Prospect Theory, Mental Accounting, Nudges: Applications to Economics, Finance, Marketing, Public Policy, and to COVID-19 Pandemic Management

Gurumurthy Kalyanaram[1]

Abstract

In this article, we present three important behavioral/cognitive theories: Prospect theory, mental accounting, and nudge theory. We also briefly present applications of these theories to consumer, financial, and product markets, and to public policy decisions.

Finally, we discuss the application of these three theories to management of the current pandemic (COVID-19) situation, including strategizing and communicating productively. Specifically, we examine the framing of the non-pharmacological mandates, the applicable models for closing and re-opening decisions, and methods to increase the odds of diffusion of accurate information.

There are three useful insights. One, we find that framing matters in increasing the effectiveness of the mandates: exposure to gain frames yielded more support. Two, instead of closing, opening, and closing again, it is better to keep the economy (and schools/colleges) closed for a longer time period so that it does not have to be closed again. Three, an accuracy nudge increases the flow of accurate information and attenuates the false information.

[1] City University of New York, New York, NY, USA

Corresponding Author:
Gurumurthy Kalyanaram, City University of New York, New York, NY 10017, USA.
E-mail: kalyan@alum.mit.edu

Introduction

With their pioneering studies, Tversky and Kahneman (1972, 1974) and Kahneman and Tversky (1972) provoked a new thinking on human decision-making. Thus, behavioral and cognitive economics, finance, and marketing emerged.

In their studies, the researchers found that human decision-making was neither linear nor endowed with rationality, as was generally postulated till then. Human beings used a variety of heuristics to make choices and judgments under uncertainty.

Tversky (1972) identified an important heuristic related to human choice. This choice heuristic is called the Elimination by Aspects (EBA) model because the ultimate choice is series of eliminations. This is a probabilistic rule in which, at each stage, a consumer chooses an aspect proportional to her/his measures (i.e., probability proportional to that aspect's importance for the consumer.) Over time, researchers have assumed that a consumer eliminates aspects in a fixed order. Accordingly, the process of elimination continues until only one alternative remains, and that remaining item is assumed to be the one chosen by the consumer.

Tversky and Kahneman (1972, 1974) identified three important heuristics related to judgments: representativeness, availability, and adjustment from an anchor. Representativeness is a heuristic where a decision-maker makes a judgment "about the performance or characteristics of an object" (e.g., a brand or another person) based on the similarity of that object to a known object, schema, or category (Kardes et al., 2004). Such judgments are overinfluenced by similarity. Availability is a heuristic where a human being bases her/his assessment of the plausibility of an event on the number of such similar events that come to her/his mind. Finally, human beings carry a reference point or anchor value, particularly where numerical values are involved. The new information is adjusted and/or accommodated based on the anchor value. The concepts of an anchor point/value and accommodating the new information were also addressed by adaptation-level theory (Helson, 1964) and assimilation-contrast theory (Sherif et al., 1958).

On the basis of ample experimental/empirical evidence, Tversky and Kahneman developed prospect theory (Kahneman & Tversky, 1979) as an alternative to expected utility theory. Based on the extant research in behavioral/cognitive economics, finance, and marketing, Thaler (1999) developed mental accounting theory. Finally, Thaler and Sunstein (2008) applied these theoretical foundations to present the nudge theory.

Accordingly, we present these three important theories and the extensive research on applications of these theories to consumer, financial, and product markets, and to public policy decisions. The rest of the article is organized as follows. The following three sections discuss prospect theory, mental accounting theory, and nudge theory, and their applications. We close the article with a short illustrative application of these three theories to management of the current pandemic (COVID-19) situation, including strategizing and communicating productively.[1]

Prospect Theory

The Theory

This seminal theory is based on evidence that decision-makers:

1. Viewed changes as losses and gains with respect to a reference point
2. Assigned values to gains and losses rather than to final assets
3. Replaced probabilities with decision weights
4. Underweighted probable outcomes compared to certain outcomes (certainty effect)
5. Discarded the components shared by all choices under consideration (isolation effect).

The certainty effect contributed to risk aversion in choices involving sure gains and to risk seeking in choices involving sure losses. The isolation effect led to inconsistent preferences when the same choice is presented in different forms. Finally, the "framing" of issues (i.e., the context) was important input in our choices and decisions. The following principles follow from the theory:

1. *Reference-level dependence:* A decision-maker views consequences (monetary or other) in terms of changes from the *reference level*, which is usually that individual's *status quo*.
2. *Gain and loss functions:* The gain function is concave (risk averse), and loss function is convex (risk seeking).
3. *Loss aversion:* The resulting value function is steeper for losses than for gains; losing $100 produces more pain than gaining $100 produces pleasure.

