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CHOICE – WHAT CAN GO WRONG?

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ABSTRACT

The elegant economic picture of rational consumers achieving Pareto optimality through trade in decentralized self-organized markets is blurred by market imperfections and choices inconsistent with consumer self-interest. Behavioral economics has documented these errors in choice, and considered interventions that can mitigate harm to individuals from bad choices. This essay considers more broadly market distortions that arise when sellers design and market products to exploit consumer errors, and suggests market management policies to mitigate these distortions. I give examples in which consumers' lack of attention and diligence in collecting, filtering, and processing information has an outsized effect on market outcomes. I discuss identification and estimation of a two-stage model of decision-making, with attention determined in the first stage, and choice among alternatives described in the second stage. The stages in this model are linked by unobservable factors and identified by available information specific to each. I use this model to quantify the effects of inattention in a market for health insurance.

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1. Foundations. At the core of classical economic analysis are three fundamental propositions²:

- A. *Economic agents act in their self-interest.*
- B. *Trade advances self-interest by allowing agents to specialize and benefit from comparative advantage.*
- C. *Markets promote agent self-interest by enabling and regularizing trade.*

There is considerable anthropological and neurological evidence that trade indeed played a critical role in the evolution of human society.³ Trade outside familial groups requires sufficient mutual trust and empathy to find trading opportunities, and sufficient skills in communication and calculation to complete transactions. These requirements favored social species disposed to these traits, and selection on propensity to trade may explain the evolution of homo sapiens as the planet's dominant species. *We are wired to be self-interested traders in diverse societies.*

Under ideal conditions, economic agents in markets “vote with their feet” to choose goods and services of higher quality or lower cost. This provides the incentive for suppliers to operate efficiently, shift flexibly to satisfy demands, and innovate to more competitive products. Economists from Adam Smith, Frances Edgeworth, and Vilfredo Pareto to Oskar Lange, Tjalling Koopmans, and Leonid Hurwicz have described how self-interested trading in decentralized markets with common information arbitrages away “deadweight losses” and achieves efficient resource allocation. It is unnecessary under these ideal conditions to have a central authority to collect and process the information that centralized allocation requires.

² Omnibus terms such as “economic agent”, “self-interest”, “trade”, “comparative advantage”, and “market” span distinctions that can matter for assessment of choice behavior. For example, we think of economic agents as unitary decision-makers, but households and firms are typically “committees” with both shared and individual resources and goals. Self-interest is usually defined in terms of personal consumption or profit, but in reality encompasses the conduct, well-being, and approval of others and is jumbled by perceptions. Trade involves exchange of goods and services, but more generally is an experience conducted within a cultural and institutional framework that carries its own rewards. Comparative advantage is simple in concept, but complicated when risk, power, and incentives for innovation are considered. Markets are in abstract simple self-organized forums where economic agents gather to trade, but in reality are usually private or social organizations that compete for the business of economic agents by providing platforms, information, guardrails, and fulfillment services that facilitate trade. Markets can influence how commodities are defined and designed, and can be either public or gated with rules for admission. McFadden and Train (2023) discuss more extensively economic terminology and its relation to welfare analysis.

³ Humans are distinguished in various degrees from other animals by bipedalism, opposing thumbs, ability to form the sounds and concepts required for spoken language and counting, and ability to form large social groups that acquire and share common ideas and engage in trade of goods and services. Schulz (2022) cites Adam Smith (1776, I i) for a passage describing widespread trade as distinguishing humans from other species, and (motivating Darwin) attributing it to the co-evolution of trade and human capacities. See also Henrich et al (2004), Horan et. al. (2005), Ridley (2010), Bowles and Gintis (2011), Harari (2015).

A prerequisite for markets to allocate resources well is that consumers behave rationally in advancing their self-interest. Classical economists such as Jeremy Bentham and Francis Edgeworth considered rationality self-evident, with predetermined tastes and beliefs that are beyond challenge or modification, and include regard for others as well as self. Their attitude is nicely summed up in a quote from Frank Taussig (1912):

“An article can have no value unless it has utility. No one will give anything for an article unless it yield him satisfaction. Doubtless people are sometimes foolish, and buy things, as children do, to please a moment’s fancy; but at least they think at the moment that there is a wish to be gratified. Doubtless, too, people often buy things which, though yielding pleasure for the moment, or postponing pain, are in the end harmful. But here ... we must accept the consumer as the final judge. The fact that he is willing to give up something in order to procure an article proves once for all that for him it has utility – it fills a want.”

Consumer whimsey and myopia were thus recognized as idiosyncrasies that could affect individual well-being, but not flagged as traits that could interfere significantly with the functioning of markets. An underlying assumption was that consumers embracing freedom of choice were also responsible for their choices, *caveat emptor*, and consumers would learn from the sting of bad choices to make good choices.

2. Markets Can Break Down. Real world markets are not necessarily ideal. It has long been recognized that markets can break down or yield inefficient outcomes when ownership and control of a resource is poorly established (Pigou, 1920), information on product quality or price is asymmetric among market participants or costly to acquire (Akerlof, 1970; Diamond, 1971), contract enforcement is costly (Williamson, 1975; Hart and Holmström, 1987; Laffont and Martimort, 2002; MacLeod, 2007), reckoning can be delayed indefinitely (Magill and Quinzii, 1994), market prices can be manipulated because there are too few participants, some participants are too large, or participants collude (Tirole, 1992), or consumer choice exhibits systematic departures from rationality (McFadden, 1999, 2006). It is also understood that market efficiency does not guarantee, and may even be incompatible with, social norms for fairness and equity.

