1 Summary

My primary research interest concerns product pricing with market power. In some cases my research is motivated by observing perplexing pricing patterns and asking what about the environment, the objectives of sellers, or biases of customers can lead to such pricing? In other cases my motivation is reversed: I am intrigued by an interesting environment or regulatory intervention and ask what are its implications for optimal pricing? In either case, I approach the problem using a combination of economic theory and empirical observation and testing.

Pricing is a broad research topic, but I am particularly interested in situations in which consumers or other relevant market participants act like real people rather than Homo economicus because they are biased, boundedly rational, or have non-standard preferences. In other words, I study questions that fall within the emerging field of Behavioral Industrial Organization.

A prime example is a branch of my research that I describe in “Dynamic Nonlinear Pricing: biased expectations, inattention, and bill shock” (International Journal of Industrial Organization 2012), and that I outline below in Section 2. A sequence of three of my papers highlights the importance of modeling and measuring both bias and inattention to understand firms’ pricing decisions and evaluate public policies such as the Federal Communication Commission’s (FCC) recent bill-shock agreement with cellular carriers (Grubb 2009, 2015b; Grubb and Osborne 2015).

In “Selling to Overconfident Consumers” (American Economic Review 2009), which I describe in Section 2.1, I show that consumer overconfidence can explain why cellular phone service plans include ‘free’ minutes or data followed by steep overage fees for additional usage. The paper highlights the importance of consumers’ expectations about future consumption at the time of contracting...
but still assumes that there is single consumption choice after a contract is signed. Two more recent papers relax this assumption by recognizing that consumption choices themselves are spread out over time. Consumer recall of past consumption becomes important in this richer environment, which allows me to examine the role of consumer inattention and its proposed remedy: bill-shock alerts that notify consumers when they reach consumption thresholds. In “Consumer Inattention and Bill-Shock Regulation” (Review of Economic Studies 2015b), which I describe in Section 2.2, I show that bill-shock regulation will harm some consumers and lower total welfare in fairly competitive markets if consumers are aware of their own inattention, but that such regulation can be beneficial if consumers naively expect to be attentive. In “Cellular Service Demand: Biased Beliefs, Learning, and Bill Shock” (American Economic Review 2015 with Matthew Osborne), which I describe in Section 2.3, we structurally estimate consumer biases from cellular-phone billing-data and counterfactually simulate the effect of implementing the recent bill-shock agreement between cellular carriers and the FCC. Our results predict that, had the agreement been implemented during our sample period, it would have reduced consumer welfare by an average of $33 per person annually when endogenous prices changes are taken into account.

This line of research is actively ongoing in at least two respects. First, Matt Osborne and I are studying an analog of bill-shock alerts in retail banking — low balance alerts that can help checking account holders avoid unintentional overdraft fees. Our project, which I describe in Section 2.4, is at a very early stage but we anticipate receiving valuable panel data on consumers’ banking transactions and low balance alerts from a personal finance software provider imminently. Second, in the past year I have taken a step back to consider the “big picture” in the field of behavioral IO that encompasses this line of research. I am co-editor with Vic Tremblay of a special issue on behavioral industrial organization for the Review of Industrial Organization. In addition to an introduction to the special issue with Vic, I have written two invited papers for the special issue. The first, “Behavioral Consumers in Industrial Organization: An Overview” (2015), succinctly overviews the industrial organization literature with behavioral consumers, dividing it into three branches. I survey one branch in a second paper for the special issue, “Failing to Choose the Best Price: Theory, Evidence, and Policy” (2015). A second branch, to which my own papers are important contributions, I cover much of in “Overconfident Consumers in the Marketplace” (Journal of Economic Perspectives, forthcoming). I describe these survey papers in Section 3.

A second branch of my research within the broad umbrella of pricing with market power concerns online display-advertising auctions. I am currently revising “Peaches, Lemons, and Cookies: Designing Auction Markets with Dispersed Information”, a 2014 working paper with Susan Athey, Ittai Abraham, and Moshe Babaioff that I describe in Section 4. We find that whether the in-
dustry standard second-price auctions have lower revenue than first-price or other auction formats depends importantly on whether or not web browser cookies help advertisers identify good customers (peaches) or bad customers (lemons). I plan additional research this summer on online display-advertising auctions in collaboration with The Rubicon Project, an auction house for online display-advertising.

