lenders to compute the probability that a loan will end in foreclosure, with penalties attached when this computation is not credible. Since regulators and credit agencies also care about these probabilities (albeit for different reasons), widely acceptable models for computing this risk should become available. These models would obviously integrate features of mortgages such as prepayment penalties and negative amortization, both of which could raise the probability of default.

Once mortgage originators are forced to compute these probabilities, there are two different regulatory regimes that can be envisioned. In the first, lenders would be required to disclose the results of this computation to borrowers. In the second, borrowers would simply not be allowed to sign loans whose probability of ending in foreclosure exceeds some critical number. The former solution would seem preferable except for the fact that naïve borrowers might not take the warning implicit in these calculations seriously.

The Rationale for Low Inflation

Anti–price gouging legislation and limitations on mortgages are controversial policies. By contrast, there is substantially more agreement that inflation should typically be low. The question I tackle here is why this consensus is so strong. One reason that flows directly from the earlier analysis is that inflation increases consumer regret. The reason it does so is that inflation increases the frequency with which prices rise, and each price increase has the potential to lead consumers to wish they had bought the good earlier. Thus, a policy of low inflation lowers regret, and thereby increases well-being.

Di Tella, MacCulloch, and Oswald (2001) demonstrate that, indeed, inflation reduces reported "life satisfaction." Equally remarkable is the fact that in opinion polls inflation has historically often been seen as the most serious problem faced by the United States. Fischer and Huizinga (1982) display Gallup Poll data showing that there were more people seeing inflation as a more serious problem than unemployment in 1951, when inflation was about 6 percent and unemployment about 3.3 percent. While the rank of the two problems reversed in the late 1950s and early 1960s, inflation became more important once again starting in the mid-1960s, when it was equal to about 3.5 percent. Hibbs (1979) computes the determinants of the relative importance of these two issues. His conclusion is that, when the unemployment rate is unchanging, more than 50 percent of respondents see inflation as a more serious problem than unemployment as long as inflation exceeds 6 percent.

The question is whether the depth of people's concern for inflation would make sense if people cared about prices only in the manner that is

standard in economic models. In other words, could consumers who see prices exclusively as indicators of what they can afford be as perturbed by inflation? Inflation is known to have two consequences. The first is that it leads people to economize on money balances. However, because total expenditures on money balances are modest, this effect should be modest as well.

The second is that inflation increases the volatility of relative prices because different firms do not adjust their prices at the same time. From the point of view of conventional welfare measurement, Rotemberg and Woodford (1997) show that this is an important reason to keep inflation low. What is less clear is that this explains why typical consumers want inflation to be low.

To see this, it is worth recalling that for fixed real income in terms of a particular good, price volatility is actually good for consumers. Even with dispersed relative prices, consumers can afford the bundle they would buy if all prices were set at their mean levels. Consumers can do even better, though, by tailoring purchases to the particular pattern of relative prices that they face. The volatility and dispersion of relative prices induced by inflation can therefore only hurt consumers if it reduces their mean real income.

As it happens, inflation does reduce real income for a given level of employment. The reason is that those firms that charge a low price sell more since firm output is determined by demand. This reduces the average income of firms, and indirectly that of workers. Moreover, the law of diminishing returns implies that the firms that sell more have lower labor productivity, so that price dispersion across firms implies that a disproportionate fraction of goods is produced by firms whose productivity is relatively low. These effects reduce real income for a given level of employment and thereby also imply that inflation raises the level of employment that is needed to produce a given level of real income. This required increase in work effort (and reduction of leisure) is the reason why Rotemberg and Woodford (1997) find that inflation reduces welfare even for a given level of GDP. What is not implied by this analysis is that people will be aware that inflation is reducing GDP for a given level of employment, and much less that this is the reason they dislike inflation.

Indeed, the opinion polls analyzed by Fischer and Huizinga (1982) suggest that consumers do not regard inflation as having had a major effect on their real income. Rather, what bothers them about inflation seems to be something else.

