Decision Making Under Uncertainty:
A (Second) Wakeup Call for the Financial Planning Profession

by Glenn S. Daily and Laurence J. Kotlikoff

Abstract

During the past decade, the financial planning profession has made great progress in dealing with uncertainty by adopting stochastic methods of analysis, especially simulation techniques. It's time for a new challenge: provide better advice by using dynamic, rather than static, methods of analysis. Dynamic programming and real options analysis are powerful, complementary tools for creating more realistic models of the planning situations that people face.

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In 1997 in the *Journal of Financial Planning*, Lynn Hopewell issued a challenge to the financial planning profession: provide better advice to clients by adopting stochastic methods of analysis.[1] Since then, the profession has taken up that challenge. Monte Carlo simulation is a frequent topic at industry conferences. Technical articles have appeared in trade publications, and simulation capability has become a standard feature of financial planning software.

Now it's time for a new challenge: provide better advice by adopting dynamic methods of analysis.

Static vs. dynamic

Dynamic methods of analysis take account of future choices when deciding what to do in the present. Static methods ignore the interplay between present and future. Decision makers who use static methods miss out on opportunities to make better decisions.

Consider the two-player children's game that starts with 21 sticks on the floor. Each player in turn can pick up one, two or three sticks, and the person who picks up the last stick loses. A player who thinks only about the current move might follow a simple rule like "choose one stick until the end gets nearer." A player who thinks dynamically will start at the end and work backward. You know that you can win if you leave your opponent with five sticks, and therefore with nine sticks, and therefore with 13 sticks, and therefore with 17 sticks. Two players who think dynamically will quickly realize that whoever goes second wins.

Dynamic methods of analysis lead to better decisions than static methods because they are more realistic. Static methods implicitly assume that all of the decision making takes place upfront. You set the train in motion, it runs along the track, and the analysis tells you if the track will take you where you want to go. In real life, however, you have many chances to revisit your decisions and to make adjustments based on new information. Furthermore, you know that you will have these opportunities, and you can take this into account in deciding what to do now.

The first challenge to the financial planning profession required learning about simulation techniques. This new challenge requires learning about dynamic programming and real options analysis, two complementary tools for creating more realistic models of financial planning situations and finding better solutions.

Dynamic programming is a mathematical technique for solving problems involving sequential planning decisions. Real options analysis is a way of thinking about the value of flexibility. If the variables in a real options problem can be adequately quantified, dynamic programming can be used to find a solution.

Dynamic programming

When you're faced with a non-trivial problem involving sequential decisions, you can turn to dynamic programming, a mathematical approach to finding the best sequence of decisions to reach a desired goal.[2] When the result of each intermediate decision is known with certainty, you use deterministic dynamic programming. When the result at each intermediate stage is probabilistic, you use stochastic dynamic programming.

Economists have used dynamic programming to solve financial planning problems for decades. Samuelson (1969), Fama (1970), Merton (1971), Brown (1987) and Campbell and Viceira (2002), among others, analyzed how individuals should make consumption, savings and asset allocation decisions over their lifetimes. Friedman and Warshawsky (1988) and Brown (2001) analyzed the demand for individual life annuities. Babbel and Ohtsuka (1989) explained why informed consumers might choose to own both term and cash value life insurance. Apelfeld, Granito and Psarris (1996) determined the minimum excess return needed to justify pursuing an active management strategy for taxable equity portfolios. Altonji, Hayashi and Kotlikoff (1997) analyzed the timing and magnitude of lifetime gifting between parents and children. Gollier (2003) showed that the optimal demand for insurance may be lower if the model is dynamic rather than static. Brown and Finkelstein (2004) explained why tax incentives for the purchase of long-term care insurance are not likely to be effective as long as Medicaid remains a secondary payer when individuals have private insurance.[3]

Dynamic programming was developed in 1953 by the renowned mathematician Richard Bellman when he was doing research on multistage decision processes at the RAND Corporation. It relies on his principle of optimality: the optimal decision at the next stage is independent of the decisions made in the earlier stages. This means that the immediate decision depends on the current state without regard to how you got there, and that each future decision will depend on the new current state without regard to the earlier decisions.

