Does Information Change Behavior?

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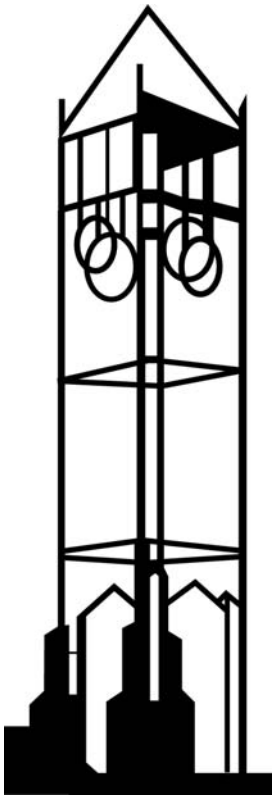

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Abstract: This paper reviews and synthesizes the theory of information economics and empirical evidence on how information changes the behavior of consumers, households and firms. I show that consumers respond to new information in food experiments but perhaps not in retirement account management. Some seeming perverse consumer/investor decision making may be a result of a complex decision with a low expected payoff.

Key Words: information economics, consumer behavior, behavioral economics, moral hazard, adverse selection.

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In developed countries there is a steady stream of new consumer goods and services. The adoption or use of these new goods and inputs can, but need not in all cases, increase consumer welfare. An issue is whether economic agents consistently respond in a rational way to new information about these goods and services. Early economics largely assumed that information was abundant or perfect, and it has only been during the last half century that economists have taken a more careful look at the economics of information and how it affects outcomes (Stiglitz 2000). The recognition that information is imperfect, that obtaining information can be costly, and that asymmetries of information exists has profound implications for the actions of firms and households. Early research in this area assumed that economic agents respond rationally (Stigler 1960; Hirshlifer and Riley 1992) so that if more information became available, it would improve welfare. However, some recent work in behavioral economics has cast doubt about the rational use of information, at least for some decisions (Tversky and Kahneman 1974, 1981, 1991; Choi et al. 2006). One important dimension of information is whether it is public or symmetric, i.e., generally available to all agents at minimum costs, or private or asymmetric, i.e., some agents have more information than others and this rises the possibility that these agents use their superior information to affect outcomes in their favor (Molho 1997). Third-party verifiable information can sometimes be used to induce agents with private information to be more revealing about the information that they have (Milgrom and Roberts 1986).

The objective of this paper is to review and synthesize the theory of information economics and empirical evidence on how information changes the behavior of consumers, households and firms. I first review the foundations of the economics of information. Then, I review experimental and other evidence on how consumers' prior beliefs and diverse information affect decisions on new food products and retirement saving accounts. Consumers regularly purchase food but they infrequently make retirement saving account decisions, and both may have long–term consequences. A related issue is how the

education of decision makers affects their decision making, and whether education and information are enough to empower decision makers to make "good" decisions. I show that consumers respond to new information in food experiments but perhaps not in retirement account management. Some seeming perverse consumer/investor decision making may be a result of a complex decision with a low expected payoff.

The Foundations of the Economics of Information

Economists before the middle of the 20th century were sometimes aware of information issues in their models of household, firm and government behavior, but they modeled problems as if information was perfect. A key advance has been to realize that essentially two types of information exist—public and private information. Public, or symmetric, information is in essence available to everyone but it might be free, or more likely costly to obtain. Private information is information that is only privately known—hence, asymmetric—, and it may be in the hands and under the control of informed and interested parties who may choose to use it strategically, i.e., to increase their welfare relative to welfare of others. Hence, the recent recognition that information is imperfect, that obtaining information is costly, and that important information asymmetries sometimes exist and affect agents' behavior has had a profound effect on understanding otherwise puzzling phenomena (Stiglitz 2000).