The political, administrative, and legal institutions of society shape markets, place social restrictions on trade, and influence market stability and sustainability. Many social goals are attainable without compromising the incentives that make decentralized market resource allocation

work, through the mechanisms of market regulation, legal guardrails and enforcement, management of the means of production, social incomes policy, and introduction of facilitating derivative markets (e.g., Coase, 1960). However, poorly designed and executed market interventions can severely distort trading opportunities and terms without successfully controlling socially undesirable trade. For example, the USA makes trade in dangerous recreational drugs illegal and restricts economic migration, but the result is that trade in these products is driven to unregulated underground markets that are even more dangerous. *Humans wired to trade also are wired to pursue trade advantage and evade and subvert society's trade restrictions.*

3. The Behavioral Challenge. The classical economists' view of rational consumers is challenged by findings from brain science, cognitive psychology, and behavioral economics, and by modern marketing practices tuned to consumers' vulnerabilities.⁴ The classical notion of utility does have a physiological analog: areas of the mid-brain around the amygdala contain a concentration of dopamine receptors whose stimulation produces the sensation of pleasure. However, beyond this, things get complicated.⁵ Humans exhibit *hedonic stasis* -- quick adaption to the status quo, and hypersensitivity to gains and losses from this state. Pleasure and pain are distinct and are attached to *experience* rather than to the goods or services associated with experience, to *process* rather than *outcome*. The brain is organized like a bureaucracy, with imperfect communication between separate centers for threat detection and assessment, pain avoidance, gains, losses, current experience, anticipated experience, risk, and information storage and retrieval. This brain wiring evolved selectively to help us detect and evade predators; but now it makes us susceptible to asymmetric loss aversion, ambiguity aversion, status quo bias, and present-bias that can affect how we fare in modern market environments.⁶

4. Information, Attention, and Perceptions. Many of the systematic departures from rationality found in cognitive experiments and markets are explained by how we collect, filter, store, retrieve, and process information to form perceptions. Our evolved capacity to react quickly to signals of threat or opportunity is poorly adapted to systematic and consistent processing of

⁴ For overviews, see Kahneman and Tversky (1984), McFadden (1999,2006,2014), Camerer et al (2004).

⁵ See, for example Glimcher et al (2009), Vartanian and Mandel (2011).

⁶ "Status quo bias" elevates perceived well-being from one's current state compared to alternative states. "Present bias" sharply discounts the future relative to the present, and is often described in terms of hyperbolic discounting of deferred gratification. These biases are documented in behavioral studies of impulse trading and inertia; see Kahneman et al (1999). Bernheim et al (2018), Dube and Rossi (2019).

large information flows. This gives sellers openings to select and spin the information they provide, and this challenges our ability to make market choices that maximize our self-interest. This is not news. “The Frogs”, a comic play by Aristophanes performed in 405BC, lamented the debasement of markets by fraudulent products designed to trap the unwary, and the analogous debasement of politicians and playwrights. Information asymmetries lead market participants to mistrust agents’ representations, and induce adverse selection and moral hazard. Establishing and policing standards for information disclosure by sellers and buyers, and fiduciary rules for market intermediaries (sales agents, brokers), is an age-old and continuing problem (Hart and Moore, 1988; Homström and Milgrom, 1991). What is newly prominent is *choice overload* (Chernev, Böckenholt, Goodman, 2015) -- the deluge of information facing consumers in the digital age, the replacement of accountable personal associates by digital influencers as curators of information, and the introduction of marketing tools that phish for consumer’s choice histories and cognitive fallibilities and use data tools like discrete choice analysis to design and promote products and trades that entice and ensnare consumers.

In this essay, I will concentrate on *limited attention* as a point of consumer vulnerability.⁷ The behavioral economist Herb Simon (1971) said that “*A wealth of information creates a poverty of attention*”. It is true that attention is a scarce resource, and as consumers we must pick the choice situations where we concentrate attention and do diligent preparation⁸, leaving the remainder to quick and casual choices based on defaults, experience, and advice from social networks. Inattention is not necessarily irrational; Simon (1955,2000) identified the allocation of scarce attention as a “boundedly rational” choice based on priors regarding payoffs to diligence. However even “boundedly rational” inattention creates vulnerabilities, and my corollary to Simon’s proposition is that “*A poverty of attention creates a wealth of opportunities for hacking choice.*”

⁷ Not all behavioral inconsistencies can be described as the result of inattention; some may come from more fundamental breakdowns of rationality such as failure of consumers to have well-defined preferences that are independent of situation and context. However, when inconsistencies between rational preference maximization and choice behavior are attributable to inattention in information retrieval, formation of perceptions, and the decision-making process, the critical economic concept of self-interested economic agents is preserved. Then, inattention in information gathering and processing is a good working hypothesis to explain anomalies in economic behavior unless and until there is persuasive evidence of more fundamental breakdowns in rationality.

⁸ Kahneman (2011) terms this “slow thinking”, and the alternative use of a casual or heuristic process “fast thinking”.

The economics profession's libertarian-leaning aphorism "*De gustibus non est disputatum*" discourages overregulation of trade, but has been less successful in guiding rules for disclosure, transparency, and honest dealing in markets to give consumers a reasonable chance to attend to and exercise due diligence in their choices. A challenging question of market management is how to balance protecting consumers from their own vulnerabilities while preserving freedom of choice and the incentives that good choices provide for efficiency and innovation. I will give you examples of modern marketing practices that can harm consumers and degrade market efficiency and are not effectively policed by traditional market regulation.

5. The Law of One Price. In markets characterized by symmetric information among participants and unrestricted opportunities for resale, arbitrage assures that identical products trade at the same price. In markets without this "*Law of One Price*" property, participants must engage in search and bargaining to find and execute good trades, and these frictions reduce efficiency; see for example Diamond (1971,1984). As the literature on financial markets shows, "noise traders" who fail to utilize available common information can undermine rational arbitrage.⁹ Salop and Stiglitz (1977) and Burdett and Judd (1983) show that with costly search, markets can exist in steady state with a dispersion of prices, particularly when search costs are heterogeneous in the population. What matters for the discussion here is that these equilibrium price distributions depend on consumer perceptions of search costs and benefits. If consumers' beliefs on search costs are biased upward, perhaps due to risk-aversion or present bias that gives "a bird in the hand" a status quo advantage over future opportunities, these consumers may terminate search prematurely even when the expected economic payoff to continuing is substantial. This lack of search diligence results in higher, more disperse prices, decreasing market efficiency.¹⁰ Sellers gain "temporary" market power by discouraging search. For example, sellers may offer discounts for impulse purchase, shroud added fees until they are revealed in the process of purchase, raise barriers to contingent or revokable trades, and warn of shortages and price increases as reasons to stop search. One common sales tactic is to offer to match or beat any documented alternative price. Ostensibly, this increases the incentive for further search, but many consumers interpret an offer to match as evidence that the price at hand cannot be beat and further search is pointless.

⁹ See Shleifer (2000), Tetlock (2006).

¹⁰ The consumer becomes more vulnerable to misperceptions when the distribution of prices is unknown, and they must infer the expected gain to future search from past offers and advice.