Loss-Aversion Effect

The principle of loss aversion, that is, the asymmetric effect of losses and gains (losses are greater than gains) has found applications in many industries, markets, and public policy decisions. The empirical evidence has been growing.[2]

Pricing Decisions in Consumer Markets

In their seminal work, Kalyanaram and Little (1994) found that consumers reacted more sharply to price increases (losses) than price decreases (gains). Using scanner panel data for sweetened and unsweetened drinks (from the US market), and employing a logit model, the authors calibrated a model that incorporated the reference price, the latitude of price acceptance, and price losses and gains. The authors discriminated between the models and identified the best model using the log-likelihood ratio test of differences in explanatory power of the models.

The empirical results showed that the price increases decreased the utility by 1.20 and 1.29 in the sweetened and unsweetened drinks, respectively, and the price decreases increased the utility by 0.76 and 0.93, respectively. All these estimates were significant at the 95% confidence level. The research also found support for a latitude of price acceptance around the reference price. They estimated the magnitude of the width of the latitude, which was defined as a function of price variability in the extant research findings. The width of the latitude is estimated to be about 1 standard deviation.

Subsequent to the findings by Kalyanaram and Little (1994), many researchers in marketing have found that the loss-aversion effect in pricing is significant. Briesch et al. (1997), Bronnenberg and Wathieu (1996), Dayaratna and Kannan (2012), Delle Site and Filippi (2011), Erdem et al. (2001), Habib and Miller (2009), Han et al. (2001), Hess and Rose (2009), Hess et al. (2012), Hu et al. (2012), Johnson and Meyer (1995), Kalyanaram and Little (1989), Kalyanaram and Winer (1995), Kivetz et al. (2004), Kopalle et al. (2012a, 2012b), Kwak (2007), Masiero and Hensher (2010), Mazumdar and Papatla (2000), Moon et al. (2006), Newman and Newman (2007), Neumann et al. (2012), Nicolau (2011), Pauwels et al. (2007), Rose and Masiero (2010), and Terui and Dahana (2006a, 2006b) have established loss aversion across a variety of data sources, product and service categories, and methods of analyses. Researchers have established these findings across individual levels and/or aggregate data from Australia, Europe, United States, and other markets, and across consumer-packaged goods data (such as bacon, beverages, chocolate, coffee, cola, crackers, detergent, drinks, ketchup, orange juice, peanut butter, and tuna), consumer durables data (such as personal computers, laptops, and digital cameras), and service data (car travel, flight travel, holiday destination choice, and hospital services). The researchers have used a variety of empirical analyses and models such as latent class models, deterministic segmentation models, mixed logit model with continuous distribution of parameters, and logit and probit models.

Pricing Decisions in Financial Markets

Several asset-pricing models (Barberis & Huang, 2001, 2008; Benartzi & Thaler, 1995; Haigh & List, 2005) have been developed, using the principle of "loss aversion." Benartzi and Thaler (1995) developed a single-period portfolio model on the basis of prospect theory. Barberis and Huang (2001) extended this model. They examined asset prices when the investors weight the changes to the values of their financial wealth at least as much as the asset prices. The researchers find the following:

1. Investors are loss averse over these fluctuations, and the degree of loss aversion depends on their prior investment performance.
2. The framework also helps in explaining the high mean, excess volatility, and predictability of stock returns, as well as their low correlation with consumption growth.

Haigh and List (2005) found that myopic loss aversion was actually higher among professional traders than nonprofessionals such as students. Barberis and Huang (2008) studied the asset-pricing implications of cumulative prospect theory. Their analysis has yielded an interesting insight, "a security's own skewness can be priced: a positively skewed security can be 'overpriced' and can earn a negative average excess return." Grüne and Semmler (2008) extended these models to a dynamic environment. In all these models, using loss aversion produces "better results than one usually obtains from pure consumption-based asset pricing models," a surprising result.

Barberis (2013) offers a thoughtful review of the impact of prospect theory on finance.

Product Announcement Decisions

In an interesting paper, Natarajan et al. (2010) examined the reaction of a stock market to the announcements of new product decisions by the firms. The announcements were categorized as negative news and positive (negative) news. The first category included product withdrawals, "delays in launching new products, cutbacks in investments, and product abandonment announcements." The second category included "announcements of new products during tradeshows, the test marketing of new products, press releases and stories relating to the next generation of technology products, and new product-related investments, which also included launch of new products and/or extension of a newly launched product into new markets."

The researchers employed event study methodology (Fama et al., 1969) to calculate the market value of the firm, following the announcement of new products. They found that the cumulative abnormal returns were positive and statistically significant. While test market and national launches generated positive reaction in market returns, announcement of delays and exits generated a sharp negative reaction. The negative reaction is much sharper than the positive reaction.

Meta-analysis of Loss-Aversion Effect

There have been three meta-analytic studies that have reviewed a large number of research outputs and established the asymmetric effect of price increases and decreases:

1. Meyer and Cramon-Taubadel (2004) surveyed over 40 studies and found that the asymmetric price was consistent and robust. There were differences in the magnitudes of the effect, largely driven by econometric methods.
2. Employing random-utility models, Neumann and Bockenholt (2014) examined 33 studies in their meta-analysis. They found that the loss-aversion effect was robust across many categories.

