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NEWSLETTER

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NEWS OF PEABODY RIVER

This issue of the *Newsletter* is at least a month overdue. There is just one reason for this: The essay was difficult to complete, and that was because the subject itself is difficult. But I've now worked out all the problems, and I hope that my efforts to make myself clear will pay off. You will be the judge of that.

The result of this delay is that our overview of 2011 is somewhat stale news. But it's still good to put down our review for the record, which will give some perspective to the markets' two healthy months that began the new year.

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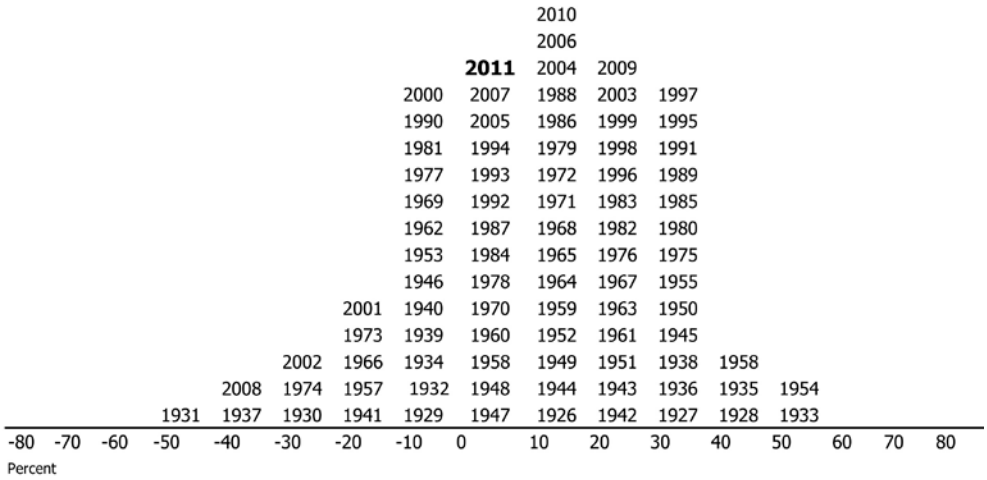
BRIEF REVIEW OF 2011

2011 was proceeding unexceptionally until the second half of the year, when, following the growing (and seemingly unending) economic crisis in Greece and concerns over the government debt of other European countries, foreign stock markets plummeted, and emerging markets more than even the developed markets.

Of the various equity groups, large-capitalization domestic stocks, represented by the S&P 500, did best of all. For the entire year, the S&P 500 had a total return of 2.11%. All of that return came from dividends; the price of the S&P 500 was almost the same at the end of the year as it had been at the beginning. The following chart shows the position of 2011 in U.S. stock market history.



As an example of what happened to the stocks of emerging markets, consider China, whose stocks had a return of -18.41%. Broadly, the international stock markets returned -13.76% in 2011. Moreover, in the face of the crisis, the dollar remained strong. The returns that I just quoted are dollar denominated, and reflect the dollar's strength. Even diversification within the U.S. didn't help. Small-capitalization U.S. stocks, represented by the MSCI US Small-Cap 1750 Index, had a return of -2.75%, and the corresponding Small-Cap Value Index had a return of -4.04%.

Bonds, in contrast to stocks, did very well. The Barclays Capital Aggregate Bond index, which represents, as the name suggests, all U.S. bonds, government and corporate, of all maturities, had a return of 7.84%. U.S. government bonds alone, confounding most experts, turned in an even better return. By one measure, U.S. long-term government bonds had a return of more than 28%.

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ESSAY: WHY INVEST?

This month, the second part of a two-part essay.