If you have recently purchased an airline ticket, hotel room, or rental car, you may have had the experience that when you return to complete your booking after a preliminary search, the price has increased. Your search history acquired by the booking agency allows them to predict your willingness to pay (WTP) and reprice the product in response. This both breaks the law of one price and penalizes you for leaving a search history trail, raising search cost and reducing market efficiency. In the terminology of Pigou (1920), these sellers are practicing third-degree price discrimination.¹¹ Price discrimination in this form is fully efficient *if* every consumer with WTP exceeding marginal cost is a buyer, although its impact on equity is extreme, with sellers capturing all market surplus and consumers with high WTP experiencing the greatest loss relative to a one-price market equilibrium. In practice, seller restrictions to stop consumers from impersonating those with lower WTP and to prevent arbitrage by resale interfere with efficient trade.

Firms cannot forecast WTP precisely, and with imperfect discrimination consumers buy only if their true WTP exceeds their offered price. This can more than offset the gains of low WTP consumers allowed into the market by price discrimination. For example, suppose a monopoly seller with zero marginal cost uses demographics or search history to identify two consumer segments, A and B. Segment A contains N_1 consumers with WTP w_1 and N_2 consumer with WTP w_2 . Segment B contains N_3 consumers with WTP w_3 . Suppose $w_1 > w_3 > w_2$. Profit is increasing in prices other than at demand jumps, so that the only candidates for profit maximization are $(p_A, p_B) = (w_1, w_1)$, (w_2, w_2) , or (w_3, w_3) , and with discrimination allowed, (w_1, w_3) or (w_2, w_3) .

	(p_A, p_B)	Demand	Profit	Consumer Surplus (CS)	Total Surplus (TS = Profit + CS)
1	(w_1, w_1)	N_1	$w_1 N_1$	0	$w_1 N_1$
2	(w_2, w_2)	$N_1 + N_2 + N_3$	$w_2(N_1 + N_2 + N_3)$	$(w_1 - w_2)N_1 + (w_3 - w_2)N_3$	$w_1 N_1 + w_2 N_2 + w_3 N_3$
3	(w_3, w_3)	$N_1 + N_3$	$w_3(N_1 + N_3)$	$(w_1 - w_3)N_1$	$w_1 N_1 + w_3 N_3$
4	(w_1, w_3)	$N_1 + N_3$	$w_1 N_1 + w_3 N_3$	0	$w_1 N_1 + w_3 N_3$
5	(w_2, w_3)	$N_1 + N_2 + N_3$	$w_2(N_1 + N_2) + w_3 N_3$	$(w_1 - w_2)N_1$	$w_1 N_1 + w_2 N_2 + w_3 N_3$

The table above gives demand, profit, consumer surplus (CS), and total surplus (TS) for each price configuration. The profit-maximizing row among rows 1-3 determines the one-price market equilibrium, and the profit-maximizing row among rows 4-5 determines the equilibrium when discrimination is allowed. For row 1 to be the single-price profit maximum requires

¹¹ See also Varian (1985).

$(w_1 - w_2)N_1 > w_2(N_2 + N_3)$, implying $(w_1 - w_2)N_1 > w_2N_2$, and for row 5 to be more profitable than row 4 is $w_2N_2 > (w_1 - w_2)N_1$. These conditions are inconsistent, so that the combination of one-price row 1 and discrimination row 5 is ruled out. However, all other combinations of a one-price row from 1-3 and a discrimination row from 4-5 are possible, with the property that discrimination is more efficient for the combination of rows 3 and 5 or the combination of rows 1 and 4, one-price is more efficient for the combinations of rows 2 and 4, the combination of rows 2 and 5 is equally and fully efficient, and the combination of rows 3 and 4 is equally but not fully efficient. For $w_1 = 10$, $w_2 = 4$ and $w_3 = 5$, the table below gives values of N_1 , N_2 , and N_3 that yield each of these cases, showing that imperfect third-degree price discrimination can be either better or worse for market efficiency than a one-price equilibrium.

N_1	N_2	N_3	One-price Equilibrium	Discrim. Equilibrium	One-price TS	Discrim. TS
42	50	8	Row 1	Row 4	600	550
25	25	50	Row 2	Row 4	560	560
20	40	40	Row 2	Row 5	560	560
20	5	75	Row 3	Row 4	575	575
5	20	75	Row 3	Row 5	425	230

Modifying this example by introducing marginal cost that varies with consumers (e.g., due to variation in cost of servicing the product), permitting sellers to vary product features (with accompanying costs) across segments in addition to or instead of prices, or considering rival suppliers, allows examination of the effects on market equilibrium and welfare of adverse selection, discrimination by social segment in underwriting, product positioning, and redlining, and rules governing discrimination across social segments.

6. Subscriptions. A few decades ago, subscriptions were mainly limited to magazines, and renewing a subscription required attention and positive action. In our digital age, the business model of selling by subscription with automatic renewal has become widespread. The service might be an internet dating site, music or entertainment streaming, or an arrangement that keeps your printer supplied with ink. The subscription is offered initially at a low introductory rate, or even as a free trial, with statements like “Automatic renewal at the regular rate”, and “You have the option of cancelling at any time”. What can go wrong with this offer, and why should you be alert? First, even though you may technically be able to cancel at any time, this may be

burdensome to do, particularly if the seller does not make it easy to retrieve information on the transaction. Second, the “regular rate” to which the subscription reverts after the introductory period is often shrouded. If the increase in subscription cost is not evident enough to trigger your attention, you may fail to cancel even if you would not choose the service at the full price. The way the subscription offer is structured, and the shrouding of its less desirable attributes, are not accidental – they are a profitable exploitation of your inattention.

