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Anomalies
Risk Aversion

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Economics can be distinguished from other social sciences by the belief that most (all?) behavior can be explained by assuming that rational agents with stable, well-defined preferences interact in markets that (eventually) clear. An empirical result qualifies as an anomaly if it is difficult to "rationalize" or if implausible assumptions are necessary to explain it within the paradigm. Suggestions for future topics should be sent to Richard Thaler, c/o Journal of Economic Perspectives, Graduate School of Business, University of Chicago, Chicago, IL 60637, or ⟨thaler@gsb.uchicago.edu⟩.

Introduction

Most of the columns in this "Anomalies" series have discussed empirical results that, if taken at face value, immediately strike economists as violations of the standard economic model. Risk aversion, the topic of this entry in the series, is rather different. Here the behavior we will point to—the hesitation over risky monetary prospects even when they involve an expected gain—will not strike most economists as surprising. Indeed, economists have a simple and elegant explanation for risk aversion: It derives from expected utility maximization of a concave utility-of-wealth function. This model is used ubiquitously in theoretical and empirical economic research. Despite its central

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place, however, we will show that this explanation for risk aversion is not plausible in most cases where economists invoke it.

To help see why we make such a claim, suppose we know that Johnny is a risk-averse expected utility maximizer, and that he will always turn down the 50-50 gamble of losing $10 or gaining $11. What else can we say about Johnny? Specifically, can we say anything about bets Johnny will be willing to accept in which there is a 50 percent chance of losing $100 and a 50 percent chance of winning some amount $Y? Consider the following multiple-choice quiz:

> From the description above, what is the biggest Y such that we *know* Johnny will turn down a 50-50 lose $100/win $Y bet?
>
> a) $110
> b) $221
> c) $2,000
> d) $20,242
> e) $1.1 million
> f) $2.5 billion
> g) Johnny will reject the bet no matter what Y is.
> h) We can't say without more information about Johnny's utility function.

Before you choose an answer, we remind you that we are asking what is the highest value of Y making this statement true for *all* possible preferences consistent with Johnny being a risk-averse expected utility maximizer who turns down the 50/50 lose $10/gain $11 for all initial wealth levels. Make no ancillary assumptions, for instance, about the functional form of Johnny's utility function beyond the fact that it is an increasing and concave function of wealth. Stop now, and make a guess.

Did you guess a, b, or c? If so, you are wrong. Guess again. Did you guess *d*? Maybe you figured we wouldn't be asking if the answer weren't shocking, so you made a ridiculous guess like *e*, or maybe even *f*. If so, again you are wrong. Perhaps you guessed *h*, thinking that the question is impossible to answer with so little to go on. Wrong again.

The correct answer is *g*. Johnny will turn down *any* bet with a 50 percent risk of losing at least $100, no matter how high the upside risk.

Johnny would, of course, have to be insane to turn down bets like *d*, *e*, and *f*. So, what is going on here? In conventional expected utility theory, risk aversion comes *solely* from the concavity of a person's utility defined over wealth levels. Johnny's risk aversion over the small bet means, therefore, that his marginal utility for wealth must diminish incredibly rapidly. This means, in turn, that even the chance for staggering gains in wealth provide him with so little marginal utility that he would be unwilling to risk anything significant to get these gains.

The problem here is much more general. Using expected utility to explain anything more than economically negligible risk aversion over moderate stakes such as $10, $100, and even $1,000 requires a utility-of-wealth function that predicts absurdly severe risk aversion over very large stakes. Conventional expected utility theory is simply not a plausible explanation for many instances of risk aversion that economists study.

We spell out the logic behind this claim in the next section, and in the process attempt to convey why the failure is inherent to an approach that seeks to explain modest-scale risk attitudes in terms of marginal utility of wealth. In the remaining sections, we then present examples of how the expected utility framework has misled economists and briefly describe what we believe is a better explanation for risk aversion.