3. In a more recent meta-analysis, Walasek et al. (2018) found that the loss-aversion effect was significant, and their estimate of the loss-aversion coefficient was 1.31, slightly smaller than some of the previous estimates.

In another domain, Saini et al. (2018) found that the asymmetric effect was applicable to quantity increases (seen as gains) and decreases (seen as losses) for the same price in a study of consumer-packaged goods in India.

Public Policy Implications of Loss Aversion

There have also been interesting policy studies to examine how price-loss aversion may be effectively used as a policy tool to improve outcomes.

For instance, price-loss aversion has a more dominant effect on household mobility than equity constraints. Price-loss aversion has roughly two-and-a-half to three times more impact of equity constraints (Engelhardt, 2001). Additionally, the study also found that "household intra-metropolitan own-to-own mobility responds differently to housing price losses than to gains." A second instance is the impact of loss aversion on commercial property prices. Genesove and Mayer (2001) and Bokhari and Geltner (2010) found that loss aversion had a significant effect on pricing of commercial property in the Boston market in the 1990s and in the US market in the 2000s. A third illustration is the power of loss aversion in improving the quality of teaching in schools. In a very interesting study, Fryer et al. (2012) found that if teachers were "paid in advance and asked to give back the money if their students do not improve sufficiently," the performance of the students improved dramatically. Specifically, math test scores went up very substantially—"equivalent to increasing teacher quality by more than one standard deviation."

Mental Accounting

Theory

Building on prospect theory, Thaler (1985) developed a new model of consumer behavior "using a hybrid of cognitive psychology and microeconomics." The model organizes the "mental coding of combinations of gains and losses" based on prospect theory's value function. And the evaluation of purchases is modeled using the new concept of "transaction utility."

Mental accounting is the set of "cognitive operations used by individuals and households to organize, evaluate, and keep track of financial activities" (Thaler, 1999). There are three inter-related components of mental accounting. The first component discusses how outcomes are framed and experienced by an individual. The second component involves how different incomes and expenditures are categorized and assigned to different mental accounts. The third component addresses the characteristics of these mental accounts, including the frequency of evaluation and the breadth/scope of the accounts. Each of these components "violates the economic principle of fungibility" (Thaler, 1999). Therefore, it is clear that "mental accounting influences choice" (Thaler, 1999).

Based on these principles, Thaler (1985) proposed a transaction utility theory. Here, the decision-maker first evaluates potential, and then approves or disapproves the transaction. "The first stage is a judgment process, whereas the second is a decision process."

Implications/Principles

There are important and evident implications/principles.[3] They are "segregate gains and integrate losses." As a corollary, we have these principles: "silver linings" (segregate small gains when they are combined with large losses) and "cancellation" (integrate [or cancel] losses when combined with larger gains).

Segregation and integration concepts have found wide application. The pricing strategy has been one of the most important applications. For instance, segregation of gains argues that when giving price discounts (perceived as gains), it is better to offer multiple discounts than combining all of them in one offering. Why? Because the sum of smaller positive utilities generated from each of the multiple discounts is greater than the one large positive utility generated by combining all of them into one offering, that is, since v is concave, $v(x) + v(y) > v(x + y)$ segregation is preferred.

However, in raising prices (perceived as losses), it is prudent to bundle the entire price rise in one event (this represents integration of losses). Why? As the value function postulates that losses are steeper, and this implies that it is better to combine all the losses. The total sum of dis-utilities from each loss is greater than the dis-utility from one large loss, which aggregates all the individual losses, that is, since $v(-x) + v(-y) < v(-(x + y))$, integration is preferred.

"Silver lining" and "Cancellation" concepts are illustrated thus. Consider the following two situations:

Situation 1: Gain of $40 and loss of $4,000
Situation 2: Loss of $70 and gain of $100.

In situation 1, it is recommended that we segregate the small gain and the big loss. Whereas the big loss will obviously be painful, the small gain will bring a small hedonistic pleasure to the individual (silver lining). Why deprive an individual of small pleasure? In situation 2, the loss will bring pain and the gain pleasure. But if we combine the loss and the gain, there is a small net gain (or in some cases, the net loss is much smaller) which brings pleasure (smaller than the original amount), but the pain is cancelled completely.

Nudge Theory

Theory

Nudge is an intervention that gently steers individuals toward a desired action by framing the choice architecture and context to present the action as beneficial and

gainful. Unlike mandates and bans (e.g., criminal and/or civil statutes) or economic (or other) incentives/disincentives (e.g., subsidies and/or taxes), a nudge is a "liberty-preserving approach" that steers an individual in a particular direction.

Thaler and Sunstein (2008) built on the prospect theory principles of framing, loss aversion, and assignment of gains and losses with respect to a reference point. The researchers demonstrated that the architecture could impact choices substantially. Appropriate framing can make it easier for people to choose what is best for themselves, their families, and their society. The researchers illustrated how appropriate framing of the "choice architecture" can facilitate in nudging us to more beneficial decisions both in personal and public lives.

The researchers defined a nudge as thus:

> A nudge, as we will use the term, is 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.