7. Focal Pricing. There is an observation in marketing that consumer demands surge at specific monetary price trigger points, termed *focal prices*, with the implication that products should be designed to be sold at these prices. Figure 1 shows for example the distribution of the cents portion of U.S. dollar prices for typical branded products sold in discrete units and considered reasonably close substitutes in their respective markets – toothpaste, aspirin, acetaminophen, anti-acid remedies, chess sets, and digital games for PC’s. Prices \$x.99 are clearly focal, although prices in the range \$x.94 to \$x.98 also occur more frequently than expected with a uniform distribution.¹²

Figure 1. Distribution of the Cents Portion of Prices for Common Products

Range of Cents		Observed Percent					
	Expected Percent	Tooth-paste	Aspirin	Aceta-minophen	Anti-Acids	Chess Sets	Digital Games for PCs
\$x.00	1%	4.7%	8.7%	2.2%	6.8%	15.9%	11.3%
\$x.01 to \$x.48	48%	18.6%	17.4%	40.0%	17.6%	5.1%	5.7%
\$x.49 or \$x.50	2%	9.3%	4.4%	8.9%	10.8%	5.8%	2.3%
\$x.51 to \$x.93	42%	16.3%	8.7%	8.9%	16.2%	8.0%	10.2%
\$x.94 to \$x.98	5%	24.4%	39.1%	8.9%	24.3%	18.1%	29.9%
\$x.99	1%	26.7%	21.7%	28.9%	24.3%	47.1%	40.7%
\$x.y9 and y < 9	9%	10.5%	8.7%	15.6%	12.2%	5.5%	7.3%
Number products		86	23	45	52	138	177

Source: Amazon on-line store, first price displayed for each listed brand, 12/28/2022 to 2/16/2023.

¹² The term “focal” is commonly used to refer to any price level or range that occurs substantially more frequently than expected if prices were distributed uniformly. To make this definition scientifically useful, criteria for classifying price points as focal and distinguishing these points from noise need to be justified by relating them to agent behavior that is systematic across a broad range of products and market organizations.

If all consumers are fully-attentive and neoclassically rational, there should be no demand surges at monetary price points like \$x.99. Suppose each consumer faces the choice of buying one unit of a product or going without. With little loss of generality, each consumer's well-being is characterized by a conditional indirect utility function $V(I - dp, d)$, where I is income and p is the product price, denominated in U.S. cents for a fixed level of the CPI, and $d = 1$ if the consumer acquires a unit of the product, $d = 0$ otherwise. The consumer will buy the product if $V(I - p, 1) > V(I, 0)$. This utility function will in general be smoothly increasing in I , and for products whose unit price is small relative to income will be correspondingly smoothly decreasing and approximately linear in p . There is no “money illusion” in this theory, so market equilibrium product prices should have distributions that do not have major peaks at specific monetary units.

The empirical evidence in Figure 1 appears inconsistent with full-attention neoclassical consumer rationality. What are the root causes of focal pricing, and what do these factors imply for market outcomes and consumer well-being? One possibility raised in the literature is that focal prices are chance coordination points in market games, like “sunspots”, untied to consumer behavior; see Crawford (2008), Sitzia and Zheng (2019). Another literature suggests that focal points like \$x.99 in Figure 1 originate from consumer inattention to the cents portion of prices (dollar-focus), causing demand to surge when the dollar digits in monetary prices drop from \$(x+1),00 to \$x.99; see Basu (2006), Hackl et al. (2014), Strulov-Shlain (2021).

Consider an oligopoly with $k = \{1, \dots, K\}$ firms, each selling discrete units of a branded product in competition with rivals selling similar products. Suppose seller k has a constant marginal cost mc_k and a price p_k for its product, with $p_0 = 0$ for no purchase. Suppose these sellers face a population of N consumers in which each potential buyer has a (money-metric) conditional indirect utility function for a unit of product k , $V(I - d_k p_k, d_k, \varepsilon_k) \equiv I - d_k \left(p_k + \frac{A}{B} \right) + \varepsilon_k / B$, where d_k is a choice indicator, A and B are parameters with $B > 0$, and the ε_k are independently EV1 distributed taste disturbances with $\text{Prob}(\varepsilon \leq x) = e^{-e^{-x}}$. Suppose the products are mutually exclusive so the consumer maximizes conditional utility by buying at most one unit of one of the products. Then the sum of the choice indicators is zero or one. If all consumers are perfectly attentive, the share of the population buying product k is $s_k = e^{-A-Bp_k} / (1 + \sum_{j=1}^K e^{-A-Bp_j})$, a

multinomial logit model, and $Q_k = N s_k$. The expected maximum indirect utility per consumer in this case, given optimal choice, is

$$u = \mathbf{E}_\varepsilon \max_{j=0,1,\dots,K} \left(I - \left(p_j + \frac{A}{B} \right) + \frac{\varepsilon_j}{B} \right) \equiv I + \frac{1}{B} \log \left(1 + \sum_{j=1}^K e^{-A-Bp_j} \right).$$

Consider a policy comparison of a default “as-is” state (“ai”) and an alternative or “but-for” state (“bf”), with prices p_j^{ai} and p_j^{bf} in these states. Let $w_j = (p_j^{ai} - p_j^{bf})/p_j^{ai}$ denote the proportional change between states in the price of product j . The population net gain in utility $\Delta U = N \Delta u$ in moving from the as-is to the but-for state is

$$\begin{aligned} \Delta U &= \frac{N}{B} \log \left(\frac{1 + \sum_{j=1}^K e^{-A-Bp_j^{bf}}}{1 + \sum_{j=1}^K e^{-A-Bp_j^{ai}}} \right) \\ &\approx \sum_{j=1}^K w_j p_j^{ai} Q_j^{ai} + \frac{B}{2} \sum_{j=1}^K w_j p_j^{ai} Q_j^{ai} \{ p_j^{ai} w_j - \sum_{i=1}^K s_i^{ai} p_i^{ai} w_i \}, \end{aligned}$$

with the last approximation obtained by a second-order Taylor’s expansion around “as-is” prices. The leading term $\sum_{k=1}^K w_k p_k^{ai} Q_k^{ai}$ in this approximation, termed the *overcharge*, is widely used in policy and legal applications as a measure of the (net) gain to buyers in moving from the as-is to the but-for state. The last term in the approximation incorporates the (net) gain to as-is non-buyers who become but-for buyers, and is typically positive in applications where supplier misconduct has inflated prices.¹³

Now suppose a share θ_{99} of the population is partially attentive and dollar-focused; i.e., these consumers ignore the difference between prices \$x.yz and \$x.99. Let $f(p, m) = m \cdot \text{floor}(\frac{p}{m})$, where m is an integer and the floor function returns the largest integer that is less than or equal to its argument. Define $D(\mathbf{p}, m) = 1 + \sum_{j=1}^K e^{-A-B \cdot f(p_j, m)}$, where $\mathbf{p} = (p_1, \dots, p_K)$. Demand for product k is then

$$Q_k = N \left\{ \frac{(1-\theta_{99})e^{-A-B \cdot f(p_k, 1)}}{D(\mathbf{p}, 1)} + \frac{\theta_{99}e^{-A-B \cdot f(p_k, 100)}}{D(\mathbf{p}, 100)} \right\}.$$

¹³ The indirect utility function, the multinomial choice probabilities that come from random utility maximization, and the Roy’s identity mapping from expected maximum utility to demand are all standard results from discrete choice theory; see for example Ben-Akiva and Lerman (1985), McFadden (1973,2014), Train (1986).