5. Conclusions

This paper has considered three psychological reactions to prices. The first is that consumers are unmindful of them. The second is that consumers experience regret upon discovering that they paid more than they could have if they had acted differently in the past. The third is that people become upset when they see prices they deem unfair. I have tried to connect these reactions by noting that regret can be enhanced if consumers do not pay close attention to prices, and that feelings of regret can cause anger if consumers conclude that the price-setting firms were not sufficiently empathetic towards their regret.

These reactions complicate the price-setting problem of firms. On the one hand, consumer naïveté opens up many opportunities for exploiting consumers. On the other hand, consumers can become angry when they see firms that seem uncaring in their willingness to cause regret. In some cases, this potential for anger is sufficient to discipline firms. The result is that certain pricing patterns can be explained as attempts to avoid arousing such anger.

At the same time, however, it is clear that some firms are willing to anger their customers, particularly in the event of pricing decisions made following natural disasters. Similarly, consumers are upset when lenders contribute to the loss of other people's homes. This paper suggests that these reactions can explain why consumers seek legislation that limits the freedom to set prices in credit markets and in markets where emergencies suddenly raise consumer demand for certain goods and services. The paper also shows that such public policies can be Pareto optimal in the presence of these reactions. Lastly, I have suggested that consumer regret at not having purchased goods right before a price increase can be reduced by curtailing inflation and that this is a reason for central banks to pursue price stability.

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Notes

1. Di Tella and McCulloch (in this volume) show that self-reported "life satisfaction" is more correlated than self-reported happiness with macroeconomic variables. Interestingly, life satisfaction does not appear to have the same emotional intensity as happiness.

2. For a discussion of the determinants of anger, see Berkowitz and Harmon-Jones (2004) and the symposium that follows.

3. For a model of this change in preferences, see Rotemberg (2007). For neurological evidence that some pleasure centers of the brain light up when people harm those that have behaved selfishly in an economic exchange, see De Quervain et al. (2004).

4. For a paper that discusses this literature, see Xia, Monroe, and Cox (2004).

5. As discussed in Rotemberg (2007), the idea that people react with anger when rejecting the hypothesis that others are minimally altruistic can also explain other field and experimental findings.

6. For a survey that obtains somewhat similar results, see Feinberg, Krishna, and Zhang (2002). They show that subjects that have purchased a brand's product in the past (in the sense of allocating "points" to it), reduce these purchases if this brand offers a discount to new customers. They also show that subjects that used to purchase brand *b* reduce their purchases of this brand if brand *a* offers a discount to its past customers. They see this reaction as being driven by "jealousy," though this effect might also be due to an assessment that brand *b* is not sufficiently altruistic in its promotional strategy.

7. See Scott Barancik, "Hotels treated guests like family," *St. Petersburg Times*, August 18, 2004. Available at http://pqasb.pqarchiver.com/sptimes/access/680124751.html?dids=680124751:680124751&FMT=FT&FMTS=ABS:FT&date=Aug+18%2C+2004&author=SCOTT+BARANCIK&pub=St.+Petersburg+Times&edition=&startpage=1.D&desc=Hotels+treated+guests+like+family+Series%3A+HURRICANE+AFTERMATH (accessed August 18, 2009).

8. Lois M. Collins, "Disasters reveal the stuff we're truly made of," *Deseret Morning News,* September 16, 2004, A19 Opinion. Available at http://www.deseretnews.com/cgi-bin/cqcgi_plus/@plus.env?CQ_SESSION_KEY=QSOBFGWCTAXK&CQ_CUR_DOCUMENT=1&CQ_TEXT_MAIN=YES (accessed August 28, 2009).

9. Martha Musgrove, "Free market? It's price-gouging—and it stinks!," *Miami Herald*, September 1, 1992, 39A Editorial.

10. These incentives are absent in the Barro and Romer (1987) analysis of ski-lift pricing because they assume that firms operate at a capacity constraint (though their analysis would of course be equally valid when ski areas operate at less than full capacity as long as marginal cost were zero) so that consumers are unable to increase total output.