With information being imperfect, the uniformed agents can easily make bad decisions, but they may be unaware of the information problem that they face. Hence, what they don't know can clearly hurt them in real world decision making. Stigler (1961) was the first to treat the economics of information of decision makers as a search process guided by the application of basic economic principles. He argued that individuals and firms would equate the marginal benefits of acquiring additional information to the marginal costs, thereby tracing out a demand curve for information. He, in particular, showed how the calculation could be done, but did not focus on the implications for market clearing prices.

Related to Stigler' research, McNulty and Huffman (1996) have shown that the market equilibrium price would be affected by the actions of decision makers acquiring optional amounts of information. They consider a competitive industry in which there is both stochastic demand and a production lag for a single commodity. All agents observe costless endogenous information (regular market clearing prices), and some agents are informed and observe additional costly exogenous information. The solution for market equilibrium prices is shown to depend on demand shocks and the private information set of decision makers. When agents have disparate information, they show that it is important to specify how price information is transmitted from the informed to the uninformed agents. The paper provides a precise expression that relates the signal that the uninformed agents can infer from market prices to the demand shock, the informed agents' expectation of the demand shock, and the number of informed agents. They provide the surprising result that market prices can become either more informative (representing a positive externality) or less informative (a negative externality) as the number of informed agents increases. They show that positive externalities are much more common when the predictable component of the demand shock is generated by a moving average process than when it is generated by an autoregressive process. They also show that irrespective of whether information externality is positive or negative, some agents will most likely remain uninformed.

Akerlof (1970) was the first to show that asymmetric information, as quality uncertainty about a commodity, can cause the market to degenerate into one consisting of only low-quality commodities. The underlying information asymmetry can be described as follows. An owner of a used car is better informed about its quality that a potential buyer; the used car for sale might be a "lemon." The quality of used cars is private information, and this can lead to adverse selection—uncertain car quality before the sale. Since "poor" and "good" used cars may look approximately alike to potential buyers, the poor and good quality cars will clear the market at the same price. However, the larger is the share of poor quality cars on the market, the lower the market clearing price of used cars. Under these circumstances it may become difficult to sell a good used car at a fair price. As better and good used cars are withdrawn from

the market, the market clearing prices for used cars will continue to decline. The consequence will be either a market consisting only of poor used cars (lemons), or no used car market will exist at all. The adverse effects of asymmetric information in these situations gives rise to "adverse selection" and an inefficient market equilibria. Adverse selection arises when the informed individual's (e.g., the seller of a used car) trading decisions depend on her privately held information in a manner that adversely affects uninformed market participants (e.g., buyers of used cars), i.e., asymmetric information exists between two parties prior to contracting. See Mas-Colell et al. 1995, pp. 436-437.

However, not all is lost because potential buyers of products with quality uncertainty can invest (in verification, certification, or search) to obtain more information. For example, private mechanics exist, who for a fee, can provide a relatively accurate assessment of the quality of a used car. Thus, quality uncertainty creates a demand for a new type of information—private assessments of a particular used car's quality. Since the mechanic is paid by the potential buyer, he has an incentive to deliver the type of information that is useful to otherwise uninformed potential buyers. Moreover, publications like *Consumers' Report* have added new sections that provide ratings of the "average quality" or reliability and economy of used cars by model and brand over the model years 1999-2008 derived from information obtained from owners of these cars. For example, among small cars, the Honda Civic and Toyota Corolla are ranked among the best quality in the most recent Consumers' Report, and the Chrysler Pacifica and Pontiac Aztex are rated among the worst in used cars (Consumers Union 2009). This model-brand-year specific information is now available at a low cost to consumers. Hence, new institutions have arisen to resolve some types of information problems.