Suppose that each firm chooses a price in integer cents to maximize its profit, given its rivals' prices. A Nash Equilibrium (NE) is characterized by a price vector $\mathbf{p}$ in which each seller's price maximizes its profit conditioned on the prices of its rivals. For example, suppose demand parameters $A = 2$, $B = 0.04$, and $N = 100$ million households. Suppose $K = 100$ products. Suppose seller k has marginal cost $99 + k$ cents, so these marginal costs are distributed evenly between 100 cents and 199 cents. Figure 2 gives the average of the NE prices across this market for full-attention and inattention cases.

Figure 2. Nash Equilibrium with Consumer Inattention

Attention Case	Sales-weighted Average NE Price	Market Sales (millions)	Share NE of form \$1.99
Full Attention: $\theta_{99} = 0\%$	\$1.745	2.232	1%
Inattention: $\theta_{99} = 1\%$	\$1.760	2.255	27%
Inattention: $\theta_{99} = 3\%$	\$1.806	2.324	52%

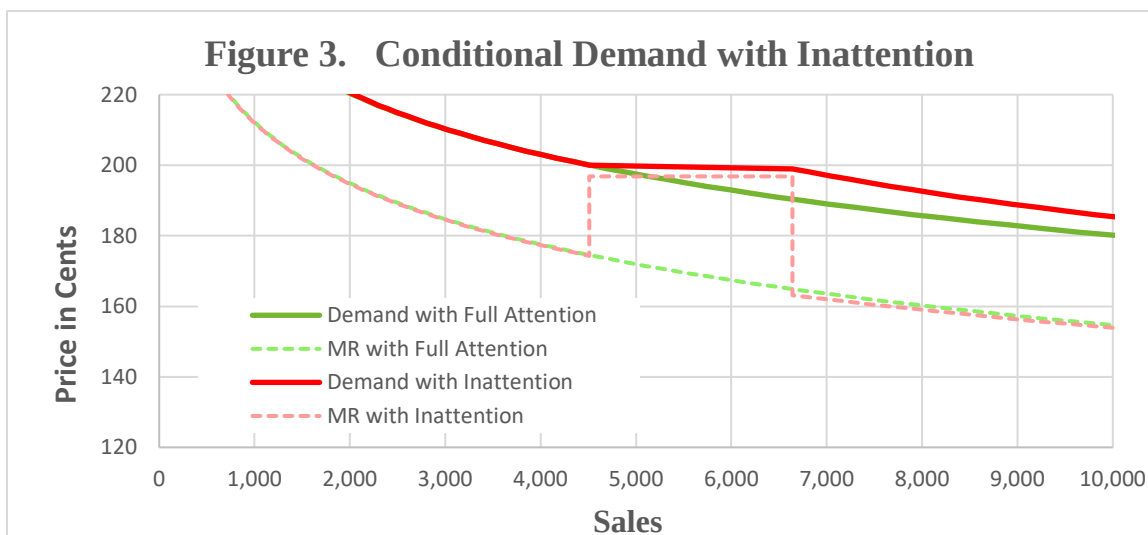
The range of marginal costs in the example is selected so that Nash equilibrium prices bracket a price of \$1.99. These NE prices range from \$1.25 to \$2.26, so the expected share of products priced at \$1.99 when prices are evenly distributed is about 1%. Small departures from full-attention rationality in price perception, here 1% to 3% of the population that is dollar-focused, is sufficient to make \$1.99 focal, with a 27% to 52% share of the NE product prices. Further, comparing the inattention to the full-attention Nash equilibria, the \$1.99 focal price is an "attractor", pulling up prices of products that in the full attention case are below \$1.99, and pulling down prices of products that are above \$1.99.¹⁴ The presence of dollar-focused consumers has little effect in this example on average market price or overall demand, thus little effect on the well-being of the full-attention buyers in the population, but the presence of a focal price obviously has a negative effect on the well-being of the approximately 23 thousand dollar-focused buyers who would not have bought had they been paying attention.¹⁵ One numerical example is far short

¹⁴ For example, the product with marginal cost \$1.57 is priced at \$1.82 in the full-attention case and \$1.90 in the 1% dollar-focused case, while the product with marginal cost \$1.87 is priced at \$2.12 and \$1.99 in these respective cases.

¹⁵ A feature of this market with $K = 100$ is that no product has a share greater than 4%. As a result, the demand for product k is close to $Ne^{-A-B \cdot p_k}[1 - \theta_{99}(1 - e^{-B \cdot (f(p_k, 100) - p_k})]$, independently of the pricing of rivals. Then Nash equilibria are close to the equilibria achieved in Chamberlin monopolistic competition where each firm prices in isolation to maximize its local monopoly profit given this approximate demand.

of a theorem, but the example suggests that even a little consumer inattention to price can lead to pricing patterns like those in Figure 1.

Figure 3 shows why a small share of dollar-focused consumers can have a large effect on a market. This figure gives, in red, the conditional demand curve facing a firm and its associated marginal revenue curve when the prices of 99 symmetric rivals are at 199 cents, and $\theta_{99} = 1\%$. For comparison, the figure gives, in green, the conditional demand curve with full attention, and its associated marginal revenue (MR) curve. The partial attention demand curve surges at \$1.99, and at this surge, marginal revenue jumps up to almost the focal price. Then, for a substantial range of marginal costs, the profit-maximizing Nash response of this firm will be at the \$1.99 price where marginal revenue is falling and crosses marginal cost.



The presumption in regulatory and legal settings is that economic agents act in their perceived self-interest as characterized and quantified by neoclassical economic theory. This presumption is challenged when inattentive consumers through their influence on pricing alter both the level and distribution of harm arising from seller misconduct, not only for themselves but also for their attentive colleagues. For example, in the oligopoly example considered above, suppose that in violation of anti-trust law, the firms agree collusively to a price floor of \$1.99. The market average price is higher as a result, first because the prices of products below \$1.99 obviously increase, and second because the reduced rivalry allows increases in the prices of products that absent collusion were just above \$1.99. These effects are present in both the full-attention and inattention cases.