11. This regret-based explanation is not so much an alternative to the "mental accounts" hypothesis of Prelec and Loewenstein (1998) as a potential reason why people create mental accounts in the first place. One advantage of carrying mental accounts for different categories of consumption is that if one does so successfully, they may eliminate regret from marginal purchases in a category as long as total purchases within the category are within the amount budgeted in the mental account.

12. See Sheshinski and Weiss (1977) for an early formalization of this idea and Golosov and Lucas (2007) for a recent one.

13. As shown by Gertler and Leahy (2006), if idiosyncratic shocks are sufficiently large and recurrent, firms with administrative costs of changing prices will mostly change their prices in response to such idiosyncratic shocks. Thus, the probability of a price change will be essentially constant if the distribution of idiosyncratic shocks is constant.

14. While these models do not describe the literal behavior of individual firms, they are both tractable and capture two essential features of sticky prices. The first is that this stickiness increases the correlation of current and past prices. The second is that if firms are forward-looking, the rigidity of prices leads current prices to be more correlated with the future determinants of prices. In spite of their imperfections at describing micro phenomena, these models may thus remain useful as vehicles for organizing macroeconomic data.

15. In fact, Hoch, Drèze, and Purk (1994) show that stores that are known for EDLP also sell a high fraction of their goods in special promotions, though these discounts tend to be less deep than those at high-low stores.

16. See Steve Bousquet, "Few suits in cases of price gouging," *St. Petersburg Times*, August 16, 2006. Available at http://pqasb.pqarchiver.com/sptimes/access/1095765241.html?dids=1095765241:1095765241&FMT=FT&FMTS=ABS:FT&type=current&date=Aug+16%2C+2006&author=STEVE+BOUSQUET&pub=St.+Petersburg+Times&edition=&startpage=1.B&desc=Few+suits+in+cases+of+price+gouging (accessed August 18, 2009).

17. See Allison North Jones, "West Palm Days Inn settles storm gouging suit," *Tampa Tribune*, October 4, 2004, 3 Metro.

18. Barry Meier, "Do higher prices for gasoline mean drivers were gouged?," *New York Times*, October 6, 1990, Section 1, p. 29. Available at http://www.nytimes.com/1990/10/06/style/consumer-s-world-do-higher-prices-for-gasoline-mean-drivers-were-gouged.html?scp=9&sq=electric%20generators%20%245,000&st=cse.

19. Ibid.

20. The implausibility that in this setting selfish considerations lead to political mobilization may also cast some doubt of its importance in other settings where observers have been quick to presume that self-interest is responsible for government-induced inefficiency. See Rotemberg (2003) for a discussion of these issues in the context of tariffs.

21. See Ho and Pennington-Cross (2007) for a description of the numerous state laws that strengthen HOEPA either by changing the high cost trigger or by curtailing specific practices including the use of "balloon" payments when the mortgage comes to an end.

22. U.S. Code 15, 1639(h).

23. This is similar to the perspective of Gruber and Kőszegi (2001) who compute social welfare by assigning their "long-run preferences" to time-inconsistent smokers.

24. A libertarian might further claim that *A* himself is made worse off by the simple act of restricting his choice.

25. There were over one million entries for this term on Google as of July 2007.

26. "Protesters at KC Fed," *Kansas City Star*, June, 7, 2007, C3 Business.

27. This report is available at http://www.huduser.org/publications/pdf/treasrpt.pdf.

28. See http://www.cambweb.org.

29. http://www.mortgagenewsdaily.com/Mortgage_Fraud/Predatory_Lending.asp (accessed August 19, 2009). These definitions are related in that, for example, fraudulent loans do not benefit borrowers. These definitions are not identical, however, in that a borrower might well not benefit from a loan even if its interest rate is properly "risk-based." What matters, of course, is not how different people define the concept but which aspects of lending induce the most revulsion. Empirical research on what upsets people about different loans is urgently needed.

