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Three Things Every Executive Should Know About Risk

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Abstract

BUSINESS EXECUTIVES OFTEN HAVE TO MAKE MAJOR DECISIONS WITHOUT KNOWING EXACTLY HOW THEY WILL TURN OUT.

Many factors, all of them well beyond his or her control, can affect the outcome of those decisions. To do a good job on these "big bet" decisions, executives must base their actions on the best available information, solid reasoning, and clear thinking. This paper explores how executives can best deal with the uncertainty and risk inherent in their decisions.

The business executive's job is daunting. He or she is called upon to make important decisions without knowing exactly how they will turn out. Many factors well beyond the executive's control, such as future economic trends, the behavior of competitors, the success or failure of new technology, and possible governmental regulation, all affect whether the decisions will turn out well or poorly.

Some of these decisions are what we call "big bets"—involving significant levels of investment where the return is quite uncertain. To do a good job on these "big bet" decisions, the executive will want to base them on the best available information and on solid reasoning and clear thinking.

But many executives remain confused about how to deal with the uncertainty and risks inherent in their decisions. This article is intended to help clear up that confusion.

Here are three things that every executive should know about dealing with risks

- Properly taking risk into account in decision making is a straight forward matter.
- Using a high hurdle rate is a bad way to adjust for risk.
- Most large corporations destroy value by setting their risk appetite too low.

Properly taking risk into account in decision making is a straight forward matter.

Let us start with an example. Suppose your company has a choice of investing in one of two ventures (Figure 1). With the first venture, which we will call "Big Upside," $100 million is invested and there is a 50 percent chance of tripling the investment (gaining a net of $200 million) and a 50 percent chance of losing the investment entirely. With the other venture, called "Prudent Risk," $60 million is invested and there is a 70 percent chance of doubling the investment (gaining $60 million) and only a 30 percent chance of losing the investment. Assuming you are confident that these numbers are correct, in which venture should your company invest?

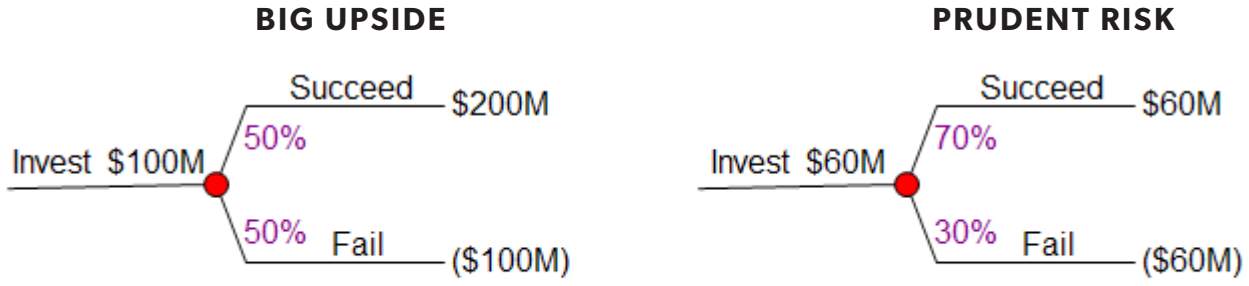


Figure 1: Two Ventures

To understand how to answer that question, it will be very useful to consider an analogy—that of making decisions when cash flows differ in their timing. Consider a second hypothetical choice for your company, between two bonds—Long and Short. The Long Bond pays you $200 million 15 years from now, while the Short Bond pays $50 million two years from now (Figure 2). Let us assume that these payoffs are absolutely guaranteed and that your company has the right to choose one of them for free. Which bond should your company choose?