The principle of optimality lets you divide a big problem into a series of smaller ones that can be solved recursively, starting at the end and working backward. People do this intuitively when they figure out what time to leave on a trip by working backward from the desired arrival time.

Dynamic programming is used routinely in mathematics, engineering, economics and other disciplines to solve problems in which today's optimal action requires knowing how one will act tomorrow given decisions made today. Take, as an example, deciding how much to spend today. If the objective underlying this decision is to smooth your living standard, you need to determine whether spending $X this year will or will not leave you with enough resources next year to maintain the living standard associated with spending $X now. Hence, you need to know what living standard you would generate next year for each level of resources you might choose to bring into next year. Thus, you need a spending plan for next year before you can figure out what to do this year. Since this is true for any year in question, it implies that the way to solve the problem is to work out a plan for the last year and then use it to work out a plan for the next to the last year. The next-to-the-last-year plan is then used to work out a plan for the next to the next to the last year, and so forth going back to the current year.

ESPlanner

Dynamic programming lies behind a new generation of financial planning software, pioneered by *ESPlanner*.[4] Table 1 shows the key characteristics of four generations of software. The methodology in early financial planning spreadsheets was static and deterministic: the user specified the portfolio rate of return and other assumptions, and the spreadsheet computed the results. These spreadsheets were improved by incorporating Monte Carlo simulation to produce a probability distribution of results; however, they still modeled the planning decision as a one-time event.

Table 1
Four generations of financial planning software

	Deterministic	Stochastic
Static	First generation: User chooses input values; all planning decisions occur at the beginning.	Second generation: Input values are random variables; all planning decisions occur at the beginning.
Dynamic	Third generation: User chooses input values; planning decisions occur continuously as events unfold.	Fourth generation: Input values are random variables; planning decisions occur continuously as events unfold.

ESPlanner uses the more powerful mathematics of dynamic programming to help households determine their maximum sustainable living standard subject to their available economic resources, tax liabilities, borrowing constraints, expected rate of return on assets, family size, retirement plan contribution limits, and other relevant variables. After *ESPlanner* solves for a sustainable living standard path, it translates this path into two primary recommendations: the amount that you should spend each year on consumption and the amount of life insurance that you should buy (using annual renewable term as a convenient proxy to estimate the cost). In the case of married couples and partners, *ESPlanner* provides separate year-by-year life insurance recommendations for each spouse. It also provides contingent planning recommendations after the first spouse's death to maintain the standard of living of survivors.

ESPlanner's patented optimization algorithm consists of two interactive dynamic programs that converge to a solution. One of the programs formulates spending plans such that the amount spent this year leaves you with enough resources next year to generate the same living standard *provided* the amount spent this year does not leave you with more debt next year than you tell the program you are willing to hold. If you are up against your debt limit, the program limits your spending this year so that you do not exceed that limit.

ESPlanner's second dynamic program determines how much life insurance each spouse needs to purchase each year for the household to maintain the same living standard through time that would arise if no one died prematurely. The program recognizes that how much insurance survivors need depends, in part, on how much insurance the survivors themselves will need to purchase over time and, therefore, on the amount of life insurance premiums that they will have to pay. Hence, this year's decision with respect to, say, the husband's life insurance depends on next year's decision (if the husband dies) by the surviving widow as to how much life insurance she, herself, will purchase. Again, we have current decisions depending on future plans: today's life insurance need is computed by starting in the future and working backward.

Each of *ESPlanner's* two dynamic programs utilizes the other program's outputs as inputs. For the programs to be mutually consistent, the output from each program when used as input to the other program must generate output from the other program, which, when used as input by the first program, produces the same output as originally utilized. To achieve consistency, *ESPlanner's* two programs iterate with each other — passing data back and forth — until they converge as just defined.