30. Competition among lenders, so that their margins are low, implies that their altruism must be particularly low if they are willing to impose large costs on borrowers. This need not imply that monopoly lenders will be seen as more altruistic if they extend such loans because their monopoly status should lead them to value the marginal utility of poor borrowers highly relative to their own.

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Comments on "Behavioral Aspects of Price Setting and Their Policy Implications" by Julio J. Rotemberg

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Rotemberg's paper fits into a theme found in his other work in macroeconomics, which is to explore ways in which the price mechanism may break down. His examples and analysis show how various aspects of human behavior might lead to the breakdown of the traditionally accepted price mechanism. Rotemberg distills from the behavioral literature a short list of phenomena which he thinks are important for understanding prices. He then describes several aspects of consumer behavior which he thinks are hard to understand from the perspective of traditional economic thinking and argues that such behavior can be explained by these behavioral phenomena.

In my view the overall case Rotemberg makes for resorting to behavioral thinking is weak. I make my case in two ways. First, I describe simple neoclassical alternatives to his behavioral interpretations of the evidence. Second, in the case of sticky prices, I argue that the empirical evidence is not as damning to conventional theories of sticky prices as Rotemberg would like us to believe, and that the behavioral theory he describes is actually inconsistent with the available empirical evidence

Rotemberg motivates the importance of the behavioral concepts he describes using the straw man device, his being *homo economicus,* the rational, clear-thinking automaton who populates traditional economic models. This straw man is torn down in several steps. First, Rotemberg describes empirical evidence that consumers do not remember the prices they paid for recently purchased goods. This evidence is interpreted to mean that certain economic outcomes are not driven by the actions of homo economicus. I am skeptical of this interpretation. Certainly it is the

case that there are some prices consumers do remember. People remember the price they paid for their house, their car, and other big-ticket items. So in some situations consumers remember the prices they paid, and in other less important situations they do not. This is not particularly damning for neoclassical economics. It merely suggests that information is costly to process.

Accepting that there are limitations on how we process information does not mean that economists need to abandon their neoclassical principles. One way of interpreting the evidence is that individuals weigh the costs and benefits of performing a detailed analysis of the prices they face, and sometimes choose to avoid paying the costs of processing the price information. Such a theory would suggest paying more attention when the price of the good is likely to be very high. Costly information acquisition can and probably should be incorporated into our models. Observing that human beings do not process information perfectly is not in and of itself a compelling reason to abandon neoclassical principles. However, the notion that consumers face difficulties processing information is important for Rotemberg's analysis because he needs people to make mistakes so that they can later regret these imperfect decisions.

The next behavioral concept Rotemberg introduces is that economic agents often react emotionally to the prices they face. For example, consumers sometimes express anger when prices are perceived as being "unfair." Human beings are bundles of emotions. We respond emotionally to everything around us. So it should not be surprising that in the realm of economic activity emotional behavior is observed. Happiness is an emotion, and this is conventionally thought of as being well-captured by the utility function formulation. It is not clear why anger, a form of displeasure, is not consistent with the utility function formulation. So the presence of anger on the part of economic agents is not obviously damning for conventional modes of economic thinking.

What is crucial for Rotemberg's analysis is that there is feedback from emotional behavior to observed patterns of pricing by firms. In Rotemberg's view of the evidence, consumers get angry at firms that make them regret a purchasing decision, they act in such a way as to avoid making a purchase that they may later come to regret, and firms set prices in such a way as to avoid angering their customers. An alternative view is that

this observed anger is merely a reflection of some displeasure being experienced along with the bundle of goods being consumed. That firms seek to supply goods that yield pleasurable outcomes for consumers is a basic premise of neoclassical economics. The buying experience is part of the bundle of goods that is consumed when making a purchase. That firms act to make this buying experience pleasurable, for example by ensuring that the experience does not generate "anger" among consumers, seems entirely within the realm of standard economic analysis. It does not require a special explanation of firm behavior.