Decision-making

Extant research has shown that the biases and heuristics are important elements of all human choices and decisions. Some of these choices and decisions are pedestrian, others consequential, some with a shorter time horizon, and others with a longer time horizon. But all decisions and choices are subject to biases, which make us susceptible to errors in judgment. As Kalyanaram and Muralidharan (2011) assess,

> Individually and collectively as a society, our errors in judgment can be very consequential. For instance, we are consistently "over-confident" about our abilities and the outcomes of events, and how this leads to imprudent risk-taking. The "above average effect" is pervasive generating unrealistic optimism. The "irrational exuberance" in the high-tech industry or the housing market illustrates this nicely. Of course, in both the cases unrealistic optimism eventually led to pain and agony. On temptation and self-control strategies, the authors show the values of "mental accounting" and budgeting. In the budgeting context, monies are not fungible (if the money dries up in one budget, and even if the monies are available in another budget line, rules do not normally permit use of monies from the second budget for items in the first budget).

Applications and Examples of Nudges

Here, we list a few representative nudges. Please see Sunstein (2014) for a succinct summary of nudging strategies.

Default Rules and Precommitment Strategies

Let us consider personal financial decisions relating to individual savings and investing strategies, and management of credits and loans. Individuals save and invest best when savings and investments are the default rules. "Automatic" enrollment in a defined benefit savings plan and in an investment plan is an

illustration of default rules. If an individual does not want to invest, she/he must deliberately opt out of the savings and investment programs. The default rules (nudges) produce much better outcomes than education and persuasion programs.

The same nudging strategy of "automatic enrollment" (default rule) produces effective outcomes for enrollment for education, health, and such programs that would enhance productivity and prosperity of an individual.

Related to the default rule, precommitment is another important nudging strategy. The precommitment nudging strategy asserts that setting a definitive (often numeric) goal increases the odds of attaining that goal. For instance, setting a definitive goal of saving at least $500 a month yields better outcomes than the more general goal of "I want to save more." When the precommitment strategy is combined with the default rule, results dramatically improve.

Explicit Cues Including Warnings

Where the risks are high, it may be worthwhile to provide explicit cues and/or warnings. For example, human beings are terribly bad in conservation of energy because energy is invisible. Accordingly, "visual cues such as a visible sign which will illumine red if the person consumes too much energy and green if the person consumes prudent level of energy are recommended. This simple visual cue successfully nudges human beings to conserve energy" (Kalyanaram & Muralidharan, 2011). A similar approach is suggested to present the dangers of smoking and/or obesity.

Freedom

This category of nudges deals with issues such as choices in schools for educating one's kids, ways to reduce medical liability, and increasing the odds of success of marriage:

> An interesting nudge to increase the odds of high school students attending colleges is to make application to a college a requirement for high-school graduation. While this nudge is interesting and is employed in San Marcos, Texas, the large-scale applicability of this nudge while being compliant with the law, is doubtful. Another suggestion is that society should let patients sign a private contract releasing the doctors of liabilities, but the courts do not like such arrangements. (Kalyanaram & Muralidharan, 2011)

Herd Mentality/Conformity

With regard to conformity, human beings conform because they do not want to stand out, that is, they do not want to be noticed as different from others. As a result, we observe herd mentality. Perhaps because of ego and/or insecurity and/or vanity, human beings tend to inflate their importance and worth and assume that the world is observing them carefully. However, as evidence shows, this is not a correct assumption, that is, the world is not as interested in us as we think.

> Accordingly, if we can "nudge" human beings away from the assumption of "spotlight effect," then their decisions and choices are less likely to be conforming and hence error-prone. In addressing the "choice architecture," the authors set out the commonsensical principle that stimulus, that is, the signal should be consistent with the desired action and/or behavior. (Kalyanaram & Muralidharan, 2011)

Application of Prospect Theory and Related Concepts/Theories to Management of COVID-19 Pandemic[4]

In this section, we discuss the application of prospect theory and related theories/ concepts to management of COVID-19 pandemic.

Framing of the Message/Mandate

Hameleers (2021) studied the application of prospect theory to the compliance of social interventions (such as face coverings, social distancing, and lockdowns) in mitigating the diffusion of coronavirus (COVID-19) in two different settings: the United States and the Netherlands. The study specifically examined the effects of loss and gain frames on "preferences for risk-seeking versus risk-aversive interventions," and "stricter interventions to fight the virus." The results suggested strong support for framing. Exposure to gain frames yielded more support for stricter interventions than loss frames. Based on its empirical findings, the study makes the following recommendation:

> … if governments want to motivate support or policies and preventative measures that have more certain outcomes (i.e., preventions such as social isolation or a shut-down of social life), they should rely on gain frames instead of loss frames (i.e., focusing on the amount of lives that can be saved if citizens incorporate the advice to integrate preventative behaviors in their daily routines).