In the process of reaching convergence, the program also iterates on all current and future federal and state tax payments — not just for those "states of nature" in which no one dies prematurely, but also for those states in which there is premature death of a spouse or partner. This iterative solution for the determination of taxes deals with the chicken and egg problem associated with taxes and spending: one can't determine how much to spend without knowing what one will pay in future taxes, but one can't determine future taxes without knowing current saving, which will affect the level of future asset income and, thus, future taxes.

Conventional financial planning software lacks the mathematical power to determine the maximum sustainable standard of living that a household can afford. Instead, it puts the burden of goal setting on the client, and it simply calculates whether the client's resources are sufficient to accomplish the goals. Setting the right target is essentially impossible. Hence conventional software will invariably recommend either too little or too much saving as well as too little or too much life insurance. Comparisons of *ESPlanner*'s recommendations with those of conventional software programs indicate that even small targeting mistakes can lead to huge mistakes in current saving and insurance recommendations. The reason is that small targeting mistakes apply to all retirement years as well as all potential years of survivorship.

ESPlanner also uses dynamic programming in its Monte Carlo simulations, which show the variability of a household's living standard in each future year. *ESPlanner* generates 500 random paths of rates of return, applies its dynamic programming algorithm to each path and then tabulates the results. The dynamic programming takes account of future levels of taxable income. Consequently, its simulations show that a household's living standard will not necessarily soar if its portfolio value doubles because of the extra taxes it will have to pay, nor plummet if its portfolio value drops because of the concomitant decline in its taxes.

ESPlanner is a product of what economists know about financial planning. Economists have long recognized that spending, saving, investing and insuring are multistage decision processes, and dynamic programming has become an indispensable tool in their analytical toolbox.

Real options analysis

Option-pricing theory is one of the major accomplishments of modern finance. It was developed in the early 1970s to provide a rational basis for valuing financial instruments with option features, such as publicly-traded puts and calls and corporate debt. Within a few years, economists realized that this theory also provided insights into capital investment projects, such as oil drilling, pharmaceutical research and development, and electrical power generation.[5]

“Real options” are the dimensions of flexibility that are present in investment projects; Brealey and Myers define them as “opportunities to modify projects as the future unfolds.”[6] Real options arise in situations involving uncertainty, irreversibility and timing. If there is no uncertainty, or if a decision can be reversed without cost, nothing is gained by waiting to see how the future unfolds. If the decision can’t be postponed, all of the decision making takes place upfront. Flexibility turns investing into a dynamic process involving sequential decisions.

In business finance, real options include the option to delay, to increase or decrease scale, to switch inputs or outputs, to invest in stages, and to abandon. In personal finance, the type of flexibility that planners are most likely to encounter is the option to wait; that is, the option to delay making an investment, implementing a planning technique, or taking some other action. Many profitable opportunities do not disappear immediately. For example, the opportunity to buy a cash value life insurance policy won’t vanish anytime soon. You may lose the chance to buy a particular policy, but you’ll be able to buy substitutes that provide the same tax advantages in relation to term insurance.

Milestones in real options analysis

1973 Fischer Black and Myron Scholes, "The Pricing of Options and Corporate Liabilities," *Journal of Political Economy* (May/June); and Robert C. Merton, "Theory of rational option pricing," *Bell Journal of Economics and Management Science* (Spring). The famous Black-Scholes formula for the value of a call option on a non-dividend-paying stock, derived from the insight that an option can be replicated by a dynamically hedged combination of a risky asset and a risk-free asset.

1977 Stewart C. Myers, "Determinants of Corporate Borrowing," *Journal of Financial Economics* (November). The debut of the phrase "real options," in the context of analyzing a corporation's future investment opportunities as call options.

