

Richard Thaler: The anomalies of life

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ABSTRACT

For four decades, the spirited, contentious ideas of Richard Thaler, laureate of the 2017 Nobel Prize in economics, have perturbed economics and finance as well as decision theory, accounting, marketing, law, and public policy. We review Thaler's research philosophy and principal contributions, with an emphasis on his contributions to finance. In particular, we summarize and evaluate his work on inefficient markets, framing, decisions under risk, and choice architecture.

Keywords: Thaler, Behavioral economics, mental accounting, nudge, framing, investor sentiment, equity premium, market efficiency

*Unless a science is thoroughly shaken up from time to time,
its practitioners tend to become a spiritless and stultifying lot ..
Significantly original work,
with its .. controversies, feuds, victories and defeats,
appears necessary to maintain the esprit of a science.*
George Stigler

*The best test of truth is the power of the thought
to get itself accepted in the competition of the market.*
Oliver Wendell Holmes

On October 9, 2017 Richard H. Thaler was awarded the Sveriges Riksbank Prize in Economic Sciences in Memory of Alfred Nobel for his contributions to behavioral economics. The ritual is standard. After a first telephone call from Adam Smith, editor-in-chief at Nobelprize.org, the laureate receives a second call from the Secretary General of the Royal

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Swedish Academy of Sciences.³ Soon a press conference gets underway and journalists ask questions. Thaler was asked: What is the most important impact of your research? Also, what was your first thought when you received the telephone call?⁴ To the first question, Thaler responded: “The recognition that economic agents are human and that economic models have to incorporate that.” In answer to the second, he joked: “I no longer will have to call my colleague Eugene Fama Professor Fama on the golf course.”

Thaler’s notion, that “economic agents are human,” is what he has repeated throughout his scientific career, e.g., in the *Journal of Economic Perspectives* in 2000, “From homo economicus to homo sapiens,” in his 2018 Philadelphia presentation to the *American Economic Association*, and in *Misbehaving*: “We ... have to stop assuming that ... [abstract] models [that describe the behavior of imaginary Econs] are accurate ... , and stop basing policy decisions on such flawed analyses” (2015, p. 9).

Thaler became interested in the nature of decision processes when he was a doctoral student. He tried to estimate “the value of a human life,” a valuation question already of interest to Irving Fisher early in the 20th century (Cook, 2016). In his very first experimental study, Thaler considered two scenarios:

- A. Suppose by attending this lecture you have exposed yourself to a rare fatal disease. If you contract the disease you will die a quick and painless death sometime next week. The chance you will get the disease is 1 in 1,000. We have a single dose of an antidote for this disease that we will sell to the highest bidder. If you take this antidote the risk of dying from the disease goes to zero. What is the most you would be willing to pay for this antidote? (If you are short on cash we will lend you the money to pay for the antidote at a zero rate of interest with thirty years to pay it back.)
- B. Researchers at the university hospital are doing some research on that same rare disease. They need volunteers who would be willing to simply walk into a room for five minutes and expose themselves to the same 1 in 1,000 risk of getting the disease and dying a quick and painless death in the next week. No antidote will be available. What is the least amount of money you would demand to participate in this research study?

3 However surprising it may be, “Adam Smith” is a factually correct name.

4 See the video at <https://www.nobelprize.org/mediaplayer/index.php?id=2729>.

Economic theory is unambiguous: the two money amounts should be close. The answers provided by students were very different, however. Many said that they would refuse to participate in experiment B at any price. This finding is psychologically intuitive. The trouble is that it contradicts orthodox economic theory. In that particular sense, the result defines an *anomaly*, a conflict between what is actually observed and what the pure logic of choice informs us should happen if human nature conforms to rational economic man (in Latin, *homo economicus*). Could it be that many individuals are not astute utility- and value-maximizers with sound foresight and calculation skills? That real-life people systematically fall short on these criteria? That their irrationality can be modeled? Thaler answers all these questions in the affirmative.

Financial decisions made in households, markets and organizations have been of singular interest to Thaler.⁵ Even today, many finance academics and practitioners still live in Fama's hyper-rational world. For many purposes, it is a grave mistake to ignore behavioral insights, however. Thaler expands the contributions of two former "behavioral finance" laureates of the Nobel Prize (Daniel Kahneman in 2002 and Robert Shiller in 2013) as well as related ground-breaking work in economics by George Akerlof, George Katona, Thomas Schelling, Vernon Smith and Herbert Simon.⁶

Life is capricious. It so happened that I (Werner De Bondt) was Thaler's first doctoral student and also the earliest person to draw him into neoclassical asset pricing and investment theory.⁷ One motive was that academic finance is blessed with plenty of large data bases. Hence, it is a good place

5 Note how his first thoughts upon receiving the phone call from Stockholm drifted towards Eugene Fama, the 2013 Nobel Prize laureate.

6 The historical origins of "behavioralism," a term first used during the 1950s, can be traced to the scientific study of politics at the University of Chicago School of Political Science led by Charles Merriam or, even earlier, to Graham Wallas, Arthur Bentley and Walter Lippmann (1922). The Ford Foundation played a key role. For more discussion and evaluation, see Dahl (1961). Herbert Simon was a student in political science at Chicago during the 1930s and later (1996) said that Chicago and Merriam "did much ... to teach me the strategies of subversion I ... employed in attacking orthodoxy in economics and psychology, and to focus my sights on the phenomena of human thinking and problem solving as the essential core of both organization theory and economics."