Sanders et al. (2020), however, found the support for framing to be weaker. "Participants seeing the loss frame are slightly (but not significantly) more in favour of faster easing, and less likely to comply." This difference may be attributable to a numbing/satiation/fatigue effect moderating the results. Hameleers (2021) study was conducted when the pandemic had just started, but the study by Sanders et al. (2020) was conducted during the full throttle of the pandemic.

Re-opening Decision

Underlying prospect theory is the consumer choice heuristics. One such heuristic is EBA. This decision-making rule has proved to be an efficient algorithm. EBA is a noncompensatory model when generalized. The noncompensatory decision-making involves identifying a set of criteria relevant to the decision and assigning an acceptable threshold value for each criterion (Einhorn, 1970). The noncompensatory model has two principles. The first principle is that of sequential consideration of criteria. The sequence generally follows a pattern such as the most important to least important attribute or feature. But the sequence may also not follow any pattern. The second principle is that of a critical tolerance or threshold level for each attribute. Unless the attribute satisfies the threshold levels for each attribute, the choice is discarded. This is similar to the satisficing principle proposed by Simon (1955). In summary, in a noncompensatory model (EBA), decision-makers are interested in certain threshold levels on each criterion. Values greater or less than the threshold value are, of course, welcome, but the threshold level should be sufficient.

EBA has important application to pandemic management, and specifically, the decision to reopen the economy/society. Here is an illustration of a

noncompensatory, EBA model. For instance, a policy decision-maker may want the positive test rate for the virus to be no more than 1.5%, at least 25% of beds to be available for Intensive Care Unit (ICU), and capacity to conduct at least 20,000 tests a day. If the respective values are 1.2%, 30%, and 22,000, then the region is ready to be opened. On the other hand, if the respective values are 1.2%, 20%, and 22,000, then the region is not ready to open because the availability of ICU beds is less than the threshold value.

EBA models are likely to be more efficient and less biased. They are more efficient because the model requires lesser number of inputs (enumeration of criteria and setting threshold levels) than the compensatory decision-making model that requires a greater number of inputs (enumeration of criteria, assessing their relative importance weights, rating each criterion on performance, and setting a threshold composite score). Second, EBA is a heuristic (see Hauser et al., 2009).[5] Noncompensatory models are likely to be less biased, because there are smaller number of subjective inputs into the model.

Here, we describe the re-opening strategy of the State of New York in the United States as an application of EBA and noncompensatory model. The State of New York was deliberate in its reopening strategy in two ways. First, the State divided the entire State into various individual regions, and let each region be independent of the other in reopening decision. Second, the State adopted a strategy of phased reopening. The State adopted a successful re-opening strategy and as Dr Anthony Fauci has observed, the state did it "correctly."[6] From its peak of about 800 deaths a day in mid-April, mortality shrunk to about 10–20 per day (based on reports on July 21, 2020).[7] The number of hospitalizations decreased from about 17,000 to 18,000 per day in the peak in mid-April to about 700 to 800 per day (based on reports on July 20, 2020).[8] The success can be attributed to many elements: setting clear decision-making parameters,[9] and adhering to the parameters. Both elements were challenging because of the political ecology. Specifically, the State clearly enumerated the six criteria[10] and the specific threshold value for each of the criteria. The State did not deviate from the requirements. The State opened a region only when it fulfilled all the six required threshold values corresponding to the six criteria.

Of course, effective decision-making depends on sound inputs. Some of the main inputs are forecasts of the number of deaths and the resource requirements such as regular beds and ICU beds. Here, Kalyanaram and Mukherjee (2020) have developed an accessible and parsimonious model to forecast the number of deaths. Please see their paper for the details.

Closing and Re-opening Decision Strategy

We know that mental accounting theory affirms that we should segregate the gains and integrate the losses. In this context, what should be the strategy with regard to closing the economy (and schools/colleges)? Obviously, closing the economy is a loss. Assume a government closes the economy and reopens after a period of closure, and assume that the government is forced to close the economy again. This is not an optimal decision. Integration of losses advises us that instead of closing, opening, and closing again, it is better to keep the economy (and schools/colleges) closed for a longer time period so that it does not have to be closed again.

Increasing the Odds of Diffusion of Accurate Information

Finally, nudge theory offers useful insights into how we can accentuate the correct information about the pandemic and attenuate the misinformation. Pennycook and his colleagues (2020) showed that an ''accuracy nudge'' from social media networks could curtail the spread of misinformation about COVID-19. An ''accuracy nudge'' is a reinforcement and/or indirect/implied suggestion that would increase the odds of considering the accurate information and rejection of incorrect information. Pennycook used the rating of an accurate headline as the accuracy nudge before the subjects were asked to share their willingness to share the news provided to them. And this simple intervention increased the odds of spreading/sharing accurate information.

Earlier in the year, Nekmat (2020) also showed that nudges decreased the odds of dissemination of inaccurate information. The study found that ''fact-check alerts could, indeed, deter users from disseminating news misinformation to others on social media.'' Such a nudge appears to work because of loss aversion—in this case, loss of peer reputation and recognition. A fact-alert check highlights the risk of sharing faulty news, evoking loss aversion. As the study points out, ''This restraint aligns with prior studies evincing users' inclination to preserve their social status and approval in peer networks for sharing news and information on social media.''