1979 John C. Cox, Stephen A. Ross and Mark Rubenstein, "Option Pricing: A Simplified Approach," *Journal of Financial Economics* (September). An explanation of the lattice model for valuing options, requiring only basic arithmetic. They got the idea from William Sharpe.

1992 Jonathan E. Ingersoll, Jr. and Stephen A. Ross, "Waiting to Invest: Investment and Uncertainty," *Journal of Business* (January). A sentence to remember: "The ability to delay a project means that almost every project competes with itself postponed."

1994 Avinash K. Dixit and Robert S. Pindyck, *Investment under Uncertainty*. A rigorous explanation of the intuition and mathematics of real options analysis, including a primer on stochastic calculus and dynamic programming.

1995 Lenos Trigeorgis (ed.), *Real Options in Capital Investment: Models, Strategies, and Applications*. A collection of papers by various authors. Explains the relationship of real options analysis to other dynamic methodologies and presents a general model of real options using dynamic programming.

1997 *Real Options: Theory Meets Practice*. Inauguration of an annual international conference for academics and practitioners.

1999 Martha Amram and Nalin Kulatilaka, *Real Options: Managing Strategic Investment in an Uncertain World*. A non-technical book aimed at practitioners, with the goal of explaining real options analysis as a way of thinking.

2001 Gregory Taggart, "Wait & Seek," *Bloomberg Wealth Manager* (November). A cover story about real options in a major trade publication for personal financial planners.

When you have a choice between now or later, you need to have some way of choosing. Real options analysis is a powerful way of thinking about that choice. Table 2 shows the analogy between the features of a call option on common stock and the option to wait.

Table 2
Analogy between a call option and the option to wait

Call option on common stock	Option to wait
Financial option, associated with an underlying financial instrument	Real option, associated with an underlying investment project
Option price (the value of an exchange-traded or over-the-counter option)	Total value of the project: dynamic net present value = static net present value + value of real options
Shares of common stock	Benefits of project
Stock price	Present value of expected benefits
Volatility of stock price	Uncertainty about the project's value
Exercise price	Investment cost
Intrinsic value (the difference between the stock price and the exercise price)	Net present value of expected benefits minus investment cost
Expiration date	End of opportunity to invest
Dividend	Forgone benefits
Risk-free interest rate	Risk-free interest rate

The fundamental equation of real options analysis is: dynamic NPV = static NPV + value of real options. If there are no real options — that is, if there is no flexibility — traditional (static) net present value techniques apply. To understand real options analysis, you need to keep your eye on the analogy between a call option on common stock and the option to wait to invest.

When should you exercise a call option on common stock? Conceptually, if the benefit of waiting is greater than the cost of waiting, then you should wait; if not, you should exercise. The benefit of waiting is the opportunity to see if the stock price goes up or down, while earning interest on your money in the interim. Options have value because of asymmetry; they let you enjoy good outcomes and walk away from bad ones. The cost of waiting is that you don't receive any dividends.

If a stock pays no dividend, then you should not exercise the call option before the expiration date; there is a benefit to waiting but no cost. In this case, holding the opportunity to buy the stock is better than holding the stock itself. (If you think that the stock price will fall, you should sell the option, not exercise it.)

If a stock pays a dividend, you should exercise the call option if the intrinsic value of the option today is greater than the value of the option after the stock goes ex-dividend tomorrow. In this case, holding the stock itself is better than holding the opportunity to buy it.