Another point worth making here concerns Rotemberg's focus on consumer-firm interactions. Indeed many of the examples he describes are based on evidence collected from grocery stores. It seems important not to place too much emphasis on such evidence—there is a huge amount of economic activity that takes place outside of grocery stores! For example, a huge fraction of economic transactions occur on a business-to-business basis. I am not convinced that emotions like regret and anger are very important in these situations. Business-to-business transactions are inherently cutthroat. Of course, relationships are formed by agents of firms, but ultimately business is about making a profit. Anger and regret may be experienced as a by-product of this process, but these emotions are not inconsistent with the pursuit of profit. Again, humans essentially are bundles of emotions, and it would be surprising if we did not observe these feelings arising in the course of engaging in economic activity.

The final key behavioral idea described in the paper is that people expect a minimal level of altruism from those with whom they conduct transactions. According to Rotemberg, firms chose to display a certain level of altruism because this is what consumers expect of them. He brings up the recent example of the iPhone in which there was consumer outrage at Apple dropping the price soon after the phone was put on the market. I actually think this example has a simple explanation in terms of implicit contract theory. It is natural to express anger when one party to a contract has reneged on the terms of the contract. It is well-known that the prices of new consumer durable goods are initially high and then fall over time. All consumers purchasing the iPhone should have been aware that the price would eventually fall. The implicit deal consumers who purchased the iPhone at the initial price had with Apple was that

they would have exclusive use of the iPhone for a certain period of time because they paid a high premium price. The "mistake" Apple made was in dropping the price by $200 only two months after the iPhone first went on sale. Apple's response to the ensuing anger, which was to provide a $100 coupon for future Apple purchases, was its way of admitting it had violated the implicit contract. By making the admission, it was hoping to retain its reputation as an honest broker in the marketplace, thus protecting future sales. There is nothing about this situation which requires one to resort to behavioral concepts to explain the outcome. Apple's response certainly had nothing to do with altruism.

Yet I do not want to suggest that firms never display altruism. An example not raised in Rotemberg's paper is that firms advertise their charitable giving. Such behavior presumably is intended to convey a favorable impression of the firm. Such positive impressions are part and parcel of the buying experience and easily fit into a standard utilitarian analysis.

Of course, in many commercial transactions consumers do not expect any altruism whatsoever on the part of firms. We are all familiar with the Latin phrase, "caveat emptor," which in plain English means "let the buyer beware." For example, no one expects a used-car dealer to behave altruistically toward its customers. And with firm-to-firm transactions, it seems unlikely that there is an expectation of altruism among either party. Without incorporating a universal expectation of altruism, it is hard to see how one can build a theory of economic behavior with wide-ranging applications. It also seems unwise to build a separate theory for every case.

The interactions between firms and workers may be an important exception in which altruism does play a role. Rotemberg (2008) has used the idea that firms are expected to deliver a minimum level of altruism to describe firm-worker interactions. In his model Rotemberg is able to generate a weak response of wages to productivity shocks, an empirically appealing result. The difficulty I have with such a model is that firms behaving in a way that appears altruistic may just reflect a particular remuneration strategy. It is not necessary to assume that firms are expected to behave altruistically to account for outcomes that appear altruistic. Indeed implicit contract theory yields outcomes that appear altruistic but are nothing of the sort. Again, Rotemberg is describing phenomena which he suggests require a behavioral explanation, but actually have a straightforward interpretation in terms of conventional economic thinking.

The final issue I will discuss concerns sticky prices. In this context the straw man is "menu costs." Rotemberg argues that the recent explosion of microeconomic evidence on sticky prices is inconsistent with a menu cost interpretation. Yet menu costs are probably the most well-developed micro-founded model of sticky prices. So if the evidence does not look good for menu costs then, according to Rotemberg, this leaves an opening for a behavioral explanation. Rotemberg views the evidence as damning for the menu cost view because it reveals that price changes are frequently very small. This is hard to square with Rotemberg's interpretation of menu costs as reflecting the purely administrative costs of changing every single price. I think the current prevailing view of menu costs is that firms follow pricing strategies, and that menu costs reflect the costs of changing these strategies. Formulating a price strategy involves using high-wage talent. This high-wage talent has better alternative uses of its time. Consequently, firms infrequently adjust their pricing strategies. Any given pricing strategy could involve small price changes over time, so evidence that there are many small price changes is not damning for the modern menu cost view.