Conclusions

The impact of behavioral decision theories—and particularly, the prospect, mental accounting, and nudge theories—has been very substantial across many disciplines, including economics, finance, marketing, and public policy.

The scholarly research in this area has been deep and interdisciplinary. But there is much more to be done. Most of the extant research has been experimental. There is much room for analytical and empirical work. There is also a productive opportunity to identify empirical generalizations which can form the foundation for further scholarly research and robust managerial insights.

Declaration of Conflicting Interests

Funding

Notes

1. This manuscript draws from the published and draft research work by Gurumurthy Kalyanaram. To make the points succinctly, we periodically cite the extant findings directly from the various research outputs.

2. The draft manuscript by Kalyanaram and Winer (2020) on 'Behavioral Response to Pricing' prepared for the special issue of *Journal of Retailing* has a detailed description of loss-aversion effect. The material in this section has been adapted from the mentioned working paper.

3. Here is a public policy application. In a recent paper, Muehlbacher et al. (2020) argued that the mental segregation of taxes due from net income affects a taxpayer's reference point in the compliance decision and results in higher tax compliance.

4. The draft manuscript prepared by Kalyanaram (2020) for the *Society for Advances on Management* discusses this topic at substantial length, and the material here is adapted from this manuscript.

5. http://www.mit.edu/~hauser/Papers/Hauser_Ding_Gaskin_Sawtooth_Consideration_ May_02_09.pdf

6. https://www.pbs.org/newshour/show/how-fauci-says-the-u-s-can-get-control-of-the-pandemic

7. New York city reported zero mortality for the first time since March 2020 on or around July 20, 2020. See: https://www1.nyc.gov/site/doh/covid/covid-19-data.page

8. https://www.cdc.gov/covid-data-tracker/#cases

9. As we have already described, setting clear measurable goals is a successful nudge that produces better outcomes.

10. *Criteria 1–2: Decline in Total Hospitalizations and Decline in Deaths*. A region had to experience "a sustained decline in total net hospitalizations—the total number of people in the hospital each day, calculated on a three-day rolling average—over the course of a 14-day period."

    Criterion 3: New Hospitalizations. Here the requirement was "the occurrence of fewer than two new hospitalizations per 100,000 residents (measured on a three-day rolling average)."

    Criteria 4–5: Hospital Bed Capacity, ICU Bed Capacity. The condition here was that a region "must have at least 30% of their total hospital beds available before a phased re-open can begin."

    Criteria 6: Diagnostic Testing Capacity. "Phased re-openings will depend on the ability of each region to achieve 30 tests per 1,000 people per month."

References

Barberis, N., & Huang, M. (2001). Mental accounting, loss aversion, and individual stock returns. *Journal of Finance*, *56*(4), 1247–1292.

Barberis, N., & Huang, M. (2008). Stocks as lotteries: The implications of probability weighting for security prices. *American Economic Review*, *98*(5), 2066-2100. https://doi.org/10.1257/aer.98.5.2066

Barberis, N. C. (2013). Thirty years of prospect theory in economics: A review and assessment. *Journal of Economic Perspectives*, *27*(1), 173–196. https://doi.org/10.1257/jep.27.1.173

Benartzi, S., & Thaler, R. (1995). Myopic loss aversion and the equity premium puzzle. *The Quarterly Journal of Economics*, *110*(1), 73–92.

Bokhari, S., & Geltner, D. (2010). Loss aversion and anchoring in commercial real estate pricing: Empirical evidence and price index implications. *Real Estate Economics*, *39*(4), 635–670.

Briesch, R. A., Krishnamurthi, L., Mazumdar, T., & Raj, S. P. (1997). A comparative analysis of reference price models. *Journal of Consumer Research*, *24*(2), 202–214.

Bronnenberg, B. J., & Wathieu, L. (1996). Asymmetric promotion effects and brand positioning. *Marketing Science*, *15*(4), 379–394.

Dayaratna, K., & Kannan, P. K. (2012). A mathematical reformulation of the reference price. *Marketing Letters*, *23*(3), 839–849.

Delle Site, P., & Filippi, F. (2011). Stochastic user equilibrium and value-of-time analysis with reference-dependent route choice. *European Journal of Transport and Infrastructure Research*, *11*(2), 194–218.

Einhorn, H. J. (1970). The use of nonlinear, noncompensatory models in decision making. *Psychological Bulletin*, *73*(3), 221–230. https://doi.org/10.1037/h0028695

Engelhardt, G. V. (2001). Nominal loss aversion, housing equity constraints, and household mobility: Evidence from the United States. *Journal of Urban Economics*, *53*(1), 171–195.

Erdem, T., Mayhew, G., & Sun, B. (2001). Understanding reference-price shoppers: A within and cross-category analysis. *Journal of Marketing Research*, *38*(4), 445–457.