The analogous rule for the real option to invest is that you make the investment if the static net present value today is greater than the dynamic net present value tomorrow. In other words, you invest if the project itself is more valuable than the opportunity to invest in it, and you wait to invest if the opportunity to invest in the project is more valuable than the project itself. This can lead to a different decision than the conventional rule that you should invest if the net present value is positive. In fact, two economists demonstrated in 1986 that it can be reasonable to wait to invest until the net present value is at least equal to the present value of the amount invested (or equivalently, that the present value of the benefits is at least twice the present value of the amount invested).[7]

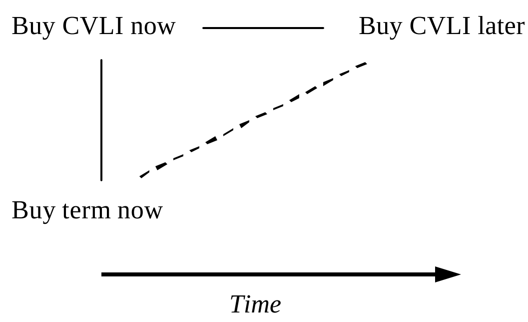
Real options analysis has already been applied to many personal finance decisions, including defaulting on or prepaying a mortgage, leasing a car, converting a traditional IRA to a Roth IRA, buying a life annuity, and choosing between term and cash value life insurance.[8] For some problems, you can get a quantitative solution that provides clear guidance about what to do. More often, however, real options analysis simply offers a better way of thinking about the problem, leading the planner to ask more questions and explore other choices.[9]

When you adopt an options perspective, you start to see non sequiturs all over. Analyses that seemed persuasive to you suddenly seem incomplete. Here are six short case studies.[10]

Case #1: Term vs. cash value life insurance

Suppose you can show that buying a cash value life insurance policy is better than buying term and investing elsewhere. Does that mean that you should recommend the cash value policy? Not necessarily.

Familiar “buy term and invest the difference” comparisons correctly answer this question: if you have a one-time-only choice between term and a cash value policy, which one should you choose? Who is asking that question? No one, because that’s not the situation that people face. What people really want to know is this: which one should I choose now, given the fact that I will have many opportunities to choose again later?



In the traditional view, there are only two choices to consider: buying term now or buying a cash value policy now. The real options perspective adds a third choice — buying a cash value policy later — and it adds a new task. To recommend buying a cash value policy, it is not enough to show that the cash value policy is better than term. You also have to show that buying the policy now is better than buying it later.

An investment in a cash value policy involves irreversibility, because the rate of return in relation to term insurance is generally unattractive for many years after issue. It involves uncertainty, because the benefit of a cash value policy in relation to term depends on the holding period, the policy's performance, future tax rates, your future health, and future term and cash value policies that become available. And it involves the option to wait, because you can buy term insurance that is convertible to an equivalent cash value policy.

When you go shopping for life insurance, you hold the opportunity to invest in a cash value policy, and you must decide if you would rather keep the opportunity (by buying term and investing elsewhere) or give up the opportunity and buy the policy. Conceptually, the decision is simple: if the policy itself is more valuable than the opportunity to buy it, buy the policy; otherwise, wait (and buy convertible term).

What is the value of the policy itself? It is the risk-adjusted net present value in relation to term, a calculation that has been done in many variations for a hundred years. It reflects the expected probability distribution of the good and bad outcomes from owning the policy.

What is the value of the opportunity to buy the policy? That is much harder to determine. You have to take account of all possible future paths of all of the sources of uncertainty of the value of the policy in relation to term. This hurdle brings the analysis to a halt, but there is another way to apply the real options framework in this situation.

Start with a sales illustration for the cash value policy, assuming that you buy it today. Choose a delay period — say, three years — and choose a measuring point — say, the death benefit at age 100. Obtain another sales illustration that assumes that you buy the policy after the delay period and pay the same annual premiums as in the first illustration, and that solves for the lump-sum additional premium needed to have the same policy value at the measuring point. Then figure out the rate of return that you would have to earn on the difference between the premiums for the cash value and term policies during the delay period in order to have enough for the required dump-in. Compare that with what you can reasonably expect to earn on other investments during the delay period.

This procedure gives you an idea of the cost of waiting, and it lets you apply the rules for the optimal exercise of a call option. If it seems easy to earn the required rate of return, then there is no cost of waiting, so you have a situation that is analogous to owning a call option on a non-dividend-paying stock. The rule is clear: don't exercise the option, which means don't buy the policy.