7 We met at Cornell University in Autumn 1978 in a seminar, taught by Thaler (at the time, still an assistant professor), on the *Economic Foundations of Public Policy*. Many class meetings touched upon problems of public spending and taxation in democracy, e.g., the foolishness of voters, the myopia of politicians, and rising government debt. The course became a long, friendly discussion between Thaler (on the right, referring to James Buchanan, Ronald Coase, Anthony Downs, Sam Peltzman, Richard Posner, George Stigler and Gordon Tullock), myself (often relying on Richard Musgrave) and a second exchange student from Belgium, Madeleine Baudinet (on the left, sometimes reciting Karl Marx). A new course, on *Behavioral Decision Theory*, brought us together once more during the Spring of 1979. Invited by Thaler, and sponsored by CIM (Belgium), I returned to Cornell in the Fall of 1980 to pursue a doctoral degree. I majored in managerial economics. At Cornell, Robert Jarrow and George Oldfield taught seminars in mathematical finance (based on texts of Jonathan Ingersoll, Robert Merton, and others) that were thoughtful but, I would contend, almost entirely disconnected from empirical reality and professional practice. This led me to distrust neoclassical asset pricing theory, and to study the stock market from a psychological perspective.

to test the validity of psychological theories. Besides, a common critique of experimental research is that laboratory tests are artificial and that a key reason why the results cannot be trusted is that the monetary stakes are low. Agents become rational optimizers as soon as it pays them to do so, economists think. For this reason too, the study of financial anomalies is advantageous since it circumvents the “low stakes” analysis.

Below, we discuss four areas of finance where Thaler’s behavioral contributions have paved the way for much later research. The first area is the *inefficiency of world financial markets*, especially the over- and underreaction of prices to news, and the role of investor sentiment. The second topic is *framing*. This concept is fundamental to how investors manage their portfolios and “mentally” account for their actions. The third area has to do with attitudes toward risk and, in particular, the *equity premium puzzle*. The last topic is *choice architecture*.

Our paper ends with a more general discussion of Thaler’s contributions to economics, management and public policy. Many of his distinctive ideas, aside from behavioral asset pricing, first appeared in a manuscript published in the *Journal of Economic Behavior and Organization* (1980) that catalogued a series of irregularities in consumer choice, and pointed to shortcomings in human judgment and choice, modeled along the lines of Kahneman and Tversky (1973, 1979), as a way to interpret people’s behavior.⁸ Even though it took time, this remarkable paper has become exceedingly influential. Today, nearly 40 years later, Thaler and countless others go on to elaborate the insights of his 1980 article, and to integrate economics with psychology.

1. Inefficient markets

Thaler challenged the efficient markets literature with papers on over- and underreaction, limits to arbitrage, and sentiment.

In retrospect, the 1980s were not an easy time to question the dogma of efficient financial markets. At least at universities, market efficiency was

8 Dobelli (2013) offers an up-to-date catalog of human failings. The “heuristics and biases” program, with its gloomy implications, is not deprived of prominent critics. See, e.g., Gigerenzer and Brighton (2009) who argue that “biased minds make better inferences.” In a similar way, without personally disparaging the quest for reason, Simon (1995) and Smith (2008) insist that error-prone heuristics may still be ecologically rational if adapted to the structure of the environment. This was, in fact, the position of the English classical economists such as David Hume or Adam Smith.

seen as an unshakable truth. Michael Jensen judged that “there is no other proposition in economics which has more solid empirical evidence supporting it than the efficient market hypothesis” (Jensen, 1978). Even if one admitted that investors are boundedly rational and not without emotion, the idea of efficient markets still looked reasonable because it was thought that the “smart money” on Wall Street would take advantage of individual people’s euphoria or hysteria. Hence, market prices could not systematically deviate from the fundamental values of traded securities (Friedman, 1953). Prices would reflect all that is known and that can be known.

The random walk evidence put together and reviewed by Fama (1965, 1970) greatly strengthened the belief in efficient markets.⁹ While the theory can never be falsified, it does have testable implications. But, in truth, the assertion that “the price is right” is built on faith in the rationality of the representative agent, an ideal type referred to as *homo economicus*. Rational investors, or “Econs,” are assumed to take all available information into account and not to make any foreseeable mistakes, in essence, because finance theorists rigidly maintain that cognition—the cost of reasoning—is free of charge and that emotional and social-psychological factors do not distort market outcomes.¹⁰

The theory also implies the non-existence of arbitrage opportunities, or the “law of one price.” Two assets generating the same net stream of future cash-flows or services should always sell for the same price. However, the law of one price does not necessarily ensure that the price is right, e.g., when all real estate in London is overpriced, yet specific homes are priced “correctly” relative to others in close proximity (Lamont and Thaler, 2003b).

1.1. Market overreaction

To repeat, I (Werner De Bondt) arrived at Cornell University in 1978 as an exchange student from the Catholic University of Louvain in Belgium.

9 Much of this evidence was gathered before the invention of the capital asset pricing model, i.e., before there was a (temporary) theoretical consensus among asset pricing theorists about how fundamental value may be measured. One should also keep in mind that, for tests of the law of one price, no asset pricing model is needed, only the presence of close substitutes and enthusiastic arbitrageurs. For a recent summary of empirical asset pricing research (with an emphasis on behavioral insights), see De Bondt (2018).

10 The philosophical debate about human rationality goes back to ancient times but was greatly magnified during the Age of the Enlightenment when economics was born as a social science. John Stuart Mill explicitly introduced *Homo economicus* (see, e.g., Hayek, 1960, p. 61). Persky (1993) traces the history of the concept, as do Myrdal (1929) and Schumpeter (1940). Other stimulating political, sociological, legal, cultural, ethical and neurological discussions of human nature and rationality include Colombo (2009), Haidt (2012), Henderson (2007), Lo (2013), Nussbaum (1997), Rinaldi (2009), Sen (1977), H. Simon (1995), R. Simon (2015), and Zafirovski (2014).