Beyond the broad umbrella of pricing with market power, my secondary research interest to date is in strategic communication and reputation building. In “Developing a Reputation for Reticence” (Journal of Economics & Management Strategy, 2011), which I describe in Section 5, I show that informed experts may hide favorable information in order to protect their ability to conceal unfavorable information. The rest of this statement describes these main areas of my research in more detail.

2 Dynamic Nonlinear Pricing for Real Consumers

Nonlinear pricing schemes, such as volume discounts, are important tools for converting consumer surplus into profits. In the large literature on nonlinear pricing, models are predominantly static. Nevertheless, nonlinear pricing often arises in dynamic environments where consumers’ purchase decisions are spread out over time. For instance, a cellular phone customer in the US must first choose a calling plan, which involves trading off the size of monthly fees against the size of included allowances of minutes, text messages, or data. Only later does the consumer choose how many calls to make, how many texts to send, or how many gigabytes to use, which is done on a call-by-call, text-by-text, or download-by-download basis throughout the course of a month. In such a dynamic environment, consumer behavior depends importantly both on expectations about future consumption patterns (such as when choosing a calling plan) and on consumer recall about past consumption (such as when trying to recall if one has already exhausted an allowance of included minutes).

My research provides compelling evidence from both consumer behavior and firm pricing that our standard assumptions of rational expectations and perfect recall are both unrealistic and unsatisfactory for understanding nonlinear pricing in such dynamic environments. A sequence of three of my papers, which I discuss in the next three subsections, highlights the importance of modeling and measuring both bias and inattention to understand firms’ pricing decisions and to evaluate public

---

1 Rochet and Stole (2003, Section 9) survey dynamic nonlinear pricing models with standard consumers, such as Courty and Li (2000). Spiegler (2011) surveys models with nonstandard consumers, such as DellaVigna and Malmendier (2004) and Eliaz and Spiegler (2008).

3
policies such as the Federal Communication Commission’s (FCC) recent bill-shock agreement with cellular carriers (Grubb 2009, 2015b; Grubb and Osborne 2015).

2.1 Selling to Overconfident Consumers

As discussed in Grubb (2009), firms commonly offer three-part tariffs, or a menu of three-part tariffs, in a variety of contexts. A three-part tariff consists of a fixed fee, an included allowance of units for which marginal price is zero, and a positive marginal price for additional usage beyond the allowance. A prime example is cellular phone service pricing in the US. The standard literature on nonlinear pricing does not provide a compelling explanation for such pricing patterns. Under perfect competition one expects price to be driven down to cost, while standard nonlinear pricing models suggest the highest demand consumer will pay the lowest marginal price.

In Grubb (2009), I develop two theoretical explanations for observed three-part tariffs. The first explanation maintains the standard common-prior assumption and is based on price discrimination, while the second relies on consumer overconfidence. Using cellular phone customer billing data, I rule out the first explanation, find that plan choice mistakes are consistent with overconfidence, and conclude that overconfidence is a good explanation for three-part tariff pricing in the cellular context.

At the heart of both explanations developed in Grubb (2009) is the recognition of one dynamic element of pricing: consumers must choose a calling plan when they are still uncertain about their future calling needs. The first potential explanation for three-part tariffs has the flavor of standard price discrimination, but consumers are separated based on the level of their uncertainty about future consumption rather than purely on the level of their demand. The second explanation is that consumers tend to underestimate the variance of their future demand when choosing a tariff.

Two important biases lead to the tendency of consumers to underestimate the variance of their future demand: forecasting overconfidence (sometimes called overprecision), which has been well documented in the psychology literature, and projection bias, which is described by Loewenstein, O’Donoghue, and Rabin (2003). Intuitively, underestimating variance of future demand can lead to three-part tariff pricing because consumers do not take into account the risk inherent in the convexity of the tariffs on the menu. This is because although the tariffs have a high average cost

---


3 Eliaz and Spiegler (2006) show that menus of three-part tariffs may be used to screen consumers with varying degrees of awareness about their own time-inconsistency. While I assume consumers buy all units from a single seller, Chao (2013) assumes that consumers buy from multiple sellers and argues that a dominant firm may use a three-part tariff to accommodate a competitor.
per unit for consumers who consume far above or far below their allowance, consumers are overly
certain that they will choose a tariff with an allowance that closely matches their own consumption.
(According to a pricing manager at a top US cellular phone service provider, “people absolutely
think they know how much they will use and it’s pretty surprising how wrong they are.” (Grubb,
2009)) Thus consumers expect to pay a low average price per unit, but sellers profit ex post when
consumers make large revisions in either direction.