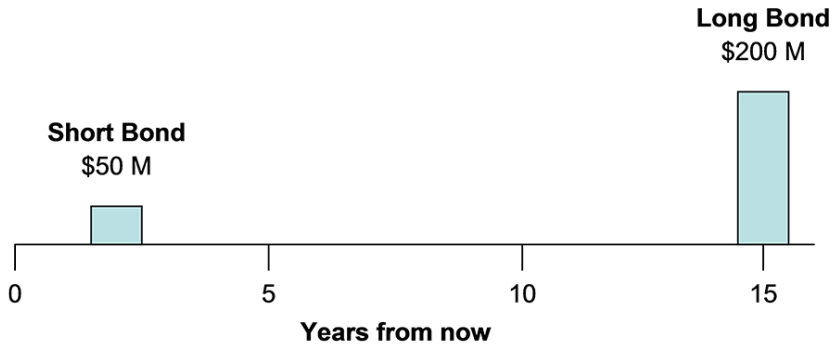
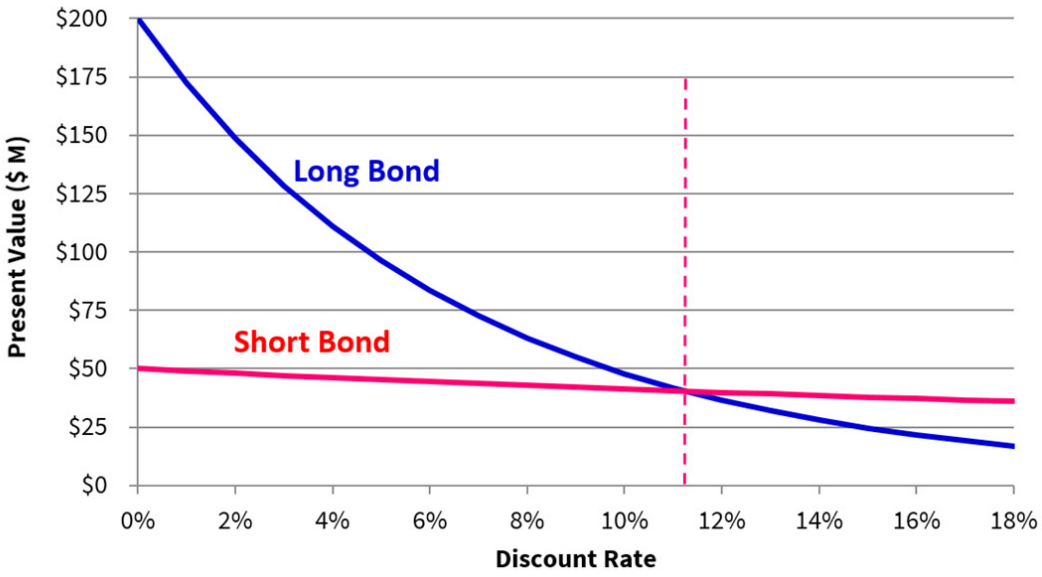


Figure2: Two Bonds

It is widely accepted that you should choose the bond that has the higher present value, which is defined as the amount of money now that is equal in value to the future cash flow, taking into account the fact that money in the future is worth less than money now. This time value of money is conveniently expressed as a discount rate, a parameter we use when calculating the present value of a future cash flow. It is quite well-known how to calculate the present value of a cash flow given a discount rate—so well-known that spreadsheet software typically has a built-in function to do it.

Figure 3 shows a chart of the present values of the two bonds for various discount rates. At a discount rate of zero, the present value of each bond would equal its payoff—$200 million for the Long Bond and $50 million for the Short Bond. Note that the present value of each bond decreases as the discount rate increases, but because its payoff is further out in the future, the present value of the Long Bond decreases much more rapidly than that of the Short Bond. The chart shows that if the discount rate is less than about 11%, the company should choose the Long Bond; otherwise it should choose the Short Bond.

Figure 3: Present Value vs. Discount Rate



But that raises the question: What is the right discount rate for the company to use? The answer to that question should be supplied by the company itself, preferably by someone in top management such as the CFO. The chosen discount rate should express the true time value of money to the company, based on its weighted average cost of capital. Let's call this the corporate discount rate. (As we shall see later, the choice of discount rate should not be based on the degree of risk in the investments under consideration.)

We can now return to the choice between Big Upside and Prudent Risk. We see that Big Upside has a much higher potential payoff than Prudent Risk ($200 million vs. $60 million). But it also carries greater risk—a much higher chance of losing the investment.

One comparison we can make is to look at the *probability-weighted average values*—$50 million for Big Upside vs. $24 million for Prudent Risk. This suggests that Big Upside should be chosen—but that might not be the right choice for your company. Making decisions based on probability-weighted averages (often called *expected values*) completely ignores the riskiness of ventures. It is akin to ignoring the time value of money when choosing among cash flows that differ in timing by looking only at the undiscounted sum of each cash flow.