Two years later, the research program on investor psychology was started. The *leitmotif* was “economic rationality,” or more correctly, the apparent lack of it. From the start, we focused on an idea in cognitive psychology proposed by Kahneman and Tversky (1973), i.e., that individuals often make bold forecasts based on information that only weakly affects the quantity to be predicted. This limitation reflects the representativeness heuristic. People’s brains are hard-wired to rely upon shortcuts that, while generally helpful, often produce predictable bias. In financial markets, representativeness may lead to overreaction-to-news, or overreaction to the past evolution of stock prices, since there is a tendency to find patterns in random series. Such dynamics may feed bubbles and generate crashes for no fundamental business reasons.¹¹ In the end, Richard and I wrote four papers on this topic (De Bondt and Thaler, 1985, 1987, 1989, 1990), the last one devoted to overreaction-in-earnings-forecasts produced by financial analysts.

Of course, the fundamental value of any asset is difficult to establish. Our work was inspired by Benjamin Graham, his joint work with David Dodd, and his investment manual, written for a wide public, *The Intelligent Investor*. At a given date t , Graham ranks the 30 stocks that define the Dow Jones Industrial Index according to their price-to-earnings (PE) ratio. He compares the returns of the 10 stocks with the lowest PE to those of the 10 stocks with the highest PE. Low PE stocks beat high PE stocks.¹²

We used a similar approach in our 1985 paper. With monthly return data from the *Center for Research on Security Prices* at the University of Chicago for the 1926-1982 period, we examined the risk-return performance portfolios of past “winners” and “losers,” defined by their cumulative returns over the previous one to five years, and compared to all securities listed on the New York Stock Exchange.¹³

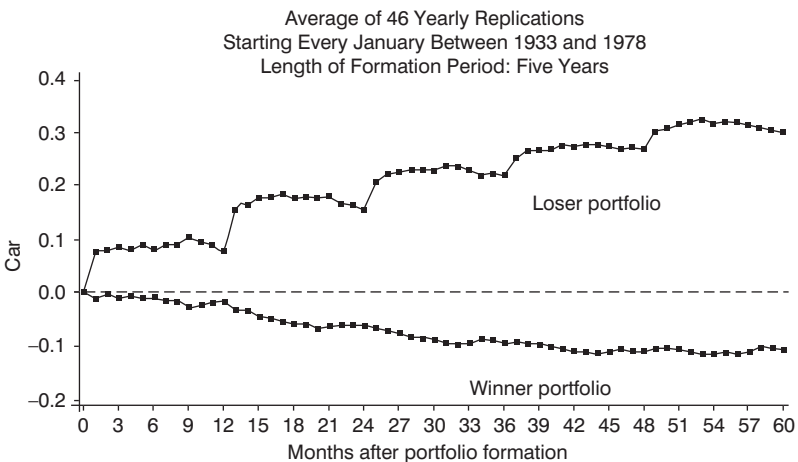
11 Among others, Keynes already pointed to overreaction in *The General Theory*: “Day-to-day fluctuations in the profits of existing investments, which are of an ephemeral and non-significant character, tend to have an altogether excessive, and even an absurd, influence on the market. It is said, for example, that the shares of American companies which manufacture ice tend to sell at a higher price in summer when their profits are seasonally high than in winter when no one wants ice” (1936, chapter 12).

12 The findings were confirmed and extended by Basu (1977), Dreman (1982), and others. De Bondt (1983) reviews past work on the PE-anomaly and further develops its behavioral interpretation. The 1983 manuscript (presented at the *Annual Meetings of the European Finance Association* in Fontainebleau, France) first articulated the exact methods used in later empirical research. My discussant was Walter Wasserfallen from the University of Bern (Switzerland).

13 For each formation period, stocks are ranked according to their past performance. The test period starts immediately after December 31, the portfolio formation date. These dates are one year apart. Figure 1 shows an equally-weighted average of all test replications between 1926 and 1982. It survives many robustness checks, e.g., corrections for risk, survivorship bias, and so on. An important innovation, relative to Graham, was to measure investor sentiment by past returns only, without reliance on accounting data.

Figure 1, reproduced from De Bondt-Thaler (1985, p. 803), presents the main result. It shows cumulative excess returns, relative to the market, for portfolios of past winners and losers over the subsequent 60 months. The return difference between winners and losers is circa 40% ---dramatic evidence of price reversals that effectively transformed asset pricing research. Figure 1 also shows extraordinary seasonality, with large positive returns earned by past loser stocks in January, and significantly negative (but less extreme) returns by past winners.

Figure 1. Average test period returns of winner and loser portfolios
(Source: De Bondt & Thaler, 1985)



Thaler (2015, chapter 22) tells the story of the paper's publication in the *Journal of Finance*, a decision that was made by the president of the *American Finance Association*, Fischer Black.¹⁴ In what Thaler (2015) calls a reaction to overreaction, Fama and French responded with two working papers in 1986 (Fama and French, 1986a, 1986b), replicating what we had

¹⁴ The refereeing process was a bit odd. The manuscript had been accepted for presentation at the annual meeting of the *AFA*, with Peter Bernstein, a senior Wall Street authority, as discussant. At the time, the various session chairs recommended to the *AFA* president which papers to print in a conference issue. Hersh Shefrin proposed our paper. By the time of the *AFA* meeting, though, many academics were acquainted with our work. For example, I had already presented it at the University of Chicago (with Merton Miller, among others, offering criticism), at Carnegie-Mellon University, and at the University of Wisconsin-Madison, where I would later accept a job offer. Black sent a letter of acceptance subject to assorted changes. The adjustments were manageable, I did not complain, and I returned the fine-tuned paper soon after. In responding to Black, I happened to misspell his first name as "Fisher." Black came back with an exposé on the origins of his name, the contrast between Fisher and Fischer, etc. I smile when I think back to these events. Black (as well as Bernstein, and later Richard Roll) were very sympathetic to the research program now known as behavioral finance. Since 1985, our paper has been cited more than 7000 times.

found, and recapping the so-called joint hypothesis argument. In a nutshell, it is hopeless to tell apart whether the overreaction findings violate market efficiency or merely contradict the troubled capital asset pricing model (CAPM). Our 1987 paper offered numerous additional robustness checks and responded to further arguments having to do with the seasonality and taxes, and time-varying risk. For example, we reported estimates of CAPM-risk indicating that past loser stocks are *less* risky than past winners. Also, the beta-measure of a hedge portfolio, long in past losers and short in winners, has a positive beta in bull markets and a negative beta in bear markets. Years later, Fama and French (1992, 1993) recognized, without theoretical defense, that size and value are indeed significant asset pricing factors. This admission played a big role in the later acceptance of empirical multi-factor models.