Grubb (2009) introduces a panel of billing records spanning February 2002 through June 2005 for
approximately 2300 student accounts managed by a major US university for a national US cellular
phone service provider. I find that customer plan choices and subsequent usage decisions are just
what would be expected from overconfident consumers. Moreover, usage patterns suggest that the
overconfidence explanation is more appropriate than the price discrimination explanation in this
particular application. Specifically, the distribution of usage by customers on a plan with a large
number of included minutes strictly first order stochastically dominates (FOSD) the distribution
of usage by customers on a plan with a small number of included minutes. This is inconsistent
with the price discrimination model given three-part tariff pricing. (The price discrimination model
predicts that firms offer the ‘free’ minutes inherent in three-part tariffs only when cumulative usage
distributions cross, which is ruled out by FOSD.)

A simple example from Grubb (2009) illustrates the role of overconfidence. Assume that firm
marginal costs are 5 cents per minute and fixed costs are $50 per customer. Consumers value each
minute of calling at 45 cents up to some satiation point, beyond which they have no additional
value for calling. When consumers sign contracts at time one, they are homogeneously uncertain
about their satiation points. Then, at time two, consumers learn their satiation points and make
their consumption choices. In particular, one third of consumers learn that they will be satiated
after 100 minutes, one third after 400 minutes, and the remaining third after 700 minutes.

If consumers and the firm share this prior belief, then it is optimal for the firm to charge a
marginal price equal to the marginal cost of 5 cents per minute\footnote{In a richer setting marginal
cost pricing would be uniquely optimal.} A monopolist extracts all the
surplus via a fixed fee of $160, earning profits of $110 per customer. Under perfect competition,
the firm charges a fixed fee of $50, leaving $110 in surplus to consumers.

If consumers are overconfident, however, marginal cost pricing is no longer optimal. For in-
stance, if all consumers are extremely overconfident and believe that they will be satiated after
400 minutes with probability one, then it is optimal to charge 0 cents per minute for the first 400
minutes, and 45 cents per minute thereafter. In other words it is optimal to have 400 “included”

---
minutes in the tariff.

A monopolist charges a fixed fee of $180, earning expected profits of $155 per customer. Ex ante, consumers expect to receive zero surplus, but on average ex post realize a loss of $45. Under perfect competition, the firm charges a fixed fee of $25, and consumers expect to receive $155 in surplus, but actually only realize $110. Consumer overconfidence allows the creation ex ante of an additional $45 in perceived consumer surplus, which is never realized ex post.

To see why this tariff is optimal, consider the pricing of minutes 100-400 and 400-700 separately. On the one hand, overconfident consumers believe that they will consume minutes 100-400 with probability 1, while the firm knows that they will actually consume them only with probability \( \frac{2}{3} \). As a result, reducing the marginal price of minutes 100-400 from 5 cents to 0 cents is perceived differently by the firm and consumer. The consumer views this as a $15 price cut and will be indifferent if the fixed fee is increased by $15. The firm, however, recognizes this as only a $10 revenue loss, and will be better off by $5 if the fixed fee is raised by $15.

On the other hand, overconfident consumers believe that they will consume minutes 400-700 with probability 0, while the firm knows that they will actually consume them with probability \( \frac{1}{3} \). Therefore from the consumer’s perspective, increasing the marginal price of minutes 400-700 from 5 cents to 45 cents does not impact the expected price paid. The firm, however, views this as an increase in expected revenues of $40.

Essentially, the firm finds it optimal to sell the first 400 minutes upfront to overconfident consumers. Then in the second period, low demand consumers use only 100 minutes but don’t receive a refund for their unused allowance, while high demand consumers buy minutes 400-700 at the monopoly price of 45 cents per minute.

### 2.2 Consumer Inattention and Bill-Shock Regulation

In late 2011, US President Barack Obama said that,

> Far too many Americans know what it’s like to open up their cell-phone bill and be shocked by hundreds or even thousands of dollars in unexpected fees and charges. But we can put an end to that with a simple step: an alert warning consumers that they’re about to hit their limit before fees and charges add up.