The proper way to make a decision in the face of risk is to choose the venture that has the higher **risk-adjusted value**, which is defined as the guaranteed amount of money that is equal in value to the uncertain venture. (In the technical literature, the risk-adjusted value is called the *certain equivalent*.) The adjustment for risk reflects the fact that the value to us of a flow of money is not necessarily proportional to the amount of money. Receiving $100 million may be worth somewhat less than 10 times the value of receiving $10 million. And at the other end, the negative value to us of losing $100 million may be much more than 10 times that of losing $10 million.

Just as we have a parameter called the discount rate to use in the calculation of present values, we likewise have a parameter, called the **quantified risk appetite** (abbreviated **QRA**), to use in the calculation of risk-adjusted value of a venture.

The QRA expresses the degree to which the company wants to take on or shun risks. The QRA is expressed in monetary units and bigger values mean more willingness to take on risk. Just as the discount rate that we use for present value does not (or should not) depend on the specifics of the cash flows we are considering, so too the QRA that we use to find the risk-adjusted value should not depend on the specific uncertain venture under consideration.

Let us consider two extreme cases. A QRA of zero means that the company will do everything it can to avoid any risk at all. The risk-adjusted value of any venture when the QRA is zero is equal to the worst possible outcome of the venture. A company with zero QRA would choose to accept a penny rather than have ownership of a venture that pays $100 million with probability 99.99 percent and nothing with probability 0.01 percent. This would be unusual behavior indeed.

The other extreme case is an infinitely large QRA. This would mean that the company always ignores the level of risk in ventures, instead making choices based only on probability-weighted average values (i.e., always "playing the averages").

For most companies, of course, the appropriate setting for QRA is somewhere between zero and infinity. As with the choice of a discount rate, the specification of QRA for a company should be done by its top management. The appropriate QRA can be assessed by having top executives say which choices they would make on behalf of the company when presented with simple example risky ventures.

A quick way to assess QRA is as follows: Consider a venture in which the company has a 50 percent chance of gaining an amount of money X and a 50 percent chance of losing half of that amount, or ½X. Note that this venture has a positive probability-weighted average value of ¼X. For small values of X, the venture looks attractive, but for large values of X, it becomes unattractive because it is too risky. Somewhere in between is a value of X for which the venture is neither attractive nor unattractive to the company—we regard it as having zero value. The company's QRA is (approximately) equal to that value of X.

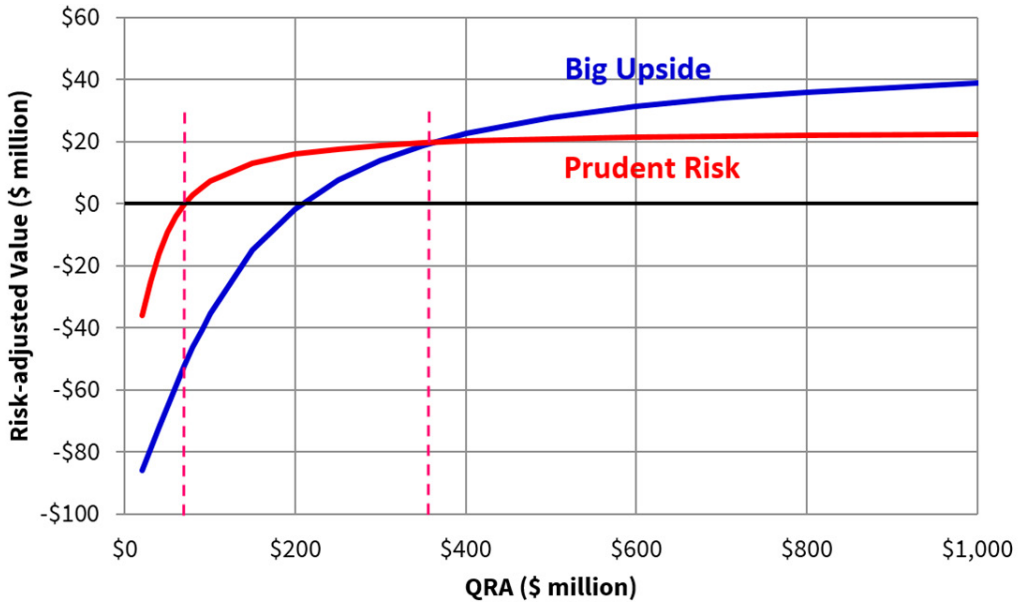
The setting of a company's QRA for decision making is a task that top management should do with care and they should review it annually. For large corporations, we have observed that the QRA tends to be in the range of ten percent to 25 percent of the company's total shareholder value. So values of QRA for large corporations tend to be in the hundreds of millions to billions of dollars.