Rotemberg describes a behavioral theory which generates acyclical price increases and procyclicality in the fraction of goods with changing prices. The size of price increases is acyclical because firms refrain from increasing the size of their price increases during periods of high inflation to avoid generating consumer regret at having not bought these goods and services at a lower price. To get the prices to rise as much as firms would like during periods of high inflation, firms must change their prices more frequently at such times. Since inflation is procyclical, Rotemberg's model appears to fit the evidence.

However, the implications of Rotemberg's behavioral model are inconsistent with other evidence which Rotemberg does not discuss. Specifically, Klenow and Kryvtsov (2008) decompose U.S. inflation into the part due to the fraction of goods whose prices change at a given time, and the

average amount by which such prices change. They find that roughly 90 percent of the variance of inflation is due to variations in the average size of price changes. That is, the size of price changes is actually procyclical, not acyclical as suggested by Rotemberg, and variations in the number of firms changing prices is not important to price dynamics at all. These findings contradict Rotemberg's behavioral theory of inflation.

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Comments on "Behavioral Aspects of Price Setting and Their Policy Implications" by Julio J. Rotemberg

John Leahy

Julio Rotemberg has written a very interesting and provocative paper. I find it hard to disagree with his premise that people respond emotionally to prices. I sympathize with the editor of the *Miami Herald* whom, according to Rotemberg, wanted to "punch out those price-gouging creeps" who raised prices after a hurricane. Raising prices may help to efficiently allocate resources, but there is also something unsavory about making a profit off of the misfortunes of others. Given that consumers react emotionally to prices, it makes sense that firms would respond to these emotions. The fallout from Apple's decision to cut the price of the iPhone by 40 percent just a few months after its introduction illustrates many of the themes in Rotemberg's paper. There was an emotional response among those who had bought the iPhone at the original price. Internet message boards were full of angry customers, some of whom felt betrayed by Apple. These consumers felt that Apple had let down the early adopters who had supported the company. In response, Apple felt obliged to issue rebates to customers who had paid the higher price.

I am going to focus my comments on the macroeconomics of pricing. In my mind the issue is not whether people respond emotionally to prices, but whether we need to include these responses in our macroeconomic models of pricing. Macroeconomics is all about simplification. The world is quite complex, and there are a lot of very real phenomenon that we could potentially include in our models. This makes the criterion for inclusion quite strict. A theory must help explain some first-order fact regarding the macroeconomic time series. I am not yet sure that the emotional responses Rotemberg is pushing meet this test at this time.

Behavioral theories have a long history in the macroeconomics literature. In some sense macroeconomics owes its existence to behavioral theories of pricing. Keynes's major amendment to the classical model was the consideration of money illusion and downward price rigidity.

Modern macroeconomics, however, has attempted to move beyond simply assuming that prices are sticky. Instead modern macroeconomics tries to derive rigid prices as the outcome of an explicit model of price determination. Some models motivate price inertia with adjustment costs, some with decision costs, and others with imperfect information. Rotemberg has been a major contributor to this research program.

In this paper, Rotemberg argues that there are major gaps in this research program. He mainly attacks theories in which there is a fixed cost of changing prices, theories commonly referred to as "menu cost pricing models." My guess is that Rotemberg questions these theories because they are the most advanced. These are the theories for which we have the most sophisticated models. These are the theories for which we have made the most progress in matching theory to data. Daniel Levy and his coauthors (1997) have gone out and tried to measure the cost of changing prices. Other people have calibrated models to fit the data on the size and frequency of price adjustment. You can take these theories and plug them into a general equilibrium macroeconomic model such as those of Christiano, Eichenbaum, and Evans (2005) or Smets and Wouters (2003)—models that do a good job or replicating macroeconomic time series—and then you can analyze counterfactuals and do policy experiments.