Obama’s statement was made at the announcement of a voluntary agreement between cellular carriers and the FCC to begin providing such usage alerts by April 2013.\(^5\)

---

As I discuss in Grubb (2015b), the situation Obama refers to, known as bill shock, can arise even when consumers are fully informed about contract terms. For example, a cellular-phone customer may know that the first 400 minutes are included while later minutes are charged at an overage rate of forty-five cents per minute. Nevertheless, he may be uncertain whether the next call will cost zero cents or forty-five cents because he does not know how many minutes he has already used. Such marginal-price uncertainty at the point of sale occurs whenever marginal prices vary with the level of consumption and, due to inattention, consumers are unaware of their past consumption when making additional consumption choices. Thus similar bill-shock regulation might be relevant to a wide variety of products and services including electricity, health insurance, and debit and credit-card transactions. For instance US checking account holders are often uncertain at the point of sale whether or not a $35 overdraft fee will apply if they have not kept track of their bank balance and this could be addressed via balance alert regulation.

Obama describes the new bill-shock agreement as part of his Administration’s “ongoing efforts to protect American consumers by making sure financial transactions are fair, honest and transparent” (CTIA - The Wireless Association 2011). Holding pricing fixed, usage alerts should at least weakly benefit consumers as Obama assumes by giving them more information to make better choices. However, firms will change prices in response to new disclosure requirements and it is therefore worth asking whether the bill-shock agreement or similar bill-shock regulation in other contexts will help consumers or raise total welfare. This is the goal of two recent papers: Grubb (2015b) models the effects of consumer inattention and bill-shock regulation theoretically and Grubb and Osborne (2015) evaluates bill-shock regulation in the specific context of cellular phones via structural estimation and counterfactual simulation.

To understand the effect of bill-shock regulation one must understand the answer to a related question: Why do firms both charge penalty fees (so that high usage triggers high marginal charges) and make them a surprise by not alerting consumers when they cross the relevant threshold? In answering this question, I also shed light on contracts, such as frequent flyer programs, that offer loyalty discounts or rewards upon crossing a usage threshold.

---

6 Since 2010, American consumers must have opted-in to overdraft protection to be in this situation.

7 Prior to its agreement with the FCC, the wireless industry trade group CTIA opposed proposed bill-shock regulation on the grounds that it “violates carriers’ First Amendment protections. . . . against government compelled speech” (Altschul, Guttman-McCabe, and Josef 2011).
In Grubb (2015b) I model consumer consumption choices and firm pricing responses when consumers are inattentive to past consumption levels. I show that there are at least two reasons for firms to charge inattentive consumers surprise penalty fees for excessive usage: First, surprise penalty fees can be useful for exploiting consumers who naively expect to be attentive and softening competition. Second, when consumers are sophisticated about their own inattention, surprise penalty fees can be useful for price discriminating between consumers with different expectations about future usage. Thus either naivete about inattention or heterogeneity in consumer expectations at the time of contracting can explain firms’ use of surprise penalty fees as well as their resistance to regulation.

Whether firms’ use of surprise penalty fees is motivated by consumer naivete or price discrimination matters for the consequences of regulation. I first consider the case in which consumers naively fail to anticipate their own inattention. I show that consumer overconfidence, as imposed exogenously in Grubb (2009), arises endogenously from naivete about inattention when firms charge surprise penalty fees. Moreover, surprise penalty fees are an optimal way to exploit that overconfidence. In contrast, underconfidence arises endogenously from naivete about inattention when firms offer surprise loyalty discounts and loyalty discounts are an optimal way to exploit that underconfidence. As a result, firms should exploit naivete about inattention either with surprise penalty fees or surprise loyalty discounts. (Surprise penalty fees may be more robust to arbitrage by sophisticated consumers.) Moreover, bill-shock regulation renders naivete irrelevant, so that it cannot be exploited and marginal cost pricing is restored.

I next enrich the model to include both attentive and naively inattentive consumers. In this case, bill-shock regulation ends cross-subsidization of attentive consumers by naively inattentive consumers. It also eliminates the socially inefficient distortions inherent in choices made by attentive consumers to avoid penalty fees and collect loyalty discounts. Moreover, if attentive consumers are more price sensitive than the naively inattentive (which is reasonable if attentive consumers are those who have both the time to track their usage and the time to comparison shop) then bill-shock regulation can benefit all consumers by stiffening competition. This can happen because bill-shock regulation eliminates an adverse selection problem (similar to that studied by Ellison (2005)) whereby the segment most attracted by a price cut (the attentive) is also the least profitable.