Owners of assets that possess uncertain quality might also try to "signal" potential buyers about their unobservable quality by taking observable actions. Signaling does not seem to be important in the used car market, but may occur in the market for other goods, including the market for skilled workers. Potential employers face uncertainty about the skills of prospective employees. Individual's might obtain more education and engage in extracurricular activities to build a larger curriculum vita to signal

to prospective employers their pre-existing superior ability. Given that acquiring education and participating in extracurricular activities are costly activities, those individuals with more ability are expected to more easily and at lower cost complete degrees and build vitae. Hence, the signaling device can successfully separate prospective workers into "high" and "low" ability types. However, note that this signally view of campus activities ignores the human capital building activity of higher education, where workers with more human capital are more productive and earn more.[1]

Likewise, uninformed parties may develop mechanisms for distinguishing, or *screening*, informed individuals who have differing information. For example, car insurance companies regularly offer a variety of policies: one policy with no (or very low) deductible (if loss) with a high premium to purchasers. Alternatively, the company may offer another policy with a large deducible and a low premium. Consumers can then select the policy that they most prefer. The "voluntary *self-selection* of drivers" will result in high-ability (low expected loss) drivers choosing the policy with a large deductible and low premium, and the low-ability (poor) drivers selecting the low deductible and high premium insurance policy. In this way the insurance company constructs a mechanism to induce drivers to reveal private information about their driving ability and a diversity of policies increases consumer welfare relative to the situation where the insurance company provides only one policy for all.

Moreover, insurance companies may use the accident-rate history of a driver as a *signal* of his future driving ability, giving low accident-rate drivers lower future policy premiums. This is likely to be efficient, given accurate public reporting of prior accidents, because it is much less costly for high-ability drivers to produce a good driving record with few accidents than for a low quality driver. However, these records would need to be conditioned on the type of environment in which driving occurs, e.g., high density urban driving versus low density small town and interstate highway driving.

[1] Huffman has provided strong empirical evidence in favor of the human capital dimension of farmers' schooling. Farmers are interesting because they are self-employed or their own employer. Huffman (1974), Rahm and Huffman (1984) and Huffman and Mercier (1991) have shown that farmers with more education respond faster to relative input price reductions in corn production, adoption of minimum tillage soil conserving practices on cash grain farms and micro-computer adoption in the early 1980s, when desk-top computers first became generally available.

Thus, *signaling* and *screening* are two mechanisms for dealing with asymmetric information prior to contracting, and in many cases, they result in a welfare improving outcome (Mas-Colell 1995).

Asymmetric information may also arise after contracting, i.e., the agent changes his or her behavior as a result of a contract, but this private information is unavailable to the principal. This type of asymmetric information, sometimes referred to as *hidden action/information or moral hazard problems*, develops subsequent to a contract, and it is the origin of so-called principal-agent problems (Mas-Colell et al. 1995). These problems are prevalent in situations in which one individual (the principal) hires another individual (the agent) to take some action for him. One example is from the insurance industry. An individual purchases car insurance, but because he now has car insurance, he drives less carefully unbeknownst to the insurance company. This type of asymmetric information is quite detrimental to contracting in a one-time contract, but if there is a long-term relationship between the principal and agent, the efficiency of this contracting relationship improves dramatically because future insurance policy premium can be determined by the individual's past driving record.

In another example, an owner of a firm may hire a manager to operate the firm. However, the owner may be unable to monitor the amount of effort that the manager puts into the job. The owner has two primary instruments at his disposal to deal with this problem. In some cases, *monitoring* is effective, e.g., if the production process is nonstochastic, then the owner can infer manager's effort from firm output. In many situations, production or profit is stochastic, and then this option is not available to managers. Owners, however, have an additional instrument—*incentive pay*. With incentive pay, i.e., the manager receiving a share of the firms profit (in addition to a wage), the manager has an incentive to carry out the owner's objective without monitoring. However, one potential problem with incentive pay under stochastic production/profits is that part of the owner's risk is transferred to the manager, and the higher is the profit-sharing rate, the larger is the manger's risk. A risk-averse manager would not be indifferent to this outcome, but it remains a second-best solution for managers to deal with hidden action/moral hazard. For example, Huffman and Just (2000) have applied principal-agent theory to

derive optimal incentive pay for scientists who differ in ability, risk preferences, cost of effort, and reservation utility when the payoff is described as the "best" of agents' output rather than total output. In this problem, asymmetric information exists on scientists effort, output is stochastic, and contracts cannot be enforced by a third party—a type of contractibility. The optimal incentive contract is linear, a guarantee plus share of output, contract and no monitoring is involved, because it is ineffective.