The Fundamental Miscalibration

The inability of expected utility theory to provide a plausible account of risk aversion over moderate stakes has been noted by several different authors, in a variety of specific contexts and with a variety of functional forms of the utility function. Some readers may be familiar with Arrow's (1971) formal limit result that expected utility maximizers are (almost everywhere) arbitrarily close to risk neutral when stakes are arbitrarily small. Rabin (2000) provides a theorem, however, that shows that the risk-neutrality implication of expected utility is not restricted to particular contexts, particular functional forms, or negligible stakes. Assuming *nothing* about the utility function except that it is increasing and concave, the theorem allows us to make statements of the form: "If an expected utility maximizer always turns down moderate-stakes Gamble A, she will always turn down large-stakes Gamble B."

The quiz with which we began is an illustration of such a statement. These statements establish the implausibility of expected utility theory by showing that absurd large-stakes risk aversion (rejecting Gamble B) follow inherently from non-negligible modest-scale risk aversion (rejecting Gamble A).

The logic behind this result is that within the expected utility framework, turning down a moderate stakes gamble means that the marginal utility of money must diminish very quickly. Suppose you have initial wealth of W, and you reject a 50-50 lose \$10/gain \$11 gamble because of diminishing marginal utility of wealth. Then it must be that $U(W + 11) - U(W) \leq U(W) - U(W\text{-}10)$. Hence, on average you value each of the dollars between W and $W + 11$ by at most 10/11 as much as you, on average, value each of the dollars between *W-10* and W. By concavity, this implies that you value the dollar $W + 11$ at most 10/11 as much as you value the dollar *W-10.* Iterating this observation, if you have the same aversion to the lose \$10/gain \$11 bet at wealth level $W + 21$, then you value dollar $W + 21 + 11 = W + 32$ by at most 10/11 as you value dollar $W + 21 - 10 = W + 11$, which means you value dollar $W + 32$ by at most $10/11 \times 10/11 \approx 5/6$ as much as dollar *W-10.* You will value the *W+ 210th* dollar by at most 40 percent as much as dollar *W-10*, and the *W+ 900th* dollar by at most 2 percent as much as dollar *W-10.* In words, rejecting the 50-50 lose \$10/gain \$11 gamble implies a 10 percent decline in marginal utility for each \$21 in additional lifetime wealth, meaning that the marginal utility plummets for substantial changes in lifetime wealth. You care less than 2 percent as much about an additional dollar when you are $900 wealthier than you are now. This rate of deterioration for the value of money is absurdly high, and hence leads to absurd risk aversion.

The theorem in Rabin (2000) builds from algebra like this to show that any attempt to explain attitudes about modest risk in terms of the utility of lifetime wealth would imply a paralyzing aversion to risks that everyone finds extremely attractive. Seen in this light, even rejecting a 50-50 lose $100/gain $101 gamble is implausible within the expected utility framework, since it implies a 1 percent drop in marginal utility for each $201 change in lifetime wealth, which implies absurd changes in marginal utility for swings of lifetime wealth of a mere $10,000 or $20,000. Table 1 provides a set of further examples based on the theorem in Rabin (2000). In each case, if a rational expected utility maximizer turns down the bet for modest stakes in the left-hand column, then logical consistency will require turning down the corresponding bet in the right-hand column.

In each case above, the left-hand column realistically describes most people's attitudes towards risk, but the implied large-scale risk attitudes describe nobody's. It bears reiterating that such results are not technical tricks, but rather an algebraic reflection of the implausible premise on which the theory is based. Think about it: Expected utility theory says risk attitudes derive solely from changes in marginal utility associated with fluctuations in lifetime wealth. Hence, the theory says that people will not be averse to risks involving monetary gains and losses that do not alter lifetime wealth enough to affect significantly the marginal utility one derives from that lifetime wealth. The conclusion that risk aversion pertains to large stakes and not small stakes isn't merely an artifact of the structure of expected utility theory—it is the central premise of the theory.