Finally, I consider the case in which consumers are all aware of their own inattention but may have either a low or a high expectation about their future demand. A surprising result is that the

---

8 Liebman and Zeckhauser (2004) analyze optimal pricing for consumers who confuse average price with marginal price (ironing) and for consumers who myopically consider only the marginal price of the current unit (spotlighting). In contrast, I assume consumers make choices optimally conditional on their limited memory.
combination of surprise penalty fees and consumer inattention can be socially valuable (as well as privately valuable to firms) and benefit some consumers by reducing allocative distortions imposed by price discriminating firms. Moreover, this is always the case in fairly competitive markets. In the cellular context, firms clearly use packages of included gigabytes of data followed by overage charges for additional usage to price discriminate across low and high usage segments. The implication is therefore that implementing the recent bill-shock agreement will hurt some consumers and lower total welfare if the cellular services market is fairly competitive and consumers are aware of their own inattention.

The intuition for the result that bill-shock regulation can harm some consumers and lower total welfare follows in two parts. Part one of the intuition is the standard logic of price discrimination with standard consumers: Suppose that if a firm could practice third-degree price discrimination it would offer low-usage consumers a discounted markup via a discounted fixed fee. When consumers self select contracts the firm must ensure that high-usage consumers are not tempted to choose a contract with a discounted markup intended for low-usage consumers. Thus, to offer low-usage consumers a discounted markup and discounted fixed fee, some marginal prices must be raised above marginal cost on the discounted contract to encourage high-usage consumers to pay a higher markup and fixed fee. When consumers are attentive, this necessarily means that allocations will be distorted downwards inefficiently.

Part two of the intuition points out an important difference when consumers are inattentive: Price changes that keep expected marginal price equal to marginal cost remain efficient. For instance, assume marginal cost is five cents per minute and consider a contract that offers included minutes at zero marginal price followed by a surprise overage rate of fifty cents per minute. If consumers anticipate overages one in five months, then the expected marginal price is five cents and allocations are efficient. Nevertheless, this price structure can still encourage a higher-volume consumer (who would make an overage more than one in five months on the contract and hence face a higher expected marginal price) to pay a higher fixed fee and markup for a contract charging five cents per minute. Thus the combination of inattention and surprise penalty fees can allow firms to charge different markups without distorting allocations. Bill-shock regulation removes this option and forces firms to impose standard allocative distortions to price discriminate, thereby reducing total welfare. Because of this inefficiency, price discrimination is less profitable and firms will charge different customer groups more similar markups. This means raising markups for low-volume customers who are made worse off but lowering markups for high-volume consumers - the only group to benefit from the regulation. Nevertheless, consumer advocacy groups who do not take into account firms’ price response to the regulation would be expected to advocate for it strongly.
— since holding prices fixed all consumers would be made better off.

2.3 Cellular Service Demand: Biased Beliefs, Learning, and Bill Shock\textsuperscript{9}

As we discuss in Grubb and Osborne (2015), whether or not the recent bill-shock agreement will benefit consumers or be welfare improving depends on a number of factors and it is therefore an empirical question whether the regulation will be good or bad\textsuperscript{10} Now that the regulation has been implemented, it is possible that a study might directly measure its consequences. Matt and I began our investigation, however, as a predictive exercise in advance of implementation. In Grubb and Osborne (2015), we develop and estimate a dynamic model of calling plan choice and calling usage using the 2002-2004 panel of individuals’ phone bills introduced in Grubb (2009). Given our estimates, we are able to make counterfactual simulations of bill-shock regulation and consumer de-biasing. Our simulations account for how firms would adjust prices in the counterfactual scenarios. Importantly, as Grubb (2009) shows that firms’ pricing decisions are shaped by consumer over-confidence, it is important that we allow for biased beliefs in our model. To relax the rational expectations assumption, we must separately identify beliefs about demand for calls from observed calling patterns. To do so, we identify the distribution of consumers’ true demand for cellular calls from their actual usage. In addition, we identify consumers’ beliefs about their future demand from their calling plan choices\textsuperscript{11} The joint distribution of beliefs and realized demand determine whether beliefs are biased in the population.

We show that consumers are responsive to marginal prices (calling jumps at 9pm when off-peak hours begin) but do not adjust calling behavior throughout the billing cycle. Our explanation is that consumers are inattentive to their own past usage. (In months with many unused minutes, an attentive consumer would stop delaying calls until 9pm once it became clear that marginal price would be zero during peak as well as off-peak periods.) We therefore assume that consumers use a constant-threshold strategy, making all calls valued above a chosen level $v^*$\textsuperscript{12} This threshold is constant throughout the month because consumers do not keep track of past usage and hence cannot condition calling behavior on past usage. By following this approach, our’s is the first empirical model which can endogenously incorporate the information arrival due to usage alerts under a bill-shock regulation regime.