In information economies, where the acquisition of information is costly but reproduction of information is approximately costless, discontinuities abound (Stiglitz 2000). Many observations are of discrete actions, e.g., choice of insurance policy A or B, and on the basis of this purchase, beliefs change discontinuously. Given discontinuous changes in behavior, market equilibrium might not exist as in a separating equilibrium because the cost of achieving separation is greater than the benefits. Moreover, when information is imperfect or markets incomplete, which almost always occurs, competitive markets are not constrained Pareto efficient (Stiglitz 2000). Taking into account the costs of improving information or creating markets, some individuals could be made better off without making anyone else worse off. The main reason is that actions give rise to externalities. Unlike the pecuniary externalities in full-competitive- equilibrium models, these affect the efficiency of markets. For example, in insurance markets with moral hazard, if individuals undertake risky actions that are not monitorable, their premium will over time be increased. It is in no ones' interest to expend the effort to reduce the risk of accidents, but government intervention might be used to create new incentives for drivers to exert greater driving care and improve welfare.

Related to the growing awareness of the important role of information economics in individual and market outcomes, Grossman and Stiglitz (1976, 1980) showed that if information is costly, there must be an *equilibrium amount of disequilibrium*. That is, persistent discrepancies between prices and fundamental values, and they provide the incentives for individuals to obtain costly information (Stigler 1960). In additiona, markets in which there is imperfect information might not clear, e.g., labor markets,

credit markets. Slight imperfections of costly information have been shown to dramatically alter market outcomes (Stiglitz 2000).

Does New Information Change Consumer/Household Behavior?

An issue is whether economic agents consistently respond in a rational way to new information about goods and services that they purchases or might purchase. I focus on empirical evidence for two types of consumer/investor decisions—the purchase of new food products and the investment in retirement saving plans. These are decisions that differ in frequency and complexity.

GM Foods and Information Effects. If all information regarding new products is public, consumers can search out this information and make informed decisions (Stigler 1961; Hirshleifer and Riley 1992), but the available information is typically incomplete and may be asymmetric. That is, some effects of the new commodity/technology on consumers and the environment are either unknown or only privately known (private information) by nonconsumers. With private information, the informed and interested parties frequently have an incentive to use their private information strategically to (Akerlof 1970, Mohol 1997), for example, to affect market conditions in their favor.

Foods made using bioengineering, often referred to as genetically modified (GM) foods, are examples of new goods that have as close substitutes similar conventional foods. However, these new GM foods are produced from plants where farmers used new agricultural technologies about which consumers might have positive or negative preferences. These new raw materials contain transgenes—genes that have been moved across species using the gene-splicing technology of Cohen and Boyer (Cohen et al. 1973, Huffman and Evenson 2006, p. 167-175). For example, genes from soil bacteria have been inserted into commercial corn and cotton varieties to create insect resistance to a particular destructive class of insects. The new herbicide-tolerant and insect-resistant genes have been inserted into commercial corn, canola, cotton and soybean varieties, and when adopted by farmers, their expected production costs are reduced. Soybeans and corn and canola are important U.S. sources of vegetable oil,

corn is source of sweetener, and corn and soybeans are significant sources of livestock feed. Cotton is a major fiber crop. This new technology did not create new foods that yield direct benefits to consumers, although they have reduced market prices of these commodities.