It is important to remember that the QRA is nothing more than a parameter used in the calculation of risk-adjusted value. It is NOT the most money that the company is willing to put at risk.

Once we know the appropriate value of QRA for our company, how do we use it to calculate the risk-adjusted value of a venture? The details of the calculation are described in the Appendix. Suffice it to say here that it is a straight-forward calculation that can easily be automated in a spreadsheet. Calculating a risk-adjusted value is just as easy as calculating an NPV.

Back to the choice between Big Upside and Prudent Risk. Figure 4 shows the risk-adjusted values of the two ventures for different values of QRA. As we would expect, as QRA increases, the risk-adjusted values of both ventures also increase. That is, as our appetite for risk grows, the value of any risky venture increases. Note that as QRA gets bigger, the risk-adjusted value of the venture with the greater degree of risk, Big Upside, rises more rapidly than does that of Prudent Risk. As QRA grows toward infinity, the risk-adjusted value of a venture approaches its probability-weighted average value. From Figure 4, we conclude that if the company's QRA is more than $350 million, it should choose Big Upside. If it is between $70 million and $350 million, it should choose Prudent Risk. And if it is below $70 million, it should walk away from both investments.

Figure 4: Risk-adjusted Value vs. QRA



In summary, taking account of risk in decision making is straightforward. It requires only that the company has assessed its QRA and that each venture is well-characterized by a range of possible outcomes with probabilities (something that most financial analysts are now taught to do). And not only is it easy, but also it is a sound way to achieve consistency in risk taking. The approach described here is based squarely on the foundation of decision science.

Using a high hurdle rate is a bad way to adjust for risk

In a typical venture, we invest some money now and get an uncertain payoff in the future. In other words, a typical venture has both risk and time components. A common way to think about valuing such a venture goes something like this:

> *"To account for the timing of the payoff, we need to discount it using our corporate discount rate. But because the payoff is uncertain, we need to discount it further by adding an appropriate amount to the discount rate."*

This higher "risk-adjusted" discount rate is often called a hurdle rate, because the venture, if successful, must have a rate of return that exceeds that hurdle rate to be attractive.

Let's see how this works with a simple example. Suppose that your company has the opportunity to invest $100 million in a venture called the "Four-Year Bet" (Figure 5). There is a 50 percent chance that the venture will pay $300 million four years from now and a 50 percent chance that it will pay nothing. Should your company make this investment?

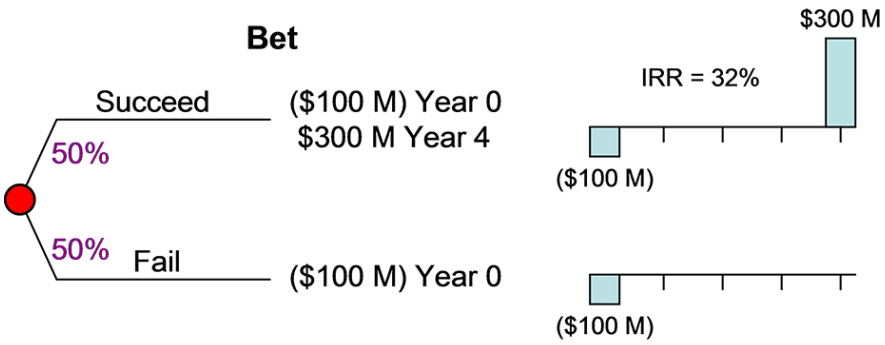


Figure 5: Four-Year Bet

If successful, this venture's rate of return is about 32 percent. Is this enough to compensate for its risk? Let us suppose that for this level of risk, your company has set the appropriate hurdle rate at 40 percent. Accordingly, you should not make the investment because its rate of return does not exceed the hurdle rate.

Consider now a similar venture called the "Two-Year Bet" (Figure 6), which has exactly the same level of risk as the Four-Year Bet but different timing—the payoff is two years from now instead of four. The Two-Year Bet has a somewhat lower payoff amount, $262 million instead of $300 million, to compensate for the fact that the payoff is two years sooner. (The present values of the two payoffs are the same at an assumed discount rate of 7 percent.)