Fama, E. F., Fisher, L., Jensen, M. C., & Roll, R. (1969). The adjustment of stock prices to new information. *International Economic Review*, *10*(1), 1–21. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=321524

Fryer, R. G., Levitt, S. D., List, J., & Sadoff, S. (2012). *Enhancing the efficacy of teacher incentives through loss aversion: A field experiment* (NBER Working Paper No. 18237, JEL No. J24). https://www.nber.org/system/files/working_papers/w18237/w18237.pdf

Genesove, D., & Mayer, C. (2001). Loss aversion and seller behavior: Evidence from the housing market. *The Quarterly Journal of Economics*, *116*(4), 1233–1260.

Grüne, L., & Semmler, W. (2008). Asset pricing with loss aversion. *Journal of Economic Dynamics and Control*, *32*(10), 3253–3274.

Habib, K. M. N., & Miller, E. J. (2009). Modeling individuals' frequency and time allocation behavior for shopping activities considering household-level random effects. *Transportation Research Record*, *1985*(1), 78–87.

Haigh, M. S., & List, J. A. (2005). Do professional traders exhibit myopic loss aversion? An experimental analysis. *Journal of Finance*, *60*(1), 523–534.

Hameleers, M. (2021). Prospect theory in times of a pandemic: The effects of gain versus loss framing on risky choices and emotional responses during the 2020 coronavirus outbreak – evidence from the US and the Netherlands. *Mass Communication and Society*. https://doi.org/10.1080/15205436.2020.1870144

Han, S., Gupta, S., & Lehmann, D. R. (2001). Consumer price sensitivity and price thresholds. *Journal of Retailing*, *77*(4), 435–456.

Hauser, J. R., Ding, M., & Gaskin, S. P. (2009, March 23–27). *Non-compensatory (and compensatory) models of consideration-set decisions* [Conference paper], Proceedings of the Sawtooth Software Conference, Delray Beach, FL.

Helson, H. (1964). *Adaptation level theory*. Harper and Row.

Hess, S., & Rose, J. M. (2009). Should reference alternatives in pivot design SC surveys be treated differently? *Environmental and Resource Economics*, *42*, 297–317.

Hess, S., Stathopoulos, A., & Daly, A. (2012). Allowing for heterogeneous decision rules in discrete choice models: An approach and four case studies. *Transportation*, *39*(3), 565–591.

Hu, G., Sivakumar, A., & Polak, J. W. (2012). Modelling travellers' risky choice in a revealed preference context: A comparison of EUT and non-EUT approaches. *Transportation*, *39*, 825–841.

Johnson, E. J., & Meyer, R. J. (1995). Empirical generalizations in the modeling of consumer choice. *Marketing Science*, *14*(3), G180–G189.

Kahneman, D., & Tversky, A. (1972). Subjective probability: A judgment of representativeness. *Cognitive Psychology*, *3*(3), 430–454.

Kahneman, D., & Tversky, A. (1979). Prospect theory: An analysis of decision under risk. *Econometrica*, *47*(2), 263–291.

Kalyanaram, G., & Little, J. D. C. (1989). *A price response model developed from perceptual theories*. MIT Sloan School Working Paper # 3038-89, MIT Marketing Center Working Paper 89-5. https://dspace.mit.edu/bitstream/handle/1721.1/2257/SWP-3038–21668377.pdf

Kalyanaram, G., & Little, J. D. C. (1994). An empirical analysis of latitude of price acceptance in consumer package goods. *Journal of Consumer Research*, *21*(3), 408–418.

Kalyanaram, G., & Winer, R. S. (1995). Empirical generalizations from reference price research. *Marketing Science*, *14*(3), G161–G169.

Kalyanaram, G., & Muralidharan, S. (2011). Nudge: Improving decisions about health, wealth, and happiness. *International Journal of Pharmaceutical and Healthcare Marketing*, *5*(4), 349–352. https://doi.org/10.1108/17506121111190149

Kalyanaram, G., & Mukherjee, A. (2020). The bass model: A parsimonious and accurate approach to forecasting mortality caused by Covid-19. *International Journal of Pharmaceutical and Healthcare Marketing*, *14*(3), 349–360. https://www.emerald.com/insight/publication/issn/1750–6123

Kardes, F. R., Posavac, S., & Cronley, M. (2004). Consumer inference: A review of processes, bases, and judgment contexts. *Journal of Consumer Psychology, 14*(3), 230–256.

Kivetz, R., Netzer, O., & Srinivasan, V. (2004). Extending compromise effect models to complex buying situations and other context effects. *Journal of Marketing Research*, *41*(3), 237–257.

Kopalle, P. K., Sun, Y., Neslin, S. A., & Swaminathan, V. (2012a). The joint sales impact of frequency reward and customer tier components of loyalty programs. *Marketing Science*, *31*(2), 216–235.

Kopalle, P. K., Kannan, P. K., Boldt, L. B., & Arora, N. (2012b). The impact of household level heterogeneity in reference price effects on optimal retailer pricing policies. *Journal of Retailing*, *88*(1), 102–114.