\textsuperscript{10}Jiang (2013) addresses the same question about bill-shock regulation but assumes consumers are unbiased.

\textsuperscript{11}Goettler and Clay (2011) measures consumer beliefs in a similar way in the online grocery-delivery market.

\textsuperscript{12}Grubb (2015b) shows that this is the optimal strategy for an inattentive consumer.
We find that consumers in our sample systematically choose overly risky plans (those plans that yield high average bills and a chance of a very large bill given underlying uncertainty about usage). While this choice pattern could be due to risk-loving preferences, we assume that consumers are risk neutral, and hence infer that they underestimate the risk that they face. In particular, we infer that consumers are strongly overconfident, underestimating the noise in their own forecasts of future tastes for calling by 62%. As a result, consumers undervalue the provision of bill-shock alerts because they underestimate the variance of their future consumption, and hence underestimated the likelihood of incurring an overage and benefiting from an alert.

Given our parameter estimates, counterfactual simulations predict the effect of bill-shock regulation had it been implemented at the start of our sample in 2002. Holding prices fixed, our simulations predict an annual increase in consumer welfare of $103 per consumer and an accompanying annual reduction in industry profits of $196 per consumer. There is no reason, however, to expect firms to maintain the same prices. We predict that firms would respond to bill-shock regulation by reducing overage rates, reducing included minute allowances, and raising fixed fees. In response, 2 percent of consumers terminate service and more than 25 percent switch to more expensive plans. As a result, firms maintain annual profits close to unregulated levels (rising by just $7 per person). However, annual total welfare falls by $26 per person and annual consumer surplus falls by $33 per person (or 4 percent of the average annual bill). This suggests that the long run effect of implementing the recent bill-shock agreement could be negative for consumers.

Many aspects of the cellular phone service market have changed since 2002, and hence the findings in the study must be treated with caution when extrapolating to policy effects today. For instance, in the 2002-2004 sample period, phones were used for talking and there were no data plans or data overages. Nevertheless, pricing changes since the bill-shock agreement went into effect have been consistent with predictions in two important respects. First, standard plans now all include unlimited talk and text, directionally consistent with the prediction that firms would lower overage rates. Second, despite losing overage fee revenue, average bills have been stable (CTIA - The Wireless Association 2013).

2.4 Overdraft Fees and Low Balance Alerts

My line of research on dynamic nonlinear pricing is ongoing. In particular, Matt Osborne and I are studying an analog of bill-shock alerts in retail banking — low balance alerts that can help checking account holders avoid unintentional overdraft fees. In 2013, US overdraft fees totalled $32 billion (Andriotis 2014) and evidence shows that individuals often incur overdraft fees because they are inattentive to account balances (Stango and Zinman 2009, 2014, Armstrong and Vickers 2012).
Our project is at a very early stage but we anticipate receiving valuable panel data on consumers’ banking transactions and low balance alerts from a personal finance software provider imminently. This firm helps consumers manage their finances, in part by scraping their bank account transaction account data nightly and sending low-balance e-mail alerts when low balances are found. (We are already in possession of a limited data set that is missing crucial fields such as end-of-day account balance, but are awaiting a revised “pull” from their database that should remedy such problems.)

We anticipate being able to observe overdraft incidence before and after an (arguably exogenous) date when selected individuals begin receiving low-balance alerts. We hope that measuring the change in overdraft incidence due to low-balance alerts will be the first step in evaluating the potential benefits of requiring banks to make low-balance alerts opt-out rather than opt-in, a policy we believe could have greater consumer benefits than the FCC’s bill-shock agreement. (In particular, there is reason to believe that the pass-through rate may be lower in retail banking than cellular phone service, and hence that banks will not make up all lost overdraft fee revenue by increasing other charges.) The Consumer Financial Protection Bureau (CFPB) is currently considering additional overdraft fee regulation to reign in the tens of billions of dollars spent on overdraft fees each year, and this policy option is one that the CFPB could consider.

An exciting aspect of the project is that the data provider has expressed openness to conducting surveys of individuals in the panel data or conducting field experiments. Field experiments could, for instance, vary alert thresholds or triggers in a way that is revealing both about optimal alert design and the underlying information constraint individuals face. Moreover, following Handel and Kolstad’s (2015) approach, we envision that survey data could usefully be combined with transaction data in any structural model we develop to predict the effects of an opt-out policy for low-balance alerts.