Readers still looking for the trick behind our seemingly preposterous claims, however, might latch onto the proviso "for all initial wealth levels." While this proviso affects the extremity of the results, getting rid of it won't rescue the expected utility model. Suppose, for instance, we know a risk-averse person turns down 50-50 lose $100/gain $105 bets for any lifetime wealth level less than $350,000, but know nothing about her utility function for wealth levels above $350,000, except that it is not convex. Then the theorem in Rabin (2000) tells us that from an initial wealth level of $340,000 the person will turn down a 50-50 bet of losing $10,000 and gaining $5.5 million. The intuition is that the extreme concavity of the utility function between $340,000 and $350,000 assures that the marginal utility at $350,000 is tiny compared to the marginal utility at wealth levels below $340,000. Hence, even if the marginal utility does not diminish at all above $350,000, a person won't care nearly as much about money above $350,000 as she does below $340,000.[1]

[1] One way to generate moderate-scale risk aversion over some ranges is with a utility-of-wealth function that is convex at some points. Such a concoction would not work, however, without simultaneously generating absurd further predictions. Friedman and Savage (1948) contrived a convex/concave utility-of-wealth

Table 1
The Necessary, Implausible Consequences of Risk Aversion at Low Levels of Wealth

If an Expected Utility Maximizer Always Turns Down the 50/50 bet...	*Then She Always Turns Down the 50/50 Bet...*
lose $10/gain $10.10	lose $1,000/gain $∞
lose $10/gain $11	lose $100/gain $∞
lose $100/gain $101	lose $10,000/gain $∞
lose $100/gain $105	lose $2,000/gain $∞
lose $100/gain $110	lose $1,000/gain $∞
lose $1,000/gain $1,010	lose $100,000/gain $∞
lose $1,000/gain $1,050	lose $20,000/gain $∞
lose $1,000/gain $1,100	lose $10,000/gain $∞
lose $1,000/gain $1,250	lose $6,000/gain $∞
lose $10,000/gain $11,000	lose $100,000/gain $∞
lose $10,000/gain $12,500	lose $60,000/gain $∞

Expected utility theory's presumption that attitudes towards moderate-scale and large-scale risks derive from the same utility-of-wealth function relates to a widely discussed implication of the theory: that people have approximately the same risk attitude towards an aggregation of independent, identical gambles as towards each of the independent gambles. This observation was introduced in a famous article by Paul Samuelson (1963), who reports that he once offered a colleague a bet in which he could flip a coin and either gain $200 or lose $100. The colleague declined the bet, but announced his willingness to accept 100 such bets together. Samuelson showed that this pair of choices was inconsistent with expected utility theory, which implies that if (for some range of wealth levels) a person turns down a particular gamble, then the person should also turn down an offer to play many of those gambles.

When Samuelson showed that his colleague's pair of choices was not consistent with expected utility theory, Samuelson thought that the mistake his colleague made was in accepting the aggregated bet, not in turning down the individual bet. This judgement is one we cannot share. The aggregated gamble of 100 50-50 lose $100/gain $200 bets has an expected return of $5,000, with only a 1/2,300 chance of losing any money and merely a 1/62,000 chance of losing more than $1,000. A good lawyer could have you declared legally insane for turning down this gamble.

By treating expected utility theory as a valid explanation of his colleague's aversion to the single gamble, and not questioning the plausibility of rejecting the aggregated gamble, we feel that Samuelson and economists since then have missed the true

function of this sort to reconcile the existence of both risk-loving gambling and risk-averse insurance preferences in an individual. But Markowitz (1952) provides simple, clear, and decisive illustrations of how the combined convex/concave functions lead to a host of patently false predictions.

implications of his equivalence theorem. Samuelson and others have speculated as to the error his colleague was making, such as thinking that the variance of a repeated series of bets is lower than the variance of one bet (whereas, of course, the variance increases, though not proportionally, with repetition). Others have played off the fact that the equivalence theorem holds only approximately to explore the precise qualitative relationship that expected utility permits between risk attitudes over one draw and many independent draws of a bet. But our argument here reveals the irrelevance of these lines of reasoning. It does not matter what predictions expected utility theory makes about Samuelson's colleague, since the degree of risk aversion he exhibited proved he was not an expected utility maximizer. In fact, under exactly the same assumptions invoked by Samuelson, the theorem in Rabin (2000) implies that a risk-averse expected utility maximizer who turns down a 50-50 lose $100/gain $200 gamble will turn down a 50-50 lose $200/gain $20,000 gamble. This has an expected return of $9,900—with exactly zero chance of losing more than $200. Even a *lousy* lawyer could have you declared legally insane for turning down *this* gamble.