Figure 4. Overcharge from a Collusive Price Floor of \$1.99

Attention Case	As-Is Collusive Average Price ^a	But-For Oligopoly Average Price ^a	As-Is Sales	Over-charge ^b (millions)	Share of Products with Positive Overcharge
Full Attention: $\theta_{99} = 0\%$	\$2.023	\$1.745	425,765	\$12.71	75%
Inattention: $\theta_{99} = 1\%$	\$2.011	\$1.760	622,291	\$16.29	63%
Inattention: $\theta_{99} = 3\%$	\$2.005	\$1.806	1,006,802	\$20.23	42%

^a Average prices are sales-weighted.

^bThe population but-for less as-is money-metric utility gain, assuming consumers are assigned their maximum attainable utility in each scenario even if inattention would make this maximum unachievable, is \$45.77 million in the full-attention case, \$41.36 million in the 1% inattention case, and \$33.31 million in the 3% inattention case. These exceed the overcharges primarily because they include harm to as-is non-buyers who would have been buyers under but-for conditions.

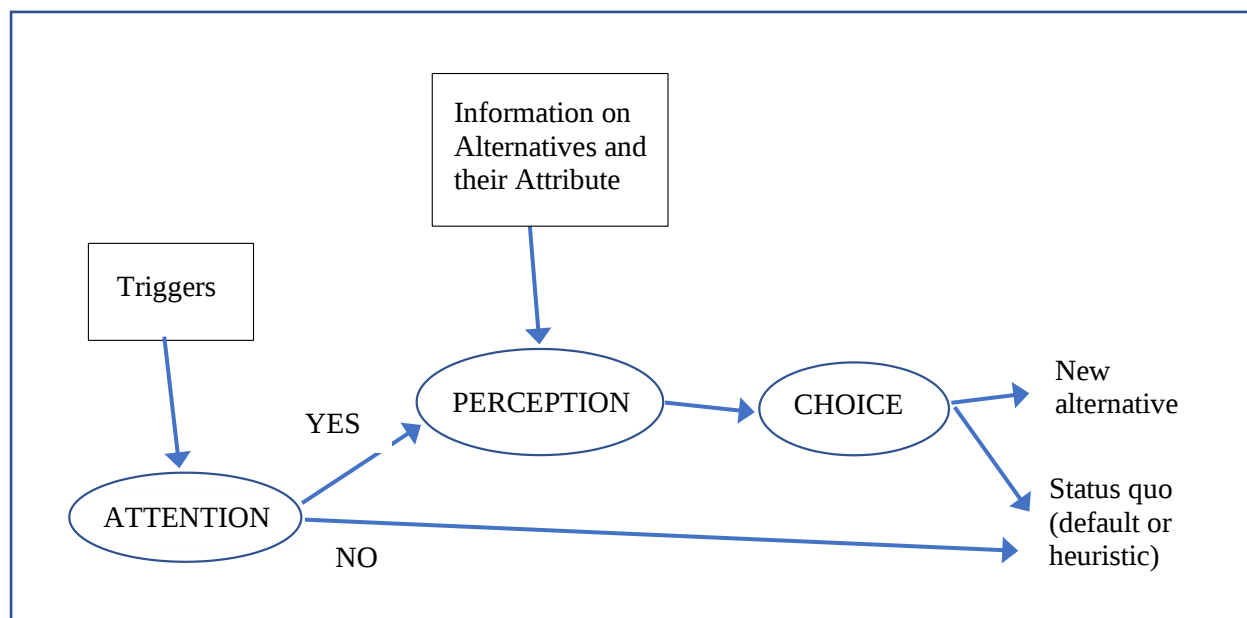
Figure 4 summarizes these effects. The overall harm from collusion as measured by the overcharge is modest, but the distribution of harm by product is more uneven in the inattention case, with a larger share of products calculated to have caused no harm because they maintain the “sticky” \$1.99 price. The example shows that inattention can induce focal prices that affect substantially the market impact of supplier behavior on individual consumers.

A common form of economic organization of a market for branded products are *consignment stores* that facilitate search among products by posting prices set by suppliers and/or by processing transactions, and charge suppliers commissions for their services. An example is the Amazon Store used to obtain the price data in Figure 1; another is a travel booking agency like Expedia. Suppose the conduct of a consignment store crosses a traditional anti-trust “red line”, say by refusing to deal with suppliers who attempt to sell through rival stores or sell direct to consumers, or requiring “most-favored-nation” clauses in contracts with suppliers. In the terminology of class action litigation, consignment store conduct is a “common effect”, but a tendency for suppliers to set prices at focal points can influence the distribution of the harm it causes consumers, as in the Figure 4 example. Are the impacts of focal pricing effects on distribution of harm sufficient to require individualized inquiry on the pricing behavior of each supplier, or is it sufficient for the determination of common effects to ignore consumer inattention? The burden of individualized inquiry on supplier pricing behavior behind the consignment store on the far side of the market would make most anti-trust challenges to consignment store conduct impractical. Then, a ruling requiring individualized inquiry would substantially chill such litigation and give consignment

stores latitude for conduct that would traditionally violate anti-trust law. Expanding the currently thin theory and empirical evidence on focal pricing would clearly be helpful to the legal community in ruling on this question.

8. Modeling Inattentive Choice. Persistence of price dispersion and imperfect discrimination in markets with costly search, inertia in managing subscriptions, and focal pricing are all examples where consumer inattention invites seller response that compromises market efficiency. Attention is time-consuming and requires individuals to allocate their time budgets between decision-making and other activities such as work, leisure, eating, and sleeping. In this essay, inattention will be treated as a result of possibly irrational or boundedly rational time allocation. In future research, it may be useful to think of attention as an input to household production that requires effort and focus as well as time, particularly when it involves collecting information on and forming perceptions of alternatives, or bargaining for purchases. This labor can be performed with varying degrees of efficiency. Thus, an hour spent deciding whether to buy a toaster, and if so what model, may be used asking random acquaintances whether they are satisfied with the toasters they have, or perusing online reviews of model attributes and prices at different retailers. One of these attention activities may be more productive or less risky than the other.