3 Behavioral industrial organization

My line of research on dynamic nonlinear pricing falls within the emerging literature on behavioral industrial organization. Recently, I have taken the opportunity presented by invitations for contributions to the Journal of Economic Perspectives and the Review of Industrial Organization to take a step back and consider the big picture encompassed by this larger literature. The result is a sequence of three review articles, two of which are published in Review of Industrial Organization

and a third which is forthcoming in the *Journal of Economic Perspectives*.

First, “Behavioral Consumers in Industrial Organization: An Overview” (*Review of Industrial Organization*, 2015) succinctly overviews three primary branches of the industrial organization literature with behavioral consumers. The literature is organized according to whether consumers: (1) have non-standard preferences, (2) are overconfident or otherwise biased such that they systematically misweight different dimensions of price and other product attributes, or (3) fail to choose the best price due to suboptimal search, confusion comparing prices, or excessive inertia.

Second, a forthcoming paper in the *Journal of Economic Perspectives* explains what we know about “Overconfident Consumers in the Marketplace”. General lessons are the following. First, firms introduce complicated pricing features to contracts in order to exploit consumer overconfidence and these pricing features are robust to competition. Second, the welfare consequences for firms and consumers depend importantly on whether overconfident consumers over or undervalue contracts, consumer heterogeneity, and market structure. Third, while overconfidence may harm consumers, consumer protection policy should be undertaken with caution. Even seemingly-innocuous nudges to improve consumer decision making may harm consumers when firms equilibrium responses are taken into account. Importantly, while the paper focuses on overconfidence, these lessons apply more generally whenever consumers misweight price elements or other product attributes. In other words, these lessons apply more generally to the entire second branch of work described in “Behavioral Consumers in Industrial Organization: An Overview”.

Many of the individual papers in this literature focus on the fine details of how overconfidence distorts consumption on the intensive margin by distorting marginal prices. At the same time, they make simplifying assumptions about market structure that imply full market coverage (all customers buy) and a pass-through rate of one. As a result, many papers ignore distortions on the extensive margin. A contribution in my review article is that I show how a simple supply and demand analysis can be used to evaluate consequences of overconfidence on equilibrium prices, quantities, and welfare, while incorporating effects on both intensive and extensive margins. This analysis relies on market properties such as the elasticity of demand and the pass-through rate but abstracts from the fine details of how overconfidence affects choices and hence is relevant to a wide variety of settings and models.

Finally, “Failing to Choose the Best Price: Theory, Evidence, and Policy” (*Review of Industrial Organization*, 2015) surveys the third branch of the IO literature with behavioral consumers. To choose the best price, a consumer must first search for prices, then select the lowest price among

---

14 The market pass-through rate measures the fraction of an infinitesimal increase in marginal cost that is passed on to consumers in higher prices. It is equal to 1 in a perfectly competitive market with perfectly elastic supply.
those found, and finally switch when prices change. The traditional explanation for consumers’ failure to choose the best price is that searching and switching are costly (Baye, Morgan, and Scholten, 2006; Farrell and Klemperer, 2007). Conditional on these costs, it is traditionally assumed that consumers’ searching and switching decisions are optimal, and that consumers will initially choose the lowest price discovered. Evidence suggests, however, that all three assumptions are overly optimistic: Consumers sometimes appear to search too little, exhibit confusion in their choices, and then show excessive inertia through too little switching away from past choices or default options. All three mistakes may contribute to positive markups that fail to diminish as the number of competing sellers increases.

There is a growing empirical literature documenting these consumer failings in the field. Moreover, there is a growing applied theory literature which attempts to model such flawed consumer decision making in conjunction with firms’ equilibrium responses through pricing or obfuscation. My survey paper is the first that attempts to start a conversation between these empirical and theoretical lines of research that have developed largely in isolation from each other.

4 Auctions for targeted online-display-advertising

As I teach my undergraduate students in my industrial organization course, auctions are a useful mechanism for setting prices when the seller is uncertain about buyer demand. They are now widespread in use for selling advertising space online - both via auctions for listings on search engine results pages for particular keywords and via auctions for display ads on other websites. Part of the tremendous growth and success of keyword advertising is undoubtedly its targeted nature - for instance advertising on the keyword “car insurance” is very likely to reach someone on the verge of purchasing car insurance. Milgrom and Weber’s (1982) linkage principle explains that this is good for seller revenues because an auctioneer typically benefits by releasing information (such as a keyword) publicly to all bidders. Increasingly, behavioral targeting via cookies is making display ads highly targeted as well. For instance, Zappos.com can bid more for a display ad on the New York Times to a web surfer that recently looked at shoes at Zappos.com. A critically important difference relative to keyword targeting is that the behavioral targeting information contained in cookies is brought to ad auctions privately by individual bidders rather than publicly disclosed to all. This introduces asymmetry both because in any given auction only a subset of bidders will have informative cookies and because popular websites like Amazon are more likely to be in the

---

15 This section describes research in Abraham, Athey, Babaioff, and Grubb (2014), “Peaches, Lemons, and Cookies: Designing Auction Markets with Dispersed Information”.
informed group. This asymmetry means that the effects of increased behavioral targeting are not well understood.