So What?

Expected utility theory certainly captures some of the intuition for risk aversion over very large stakes. But the theory is manifestly not close to the right explanation for most risk attitudes, and some of the uses to which economists put the theory are misleading.

One example arises in experimental economics. In some experiments, the researchers would like to infer subjects' beliefs from the choices that they make. Suppose, for instance, we observe that a subject prefers winning $5 in Contingency A to winning $10 in Contingency B. Though we might be tempted to infer that the subject thinks Contingency A is at least twice as likely as Contingency B, economic theory tells us that we are not allowed to do so, because we should not assume people like $10 twice as much as $5. Experimentalists have developed a clever procedure to allow them to fend off complaints of improper inference: Instead of prizes of $10 and $5, subjects are given prizes such as a 10 percent chance of winning $100 vs. a 5 percent chance of winning $100. Since expected utility is linear *in probabilities*, the 10 percent lottery ticket can be assumed to be worth exactly twice the 5 percent chance of winning the same prize.

This lottery procedure either isn't necessary, or doesn't work. If subjects are expected utility maximizers then the procedure is unnecessary, since expected utility theory tells us that people will be virtually risk neutral in decisions on the scale of laboratory stakes. If subjects are not expected utility maximizers, then the procedure cannot be relied upon to work, since subjects may not have preferences that are linear in probabilities. Either way, the economics profession has burdened experimenters with this cumbersome procedure because economists have interpreted the expected utility hypothesis literally—but not seriously.

Another example of a problematic interpretation of expected utility theory arises when behavior is compared between small and large stakes. In a discussion of the equity premium puzzle, Kandel and Stambaugh (1991, pp. 68-69) point out that the intuitive plausibility of the very high coefficients of relative risk aversion necessary to explain the equity premium depends on the scale of risk being examined. They calculate that if an investor whose current wealth is $75,000 has a coefficient of relative risk aversion of 30—consistent with the historic equity premium in their analysis—the investor will pay $24,000 to avoid a 50-50 gamble of losing or winning $25,000. While Kandel and Stambaugh agree that this degree of risk aversion is absurd, they observe that the same person would only be willing to pay $38 to avoid a 50-50 gamble of losing or winning $375, which is more plausible. They summarize such examples by writing: "Inferences about [the coefficient of relative risk aversion] are perhaps most elusive when pursued in the introspective context of thought experiments," leaving the implication that economists should use care in choosing the appropriate hypothetical examples when measuring risk aversion.

But of course the same problem makes inferences from *real* contexts elusive: Data sets dominated by smaller-scale investment opportunities are likely to yield much higher estimates of risk aversion than data sets dominated by larger-scale investment opportunities. Indeed, the correct conclusion for economists to draw, both from thought experiments and from actual data, is that people do not display a consistent coefficient of relative risk aversion, so it is a waste of time to try to measure it.

Ignoring calibration can even lead researchers to misidentify strong evidence against expected utility theory as support *for* the theory. Cicchetti and Dubin (1994), for instance, study the choice by consumers to purchase protection from their local telephone company against having to pay for repairs to their internal telephone wiring. The authors report that, on average, consumers faced a choice of paying 45 cents a month for the insurance against an average .005 probability in a given month of having to pay a total repair cost averaging $55. Hence, people were paying 45 cents a month to insure against a "risk" that will average 28 cents per month, with a small risk of having to pay $55, and a minuscule risk of having to pay more. Millions of Americans every year buy similar wiring protection, as did 57 percent of households in Cicchetti and Dubin's sample. If utility-maximizing customers had close to rational expectations about the probability of needing repair, or merely figured out that the phone company aimed to make money from them net of transactions costs, then it is implausible that they would buy the protection. In any event, it is easy to reject the joint hypothesis of approximate expected utility maximization and approximate rational expectations.[2] The au-

[2] One of our colleagues, who buys this insurance, claims he does so to improve the service he will get in the event of a claim. We do not believe that there is any evidence that the policy will in fact improve service, and we can think of reasons why it might go the other way. In any case, Cicchetti and Dubin

thors, however, draw precisely the opposite conclusion, and offer their analysis as a real-world confirmation of expected utility maximization. Their misinterpretation replicates our profession's grander-scale misinterpretation of risk aversion, because, like most economists, they fail to realize that expected utility theory does not permit risk aversion for so little money.