The early GM crop varieties were developed and marketed principally by two large chemical companies; Monsanto and Syngenta. As has been the case in U.S. agriculture for at least six decades, these companies have extensively advertised the positive benefits of their products in an attempt to raise firm profits. However, these companies have private information about GM crops that arise from laboratory, field and marketing research, and they may use this private information selectively or strategically to expand the size of the market for GM crops. A frequent story is that these new GM crop varieties enhance environmental quality, increase food availability, and reduce world hunger (Council for Biotechnology Information 2001). In contrast, environmental NGOs, including Greenpeace and Friends-of-the-Earth, have countered by asserting that foods made from GM plant materials harm human health by introducing new allergens (e.g., " Frankenfoods," Greenpeace 2003), harm the environment by possibly out-crossing with native species, reducing genetic diversity, prevent farmers from saving their own seed for future plantings, or give excessive market power to multinational companies (Greenpeace 2001a, b, c, Friends-of-the-Earth 2003). Such diverse and conflicting information leads to potential confusion among consumers (and possibly to others). Similarly, public officials are faced with a situation of information asymmetry and may not be able to discern optimal policies for GM crop varieties and GM foods, or their short- and long-run welfare effects (Hausman 2003).

In principle, society can avoid losses due to strategic behaviors of interested parties toward new technologies and products if decision makers can access independent, third-party or *verifiable information* (Milgrom and Roberts 1986, Huffman and Tegene 2002). Third-party, verifiable information provides an objective assessment of a new technology or of new products made from raw materials that use the new technology. For example, for GM foods there is the likely scientific impact of

the GM technology, its human impact, its environmental impact and its financial impact (Rousu et al. 2007).

Recent research by Rousu et al. (2007) used new advances in experimental auction markets but also incorporated concepts from statistical experimental design, e.g., randomization, and survey methods to test the hypothesis that information contained in food labels and in information treatment, constructed from information for interested and disinterested parties, affect consumers' willingness to pay for foods that are made from products containing GM for input traits. Their results showed that foods that are labeled as GM are discounted by an average of 15 percent relative to a plain labeled similar product.

The perspectives of interested parties, another type of information, are consequential in an auction market setting; pro-biotech information representing the views of the biotech industry and injected into the experiment has a significant effect of reducing bid-price differences between plain and GM-labeled product. In contrast, anti-biotech information distributed by environmental NGOs has significantly positive effects, increasing the size of bid prices differences for food that might be genetically modified. However, neither type of private information is dominant. The pro-biotech information and third-party verifiable information were shown to have similar impacts on willingness to pay for GM foods. Hence, third-party, verifiable information has a significant effect of reducing bid price differences when participants have not received pro-biotech information. Furthermore, they showed that objective, third-party, verifiable information has its greatest impact, and hence greatest potential value, when environmental NGOs are disseminating information that is quite negative about the new technology. Although the third-party information has small expected value from changing a consumers' behavior in these experiments, the expected value across all U.S. consumers of food is relatively large (Rousu et al. 2007).

If consumers place heavy weight on information from interested parties, including cheap talk, their welfare will be lower than if they use objective information (Akerloft 1970, Molhol 1997, Morris and Shin 2002). One hypothesis is that consumers who have uninformed priors are more easily swayed,

as reflected in their bidding behavior, by information from one or more interested parties, but consumers who have informed priors are relatively unaffected (Schultz 1975, Huffman 2001, Tversky and Kahneman 1981, Kahneman 2003). Another hypothesis is that the presence of third-party information affects the way that consumers use information from interested parties in placing bids.