The Story So Far

In Part I, we saw that America's present acceptance of investing as appropriate and advisable for everyone, and not just the wealthy, sophisticated, and devil-may-care, is the result of a cultural development over the course of the first half of the twentieth century. From this arose the usual arguments for investing, which put the growth of your money at the fore. But there is a sound reason not to jump into the market with both feet: You might not like the risk in there. Our recognition of this brought us to the concept of risk tolerance, a quality inherent in an individual or an institution. Whether quantified or not, risk tolerance is the amount of return the investor requires as compensation for the extra risk that comes with investing. It's a concept that is essential for making investment decisions, yet it is elusive and maddeningly difficult to specify. Even so, many investment advisors like to give the public the impression that they're proficient at determining it. At the end of Part I, then, we found ourselves in a fix: We need to know our (or our clients') risk

tolerance, yet the usual ways of evaluating it, including the ostensibly objective tool of a risk tolerance questionnaire, won't work.

Part II: How We Do It, and How Far Can We Go

There are only two ways that I can see out of this bind, at least until an economic theorist comes up with something better. One is to depend on the touchy-feely, after all. As unreliable and untrustworthy as intuition may be as an investment guide, I believe that a good investor or investment advisor, one who understands the statistics of investments, and who has self-knowledge and empathy for his clients, must make judgments of his own or of a client's level of risk tolerance. When making the determination for others, however, the investment advisor has to engage in a dialogue to ensure that the client understands what the prospective returns and risks are. If you're the client, you must know what your advisor is talking about when she talks about risk. Some of the questions on a standard risk tolerance questionnaire might prove useful if they facilitate this conversation.

The other way out of this bind requires that we look at the return-risk tradeoff differently, so let's continue to hike to the end of the first trail before returning to this junction and taking the alternative route.

Evaluating Risk Tolerance

The intuitive measurement of risk tolerance has one advantage over any attempt to measure a precise numerical value: It is practicable. And in practice, many investment advisors represent their judgment of a client's risk tolerance in either of two ways that anyone can grasp. (Whether they do so accurately is another matter, depending upon their knowledge and skill.) The representation can be verbal, like a choice from the usual range of descriptors, "aggressive" or "conservative" and so forth, or, more usefully, it can be expressed as the proportion of stocks to bonds the investor should hold in a simplified portfolio. For example, as an investment advisor, I might weigh your situation and your words and conclude that your risk tolerance is best represented by a portfolio of 60% stocks and 40% bonds. By this I'd mean that, knowing the historical statistics for the S&P 500 index (representing stocks) and an index of the bond market (like the Barclays Capital Aggregate Bond Index), I think that such a simplified portfolio would historically have matched your risk tolerance. The neat advantage of this representation is that it's numerical, with the result that, although I'm not measuring your risk tolerance directly as a number, the upshot is the same, because that historical stock/bond portfolio, with its percentage allocations and historical values for return and risk, is just as clear and precise as a direct measurement, were one possible.

Can Risk Tolerance Change?

Although economists and investment advisors speak of risk tolerance as if it were a more or less immutable personal characteristic that inheres in the investor, it has, in practice, always been subject to negotiation. The mutual fund salesmen whom I cited in Part I of this essay, trying to persuade

you to invest in the stock market, are attempting to alter your risk tolerance (though dishonestly, because they hide the risk). Newsletters and magazines for professional investment advisors like me are full of advice on how to manage clients who panic at the latest market swoon. And an advisor who converses with a client about risk in order to gain the measure of the client's risk tolerance is not only measuring it; she's almost inevitably influencing it at the same time. That is, she's determining it in both senses of the word.

No less an exemplar of the wise investor than Warren Buffett has attempted to modify the public's investment risk tolerance. In a famous essay, he retells a sort of parable first offered by Benjamin Graham, his mentor and the doyen of modern securities analysis:

> Ben Graham, my friend and teacher, long ago described the mental attitude toward market fluctuations that I believe to be most conducive to investment success. He said that you should imagine market quotations as coming from a remarkably accommodating fellow named Mr. Market who is your partner in a private business. Without fail, Mr. Market appears daily and names a price at which he will either buy your interest or sell you his.
>
> Even though the business that the two of you own may have economic characteristics that are stable, Mr. Market's quotations will be anything but. For, sad to say, the poor fellow has incurable emotional problems. At times he feels euphoric and can see only the favorable factors affecting the business. When in that mood, he names a very high buy-sell price because he fears that you will snap up his interest and rob him of imminent gains. At other times he is depressed and can see nothing but trouble ahead for both the business and the world. On these occasions he will name a very low price, since he is terrified that you will unload your interest on him.[1]

Most readers have taken this passage to be about how to take advantage of the market's setting the prices of stocks and bonds below their intrinsic value. But, as Buffett says, it is really about "mental attitude," that is, risk tolerance. Graham and Buffett are instructing the reader to be tolerant of drops in price (albeit only of the stocks and bonds of what they deem to be solid enterprises).