If you can almost, but not quite, earn the required rate of return, then you have a situation that is analogous to owning a call option on a stock that pays a small dividend. You should probably not buy the policy.

The greater the shortfall between the achievable and the required rates of return, the greater the probability that you should buy the policy now rather than later.

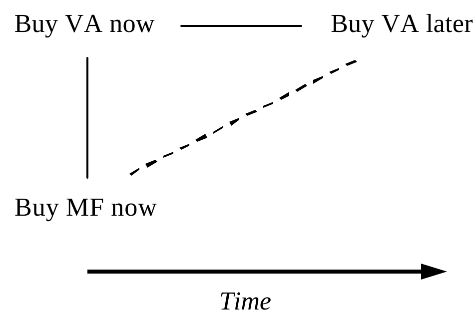
Implemented in this simple manner, real options analysis leads to a surprising discovery about the pricing of cash value life insurance: some companies have inadvertently created an incentive to buy their convertible term insurance and postpone buying their cash value policies. That is the unintended consequence of the load structure of their policies.[11]

In 1995, the Consumer Federation of America estimated that Americans lose $6 billion a year through early termination of agent-sold cash value policies. Many of these policies should not have been purchased in the first place, and real options analysis addresses this problem.

The old motto was "buy term and invest the difference." The new motto is "buy term while you wait for the right time to buy a cash value policy." If the "right time" never comes, then you've bought term insurance by default. From the real options perspective, you buy term not because term is better than whole life, but because buying whole life later is better than buying it now.

Case #2: Variable annuities vs. mutual funds

Suppose you can show that variable annuities are better than taxable mutual funds. Does that mean that you should recommend a variable annuity? Not necessarily. You also have to show that buying a variable annuity now is better than buying it later and holding mutual funds in the interim.



An investment in a variable annuity involves irreversibility, because of surrender charges, a 10% penalty tax for early withdrawals, and a long required holding period to provide higher after-tax values than mutual funds. It involves uncertainty, because the benefit of a variable annuity in relation to mutual funds depends on the holding period, investment performance and future tax rates. And it involves the option to wait, because vendors will be happy to sell you a variable annuity whenever you're ready to buy it.

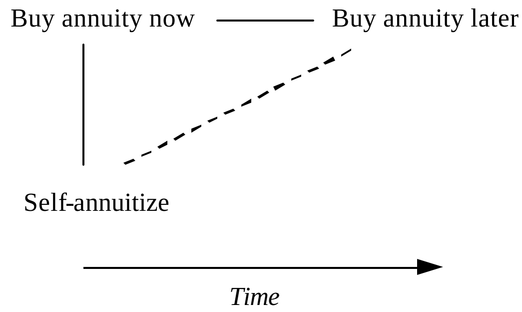
If you wait to buy a variable annuity, you forgo tax deferral (although some tax deferral is also provided by mutual funds) and the value of any guarantees (such as the guaranteed minimum death benefit, guaranteed minimum income benefit, guaranteed minimum accumulation benefit and guaranteed minimum withdrawal benefit). However, waiting lets you see how the future unfolds with regard to liquidity needs, tax rates, investment performance, new annuity products with better features, and new research on the economic value of the guarantees.

Variable annuity sales practices have led to litigation and regulatory actions. When you read touted studies promoting variable annuities over mutual funds, you'll see that the authors do only half of the work necessary to reach their desired conclusion. They don't explain why the variable annuity itself is more valuable than the opportunity to buy it, and therefore they don't "close the sale." The real options way of thinking leads to this advice to prospective variable annuity buyers: wait six months and then think about it again. Who could object to that?

Case #3: Immediate annuity vs. annuitize on your own

Suppose you can show that buying a life annuity is better than taking systematic withdrawals from a portfolio. Does that mean that you should recommend a life annuity? Not necessarily. You also have to show that buying a life annuity now is better than buying it later and annuitizing on your own in the interim.