1.2. Closed-end funds and investor sentiment

What is a closed-end fund? Imagine that 10 investors join to create a fund in which they invest \$500,000 each, and each investor owns 5,000 shares, with each share worth \$100. Then, \$5 million is available to build an investment portfolio, and there are 50,000 shares outstanding. Subsequent to its startup, the portfolio is managed and rebalanced but only the original 50,000 shares are publicly traded. Therefore, a closed-end fund is like a publicly traded company with shareholders. As such, a shareholder who wants to leave the fund must sell his shares in the market. Unlike open-end mutual funds, a closed-end fund never returns the net asset value of the shares (NAV) to its owners.

Evidently, the law of one price or, in more technical terms, “the non-existence of arbitrage opportunities in equilibrium,” should guarantee that the market value of the shares equals the value of the underlying portfolio at all times. Indeed, if there were a large valuation gap, rational arbitrageurs should seize it. Note that this does not require that all investors be clever, only that there are enough who recognize a particular opportunity. The closed-end fund puzzle addressed by Charles Lee, Andrei Shleifer and Thaler is simply that this is not happening.¹⁵

¹⁵ The puzzle was known since the 1920s if not earlier (De Long and Shleifer, 1991), but it was only studied much later (Zweig, 1973; Malkiel, 1977; Thompson, 1978). See also Dimson and Marsh (1999).

The problem has four components. First, at the issue date, closed-end fund shares are often traded at a premium. Investors who buy a share of the fund pay more than the value of the portfolio corresponding to that share. The second disturbing element lies in the subsequent decline in share prices compared to the portfolio NAV, so that the shares trade at a discount. The third element is the time-series variability of the discount/premium. Lastly, when the fund stops, either by liquidation or by transformation into an open-end fund, the discount/premium disappears.

Before Lee et al. (1991), several attempts had been made to explain the closed-end fund puzzle either based on tax stories or the differential liquidity between the shares of the fund and the securities included in the fund's portfolio.¹⁶ However, there was no straightforward explanation of either the size of the discount, or its variability over time. Thaler and his colleagues pointed to investor sentiment as the main explanation, an idea also looked at by De Long et al. (1990) and Black (1986).

Individual investors, as opposed to institutional investors, strongly prefer small-cap stocks over large firms. Accordingly, the returns on both types of stocks do not move together. More often than not, small investors are amateurs who confuse subjective noise with objective information and who are prone to fluctuations in sentiment (Black, 1986). Advocates of market efficiency mistakenly consider these investors irrelevant since, supposedly, their trades are random and also in modest amounts, compared to those of professional experts. In fact, the return earned by a hedge portfolio, long in small caps and short in large caps, is a good proxy for retail investor sentiment, and it moves with the discount on closed-end funds.¹⁷

Thus, Lee et al. (1991) challenged the notion of efficient markets by linking two recognizable anomalies. The apostles of orthodox finance were not pleased.¹⁸ Arguably, the battle was a good omen for later research on investor sentiment. The excitement during the great dotcom bubble, as well as its later collapse, further stimulated this line of work.

16 These efforts continued long after 1991, e.g., with Berk et Stanton (2007), Cherkes et al. (2009), and a special issue of the *Journal of Financial Economics* in 2012.

17 So, the trades of noise traders are correlated and create waves of optimism and pessimism. See, e.g., Dorn et al. (2008) or Barber et al. (2009).

18 Thaler (2015) reports how Merton Miller pressured René Stulz, editor of the *Journal of Finance*, to reject the paper. Instead, Stulz asked Miller to comment (Chen et al., 1993). Lee et al., joined by Navin Chopra, responded in the same issue (Chopra et al., 1993).

1.3. *The limits of arbitrage*

Limited liability, a legal as well as financial concept, implies that stock prices cannot be negative. Yet, astonishingly, market mispricing means that some assets may have negative value. Owen Lamont and Thaler (2003a) show this in the context of technology stocks carve-outs.

Imagine that a supermarket offers you a chocolate bar for \$2 and a bundle of the same chocolate bar and a candy bar for \$1.5. What do you do? Bizarrely, this example is the correct metaphor for some events in the U.S stock market at the time of the tech stock mania. Palm is the chocolate bar; 3Com, the bundle. 3Com, specializing in Ethernet technology, had acquired Palm, the maker of Palm Pilot, a forerunner of the smartphone. Unlike other tech companies, the price of 3Com stock was fairly stable. Then, in March 2000, 3Com decided to partly divest its interest in Palm. In an equity carve-out, it sold 5% of Palm to the public while keeping 95%. Efficient market theory suggests that the 95% stake of Palm stocks should be valued at 19 times the 5% stake and that 3Com should be worth more than its interest in Palm only.

3Com planned that, after a delay of six months, each 3Com share would receive 1.5 shares of Palm stock. According to the law of one price, each single share of 3Com should have been worth more than 1.5 shares of Palm because other 3Com activities were profitable, therefore had value. The day before the IPO, 3Com was trading at \$104. The IPO price was \$38. At the end of the day, however, the price had risen to \$95. (Indeed, the highest transaction price on that day was \$165.) Simultaneously, the price of 3Com fell 21%, ending at \$82. What was the stub value of 3Com? It is easy to calculate: $\$82 - (1.5 \times \$95)$ is about *minus* \$60 per share. At the level of the firm, the stub value of 3Com was *minus* \$23 billion (Lamont and Thaler, 2003a).