Results presented by Huffman et al. (2007) showed that a consumer's prior beliefs and new information (both from interested and disinterested sources) affect bidding behavior of people who participated in an experimental auction market for food items that might be genetically modified. The results contradict findings of Viscusi (1997) and Tversky and Kahneman (1974, 1992), who argued that people frequently ignore base rates. One potential explanation for this difference of outcome is that instead of measuring prior beliefs as objective knowledge (e.g., monetary lotteries), they asked lab participants to give them information prior beliefs about genetic modification. They asked participants: "How informed are you about genetic modification?" and the participants were given five options: extremely well informed, well informed, somewhat informed, not very informed, or not informed at all. This information is subjective, and they used it as a representation of Bayesian prior beliefs. Furthermore, when the probiotech, antibiotech and third-party GM information were injected a session, the participants had an opportunity to update their prior beliefs as in Bayesian learning. Huffman et al. (2007) then examined the effect of participants' prior beliefs and new information on willingness to pay for three types of GM foods available in grocery stores and supermarkets, and not a lottery.

The results of Rousu et al. (2007) and Huffman et al. (2007) have implications for information policies. Both skeptics and proponents of new technologies (i.e., interested parties) might try to manage information to achieve private objectives. This is most likely to occur in a situation where much is unknown scientifically about the new technologies or where third-party information is limited or unavailable (Milgrom and Roberts 1986, Huffman and Tegene 2002). Their results suggest that opponents to a new technology may try to target people who are relatively uninformed about the technology. Proponents of the technology may try to target people who have informative prior beliefs

for maximum effectiveness. This reasoning might explain why the Council for Biotechnology Education (a pro-GM organization) funds TV commercials during family and sports programming but the anti-GM groups invest in carrying out dramatic and spectacular shows of opposition for new technologies, (e.g., with colorful, vocal demonstrations), which may be carried by a variety of media outlets. People who are uninformed seem less likely to regularly use common media sources.

A related topic is whether consumers' education affects their decisions in a market where information from interested and disinterested parties have been injected. Colson et al. (2009) have reported on a new set of experiments of consumers' willingness to pay for fresh vegetables that are bioengineered to have product-enhanced consumer attributes of high antioxidants and vitamin C. As in the earlier GM food experiments, food labels and information treatments are shown to impact bidding behavior. However, if the products do not contain product-enhanced consumer attributes, consumers' education does not affect bids under various food-label types. However, when the fresh vegetables contain enhanced levels of antioxidants and vitamin C, the consumers who have more education are willing to pay significantly more for products where the attributes were introduced using bioengineering and genes orginated from within species. The latter GM method yields crop varieties that are most similar to those obtained from conventional plant breeding. When the attributes are introduced by generic GM or transgenic GM (from cross species transfers of genes), consumers education does not significant affect willingness to pay. Hence, consumers' education matters for decisions on products that are created by relatively sophisticated technologies and that may benefit human health.

In summary, consumers have been shown to respond as expected to information presented by food labels and information treatments generated using information from interested and disinterested parties. These experiments, however, were performed on food products, an area where consumers frequently make decisions and possess a large amount of information gained from past experience. Moreover, the outcomes of these food experiments/purchases do not have large welfare consequences for any particular consumer or household.

Retirement Accounts and Information Effects. For some time, psychologists have argued that there is more to decision making than meets the eye of an economically rational individual. For example, Kahneman and Tversky (1979) wrote a paper on how decision makers handle uncertain rewards and risks. They showed that a decision is frequently made on the way that alternatives were framed and not based on the actual value of the option. In particular, they showed that *framing* alternatives differently actually changes people's preferences regarding risky outcomes. However, decision making under uncertainty is a relatively complex decisions. There are at least two states of the world, say A and B, that occur with some probability, and these event may unfold over time, e.g., a decision maker can have A today or B next week. This has been alleged to lead to unusual inter-temporal discounting, for example, Laibson suggests that there is a fundamental tension in humans and other animals between seizing available rewards now and being patient for rewards in the future. Moreover, he alleged that people want instant gratification right now and want to be patient in the future. Broadly speaking, individuals seen to act irrationally in that they overly discount the future. However, this could mean that individuals have different rates of time preference over time—being low for near term and high for later periods. A failure to recognize that inter-temporal discount rates can differ could lead to an erroneous impression that individuals are discounting the future in an inconsistent way.[2] This line of research is part of behavioral economics and finance which incorporates psychology and economics into decision theory in an attempt to better explain human behavior (Kahneman and Tversky 1975, Kahneman 2003). This line of work incorporates scientific research on human, social, cognitive and emotional factors into the decisions of consumers, employees, borrowers, and investors.