For although risk tolerance is mutable, it surely shouldn't whip this way and that with every flutter of the market or news cycle. I often hear investors say, in response to changes in market prices and frightful or cheerful news reports, that they are becoming "more conservative" or more "aggressive." These locutions may be all right if they actually mean that, for one reason or another—a good reason, I hope, based on an economic outlook—the investor has changed his portfolio to give it a more conservative or a more aggressive slant with respect to prospective return and risk. But the locutions subvert the definition of risk tolerance if the investor means that he can handle risk only when he doesn't expect anything bad to happen. If that's what he means, then, rather as the Oscar Wilde character declares that he can resist everything except temptation, the investor is implying that he can face every risk except the prospect of a loss.

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[1] Warren E. Buffett, *The Essays of Warren Buffett: Lessons for Corporate America*, ed. Lawrence A. Cunningham, 2nd ed. (Published by the editor, 2008), p. 78.

But risk tolerance may very well change slowly over time. For an organization with an endowment, it may change as the personnel on the board's executive committee change, or as the mission of the organization changes. There is also a common belief that for individuals, risk tolerance either will or should decline as age advances. Investment professionals advise individuals to adjust their portfolios accordingly. The reason for this belief, sometimes unstated and usually unexamined, is that *investment risk declines as the time horizon lengthens*, because, on average, large bad returns will tend to be cancelled out by large good returns as time passes. And because investment risk declines as time lengthens, you can be more tolerant of it if you have a long time horizon. This explanation is so commonplace that it may seem perverse to question it. But question it, we will.

The Time Diversification Puzzle

Paul Samuelson, one of the preeminent economists of the twentieth century, published a landmark paper in 1963[2] that would have raised the hackles of investment advisors if any had read it and had hackles, because he demonstrated that this conventional idea is a fallacy. The contradiction between the common notion (that risk tolerance increases with one's time horizon) and what Samuelson demonstrated became known as the **time diversification puzzle**, where "time diversification" refers to holding an investment over many periods of time, similar to the way that "diversification" normally refers to holding multiple investments during any given period of time. (Samuelson described his work in financial theory as his "Sunday painting," a pleasant part-time recreation, but although his reputation rests on his work in the wider field of economics, his financial studies, which he kept up to the end of his life, significantly advanced the subject and are not entirely separable from his other contributions.) Samuelson proved that, although the conventional statistical measure of investment risk does, indeed, decrease with time, an investor is financially no better off because of this, if three reasonable assumptions hold. These are, first, that changes in wealth over time are entirely the result of investing, second, that investors don't change or allow a change in their investments' balance between return and risk, and third, that the investments' return in any period does not depend upon their return in an earlier period.[3] (This last means that there is no reversion to the mean in the behavior of the investments—a point that is debated by those who have made a careful analysis of historical numbers.)

Say we expect the annual rate of return of the stock market to be 7% a year,[4] and our expectation of volatility is 20% per year. (Never mind what that actually means; as usual, I'm applying the common statistical definition of volatility and its rough value, which we know from stock market history, and as I've said before, we also know that it underestimates the probability of extreme bad results.[5])

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[2] Paul A. Samuelson, "Risk and Uncertainty: A Fallacy of Large Numbers," *Scientia* (April/May 1963), pp. 1-6. In the paper itself, he barely touched on how his argument impinged on investing, but his conclusion shows that he was well aware of this.

[3] My account of the time diversification puzzle relies heavily upon Mark P. Kritzman, *Puzzles of Finance: Six Practical Problems and Their Remarkable Solutions* (New York: John Wiley & Sons, Inc., 2000), pp. 47-64. It is Kritzman, not Samuelson, who makes explicit the three assumptions underlying the argument. The first two should go without saying, but they're presented as a setup for the resolution of the puzzle.