To make a profit, arbitrageurs would have needed to purchase one share of 3Com, short 1.5 shares of Palm, and wait. The conundrum was that not enough Palm shares (by and large held by retail investors) could be loaned to arbitrageurs and sold short, even as the demand of uninformed traders for Palm greatly exceeded its supply.

Since only one firm is involved, the 3Com story looks like a special case. Yet, numerous violations of the law of one price have been detected, see, e.g., Lamont and Thaler (2003b) or Mitchell et al. (2002). This requires

more theoretical and empirical research as in Bayar et al. (2011). Suffice it to say that anecdotes like 3Com derive significance from the fact that the misvaluation is clear as crystal, and therefore throws into question the rationality of market prices on occasions when there are no close substitute assets and when security valuation is complex.

2. Framing

Psychology teaches that we should be attentive to decision processes. Process matters because it helps us to understand, to predict, and eventually to influence decision outcomes. Also, psychological processes are generally too complex to produce outcomes that correspond to the result of a comprehensive optimization exercise, as normative economic theory suggests. Herbert Simon (1957) identified some of the relevant limits, e.g., selective attention, limited memory, and search that ends as soon as a satisfactory solution has been reached. The general term to describe these tendencies was “bounded rationality.”¹⁹

Mental accounting is about cognitive operations involved in decision processes. How people look at a decision problem is crucial. This framing influences how economic agents categorize, organize, and evaluate financial data, e.g., the frequency with which activities are evaluated. Thaler proposes two types of utility: acquisition utility, referring to consumer surplus, and transaction utility.²⁰ Transaction utility measures the perceived quality of a deal, e.g., it may be the difference between the price that is paid for a good or service and the price individuals would normally expect to pay, the so-called reference price. Transaction utility can be positive (“a bargain”) or negative (“a rip-off”).²¹

19 Or, quoting Simon, “the capacity of the human mind for formulating and solving complex problems is very small compared with the size of the problem whose solution is required for objectively rational behavior in the real world – or even for a reasonable approximation to such objective rationality.”

20 Consumer surplus is the difference between the utility provided by the good that is bought and the opportunity cost of what has been given up to pay for it.

21 A classic example, vintage Thaler, is about “the beer on the beach.” Suppose that “you are lying on the beach on a hot day. . . . A companion .. offers to bring you .. a beer from .. (a fancy resort hotel) [a small, rundown grocery store]. . . He will buy the beer if it costs as much or less than what you state. But if it costs more than the price you state, he will not buy it. You trust your friend .. What price will you state?” The median answers, adjusted for inflation, were about \$7.25 for the hotel and \$4.5 for the grocery store. This shows that decision makers cheerfully pay different prices for the same beer, consumed at the same place, depending on the identity of the seller. Paying \$7.25 for a beer of a fancy resort hotel is annoying but predictable, whereas paying the same to a grocery store is inconceivable. Transaction utility matters.

Thaler's studies of mental accounting find support in the work of Kahneman and Tversky on decisions under risk and prospect theory (1979). That theory puts emphasis on the editing stage, prior to the evaluation of different prospects. The reshaping which includes coding, segregation, cancelation, and combination simplifies the problem. It transforms the outcomes and the corresponding probabilities as well.

Many later biases are captured by the value function of prospect theory (Thaler, 1980, 1985). It specifies how individuals code and evaluate outcomes. Three features stand out. First, it is defined over gains and losses rather than final wealth. Hence, a reference point is needed. Second, it is concave for gains, convex for losses and exhibits diminishing sensitivity. Third, it is steeper for losses so that a loss of \$100 creates a level of distress greater than the satisfaction generated by a \$100 gain. This implies loss aversion. The following case study illustrates diminishing sensitivity:

Imagine that you are about to purchase a jacket for \$125 and a calculator for \$15. The .. salesman informs you that the calculator [jacket] .. is on sale for \$10 [\$120] at the other branch of store, located 20 minutes away. Would you make the trip to the other store?

Quite often, people are ready to make the trip to save \$5 on a \$15 purchase but not when the price is \$125. Yet, the travel time is unaffected and so is the \$5 gain. This shows once again how decision-making is shaped by context. It also illustrates the diminishing sensitivity of the utility function. Evidently, $[v(15) - v(10)] > [v(125) - v(120)]$.

The value function explains other anomalies. For instance, standard economics predicts that opportunity costs and out-of-pocket costs matter in the same way. But Thaler (1980) and Shafir and Thaler (2006) explain that people underweigh opportunity costs because out-of-pocket costs are seen as losses whereas opportunity costs are coded as unrealized gains. Similar reasoning applies with respect to the sunk cost fallacy. Here is one of Thaler's examples:

"Vince paid \$1000 to an indoor tennis club that entitled him to play once a week for the indoor season. After two months he developed tennis elbow, which made playing painful. He continued to play in pain for three more months because he did not want to waste the membership fee. He only stopped playing when the pain became unbearable."

When a person pays for services or merchandise but does not use it, it is mentally difficult for him to deny that the payment was a pure loss. Usage, even in pain, can be an unrealistic, bogus “solution” if it helps to curtail the loss in the mental account attached to the purchase.²²

To repeat, losses cause pain and, whenever possible, are avoided. For example, investors are reluctant to sell stocks at a loss. This bias, labeled the “disposition effect,” has been known on Wall Street for decades, but the detailed empirical work of Shefrin and Statman (1985), Odean (1998) and others confirms it.

Categorization is central to mental accounting. People have different accounts of day-to-day expenses, spending on luxuries, retirement saving, and so on (Thaler, 1999). It is psychologically challenging to move funds across accounts. For example, an individual may pile up credit card debt (with an interest rate of 15%), yet at the same time refuse to take money for an earmarked savings account that earns 1%. This behavior goes against a key economic principle: fungibility.²³

Shefrin and Statman (2000) develop a behavioral portfolio theory that is based on non-fungible mental accounts and the results of Lopes (1987) indicating that portfolio choices are driven by the opposite emotions of hope and fear. On the one hand, individuals aim to secure a minimal level of comfort but, on the other hand, they also dream of great wealth. Without outside help, the overall “best” portfolio that is psychologically feasible may be a collection of multiple subportfolios, each optimal for a given mental account.²⁴ The bottom of the pyramid of assets is intended to guarantee security. It may contain cash and risk-free assets. The top of the pyramid relates to investors’ aspirations. It may consist of speculative stocks with returns that are positively skewed like out-of-the-money options.