What Does Explain Risk Aversion?

If expected utility theory doesn't explain the modest-scale risk aversion we observe, what does? We think that the right explanation incorporates two concepts that have been mentioned before in the "Anomalies" series: loss aversion and mental accounting.

Loss aversion is the tendency to feel the pain of a loss more acutely than the pleasure of an equal-sized gain. Loss aversion is incorporated in Kahneman and Tversky's prospect theory (1979), which models decisionmakers who react to changes in wealth, rather than levels, and are roughly twice as sensitive to perceived losses than to gains. When prospects are considered as gains and losses relative to the status quo (or some other reference point), and losses are weighted roughly twice as much as gains, then coin-flip bets offering less than two-to-one odds are routinely rejected. Hence, by incorporating loss aversion, prospect theory directly explains why people turn down even very small gambles with positive expected value.

Mental accounting, which refers to the way individuals and households keep track of and evaluate financial transactions, also plays a key role, because small-scale risk aversion seems to derive from the tendency to assess risks in isolation rather than in broader perspective.[3] If small-scale better-than-fair gambles were evaluated in broader perspective, people would be more likely to accept them. They would realize that by taking a series of such bets, the gains would tend to outweigh the losses in the long run. Moreover, when incorporated with their other wealth, the stakes of the bet would seem small. If, for instance, Samuelson's colleague had been asked whether he was willing to take a coin flip bet that would either increase the equity in his home by $200 or decrease it by $100, he would likely find this bet more attractive than the bet he was actually offered.

This tendency to take problems one at a time has variously been labeled decision isolation, narrow framing, narrow bracketing, or myopic loss aversion.[4] Myopic loss aversion can explain many phenomena that expected utility theory cannot, including several examples discussed in this paper. For example, Benartzi

(1994) argue that consumers are purchasing the protection entirely on its financial merits as an insurance policy.

[3] For a recent review of the literature on mental accounting, see Thaler (1999).

[4] See Redelmeier and Tversky (1992), Kahneman and Lovallo (1993), Benartzi and Thaler (1995, 1999), and Read, Loewenstein, and Rabin (1999).

and Thaler (1995) use it to characterize their explanation of the equity premium puzzle. If investors focus on the long-term returns of stocks they would recognize how little risk there is, relative to bonds, and would be happy to hold stocks at a smaller equity premium. Instead, they consider short-term volatility, with frequent mental accounting losses, and demand a substantial equity premium as compensation.

Such decision isolation is pervasive, and seems to us an essential part of any descriptive theory of how people think about risky choices. Indeed, in this way economists are just like people. In reality, we all face many small risks in life, so that decisions to reject risks on a case-by-case basis is the same as rejecting a series of risks. By turning down one bet each time he is offered one bet, but accepting a series of such bets when he thinks of them together, Samuelson's colleague gave two different answers to what is really the same question. One reason that people behave in a risk-averse manner with regard to small risks, even though expected utility theory suggests that they should behave in an approximately risk-neutral manner, is that people treat risk presented to them in isolation separately from other risks they face.[5]

We've Got Your Money Pump Right Here

We are arguing that when people decline gambles with positive expected value for modest stakes, they are violating expected utility theory. Economists have offered a class of arguments (variants of a theorem in de Finetti, 1937) that routine violations of expected utility theory cannot exist because persistent violators would be potential "money pumps"—that is, they would likely accept a series of bets that lead them to lose money with probability one. For reasons unknown to us, such a series of bets is called a Dutch book.