[4] Remember from my last essay that there is a difference between the annual rate of return, which we estimated will be no more than about 7% in the future, and the average annual return, which we estimated will be no more than about 9%. Both numbers represent the basic return, before subtraction of taxes and of the fees of investment advisors like me, and of brokerage commissions.

[5] Readers who have taken a first course in statistics will understand that it's the standard deviation of annual return.

Using these numbers alone and a standard statistical table or a spreadsheet, I can find that, over any one year, there is a probability of just under 1-in-3 that an investment in the stock market will suffer some loss, of whatever size. Here is a table of the probabilities of losing at least some of your initial investment in the stock market, for an investment held over increasing time horizons:

Number of Years	1	5	10	20
Probability of loss	1-in-3	1-in-5	1-in-8	1-in-17

At this point, you don't see a problem. The probability of losing money in the stock market is decreasing as the time horizon lengthens. That is, your risk seems to be going down.

But now consider this table. It shows how much of your initial investment you could lose, with a probability of 1-in-100, at some point during each of those same spans of time:

Number of Years	1	5	10	20
Percentage loss	36%	57%	65%	70%

This means, for example, that if you hold your investment for ten years, there is a 1-in-100 chance that you could lose *at least* 65% of your initial amount *at some point* during that time.

Seen this way, your risk is actually increasing as time lengthens, which was Samuelson's point.

If this perplexes you, and you feel that it can't be right, it's not just because you're not an economist. The puzzle has slipped up even the mathematically adept. The mathematics of probability are often discordant with common sense.[6]

Simply saying, "But I can wait to the end," doesn't resolve issue, first, because there is very seldom a definite end and (as can be shown mathematically) a rational investor will find that these increasing potential losses render the investment, if no worse, then certainly no better than the investment held over short time horizons, and second, because few investors hold their investments intact over their time horizons. Say you're investing for retirement. You're going to make withdrawals over time, and if you have to make a withdrawal after a major loss in the stock market, you're going to have much less to invest for the future. There are many retirees or would-be retirees today who learned this lesson in 2000 or 2008 despite having long time horizons.

Coming to terms with Samuelson's puzzle requires our acknowledgment that we have two definitions of risk, one in terms of volatility, the other, which I think more suitable for individual investors, in terms of the probability of loss of wealth, or rather, the loss of wealth that is possible for a given probability. As a matter of mathematics, these aren't inconsistent definitions, and one can translate between the two. Those with a fundamentalist commitment to the statistical identification of risk with volatility will argue that risk does decline over time, in that there is a tendency for the ups and downs of the market to cancel each other. But if you convert investment risk into the magnitude of a loss for a given probability, which is the practical concern of most investors, then it does not decline over time; the dispersion of possible outcomes increases.

[6] Samuelson's paradox is a variant of a classic probability puzzle, known as the "Saint Petersburg Paradox," which was invented by Nikolaus Bernoulli (1687-1759).

That seemingly leaves in shards the common notion that we can take on more risk the longer our time horizon. Can we put it back together? Yes, because the resolution of the puzzle lies in our seeing this investment conundrum in a larger economic context, in which case two of Samuelson's three assumptions no longer hold. But the explanation of this solution must await a later essay, when I will consider portfolio construction for the individual investor. Let no one persuade you, though, that you should be more tolerant of risk *only* because you have a long time to invest. Your risk tolerance very likely will, indeed, decrease over time, but you can scarcely expect to derive its correct value from an incorrect principle.