One further interesting attribute of mental accounting is the frequency with which mental accounts are opened, evaluated, and closed. Thaler and Johnson (1990) analyze how previous losses or gains affect choice. Although, in general, individuals are risk averse in the domain of gains, they become

22 The sunk cost problem can be so severe that it invites an escalation of commitment, i.e., more resources are poured into a losing project --often in the hope of turning it around.

23 The research literature in support of mental accounting is very large. See, e.g., Heath and Soll (1996). Hastings and Shapiro (2013) study choices between regular and premium gasoline and the effect of changes in relative prices. Apparently, people do not consider savings on “gas money” on par with other types of income. Category budgeting fits the data better.

24 This assertion is dubious. Choi et al. (2009) offer a lively discussion and introduce new evidence.

less risk averse and even seek risk after prior gains. Thaler and Johnson refer to a “house money” effect, a label used by casino gamblers who act as if their winnings were not real money. Likewise, after a loss, individuals often reduce their risk exposures, but the opposite is true if they imagine that there is a chance to break even, i.e., to recoup the earlier losses.²⁵

3. Myopic loss aversion and the equity risk premium

In the early 1990s, Thaler and Shlomo Benartzi, another Cornell doctoral student, took an interest in the equity risk premium puzzle uncovered by Mehra and Prescott (1985).²⁶ The equity risk premium is the return gap between stocks and (nominally) risk-free fixed-income assets such as government bonds or bills. Over the period 1889-1978, Mehra and Prescott assess the U.S. premium at 6.2% per year. Siegel (1992) finds a premium of 5.9% for 1926-1990. Premia of similar magnitude are obtained in other countries and time periods.²⁷

The premium is much too large to be explained within mainstream finance. Siegel and Thaler (1997) pose the issue as follows:

“Suppose your great-grandmother had some money lying around at the end of 1925 and, with rational expectations, anticipated your birth and decided to bequeath you \$1000. Naturally, since you weren’t born yet, she invested the money, and being worried about the speculative boom in stocks going on at the time, she put the money in Treasury bills, where it remained until December 31, 1995. On that date it was worth \$12,720. Imagine, instead that she had invested .. in a (value-weighted) portfolio of stocks. You would now have \$842,000, or 66 times as much money. This difference in returns (3.7 percent vs. 10.1 percent) is strikingly large.”

25 This phenomenon may well be called the Nick Leeson effect after the Singapore-based trader who broke the United Kingdom’s oldest merchant bank, Barings, when his luck went sour. Leeson had used derivatives to bet that the Japanese stock market would not move significantly when the Kobe earthquake hit on January 17, 1995. Later, he made a series of increasingly risky trades, this time betting that the Nikkei would make a rapid recovery. In doing so, he deceived his superiors. Unfortunately, the Nikkei did not recover in time, and the cumulative losses reached \$1.4 billion within four weeks. Leeson fled Singapore but was caught months later in Germany. Barings was declared insolvent end February 1995. Since leaving prison, Leeson has published two books. He now lives in Ireland, and sometimes appears at finance conferences as a motivational speaker.

26 Thaler (2015) portrays Benartzi as exceedingly energetic, full of stimulating ideas and perseverance, and thanks Benartzi profusely for lessening his (i.e., Thaler’s) “laziness problem.”

27 Mehra (2003) reports the following statistics: France (1973-1998), 6.3% ; Germany (1978-1997), 6.6% ; Japan (1970-1999), 3.3% ; United Kingdom (1947-1999), 4.6% ; U.S.A., (1802-1998), 4.1% ; U.S.A. (1926-2000), 8.0%.

Standard representative-agent models based on expected utility theory suggest a risk premium of only 0.35% per year, far below what is observed. A risk-aversion coefficient of about thirty is needed to vindicate the actual risk premium, yet typical estimates are around one (Arrow 1971; Kydland and Prescott, 1982; Kehoe, 1984).²⁸

In the attempt to explain high stock returns, models based on habit formation in consumption, such as Constantinides (1990), acknowledge agents' asymmetrical perception of gains and losses.²⁹ Benartzi and Thaler (1995) rely instead on loss aversion and mental accounting. A typical loss aversion coefficient is about two. This means that the disutility of losing a given monetary amount is twice the utility of gaining the same amount.

In the context of studying market risk premia, mental accounting comes into play through the dynamic aggregation rules that agents follow. Loss aversion changes the rules. Benartzi and Thaler share a story first told by Paul Samuelson (1963) who asked his MIT colleague, E. Carey Brown, an economic historian, whether he would participate in a bet that offered an even chance of winning \$200 or losing \$100. Brown declined but also said that he would accept 100 such bets. A single bet was seen as undesirable because a loss of \$100 would be deemed more painful than a gain of \$200 pleasant — an illustration of loss aversion. In contrast, 100 bets would aggregate into an attractive distribution of returns.³⁰

Samuelson's anecdote illustrates how loss-averse agents would sense less danger and take more risk if only they evaluated their performance less often. The same reasoning can be applied to the equity risk premium. Imagine an investor with a choice between a risky asset that pays 7% (with a standard deviation of, say, 20%) and a risk-free asset that pays 1%. The attractiveness of a risky asset depends on the investor's time horizon. The longer the horizon, the more alluring the risky asset. This combination of

28 Consider a bet with a 50% chance of doubling one's wealth and a 50% chance of losing half one's wealth. A person with a relative risk aversion coefficient equal to 30 would be willing to relinquish 49% of his/her wealth in order to avoid the bet (Siegel and Thaler, 1997). Much research attempts to solve the puzzle by moving away from expected utility theory, e.g., Weil (1989) and Epstein and Zin (1990). As an alternative explanation, Rietz (1988) relies on levelheaded investor fear of unlikely but possibly severe market crashes that went unrealized over the sample period.