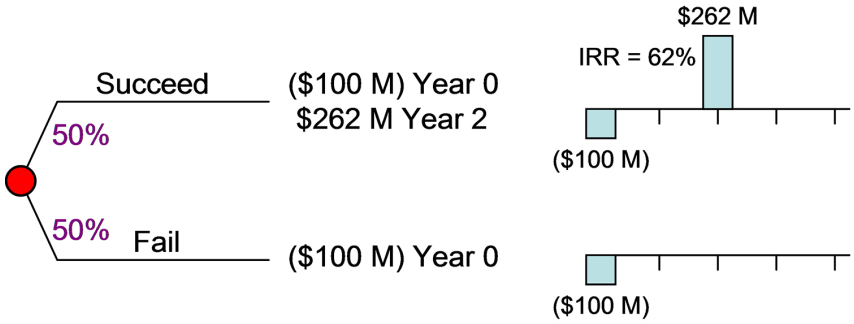


Figure 6: Four-Year Bet

If successful, the Two-Year Bet has a rate of return of 62 percent, higher than your 40 percent hurdle rate. To be consistent in your decision making between the two ventures, you would need to set a much higher hurdle rate for the Two-Year Bet than for the Four-Year Bet, even though they have the same level of risk.

This illustrates the fundamental problem of using hurdle rates to adjust for risk. In doing so, we are asking the discount rate to do two jobs, one for which it is well-suited and one for which it is not. In fact, we can imagine a third venture, the Zero-Year Bet, which is just like the Two-Year Bet except that the payoff is nearly immediate. In that case, there is no hurdle rate high enough to make the venture look too risky to take. And there are some risky ventures, like selling insurance, in which the cash flows are flipped around—a sure positive cash flow now and an uncertain negative cash flow in the future. For these ventures, using a high hurdle rate actually makes big risks look better than small risks. What is the proper way to evaluate a venture with both time and risk components? Simple. First, use your corporate discount rate to find the present value of each possible outcome of the venture. Then use your company's QRA to calculate the risk-adjusted value of the venture based on these present values.

For the Four-Year Bet, it looks like this (Figure 7): At a risk-free discount rate of, say 7 percent, the present value of the venture is $129 million if successful and negative $100 million if not.

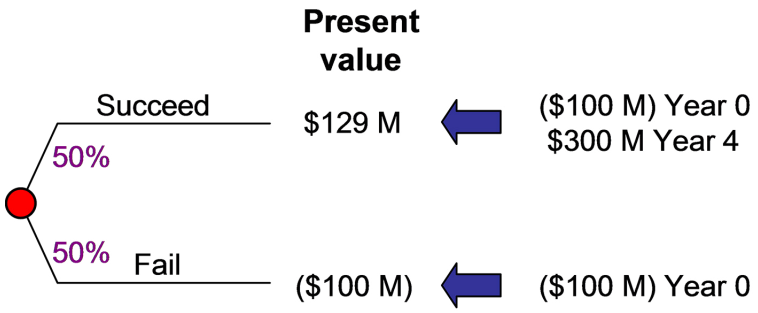


Figure 7: Valuing Four-Year Bet

Figure 8 shows the risk-adjusted value of a 50/50 chance at these present values for various values of QRA. You should invest in the Four-Year Bet only if your company's QRA is higher than $450 million.