Figure 5. The Consumer Decision-Making Process



Inattention is defined in recent literature as an element in decision-making¹⁶, at one extreme evidenced in eye movement or click-stream data (Orquin & Loose, 2013; Wiehler et al, 2022) and at the other extreme evidenced in broad economic outcomes (Guo, Skinner, Zeldes, 2022). Xavier Gabaix (2019) depicts inattention as partial rather than full adjustment from a heuristic choice (e.g., default) toward a “rational” choice (the most desirable alternative uncovered by diligent information retrieval and processing). His model can also be interpreted as depicting a heterogeneous population made up of a share who are perfectly attentive and rational, and a remaining share who are completely inattentive and heuristic, as illustrated in Figure 5, a population in which each consumer is inattentive for some share of transactions, or a mixture of both. In this interpretation, consumer are first triggered to pay attention and recognize that there is a choice to make, or if triggers are absent, left to a default or heuristic alternative such as allowing a subscription to renew without reviewing its utility. Second, attentive consumers collect and filter information on alternatives, and form perceptions of the prices and features of purchase alternatives. Third, these consumers process these perceptions, and the expression of their tastes and needs, and determine their perceived best choices. Inattention in this model leads the consumer to fail to collect or to ignore information that is available but difficult to interpret or process, or to weigh information in a manner that leads to unstable or biased perceptions, such as giving excess weight to the status quo, or prior beliefs, or alternately to recent experience or advice. Inattention may also degrade the process of preference maximization, for example by truncating search activities or limiting the scope of product attributes considered; e.g., dollar-focused attention to price. There may be hidden factors such as alertness, opportunity cost of time, and decision-making experience and acuity that influence all these stages. As described, consumers may at each stage exhibit systematic biases and vulnerabilities that leave them open to manipulation and exploitation. Salience and representativeness effects, inertia, procrastination, satisficing, and sub-optimal outcomes are all well-documented in behavioral economics¹⁷ and attributable to some form of “inattention”; see Benhabib et al (2008), Rustichini et al (2021). Critically, marketers are acutely aware of these limitations, and quite a few behavioral experiments are in fact motivated by empirical observation of marketing practice.

¹⁶ See Bodalo, Gennaioli, Shleifer, (2020); Lim (2022).

¹⁷ See Camerer et al (2004), Bernheim et al (2018), Dube and Rossi (2019).

Neither the partial adjustment or the attention-step interpretations of the Gabaix model capture the full details of physiological or psychological characterizations of attention based on process (e.g, the allocation of time to the home production activity of collecting and filtering information, and to the input of effort that determines diligence and precision in evaluating alternatives), but Gabaix’s setup is nevertheless an excellent starting point for quantifying inattention and its effects.

10. Medicare Part D plan switching. Many of the choices we make, like subscriptions, just roll over when left unattended. Our mobile phones, residential locations, occupations, employers, spouses, cars, diets, and wardrobes stay with us as defaults unless we are triggered to pay attention, evaluate our options, and consider switches. It is obviously too time-consuming (and psychologically draining) to regularly reconsider every long-term arrangement in our lives – we have to choose the situations where we focus our attention. However, we may spend too little time managing our continuing arrangements, missing significant opportunities to improve our situations. We may postpone difficult or ambiguous decisions and spend too much time on absorbing but inconsequential ones. For example, we may spend hours picking out the right ear buds, a matter of at most a few hundred euros, but less time deciding on the sound system in our new car where thousands of euros are at stake but our future experience is difficult to anticipate. Unfortunately for us, sellers are well aware that our inattention induces inertia in responding to increases in price or decreases in quality, and they design their products and processing to avoid or divert our attention. Understanding how we allocate attention, and how we can regulate markets to reduce deceptive marketing, is an important arena for research and economic market policy.

An example of a market with high consumer inertia is Medicare Part D in the USA. This is an administered gated market offering qualified prescription drug insurance policies from qualified sellers to qualified seniors. Enrollees have a yearly option to choose from about 50 plans that differ in premiums, deductibles, and formulary. They are reenrolled in their current plan if they do not actively choose to switch. The government provides an internet resource, *Plan Finder*, that gives the annual out-of-pocket costs, premiums and copayments, for each available plan when a consumer inputs their current or anticipated prescriptions.¹⁸

¹⁸ Plan Finder requires the user to pre-specify acceptable pharmacies and does not consider branded drugs that are therapeutic substitutes, and as a result can fail to identify some lower-cost alternatives.

11. A Gabaix model of inattention and plan choice. Together with Florian Heiss, Joachim Winter, Amalie Wupperman, and Bo Zhou, I have studied inattention by following the plan switching behavior of about 12 million Medicare enrollees over the years 2007-10; see Heiss et al. (2021).¹⁹ Only about 10% of currently enrolled beneficiaries switch plans each year, despite significant changes in individual circumstances and in the prices, features, and formularies of the offered plans.²⁰ This switching rate reflects substantial inertia, attributable to some combination of high switching costs and inattention. For prescription drug insurance, the question is whether market interventions to lower switching costs or raise attention are desirable to increase the well-being of elderly consumers, to reduce the cost to government from its subsidy of about 70% of this insurance, and to incentivize insurers to compete more aggressively on plan features and prices.

We initially tried a model for inattention very much like the structure proposed by Gabaix, with attention and plan choice stages and heterogeneous consumers as in Figure 2. If a consumer is inattentive, choice defaults to the previous plan. If she is attentive, then we assume that plan attributes are evaluated with information taken from Plan Finder, and she chooses an optimal least-cost plan, with some random error arising from idiosyncratic preferences or limited diligence. A similar modelling approach has been used by Ho, Hogan, and Morton (2017) and Abaluck and Adams-Prassl (2021), and there is a larger literature that considers a single-stage choice process with switching costs.²¹

We isolate attention and plan choice stages of the overall decision process by observing that when deciding whether to give the plan renewal problem your attention, you have information such as current health status and announced changes in your current plan that may trigger your attention, but before you pay attention, you do not have information on costs and attributes of new plans. If you do pay attention, and investigate the attributes of plan alternatives, this is then what is relevant, and the attention triggers are redundant. These conditions then specify omitted variables that permit econometric identification. In addition, there are some “natural experiments” in which current plans go out of operation, and the consumer is forced to pay attention because no

¹⁹ Data on more recent years are now being analyzed.

²⁰ This turnover rate is incidentally about the same as the annual turnover rate for mobile phone service providers and the automobile replacement rate in the USA, and somewhat higher than the 7% turnover rate for owner-occupied houses.

²¹ See Heiss et al (2010), Abaluck and Gruber (2011), Handel and Kolstad (2015), Bundorf et al (2019).

default is possible. Our empirical findings using this model contained some counterintuitive oddities, and this led us to consider a somewhat more complex model that accounted for an additional dimension of consumer heterogeneity.