In the theoretical paper “Peaches, Lemons, and Cookies: Designing Auction Markets with Dispersed Information” (co-authored with Susan Athey who is at Stanford, Ittai Abraham who is at VMware Research Group, and Moshe Babaioff who is at Microsoft Research’s Mountain View, CA lab), we study the revenue effect of such asymmetric information in common-value second-price auctions. (Display ads are auctioned using second-price auctions and bidder values are correlated.) A challenge is that Nash equilibrium makes no revenue prediction for these auctions. It is well known that there exists a continuum of Nash equilibria in any second-price common-value auction, with average revenues ranging from zero to the object’s expected value. We introduce a new equilibrium refinement, tremble-robust equilibrium, which selects Nash equilibria nearby those of a perturbed game in which there is a small probability of an additional random bidder. Our first application is to auctions in which only one bidder receives an informative cookie. We find that the seller’s revenue is equal to the expected value of the object conditional on the informed bidder’s worst information. Thus if cookies identify especially good users, revenues may be close to first best, but if cookies can (even occasionally) be used to identify very poor users, revenue collapses relative to the case in which cookies are disallowed. This shows that first-price auctions would generate higher revenue and hence the extreme asymmetry reverses Milgrom and Weber’s (1982) revenue-ranking result with symmetric bidders.

In the rest of the paper we study the case where multiple bidders may be informed, providing additional characterizations of the impact of information structure on revenue. We characterize the unique tremble-robust equilibrium when there are multiple informed bidders and the information structure satisfies a strong high-signal property. In this setting we are able to show that the results about peaches and lemons generalize. Relaxing the strong high-signal property, we additionally characterize the unique tremble-robust equilibrium when two informed bidders receive binary signals and we are working on the characterization for continuous signals. Finally, we conclude by briefly considering richer market designs that ensure greater revenue for the auctioneer, for example by auctioning the right to participate in the mechanism.

Note: I have developed a relationship with The Rubicon Project (I am on their advisory board), a company which auctions over 4 billion display ad slots per day. As a result, I am learning a lot about the workings of these markets and will have access to data, so I anticipate future theoretical and empirical work in this area, including a new project currently in progress.
5 Strategic Communication and Reputation

In Grubb (2011), I revisit a classic question: When does it make sense to tell the truth, but not the whole truth? The seminal “unraveling” result is that when announcements are verifiable, communication is fully revealing [Milgrom 1981]. This is because, in equilibrium, buyers infer the worst whenever a seller withholds quality information, leading sellers to reveal everything but the very worst product information. In many situations, however, there is positive probability that disclosure is prohibited for exogenous reasons. This may be due to a lack of information, a value of keeping competitors in the dark, or other direct disclosure costs. Jung and Kwon (1988) and Shin (1994, 2003) show that in this case communication is only partially revealing and senders may strategically conceal bad news. In “Developing a Reputation for Reticence” (Journal of Economics & Management Strategy, 2011) I show that the credibility with which such nondisclosure is received depends on the likelihood receivers attach to exogenous causes of nondisclosure. Thus, when there is uncertainty about senders’ exogenous reticence, senders have an incentive to develop a reputation for reticence.

My model applies to a politician making disclosures to constituents, managers making disclosures to shareholders, or sellers making disclosures about quality to buyers. I show that sellers may withhold good news about an initial product’s quality in order to protect the credibility of future nondisclosures. The increased credibility achieved by concealing good news initially leads to reduced future disclosure. Moreover, sellers may withhold good news about a second product in order to protect the credibility of a prior nondisclosure. Thus, the desire to improve the credibility of both future and past nondisclosures may motivate the withholding of good news. In all cases, sellers are more likely to choose nondisclosure when the good news is only moderately better than market expectations, and more likely to disclose when good news is exceptionally better than market expectations. Nevertheless, in some situations, firms that receive disclosable information infrequently may initially conceal all news, however exceptional it may be.

References