[2] Consider two projects, A and B, both have costs C today and A yields a positive net benefit in one year of R_1 and B yields a return in two years of $R_2 = R_1$. The one period discount rates are $r_1 < r_2$, then the net present value of the first option today is: $NPV_{0A} = - C_0 + R_1/(1 + r_1)$ and of the second option is $NPV_{0B} = - C_0 + R_2/[(1 + r_1)(1 + r_2)]$. Now Project A will always be preferred to project B. There are two reasons. First, the benefits of project B are farther in the future and must be discounted for two rather than one period to convert them into current period units, and second, the one period discount rate r_2 is larger than r_1. If r_2 is much larger than r_1, project B would have much lower value than project A. There, however, is no inconsistency in the choice among these projects.

For example, consider the situation where an employer provides retirement benefits to their employees. Plan A is a defined-benefit retirement saving plan and Plan B is a defined- contribution saving plan. Under a defined-benefit program, employee benefits are determined by a formula, similar to Social Security, usually linked to a worker's compensation, age, and tenure to the size of retirement benefits. Benefits are usually paid out as a life annuity at retirement, or in the case of a married individuals as a joint-and-survivor annuity (Beshears et al. 2006). Under this plan, most of the risk is on the employer and little risk on the employee.

Defined-contribution plans come in several different varieties. The most common one, the 401(k), is named after the section of the U.S. tax code that regulates these types of plans. The typical plan allows employees to make elective pre-tax contributions to an account over which the employee retains investment control. Many employers also provide matching contributions up to a certain level of the employee's contribution, for example 1-to-1. The retirement income from a plan depends on how much the employee elects to save per period of employment, how long they work for the employer, how generous is the employer's match, how they choose to allocate their portfolio among asset types and the performance over time of assets in the portfolio. At retirement, benefits are usually paid in a lump-sum distribution, but an employee in some cases can purchase an annuity. Relative to a traditional defined-benefit pension plan, defined-contribution plans impose substantially more risk on the worker while reducing the risk on the employer.

Beshears et al. (2006) claim that employees' decision to participation in defined-contribution plans are largely determined by "default options." If the default is that the employee must take action to sign-up, then sign-up rates after three months of tenure are about 60 percent (and after 24 months is about 75 percent). In contrast, if the default option is that the individual is automatically signed up by the firm (at the time of employment or shortly thereafter), 97 percent of new employees are participating after 3 months of job tenure. However, there are some costs to the employee; they must make a contribution now to retirement saving in order to obtain the employer's match, and it is well known that

significant transactions cost are associated with managing many small retirement savings accounts. Hence, employees who do not expect to work very long for an employer, for example, young workers, and workers who receive low wage rates would see little expected payoff to such a retirement plan. In contrast, high-wage workers who expect long-term employment will see much greater expected pay. Furthermore, it is relatively difficult to make good retirement investment decision, including managing asset allocation. This has been made clear by the performance of the stock market over the past year. All individuals who were invested in equities took a one-year roughly 40 percent decline in their retirement accounts, whether they were intensely or otherwise managed. Hence, the expected payoff to retirement account management is low.