We are unimpressed by Dutch book arguments. Our reaction to the punch line that violators of expected utility can be exploited is: "Well, yes, they can be." But our reaction to the common insinuation that such exploitation is impossible because it would necessarily lead to widespread bankruptcy is perplexity. It does not seem to us obvious that if you can take some of a fool's money from him some of the time then you can take all of his money all of the time—especially not in a world where would-be money-pumpers will compete with each other to offer victims an attractive deal.[6]

Regardless of the merits of conventional money pump arguments, however, we

[5] For direct evidence on how focusing on risk narrowly versus broadly plays a role in the degree of risk aversion, see Redelmeier and Tversky (1992), Thaler, Tversky, Kahneman and Schwartz (1997), and Gneezy and Potters (1997).

[6] To our knowledge, in fact, there is little by way of tight, formal money pump arguments that actually apply to contexts where they are invoked. For a thoughtful analysis of money pumps and their problems, see Cubitt and Sugden (1999).

would argue that the application of a more intuitive money pump argument actually *strengthens* the case for myopic loss aversion over expected utility. In particular, myopic loss-averters are susceptible to exactly the type of piecemeal, mini-money pumps that we actually observe in the world, whereas expected utility maximizers would be susceptible to extreme money-pumping of the sort we do *not* observe. To see this, let us loosen the definition of a money pump to cover situations in which parties are not literally driven into bankruptcy with probability one, but instead make decisions that mean that others can take money from them with very high probability and very little risk.

We are all endowed with thousands of small risks in life, and because we are risk averse over each of these bets, profiteers will be tempted to sell us insurance policies on all of these small risks. How might potential money pumpers go about offering a collection of individual bets that a person will accept even though it bankrupts him? The cheapest and most direct way would be to offer a person all potential insurance policies collected together as one grand insurance policy sold at an exorbitant price. But this would not work against myopically loss-averse agents, because it is precisely for collections of bets presented together that myopically loss-averse agents act reasonably risk neutral. It is only the one-at-a-time, small-scale risks for which they are willing to pay tremendous insurance rates. Because a series of unattractive bets that is blatantly presented together is going to be rejected, Dutch bookies must be circumspect when setting out to exploit myopic loss-averters and would have to offer these unattractive bets one at a time. Information and transactions costs will prevent them from taking advantage of most of these small-scale trades, but for those small-scale insurance policies that can be sold without incurring large marketing expenses—such as when a customer is already buying a good or service—such policies will be sold. Hence, in an economy of myopic loss averters, we would see widespread sales of opportunistic, small-scale insurance sold at exorbitant prices that are inconsistent with expected utility theory, but also see many similar-sized risks left uninsured.

Well, *this is exactly what we see in the world.* Expected utility theory predicts that people buy insurance that features large deductibles and very deep coverage (high maximum payouts). Instead, most insurance policies (like auto and health) are of precisely the opposite variety: low deductibles and low limits. Even greater perversions, such as collision-damage waivers on car rentals and extended warranties on household appliances, are precisely the kinds of policies people buy if they are myopically loss averse. Indeed, internal wiring protection of the type discussed by Cicchetti and Dubin (1994) is a perfect illustration for the sort of insurance we should expect to see sold to myopic loss-averters. All said, myopic loss averters are subject to many short Dutch chapters in their lives, but not to Dutch books.[7]

[7] It is also worth noting that, because myopic loss aversion predicts that exorbitant small-scale insurance prices are typically bundled with a product already being sold, it predicts money pumps in cases where competition is less likely to come into play.

Give us an expected utility maximizer who buys small-scale insurance such as internal wiring protection, on the other hand, and we'll give you a money pump you can hang your hat on. In this case, the Phone Company representative who has just sold a devout expected utility maximizer the wiring protection would go on: "While I have you on the phone, The Phone Company is willing to insure you against *all* of life's $55 risks. Do you realize, sir, that as we've been talking, the value of your stock market portfolio has several times swung wildly up and down by more than $55? We'll protect you! Give us $55,000 and we'll insure you against the possibility of a $50,000 loss." A true expected utility maximizer who has just bought the wiring protection would jump at the offer. By contrast, myopic loss-averters would call the Better Business Bureau and report a scam. While myopic loss-averters find it reasonable to pay tremendous insurance rates to mitigate isolated risks, they would be outraged to pay the same insurance rates when those risks are bundled together. Unfortunately for aspiring money pumpers, all those we see around us purchasing small-scale insurance are myopic loss-averters rather than expected utility maximizers, and hence do not provide opportunities for spectacularly lucrative large-scale insurance policies. More generally, myopic loss aversion explains the high volume of the types of small-scale "money pumping" episodes we see in the world, while expected utility theory predicts money pumping of the sort we do not see.[8]