Risk Tolerance and the Non-Rational Investor

The inquisitive reader who browses the occasional investment-related article in the popular press or a science magazine may have wondered why, except for a brief dismissal in my first essay, I haven't said more about that beguiling subject, behavioral finance. I have consistently been looking at investments as a rational actor would or should. But the concept of risk tolerance is one of the main points of contact between investing and the limited rationality that is the subject of behavioral economics.[7] Risk tolerance is largely psychological no matter how you look at it, whether it is rational or not. One of the earliest insights of behavioral economics was codified by Daniel Kahneman and Amos Tversky in what is known as **Prospect Theory**, which describes risk tolerance in a way very different from what has underlain my account to this point. It can be expressed mathematically, but its gist is that, with respect to an absolute reference level of wealth, an individual values small gains proportionally more than large gains, and fears small losses more than large losses, though losses in general hurt more than gains feel good. Described this way, the theory may seem innocuous and a fair account of human behavior. But it is easy to demonstrate that it describes irrational behavior. Here's an example that shows why:[8]

Imagine that you face the following pair of concurrent decisions. First examine both sets of choices, then decide which option you prefer for each.

First decision: Choose

A. A sure gain of $2,400, or

B. A 1-in-4 chance of gaining $10,000 and a 3-in-4 chance of gaining nothing.

Second decision: Choose

C. A sure loss of $7,500, or

D. A 3-in-4 chance of losing $10,000 and a 1-in-4 chance of losing nothing.

Choice B is worth $2,500 (= (1/4 * $10,000) + (3/4 * 0)), so a little more than Choice A, but most people prefer A to B, because it's without risk. Choice D is worth -$7,500 (= (3/4 * -$10,000) +

[7] The term used by scholars of behavioral finance is "bounded rationality." The other major point of contact is in the selection of individual stocks and bonds, the subject of the essay in Peabody River's *Newsletter*, issue 6, January 2010, "How Professional Select Investments." But the behavioral aspects of security selection were far beyond the scope of that essay.

[8] Example quoted directly, with minor changes in wording, from Hersh Shefrin, *Beyond Fear and Greed: Understanding Behavioral Finance and the Psychology of Investing* (New York: Oxford University Press, 2002), p. 25. For Kahneman's most recent version of this, see his *Thinking, Fast and Slow* (New York: Farrar, Straus and Giroux, 2011), p. 280. But this version doesn't make the internal inconsistency as stark.

(1/4 * 0)), so the same as Choice C, yet most of the same people prefer D to C. That is, at one and the same time, they would in one case give up some value in order to avoid risk, and in the other case, where the amounts of money at stake are larger, they'd take on risk, though the value is the same as the alternative choice. By the tenets of economics, these are not coherent, rational decisions.

While I continually make the point that, in the end, it is wealth, not return (which is relative change in wealth) that matters, you may have noticed that until we looked at the time diversification puzzle, wealth was mostly absent from our discussion of risk tolerance. That's because, by considering volatility as a measure of risk, we can translate risk directly into probabilities of loss. Yet Prospect Theory codifies the observation that not only do investors behave as if wealth does indeed matter in consideration of risk, but more curiously (from the standpoint of Utility Theory, which I introduced in Part I of this essay), the amount of wealth of the *status quo ante*, and the measure by which some might be gained or lost, affects the subsequent decision.

But Prospect Theory is a description or generalization of how people actually make decisions when faced with risk, rather than a normative economic model derived from first principles. It shouldn't change the theory of how one *ought* to invest. Rather, it sums up a psychological process that an investor may have to overcome on the way to identifying his or her risk tolerance for the purpose of making rational economic choices. We ought to invest to get the best value after consideration of risk. Perhaps Prospect Theory offers the kernel of an explanation of the unstable expressions of risk tolerance I described earlier. If the theory provides an accurate account of how the investor feels about the risk and return of investing, then it implies, too, that even when we observe how an investor behaves in reaction to *actual* changes in the value of his investments (as distinct from the hypothetical changes that a risk tolerance questionnaire may offer), we are *still* incapable of deducing correctly what the investor's risk tolerance actually is or ought to be. The investor may not be behaving rationally. This is all the more justification for an investment advisor to intervene and to coax out of the client a more rational expression of risk tolerance, or for the self-directed investor to engage in a bout of introspection, informed by statistical data and a knowledge of how the mind can subvert economic self-interest in the face of risk.

The Utility of Wealth

A while back, we came to a fork in the trail toward the estimation of risk tolerance and took one path, which led us through the thicket of probability theory until we arrived in the general vicinity of our destination. Let's now return to that junction and take the alternative path, which rises above probability to an overview of wealth and utility before descending again to an estimate.