Rotemberg criticizes menu cost models on three levels. First, menu cost models are unable to explain small price changes. Second, menu cost models counterfactually imply that the size of price changes should increase with the rate of inflation. Third, survey respondents tend to prefer other explanations of price inertia. Personally, I am not overly troubled by these failures. The pricing literature has dealt with each of these issues. Let me address them in turn.

Let's begin with the issue of small price changes. The first thing to keep in mind is that the average price change in the U.S. economy is surprisingly large. We have been placing price stickiness at the center of our macroeconomic models since Keynes, and it is only very recently that we have had any access to data on a broad cross-section of prices. Now

several researchers, most notably Klenow and Kryvtsov (2008), have obtained access to Bureau of Labor Statistics pricing data. This is a sample of the prices that go into the Consumer Price Index. The data begin around 1988 and represent the economy as a whole. The average price change in this data set is between 8 to 13 percent, depending on whether or not you include sales and product substitutions. Those are big price changes, and these price changes are also relatively frequent. Firms tend to adjust prices every four to seven months (again the difference depends on how one treats sales). Given that the annual inflation rate has been around 2 to 3 percent since 1988, these facts imply vast heterogeneity in price movements. Individual prices are moving all over the place. There are big jumps up and big jumps down. But explaining small price changes is not our biggest worry.

In an effort to explain large price changes, menu cost models typically rule out small price changes. This practice is troubling, but the literature has attempted to fill this gap in several ways. Some models incorporate time-varying costs of price adjustment. In other models, small and large price changes coexist because firms sell multiple goods and the costs of changing prices may be spread across goods. The price of one good may change a lot, while the price of the other one changes only a little. Decision costs and imperfect information can also give rise to small price changes. In these models some of the costs of price adjustment are born before the firm learns the true state of the world, then these costs become sunk costs when the price adjustment takes place. Before learning the true state, the firm expects to change its price by a large amount. In some cases, however, it turns out that only minor adjustments are necessary.

The second criticism is that in the data the size of changes does not respond to inflation. Let's think again about the data. There is massive heterogeneity in price adjustments. Most price changes do not take place in response to inflation. Most price changes have to do with responses to the idiosyncratic situation of the firm. It would not be surprising if the idiosyncratic situation of the firm were uncorrelated with inflation. To observe a correlation between the size of price adjustments and inflation would therefore require a large change in the inflation rate. In such cases, there are lots of other changes going on in the economy.

Third, menu costs don't come up big in surveys. In my mind, it is not obvious that they should. The Bank of England survey (Hall, Walsh, and Yates 2000) asks how important a theory is for price adjustment. Blinder's (1991) survey asks how important a theory is for the speed of price adjustment. If I am thinking about what's important for pricing, then costs, demand, and competitors' behavior are the first three things I'm going to come up with. Menu costs are tiny. Menu costs are supposed to be tiny. The entire point of the papers by Mankiw (1985) and Akerlof and Yellen (1985) was that second-order costs of adjustment have first-order effects. It is therefore not surprising that menu costs are not among the primary determinants of prices.

In my view, the survey evidence is actually favorable to menu cost theories. In the Blinder survey 70 percent of firms report that they face price adjustment costs. Moreover, survey after survey comes to the conclusion that price reviews happen more frequently than price changes. It would be quite surprising if these reviews yielded no information. The only explanation is that firms encounter some cost to changing prices in response to this information.

Now let's return to Rotemberg's theories. As I said above, one of the strong points of the menu cost theory is that you have an explicit model. You can write that model down, parameterize it, and take it to the data. I personally find Rotemberg's models and stories fascinating. I believe pretty much every one of them, but his behavioral theories of pricing have not been developed to the same level as the menu cost model.