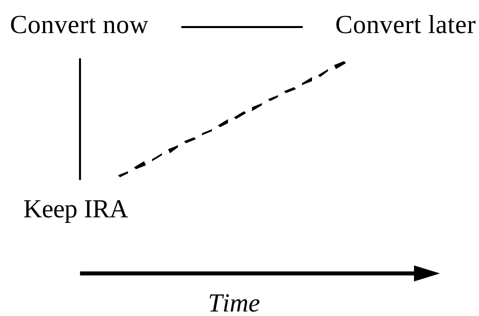
Buying a life annuity involves irreversibility, because there is usually no commutation value. It involves uncertainty, because the benefits in relation to self-annuitization are not locked in. And there is an option to wait, because annuities do not require medical underwriting.



To recommend buying a life annuity now, you have to weigh the benefits of waiting (lower price, favorable tax law changes, new product features, insurer insolvency, eligibility for substandard rates due to health problems, new research on the role of annuities in asset allocation) against the costs of waiting (higher price, forgoing the implied credit from annuitant deaths). This is an area of ongoing research, and that, of course, is a reason to wait.[12]

Case #4: Converting to a Roth IRA

Suppose you can show that converting to a Roth IRA is better than keeping a traditional IRA. Does that mean that you should recommend conversion? Not necessarily. You also have to show that converting now is better than converting later.



Converting to a Roth IRA involves irreversibility, because you cannot recover the income tax that you pay (except for a limited period for "recharacterization"). It involves uncertainty, because the benefit of a Roth IRA in relation to a traditional IRA depends on the holding period, rate of return and future tax laws. And it involves the option to wait, because you can convert whenever you meet the income eligibility requirements.

Conceptually, you should convert if the risk-adjusted net present value of the Roth IRA in relation to the traditional IRA is greater than the value of the opportunity to convert. What is the value of the opportunity to convert? That is very difficult to determine. You have to take account of all possible future paths of all of the sources of uncertainty of the value-added of a Roth IRA. Those sources include rates of return, tax rates, spending needs and mortality.

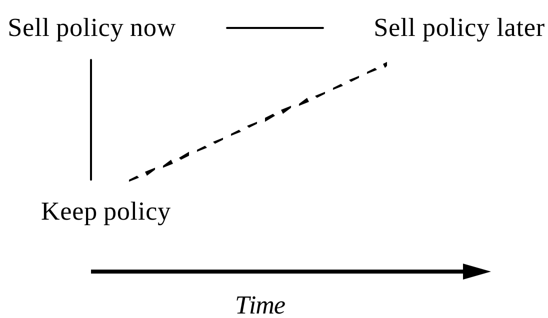
How can you apply real options analysis in this case? Start with a conventional net present value analysis that implicitly assumes that conversion is a one-time-only choice. Look at the ratio of the net present value to the income tax paid upon conversion (which is the investment in the "project"). Choose a threshold for triggering exercise of the option to convert; for example, a 100% threshold means that the net present value equals the income tax paid. (You can find some guidance for the threshold in the academic literature on real options analysis[13], but there is no assurance that solutions derived for other investment problems apply to Roth IRA conversions.)

The greater the benefit of the Roth IRA in relation to the amount invested, the more likely it is that a rigorous real options analysis would confirm that you should convert.[14]

Case #5: Life settlement

A life settlement is the sale of a life insurance policy to a third-party investor for more than its cash surrender value. The life settlement market has attracted growing interest from buyers and sellers in recent years.[15]

Suppose your client receives a tempting offer for a policy that he no longer wants. Does that mean that you should recommend selling the policy? Not necessarily. You also have to show that selling it now is better than selling it later.



A life settlement involves irreversibility, because of high transaction costs. It also involves uncertainty about the economic value of the policy to the owner and its value in the secondary market.