By way of reconciling the identification of risk with, on the one hand, volatility of returns, and on the other hand, with a shortfall in the amount of money desired, I've said that volatility can be translated into the probability of a shortfall (and always added the necessary proviso that volatility does this very imperfectly, giving a false sense of only mild insecurity regarding extreme shortfalls). This implies that it doesn't much matter which of the two definitions of risk you choose. Yet despite this, we now find that the two definitions present us with differing interpretations of tolerance. This apparent inconsistency results from a myopic focus on risk and risk aversion, and not the whole picture of the investor's well-being, a concept that theoreticians have long identified as **utility**. Utility takes into consideration *both* the level of wealth *and* changes in that level. It was this concept

that Daniel Bernoulli introduced.[9] There is monetary value—and then there is utility, which is what that monetary value is worth to us. For example, the prospect of a $10 gain or loss matters more to a beggar than to a hedge fund manager. And because risk can be understood as the probability of changes in the level of wealth, it is a constituent of utility.

But utility is no more measurable than is risk tolerance or risk aversion: You can't directly measure how much more that $10 is worth to the beggar than to the hedgie. Utility Theory does, however, explain why there is a difference and what it ought to be, and it was in opposition to Utility Theory that Prospect Theory was formulated. But whereas Prospect Theory is only descriptive, Utility Theory is both descriptive and prescriptive. Even in falling short of the mark as a description of human behavior, it still can't be beaten as a prescription for it. That's why sound investment decisions rest on the foundation of Utility Theory.

To give numerical flesh to our spectral visions of the utility of our investments, we can harness the power of computers to project future values. With **Monte Carlo simulation,** computers can fabricate the behavior over time of investments and their interactions with our planned expenditures and savings. In an earlier essay, I have already briefly described how Monte Carlo simulation works.[10] The point of it, though, is that starting from our expectations of return and the probabilities of different returns, and our planned additional investments and expenses, computers can calculate not just the range of possible values of our wealth at a chosen time in the future, but also, for each value, the probability that we will attain at least that much. Figure 1 is an idealized and simplified version of what a Monte Carlo simulation might project for a date in the future, say, 20 years from now. We're assuming that you're starting with $800,000, you're saving $15,000 every year, you've also specified your planned expenditures and their dates, and you've balanced the likely return and risk of your investments in such a way that we expect their annual rate of return to be 5%.

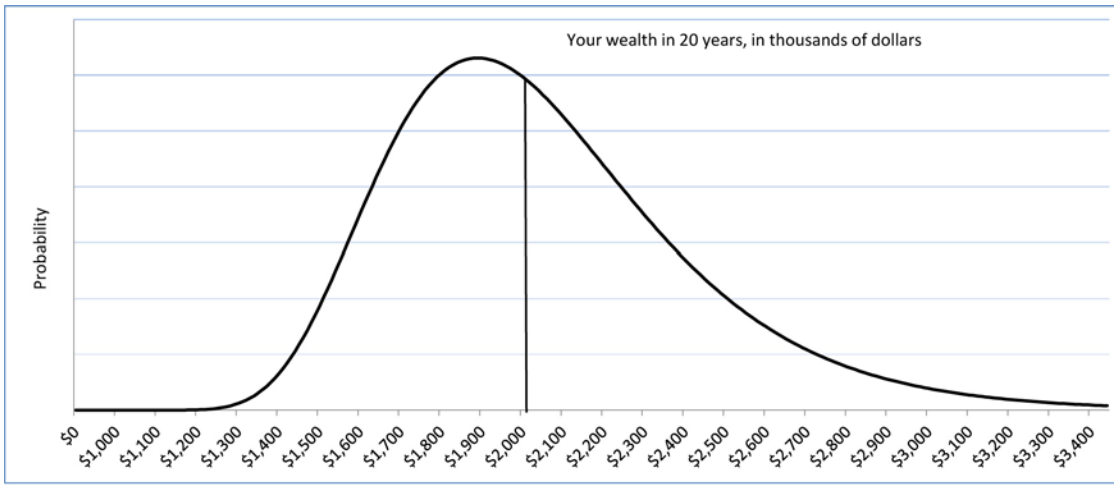

Figure 1

The chart represents a slice at one point in time, twenty years hence, through the range of possible outcomes. The height of the curve corresponds to the probability of attaining a particular value