29 The relationship between consumption and asset returns is tenuous, however, since most investors only own stocks through pension funds. Also, habit formation models do not explain differences in average returns across assets (Ferson and Constantinides, 1991).

30 To begin, consider the distribution of payments and probabilities with only two consecutive bets: (\$400, 0.25; \$100, 0.5; -200, 0.25). Next, extend the idea to 3, 4, ..., 100 bets. In cumulative prospect theory (Tversky and Kahneman, 1992), the outcomes associated with 100 bets yield a positive evaluation, but a single bet has negative value. Benartzi and Thaler (1999) also test the assertion experimentally.

loss aversion and a short evaluation period, Benartzi and Thaler label *myopic loss aversion*. It may explain why so few households buy stocks.

Specifically, Benartzi and Thaler ask what blend of the loss aversion coefficient, set at 2.0, and investment time horizon can account for the historically observed equity risk premium. The answer is an evaluation period of about one year, a result that is intuitively plausible. Of course, a counterfactual implication of this theory is that, if the representative agent somehow became more patient and farsighted, the equity risk premium would fall.

4. Choice architecture and retirement savings

People are not always the most effective stewards of their own welfare. The predicament is most severe when individuals face choices with highly uncertain but long-term important consequences, when there is no quick feedback, and when people are impulsive, short-sighted, lack self-control, and are given to false optimism.

A 2003 paper, tantalizingly titled “Libertarian Paternalism,” first introduced a set of public policies developed by Thaler and Cass Sunstein that would gain a worldwide audience with their 2009 book, *Nudge: Improving Decisions About Health, Wealth, and Happiness*. A nudge is defined as “any aspect of the choice architecture that alters people’s behavior in a predictable way without forbidding any options or significantly changing their economic incentives. To count as a mere nudge, the intervention must be easy and cheap to avoid. Nudges are not mandates. Putting fruit at eye level counts as a nudge. Banning junk food does not.”

Very many economists consider paternalism at best an irrelevant policy or, at worst, idiocy that lessens social welfare. This view, Thaler and Sunstein maintain, is built on a false assumption and two misunderstandings. The false assumption is that individuals know what is good for them, and are always competent to make choices in their own “best interest.” Much behavioral research raises serious doubts about this supposition. The two misconceptions are that paternalism must involve coercion and that it can always be avoided.

In actual fact, choices can often be managed with no infringement on personal freedom. Consider, e.g., the way that food is positioned in school

cafeterias. Without modifying the assortment of available choices, one could easily rearrange the line-up, e.g., putting fruits and mineral water in advance of sugary desserts and soft drinks. This intervention is similar to a framing effect. Furthermore, there are circumstances where a business, organization or government has no alternative but to take steps that will inevitably have some bearing on people's choices. A striking example is the case of organ donation (Johnson and Goldstein, 2003). In the world of homo economicus, a default option is immaterial; in the real world, however, it matters greatly. Signing up as a potential organ donor is often a part of obtaining a driver's license. A dozen of European nations, otherwise similar, experience radically different rates of organ donation, over 85% in some places, below 15% in others. The critical point is the way that the application form is pieced together. In some countries, individuals must check a box to enroll; in others, they must check a box not to be enrolled. As it happens, a lot of people are not inclined to check boxes!³¹

Possibly today's most well-known financial nudge is the *Save More Tomorrow* program (Thaler and Benartzi, 2004). The objective is to nudge households in the direction of more savings. Actually, the U.S. switch from defined-benefit to defined-contribution pension plans has put citizens in charge of their own retirement savings (and it also has put them at risk in case of a funding shortfall). For several decades now, the median U.S. family has saved too little. Many households are poorly prepared for retirement.³²

The program invites participants to commit themselves in advance to allocate a portion of their future salary increases to savings. Savings increases only when the paycheck rises. Therefore, future contributions are not coded as a loss and, indeed, there are no cuts in take-home pay. Moreover, after a participant has joined, the implementation is automatic. Inertia, in this case, does not undermine saving but promotes it.

Why is the *Save More Tomorrow* program an appealing financial solution, and why is it effective? The program helps to defeat at least four psychological weaknesses. The first one has to do with the inherent gut-wrenching complexity of the savings-investment problem. To determine the optimal

31 Beyond default rules, there is a wide spectrum of other behavioral interventions. Some nudges may feel like shoves. Choice architects can try to bypass, enlist or counteract psychological weaknesses. They can warn people and get them ready for action, or simply disclose valuable information in a manner that is easy to absorb, e.g., food labelling.

32 To illustrate the problem, consider how the 2005 U.S. personal savings rate was negative. 2005 was the first year that this happened since the Great Depression, however, and it may have reflected the bubble in housing values that popped soon thereafter. At the time, many Americans misconstrued home value appreciation as a replacement for saving.

savings rate, the optimal investment strategy, and (in retirement) the optimal decumulation rate is exceptionally difficult. At the same time, millions of people lack basic numeracy and financial literacy skills. Clearly, *Save More Tomorrow* does not get rid of that conundrum, but at least, it moderates the retirement income challenge. Second, individuals tend to postpone cognitively demanding choices and procrastinate. Third, even if households were able to decide what is the ideal savings solution, they may not have enough willpower to implement it, especially to stand firm in the face of unforeseen trouble. Lastly, many people experience the build-up of a nest egg as a reduction of their current consumption and view the decrease as a loss.³³

5. General discussion and conclusion

Richard Thaler's contributions to finance, economics, and social science are renowned not because of their technical wizardry but because they inserted novel ideas that contested orthodoxy. Thaler is a rebel, an agitator, *un agent provocateur*. While rationality remains a cornerstone of social science, psychological insights into economic and financial behavior are now accepted as worthy of scientific investigation and feasibly legitimate sources of public policy.