Expected Utility is an Ex-Hypothesis

While expected utility theory appeals to economists as a normative model of rational choice, almost from the beginning questions arose about the ability of the model to explain actual choices. For instance, Allais (1953) questioned whether people actually choose using linear probability weights, and Tversky and Kahneman (1981) showed that people's choices can vary depending on the wording (or "framing") of a problem, rather than its objective features. Because there have been repeated demonstrations of the shortcomings of the expected utility model, some readers may think that in pointing out further failures we are beating a dead horse.

There is much truth to this. Indeed, we aspire to have written one of the last articles debating the descriptive validity of the expected utility hypothesis. But we have also often been surprised by economists' reluctance to acknowledge the descriptive inadequacies of expected utility theory, and have found some of the

[8] An argument is sometimes invoked that irrationalities will be "driven from the market." But in this situation, it is risk-averse expected utility maximizers who will drive themselves from the market, leaving it to myopic loss-averters who will be much wealthier, and hence more active in financial and consumer markets than expected utility maximizers. This argument is along the lines of De Long, Shleifer, Summers and Waldmann (1991), who show that people who fail to maximize their expected utility will in some contexts survive markets better than expected utility maximizers.

explanations and justifications to keep expected utility alive to be remarkable. Indeed, perhaps our arguments above are not so much beating a dead horse as beating a dead parrot.

In a classic sketch from the television show *Monty Python's Flying Circus*, a customer attempts to return a parrot (a "Norwegian Blue") he bought from a pet shop earlier in the day, complaining the parrot was dead when he bought it. The sketch consists of a series of more and more surreal claims by the shopkeeper that the parrot is still alive—that it is merely resting, that it is shagged out after a long squawk, that it prefers resting on its back, and that it is pining for the fjords of Norway. To prove the parrot is dead, the customer takes it out of the cage and starts beating it against the countertop. The shopkeeper repeatedly tries to distract the angry customer from the fact that the parrot is dead by pointing out the parrot's "beautiful plumage." The customer responds that "the plumage don't enter into it," and proceeds to list numerous different ways of saying that the parrot is dead, the most famous of which is the declaration: "This is an ex-parrot."

We feel much like the customer in the pet shop, beating away at a dead parrot.[9] For nearly 50 years, economists have been fending off researchers who have identified clear departures from expected utility. Allais's paradox was thought by many economists to be a mere technicality, which should either be ignored or integrated into a normative generalization of expected utility theory. Tversky and Kahneman's devastating framing demonstrations have also been dismissed by many as mere parlor tricks. While we disagree with both of those responses, it is even more strained to view the calibration problems discussed here as some kind of technicality or parlor trick. Attempts to refute these problems more and more resemble the shopkeeper's surreal denials that the parrot was dead, and attempts to ignore the problems more and more resemble the shopkeeper's attempts to change the subject. Expected utility theory implies that people depart from risk neutrality only when facing prospects that might have a major effect on lifetime wealth. That is plainly false.

In terms of its mathematical elegance, tractability, and normative appeal, the expected utility model clearly has "beautiful plumage." But when the model is plainly wrong and frequently misleading, at some point economists must conclude that the plumage doesn't enter into it. Even the obstinate shopkeeper finally admitted the parrot was dead and conceded: "I had better replace it, then."

What should expected utility theory be replaced with? We think it is clear that loss aversion and the tendency to isolate each risky choice must both be key components of a good descriptive theory of risk attitudes. But we think it is even clearer that it is time for economists to recognize that expected utility is an ex-hypothesis, so that we can concentrate our energies on the important task of developing better descriptive models of choice under uncertainty.

[9] No animals were harmed in the writing of this article.

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