[9] Peabody River *Newsletter*, issue 12, October 2011, "Why Invest? Part I: Why We Do It and to What Extent."
[10] Peabody River *Newsletter*, issue 11, April 2011, "What Return Can We Expect from Stocks?"

shown on the horizontal axis. The vertical line marks the median outcome: there's a 1-in-2 chance that you'll end up with more, and a 1-in-2 chance that you'll end up with less (and it's a matter of statistics that the median value is greater than the value of the most probable outcome). We can create such slices for different times in the future. By varying the investment choices, re-running the simulator, and judging the range of possibilities and their probabilities of wealth at different points in time, an investor can (at least in principle) choose the set of investments that results in outcomes that are of greatest utility to him, and we can work backwards from these investments to the present risk tolerance that they imply.

In the last decade, simulation has become a popular tool among investment advisors. The projections of future wealth, however, suffer from the limitations of the simulation methods, which, unbeknownst to the users, may rest on unrealistic models of investment risk; in particular, they may underestimate the probabilities of extreme bad results. There may be other problems, too, like very inaccurate estimates of the effects of taxes and the costs of buying and selling investments, and the system may even fail to allow for changes in your risk tolerance over time. In nearly all cases, the innards of the software are proprietary, and even if the vendors were completely forthcoming, only an expert, and not the typical user, would be in a position to diagnose them. Furthermore, even if the simulation is good, the intended beneficiary of the process, the investor, may not easily grasp the representations of the results. Those of us who are "quants" too easily assume that those who aren't can grasp intuitively the probabilities of loss. Again, there must be a conversation about the results, even if you lack an advisor and you're talking over your investments only with yourself.

Conclusion

Should you choose to invest, and to the extent that you invest, you inevitably expose yourself to more than a minimal risk of loss. You invest with both the hope and the expectation of an increase in wealth, but you must face the possibility that reality may not live up to the expectation; indeed, you may end up worse off than if you had not invested at all. (Then again, it's also possible that you will exceed your expectations.) The full range of possible prospects, and their varying probabilities, matter intensely to your wellbeing. Upon them depend the likelihood of your funding your retirement, maybe your health insurance, your children's college education, and the pecuniary legacy you want to leave. You must consider not only whether your investments are good ones, but also how best to balance a reasonable expectation of their returns against the risk of harm that ensues from chasing gain.

Investments, either single stocks and bonds, or bundles of them, like mutual funds and exchange-traded funds, should be thoughtfully aggregated into portfolios that suit each investor's tolerance for investment risk, or, what amounts to the same thing, aversion to it. Every pre-packaged bundle of investments—a mutual fund, a hedge fund, a private equity fund, an ETF—reflects, either by design or by default, the return/risk tradeoff chosen by its manager. You can regard this as its manager's risk tolerance, but the manager is the agent for his clients, the investors, whose risk tolerance is likely to be different from his and among each other's. (The one exception is the so-called **target-date funds** or **lifecycle funds**, which are designed to suit the risk tolerance of the investors who hold them, though I believe that there is good reason to doubt that they do this at all well.) It is highly unlikely that any one of these investment bundles, on its own, will be right for you and your circumstances.

In my next three essays, the culmination of our explorations of basic investment concepts, we will see exactly how risk tolerance should be reckoned into the determination of a custom portfolio. We will see why, even if there are commonalities in expectations of return and risk, one person's (or institution's) portfolio is and ought to be different from another's.

Yet my view of risk tolerance is pessimistic: We need to know it, and knowledge of it is close to unobtainable, and in any case uncertain and unverifiable. We can only contemplate the possibilities that investments hold out of reward and disappointment, and we must look to both at the same time that we look inside ourselves and judge our intrinsic emotional balance between the two.