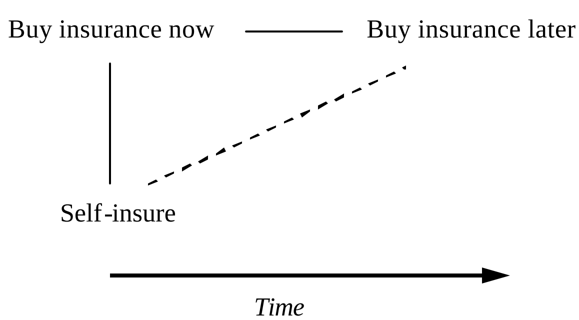
Is there an option to wait? That depends on whether the opportunity to sell the policy at today's price is likely to persist. There are several reasons to think so.

Most health problems persist; life expectancy is not a random walk. Transaction costs should go down as the secondary market becomes more efficient. If there is no change in pricing factors, the life settlement price will increase as time passes, although premiums may have to be paid to keep the policy in force. Of course, waiting to sell provides a windfall for the family if the insured dies while waiting.

On the other hand, advances in medical treatment could reduce the sales price of some policies. Investors may also offer a lower price if life settlements do not turn out to be as profitable as expected. Also, if the life settlement proceeds are going to be used to buy new life insurance, it may not make sense to wait.

Case #6: Buying insurance

For decades, economists have analyzed the decision to buy insurance by using utility theory. Because of risk aversion, a utility-maximizing individual may choose to buy insurance despite loading for expenses and profit. Real options analysis should be applied in this area only with great caution.



For example, you can wait to buy long-term care insurance (LTCI), but how do you deal with the risk exposure in the interim? If you become ill, you may be unable to buy insurance later.

Admittedly, long-term care insurance has an implicit investment component because of the level-premium structure. There is irreversibility, because there is usually no cash value. And there is uncertainty, because you don't know if the policy will provide the benefits that you'll need at a price that you can afford. There may also be an analogue to forgone stock dividends: the value of yearly protection (measured by the cost of an imaginary one-year-term LTCI policy) plus the value of guaranteed insurability (measured by the cost of an imaginary standalone option to buy LTCI).

So the elements for a real options analysis seem to be in place. However, we would not want to have to explain in malpractice litigation that we had advised a client not to buy insurance because of an "option to wait" that can be valued only by imagining products that may never exist. Not buying insurance can be a wise choice, but you should look elsewhere for the arguments.[16]

The lesson here is that real options analysis, like every tool, is good for some tasks but not others. It's also a good idea to distinguish between waiting and procrastination. Waiting, in the real options sense, involves the determined pursuit of self-interest. Procrastination, in contrast, involves a failure of self-control. The real options perspective on waiting is complemented and enriched by recent research in economics, psychology and decision analysis.[17]

Future directions

This new frontier offers both immediate and long-term benefits to planners and their clients. Practical applications of dynamic methods of analysis are already available, and more will surely be developed as practitioners become familiar with techniques that are well known in academia.

It took decades to incorporate the insights of modern portfolio theory into a new legal standard of prudent investing (the Prudent Investor Rule[18]), and that standard is already out of date. It cannot be prudent to mishandle options or to fail to demand adequate compensation for giving up flexibility. The Prudent Investor Rule will have to be revised again to incorporate the insights of real options analysis.

Dynamic methods of analysis challenge us to do better. It's a safe bet, for example, that tax laws will change many times during our clients' planning horizons. Financial advisers sometimes say that you have to deal with the tax laws as they are now, but is that good planning or just an excuse to be lazy? Isn't it likely that our advice would be better if we could somehow take into account the reality that tax laws are stochastic and that our clients will have many opportunities to react to these changing laws? Combining real options analysis with scenario planning could yield creative strategies for dealing with tax uncertainty.[19]

Our clients live in a dynamic world, and they face dynamic problems. The challenge for the financial planning profession is to acquire more powerful tools to deal with them.

Endnotes

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