Thaler contributed to many areas of social science, such as the link between law and economics (Jolls et al., 1998), perceptions of fairness (Kahneman et al., 1986), contestant choices in television shows (Post et al., 2008), and the overvaluation of top draft picks in the U.S. National Football League (Massey and Thaler, 2013).³⁴ Behavioral ideas have had an immense impact on the study of law (see, e.g., Parisi and Smith, 2005), sociology (Zafirovski, 2015), political science (Henderson, 2007), and public policy (Lynn, 1986).

The research conducted by Thaler and his co-authors has also affected financial practices, e.g., through the development of behavioral investment funds, changes in retirement programs, and changes in regulation. Consider,

33 The first implementation took place in 1998 at a midsize manufacturing firm: 78% of employees joined the program and expanded their savings with every pay raise. Almost all did not quit but stayed with the program for several pay raises. Three and a half years later their savings had almost quadrupled. Since the implementation of this pilot program, many more companies have adopted the system. Though it is tough to estimate, Benartzi says in a recent interview that the program may have added over the past decade about \$30 billion to U.S. retirement accounts (Malito, 2018).

34 Overconfident managers, the data suggest, put too high a value on new players relative to their performance. In particular, the right to recruit ahead of other teams is a curse.

e.g., programs like *Save More Tomorrow*, and more generally through the policies and mandates influenced by insights from the architecture of choice (Osborne and Thaler, 2010).

Of course, nobody knows which models will be used on financial markets in three or four decades. Considering the mounting importance of trading algorithms, it is also challenging to imagine what will be the future role of human beings in world financial markets. Whatever happens, we do know that the wisdom of the average person is limited and that actual behavior depends on a mixture of habit, impulse and intelligence. Also, that emotion is often more potent than reason in shaping public sentiment. Thaler's great contribution is to remind economists, and the public at large, of these basic facts of life.

It is interesting to observe how Thaler, in his mature years, has returned to the great, open-ended questions of political economy that animated his youth. We draw a distinction between Thaler's purely scientific contributions to economics and his current support for identifiable public policies, in particular, as these policies relate to a brand-new philosophy of government, law, and regulation. That philosophy trumpets moderation, and it advocates a middle ground, a "third way," between true believers in *homo economicus* and paternalists who clamor for command-and-control.

To repeat, *Nudge* is a deliberate effort to channel individuals into beneficial choices or behaviors that experts think are "best" for them, but people can opt out and go their own way. Nudges preserve choice and avoid direct coercion. They are often low-cost and under-the-radar. They look commonsensical, and they are not doctrinaire, surely when the issue is how to structure the provision of an existing service such as a savings plan. *Nudge* combines modern American liberalism's twin principles of benevolence and science. Of course, like any other political philosophy, liberalism involves a specific take on human nature. That view is rationalistic. It declares that human nature can be perfected, and that conscious design beats spontaneous order (Hayek, 1960). *Nudge* does not say that people want the wrong things, only that they lack the ability to attain their goals short of government assistance.

Nudge has been criticized both from the left and from the right. One danger is that the desire to help dissolves into the exercise of power by a professional class of psychological experts. Is it liberal to govern human

beings in the name of their own preferences?³⁵ *Nudge* even promotes societal ideals such as “saving the planet” from carbon emissions, or reallocating wealth, rights and entitlements. In those cases, behavioral interventions that preserve discretion may well be efficient (as, e.g., with school choice) but these types of decisions are inescapably interwoven with politics. Some sections of society gain, others lose. The experts themselves are not free from systematic error, or from outside influence, and may well disagree about the correct diagnoses and remedies. Yet, the actual psychological interventions into people’s lives would be capillary and pervasive, therefore impeding oversight. In sum, people would have to cope with “a government that is everywhere and nowhere.”³⁶

On the left side of the political spectrum, a frequent response is to applaud Thaler’s commitment to evidence-based policy-making but also to express a wish to attain public ends through a more transparent and direct application of democratically-legitimated government power. Nudges seldom offend personal autonomy, it is said. Also, nudges such as labeling or public information campaigns often fail to deliver results. Yet, while less effective, they compete with mandates, prohibitions, education, taxes, and other policy tools. At the end of the day, *Nudge* is conservative because it turns societal problems ---such as mass unemployment, lack of retirement savings, or obesity--- into personal, psychological problems. *Nudge* shifts responsibility to where it does not belong. When political vision is lacking, it serves as an excuse for government not to do more. Thus, by prolonging unacceptable and unsustainable troubles in society, *Nudge* becomes a tranquilizer rather than a solution.

No matter the critique from left and right, a great deal of research, legislation and public policy around the world has been inspired by Thaler’s virtuoso insights and opinions. We admire his genius, his brilliancy, and we are deeply thankful to him.

35 Hayek (1960, chapters 4 and 12) answers yes. The British philosophers, such as John Locke or David Hume, and the framers of the American constitution fully accepted that men recognize their own flawed nature and design institutions that restrain their worst impulses in moments of temptation. What citizens want at a given moment, their stated intentions, and their long-term interests are rarely the same. (“Revealed preferences” do not help, of course.) Thus, paternalism may be a form of self-binding --like in Homer’s tale of Odysseus and the beautiful mermaids known as Sirens.

36 Consider, e.g., Osborne and Thaler’s 2010 editorial in *The Guardian*. In this instance, we submit that Hayek (1960) would surely be in the opposing camp, denouncing Thaler’s boost to technocracy, underestimating the abilities of ordinary people and overestimating the blessings of the administrative state. Two quotes from former U.S. President Ronald Reagan may capture this sentiment. “As government expands, liberty contracts” (January 11, 1989). Also, “the nine most terrifying words in the English language are, I’m from the government and I’m here to help” (August 12, 1986).

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