Kwak, K. (2007). *Price response in multiple item choice: Spillover effects of reference price* [Unpublished doctoral dissertation]. University of Iowa.

Masiero, L., & Hensher, D. A. (2010). Analyzing loss aversion and diminishing sensitivity in a freight transport stated choice experiment. *Transportation Research Part A: Policy and Practice*, *44*(5), 349–358.

Mazumdar, T., & Papatla, P. (2000). An investigation of reference price segments. *Journal of Marketing Research*, *37*(2), 246–258.

Meyer, J., & Cramon-Taubadel, S. v. (2004). Asymmetric price transmission: A survey. *Journal of Agricultural Economics*, *55*(3), 581–611.

Natarajan, V., Kalyanaram, G., & Munch, J. (2010). Asymmetric market reaction to new product announcements: An exploratory study. *Academy of Marketing Studies Journal*, *14*(2), 1–11.

Nekmat, E. (2020). Nudge effect of fact-check alerts: Source influence and media skepticism on sharing of news misinformation in social media. *Social Media + Society*, *6*(1), 1–14. https://doi.org/10.1177/2056305119897322

Neumann, N., & Bockenholt, U. (2014). A meta-analysis of loss aversion in product choice. *Journal of Retailing*, *90*(2), 182–197.

Neumann, N., Sinha, A., & Bockenholt, U. (2012). Is extremeness aversion driven by loss aversion? Contrasting reference point models of durable product choice. *Advances in Consumer Research*, *40*, 915–196

Newman, E., & Newman, S. (2007). Reference-dependent preferences and loss aversion: A discrete choice experiment in the health-care sector. *Judgment and Decision Making*, *3*(3), 162–173.

Nicolau, J. L. (2011). Testing prospect theory in airline demand. *Journal of Air Transport Management*, *17*(4), 241–243.

Pauwels, K. H., Srinivasan, S., & Franses, P. H. (2007). When do price thresholds matter in retail categories? *Marketing Science*, *26*(1), 83–100.

Pennycook, G., McPhetres, J., Zhang, Y., Lu, J., & Rand, D. (2020). Fighting COVID-19 misinformation on social media: Experimental evidence for a scalable accuracy nudge intervention. *Psychological Science*, *31*(7), 770–780. https://doi.org/10.1177%2F0956797620939054

Rose, J. M., & Masiero, L. (2010). A comparison of the impacts of aspects of prospect theory on WTP/WTA estimated in preference and WTP/WTA space. *European Journal of Transport and Infrastructure Research*, *10*(4), 330–346.

Saini, G., Sahay, A., & Kalyanaram, G. (2018). An empirical study of latitude of quantity acceptance (LQA) in an emerging economy: India. *Journal of Global Marketing*, *31*(2), 1–17.

Sanders, M., Stockdale, E., Hume, S., & John, P. (2020). Loss aversion fails to replicate in the coronavirus pandemic: Evidence from an online experiment. *Economics Letters*, *99*, 109433. https://doi.org/10.1016/j.econlet.2020.109433

Sangkil, M., Russell, G. J., & Duvvuri , S. D. (2006). Profiling the reference price consumer. *Journal of Retailing, 82*(1), 1–11.

Sherif, M., Taub, D., & Hovland, C. I. (1958). Assimilation and contrast effects of anchoring stimuli on judgments. *Journal of Experimental Psychology*, *55*(2), 150–155.

Simon, H. (1955). A behavioral model of rational choice. *Quarterly Journal of Economics*, *69*(1), 99–118. https://doi.org/10.2307/1884852

Sunstein, C. (2014). Nudging: A very short guide. *Journal of Consumer Policy*, *37*(4), 583–588. https://dash.harvard.edu/bitstream/handle/1/16205305/shortguide9_22.pdf

Terui, N., & Dahana, W. D. (2006a). Estimating heterogeneous price thresholds. *Marketing Science*, *25*(4), 384–391.

Terui, N., & Dahana, W. D. (2006b). Price customization using price thresholds estimated from scanner panel data. *Journal of Interactive Marketing*, *20*(3–4), 58–70.

Thaler, R. H. (1985). Mental accounting and consumer choice. *Marketing Science*, *4*(3), 199–214.

Thaler, R. H. (1999). Mental accounting matters. *Journal of Behavioral Decision Making*, *12*(3), 183–206. https://doi.org/10.1002/(SICI)1099-0771(199909)12:3<183::AID-BDM318>3.0.CO;2-F

Thaler, R., & Sunstein, C. R. (2008). *Nudge: Improving decisions about health, wealth, and happiness*. Yale University Press.

Tversky, A. (1972). Elimination by aspects: A theory of choice. *Psychological Review*, *79*(4), 281–299. https://doi.org/10.1037/h0032955

Tversky, A., & Kahneman, D. (1974). Judgment under uncertainty: Heuristics and biases. *Science*, *185*(4157), 1124-1131.

Walasek, L., Mullett, T. L., & Stewart, N. (2018). *A meta-analysis of loss aversion in risky contexts* (Working Paper). University of Warwick. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3189088