12. Unobserved Acuity. We introduce a latent factor that is heterogeneous in the population and influences both the probability of paying attention and the degree of achieving the “rational” least cost alternative when paying attention. This gives the two stages a hidden Markov process structure. The model remains econometrically identified, although maximum likelihood estimation is computationally intensive. What we find in this market is that 67% of people extend their current plan by default without paying attention, and among the 33% who do pay attention, 67% choose after deliberation to stay with their current plan. Given the availability of Plan Finder, it is straightforward for consumers to obtain relatively complete and relevant information on the attributes of the alternatives they face. Not all of the consumers attending to a plan choice consult Plan Finder, but at least 60 percent do.²²

The unobserved personal characteristic that we call “acuity” influences both the probability of paying attention and the probability of choosing the wisest plan. We interpret acuity as decision-making ability, but it may also reflect opportunity cost, as it is lowest for low-income and advanced-age individuals, but also low for high-income individuals who are more likely to be time-constrained than income-constrained. Overall, we find that the costs of inattention are substantial, about 20% higher costs for prescription drugs than necessary. For low-income seniors, overspending equals about 10% of income. Switching costs are about 5-10% of annual prescription drug out-of-pocket costs, significant but plausible, and much lower than estimates that try to explain inertia by switching costs alone. We conclude that policies that increase attention, such as (1) messaging consumers that they have a choice and giving them individualized cost information on alternative plans, (2) making the Plan Finder alternative with minimum out-of-pocket cost their default rather than their current plan, requiring at minimum enough attention to override this default, or (3) establishing “reference pricing” in which out-of-pocket costs are increased for plans whose overall cost to the government exceed the Plan Finder minimum, would

²² Surveys report that about 20% of enrollees consult Plan Finder each year, although more may acquire the same information through agents, implying that 20%/33% or more of those paying attention have access to the information this tool provides.

substantially increase enrollee well-being and reduce government cost, although low-acuity individuals may be “noisy” decision-makers when they are induced to pay attention.

13. Consequences and Remedies. What are the consequences of vulnerabilities in choice behavior for consumer well-being, for market operation, and for market policy? What remedies are available for negative consequences, and what behavior and market effects require further study? This essay has given examples where mistakes in choice behavior harm the decision-maker, but beyond this induce market responses that reduce the efficiency of market resource allocation, harming all consumers. A common factor in most of these cases is inattention, causing consumers to skip some of the information collection and systematic processing tasks required for diligent choice. In the modern digital world, it has become much easier to access large volumes of information. The paradox is that this increases choice overload and pressure on the time we allocate to attention, with the result that we have become more vulnerable to biased or misrepresented information.

What remedies are appropriate? First, consider what individuals should do in their own self-interest to reduce the risk of bad choices. Mind your inattention! Be aware of how your decisions affect your well-being. Think about and systematically review the automatic decisions in your lives, and give each at least occasional attention. Be careful where you find information, and filter it for accuracy and relevance. Use friends and trusted sources in your social networks for advice and recommendations, but pick your sources carefully and remember that their tastes may not be your tastes and they may themselves not be evaluating alternatives diligently. Monitor your perceptions. Are they realistic? Be skeptical of offers that promise immediate payoffs or appear to be bargains, but may have shrouded attributes that are inconsistent with expectations.

For market regulation and management to reduce the risks of decision-making, it is first important to keep in mind that intervention in markets carries its own risks. Intervention can suppress innovations and technical progress, and reduce the flexibility markets need to respond to changing needs and tastes of consumers. There is no bright line between the aggressive sales tactics that promote and reward innovation and those that hack choice, and regulations need to be cautious in labeling sales methods as inappropriate. For example, it is in consumers’ interest to provide some information to sellers, including selected search history, that enables these sellers to

offer attractive products and prices. Further, regulators and managers are human too, with their own flaws, and there is always the problem of regulating the regulators. This said, it is sensible to have markets organized with clear trading rules and penalties for misconduct, just as sports contests work better for participants and observers when there are clear rules for play and effective, even-handed enforcement.

Society uses its political, administrative, and legal institutions to monitor markets, and establish rules and mechanisms for enforcement. Historically, these represent a mixture of precedent, common sense, and respect for the sovereignty and responsibility of firms and consumers. For example, product liability law combines the idea that economic agents act in their own self-interest and are responsible for their mistakes with the idea that guardrails are needed to promote transparency and control misrepresentation and fraud. Enforcing sensible guardrails for seller actions in the presence of the range of consumer vulnerabilities described in this essay may require a rebalancing of these ideas, particularly as regards rules for communicating information and liability for market outcomes that originate from seller conduct but are exacerbated by inattentive consumer behavior.

Ideally, fake product information and endorsements should be exposed and penalized. Suppliers should be required to post accurate price and product information in standard, understandable, publicly available formats. Aggressive sales tactics, such as “bait-and-switch” and contracts with shrouded and delayed costs and exceptions, should be constrained by market rules that allow “cooling off” and require transparency. In the end, it will always be critical for consumers to look after their own interests, so their choices drive markets to efficient allocations, but designers of economic markets should structure markets and trading rules so that diligence is rewarded and inertia induced by inattention is mitigated. Critically, consumers, markets, and government regulators all age and become brittle over time, and marketers will always continue to probe for vulnerabilities, so that designers of consumer information systems, market institutions, and regulations need to continually refresh themselves and remain flexible and attentive.

Finally, the subject of consumer departures from rationality and full attention, market consequences, and remedies for negative consequences all invite future research. Irrationalities appear complex, but they are systematic and are substantially associated with how we allocate time

to process information and form perceptions. This can and should be studied and quantified. Neoclassical and behavioral consumer theory and industrial organization are traditionally separate fields in economics; e.g., the careful consideration of firm conduct in industrial organization is often accompanied by simplistic models of passive consumer behavior, while consumer economics is often conducted assuming market opportunities are fixed and passive. A major emphasis of this essay is that both consumers and suppliers are active market participants, affecting the nature of commodities and the way they are packaged, represented, and advertised. The efficacy of market-based resource allocation depends not only on the conduct of agents on both sides of markets, but also on how the conduct of one influences the conduct of the other. With a firm understanding of how consumers behave, and how providers exploit their vulnerabilities, economists would be in a better position to design and assess the efficacy of remedies for market failures.

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