What do these behavioral theories of pricing need to get up to this level? First of all, we need some canonical forms. We need to figure out which behavioral theories are important and develop general formulations of these theories that are applicable to lots of different situations. We need parameters that we can think about and measure. For example, Rotemberg began by arguing that people don't pay attention to prices and that they have no idea what they pay. Later, however, when discussing regret, Rotemberg argued that even small changes in prices might anger consumers. Both effects are true, but both probably do not simultaneously coexist in the same situation. We need to know when people do not pay attention to prices, and when people pay a lot of attention to prices. We need to know when people regret some action or inaction, and when people let things be. We then need to figure out which is the theory we really want to take seriously. Macroeconomics has developed by looking for general explanations that work most of the time. It avoids using this story for one situation and that story for another situation. We need canonical theoretical representations that fit a variety of different examples.

Once we get a canonical formulation we can think about measurement and calibration. For example, with hyperbolic discounting, we know how to write down the problem. We know how to solve it. We can think about measuring the parameters of the model, or we can estimate these parameters by fitting the model to data. Most of the theories that Rotemberg has surveyed are not quite there yet. We do not have the decision problem written down. We don't know what parameters are important. We do not know how to go out and measure them. Right now, these are simply interesting stories. There is a lot of work that needs to be done before we can plug these theories into the pricing equation of a dynamic general equilibrium model.

Rotemberg's favorite theory, which I find attractive, is based upon a combination of regret, altruism, and anger. The idea is that when prices change, consumers regret either that they are paying too much today or that they paid too much yesterday. Altruistic firms, because they care about their consumers, take this regret into consideration when setting their prices. Consumers, expecting firms to be altruistic, react with anger when firms fail to behave altruistically. This expectation forces firms that are less altruistic to mimic the altruistic firms.

Among all of the theories discussed in the paper, this is the one that is the most fully formulated. Rotemberg has fleshed out the model elsewhere (Rotemberg 2008). The formulation, however, looks a lot like the menu cost model. I think that this is intentional. Rotemberg wants to keep what is good about menu cost pricing, while extending the theory in a direction that he sees as important. The main difference between Rotemberg's formulation and the menu cost model is that in the standard menu cost model the cost of changing prices is independent of the size of the price adjustment, whereas in Rotemberg's formulation the effective cost of the price adjustment increases as the size of the price adjustment increases. This extra degree of freedom is what allows Rotemberg to match certain facts.

I am skeptical, however, that this extra degree of freedom will be of great importance in macroeconomic models. There are many nonlineari-

ties in the menu cost model. None of these have been shown to matter in the aggregate data. What is important about the menu cost model is that it generates inertia that is first-order in magnitude. It is what allows these theories to explain the real effects of money on output and to fit the impulse responses of macroeconomic time series. Rotemberg adds another nonlinearity to the model. My guess is that the practical implications of Rotemberg's model will be very similar to the practical implications of the menu cost model. There may be differences, but these will be second-order.

Where I see the potential gains from Rotemberg's line of research is not in building better positive models of the economy, but in interpreting the welfare implications of the models that we already have. The models we have do a reasonable job of fitting the data, but the welfare implications are a bit embarrassing. Our models imply that business cycles are not very costly, that inflation is not very costly, and that policy mistakes are not very costly. If you believe the normative implications of these models, you should not be thinking about business cycles at all.

We can't escape the feeling, however, that these things are important. The amount of attention that the public pays to business cycles and inflation is just too great. It seems that these models are missing something big. Maybe what they omit is the emotional reaction to business cycles. Maybe business cycles lead to fear and regret, as in Rotemberg's models. Emotional reactions are nonrival goods. Everyone can fear losing a job without actually losing a job. Everyone can regret not buying at a low price, without anyone buying at a low price. Emotions therefore may magnify the welfare gains and losses of business cycles, and thereby bring the welfare implications of our models more closely in line with common perceptions.

Rotemberg has outlined an ambitious research agenda. Progress has been made, but there is much work to be done. I look forward to seeing where it goes.

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