Choi et al. (2006) have analyzed financial education data for a firm where seminar attendance was tracked in a way that made it possible to match seminar attendance to administrative data on both previous and subsequent saving behavior. They obtained data on individuals who attended financial education seminars between January 1, 2000, and June 30, 2000, and on 401(k) savings choices of all employees at the company on December 31, 1999, and on June, 30, 2000. About 17 percent of the firm's employees attended the financial education seminars. They found that a much larger share of individuals indicated that they were going to sign up for 401(k) participation that actually did, which was 14 percent. Likewise a much smaller share of individuals actually changed their 401(k) contribution rate, made a change in the selection of investment choices, and planned changes in the fraction of their funds allocated among various 401(k) options than what was planned at the end of the seminars. They concluded that employees in their data set were somewhat unresponsive to financial education related to retirement accounts. The initial impression might be that individuals and households are not responding rationally to new information. However, one must again ask what is the expected return from these actions?

Retirement portfolio management decisions involving risk and expected return considerations are relative complex concepts.[3] Ben-Shahar (2009), a contract law professor at the University of Chicago, has argued that households need simpler choices and not more information when it comes to retirement and financial planning. Stiglitz (2000) suggests that individuals who faced with very complex decisions fall back on "rules of thumb" for guidance. A key result from the finance literature on for stocks price movements over time is as follows. Assume that the companies in located in a country that has good auditing systems and is traded on major world exchange, then its price should follow a random walk, where there is an equal probability of the price rising or falling in the next instant of trading. New results on bubbles and busts in stock market prices suggest that the expected movement of a stock's price is sometimes more certain. However, this might be a result of the type of speculative trading that is permitted.

It has become clear that professional retirement planners have largely provided misleading information to their customers in the mid-2000s when it comes to reporting likely future performance of stock portfolio holdings. These simulations were primarily backward looking and then only over a relatively short history. They placed too much emphasis on recent stock market performance and ignored longer periods over which major economic downturns have occurred, for example the Great Depression of 1929-33 or the 1986 stock market crash, and did not incorporate the principle that generally the future movement of a stock's price may approximate a random walk. Moreover, the average rate of decline of stock portfolios over the past year has been roughly the same for those who carefully manage their retirement saving accounts. When stock market crashes, e.g., declines by 40-50 percent on average over a year and the rate of decline is similar across many stocks, and payoff to portfolio planning is low. In fact, at least one large university foundation—Harvard University—has recently reduced dramatically the amount of hired and expensive financial management services that

[3] In the research by Huffman (1974), Rahm and Huffman (1984) and Huffman and Mercier (1991) on farmers' rather technical decision making, I have measured farmers' education in years of formal schooling, which is quantum leap from the amount of information expected to affect behavior relative to seminars on financial education.

they use in managing their large foundation accounts and have reverted to much cheaper in-house asset management. The primary reason is low expected payoff to large expenditures on these management services.

However, to the extent that behavioral time inconsistencies exist, commitment devices might be a useful instrument to aid more rational decision making. Or the government might intervene and require individuals to acquire a retirement saving account—this would get the investor over the barrier erected by the fixed costs of setting up a retirement savings account. The issue would be whether the low marginal cost of future contributions to the account would lead to larger savings toward retirement than alternative arrangements.

Summary and Conclusions

In this paper, I have summarized major advances in the foundations of the economics of information and provided some examples to show how information changes behavior. I reviewed empirical evidence from food experiments showing that consumers respond in predictable ways to information presented in food labels and in information treatments constructed from diverse perspectives. Moreover, participant's education in these food experiments was shown to affect valuations of products containing enhanced consumer attributes.

Another strand of the information literature focuses on decision making with risky outcomes where costs and benefits may be spread over considerable time. In these experiments, it is alleged that consumers are affected by framing of issues rather by the real expected outcomes, or than individual tend to prefer rewards today and to be patient in the future. This may lead to a time inconsistency problem. This type of behavior is alleged to be common in workers retirement saving account management. However, a more complete modeling of the problem might take account of the low expect payoff to taking action. This seems to go a long way in explaining these behaviors. In a few cases, decisions might be improved by government imposed benevolent default options on choices or even by just simplifying the choice options. Overall, relevant information associated with new products and

services and education for decision makers have the potential for increasing rates of adoption and welfare of consumers and households and contributing to the progress of society.

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