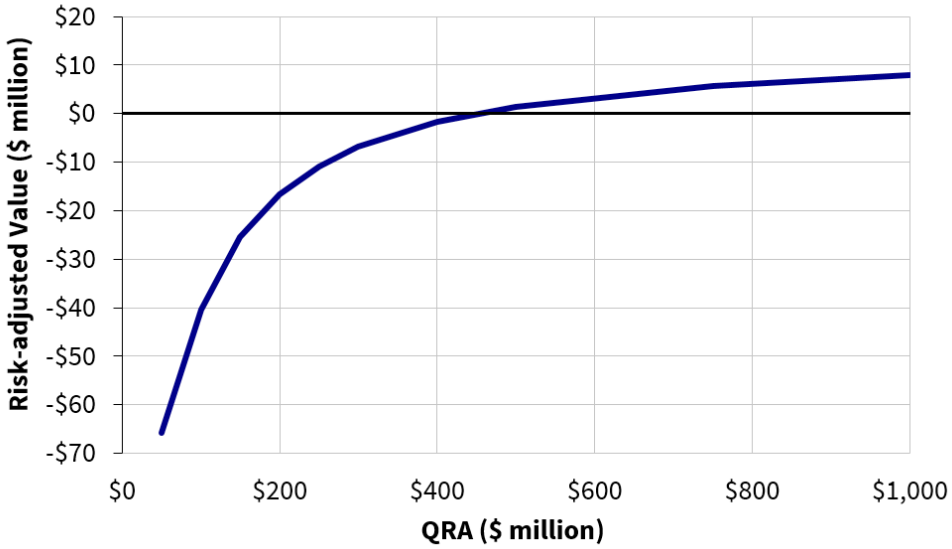


Figure 8: Risk-adjusted Value of Four-Year Bet vs. QRA

The Two-Year Bet has exactly the same risk-adjusted value as the Four-Year Bet for any value of QRA, confirming that they have the same level of risk.

Notice that doing it the proper way is easier than using hurdle rates—we do not have to figure out what the appropriate hurdle rate is for each venture. We need only the two parameters that we already know—the company's normal discount rate and its QRA.

Most large corporations destroy value by setting their risk appetite too low.

Within multidivisional corporations, it may seem sensible that each division should take on only those risks that are appropriate for its size. But this is actually a value-destroying practice.

Let us suppose that the head of a division is considering whether to invest in Big Upside or Prudent Risk. And suppose she makes decisions that are consistent with a QRA of $200 million, which seems appropriate for the size of her division that she would choose Prudent Risk because it has a higher risk-adjusted value ($16 million vs. negative $2 million).

But her division belongs to a corporation that is, let us say, five times larger than her division. From the perspective of corporate headquarters, where the QRA is $1 billion, the ventures have much different risk-adjusted values: $22 million for Prudent Risk and $39 million for Big Upside. By choosing Prudent Risk, the division head is throwing away $17 million in value.

This undesirable situation is all too common within large corporations. Decision makers at lower levels of the organization make choices that reflect far too little risk appetite given the corporation's financial strength. As a result, the corporation foregoes valuable opportunities that it should take. This practice is reinforced by organizational and behavioral factors that may make changing to a more value-creating arrangement difficult.

The remedy is for corporate headquarters to establish a clear policy (with enforcement) that all "big bet" decisions must be made consistent with the corporation's QRA (just as it should insist that all present value calculations use the same corporate discount rate). Prudence might dictate that decisions that seem too risky from the divisional perspective be reviewed and authorized by corporate headquarters. And divisional decision-makers should be supported by a corporate culture that rewards appropriate risk-taking and does NOT punish bad outcomes that are beyond their control.

Why is this important? Because corporations that consistently use an appropriately large QRA in decision making have a competitive advantage over those that do not. One of the main advantages of large size is the ability to pool risks and thereby take on value-creating ventures that smaller players reject as too risky. A corporation that gives up that advantage by playing it too safe will very likely be outperformed by one that appropriately uses its greater appetite for risk. Pooling of risks works—a portfolio of five ventures like Big Upside, for example, has an expected value more than twice that of five ventures like Prudent Risk and nearly the same probability of losing money (assuming that all ventures are independent).

Always remember that when you discount for risk, you are giving up value in exchange for safety. The more you opt for safety, the more value you lose, so you want to make sure that you find the right balance between the two.

Conclusion

The executive who understands and utilizes these points will be able to make consistently sound decisions in the face of uncertainty and risk. And although making a good decision does not guarantee getting a good outcome, making consistently good decisions is the very best that an executive can do and is very likely to result in more long-term success than otherwise.

Further Reading

In the companion to this paper, Dr. Tani addresses two additional areas that executive decision makers should understand when dealing with risk:

- Portfolio effects are important. Beware of "risk amplifiers." Seek out hedges.
- Well-designed risk-sharing can create value for both sides.

Appendix: Calculation of risk-adjusted value using QRA

Let an uncertain venture be specified as N possible outcome values V_i , each with probability P_i (i=1,2,…N).

For each possible outcome value V_i , calculate the value U_i as follows:

$U_i = EXP(-V_i / QRA)$, where EXP is the exponential function and QRA > 0

Calculate the probability-weighted average U* of the U_i values:

$U^* = (P_i \times U_i) + (P_2 \times U_2) + \ldots\ldots + (P_N \times U_N)$

Finally, calculate the risk-adjusted value of the venture RAV as follows

$RAV = -QRA \times LOG(U^*)$, where LOG is the natural logarithm function

This calculation is available as a user-defined Excel function. Please visit **www.sdg.com/RAV**