Time-Referenced Investment Policies

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Table of Contents

Executive Summary

In this article, investment policies are tailored to the changing nature of risk and return across several intended holding periods. Policies should be designed to combat pricing volatility in the short-run, be responsive to liability considerations by longer time frames, and should attempt to maximize net worth positions and lifetime consumption by the very long term. By expanding the investment policies of a portfolio or plan beyond that of a unitary time horizon, flexibility of portfolio operation is thereby increased. The investor can adjust short-term asset allocations in order to maximize long-term economic benefits. By viewing the relevant economic choices to involve consumption today versus consumption tomorrow, investment policies can expand considerably beyond the traditional and more limited trade-off of pricing volatility versus pricing return.

Introductory Note on Chronology of Paper

This working paper has evolved and grown over time. It was originally written in early 2007 as part of a series of writings by the author on modeling of investments across varying holding periods. The paper was submitted to the *Journal of Financial Planning*. After going through revisions and editorial changes, the article was published in the JFP in April, 2008, with the same name as this working paper. A draft work-up of the JFP article is available on-line, and the final version is contained in the JFP, of course. After publication of the article, new sections were added in November, 2008, and the conclusion was expanded considerably.

The Importance of Policies

Investment policies should be a critical part of a financial planner's regular activities. Charles Ellis (1998) advocated the development of clearly stated, written policies and practices. Investment policies are relevant, and often required, in many institutional settings. For instance, the development and implementation of written investment policies constitute basic responsibilities for pension trustees and administrators.

Well-written investment policies will normally include sections on objectives, constraints, policy formulation, performance evaluation, feedback and portfolio adjustment, and general oversight. Policy objectives should evaluate investment risk, and factors affecting an investor's risk tolerance should also be listed. Policies should clearly identify and fully consider the intended holding periods of a plan or portfolio (IFEBP, 2003).

Standard portfolio textbooks, such as Reilly and Brown (2000, at 287), acknowledge the need to change risk definitions across time:

> "A difference in the time horizon would require investors to derive risk measures and risk-free assets that are consistent with their investment horizons."

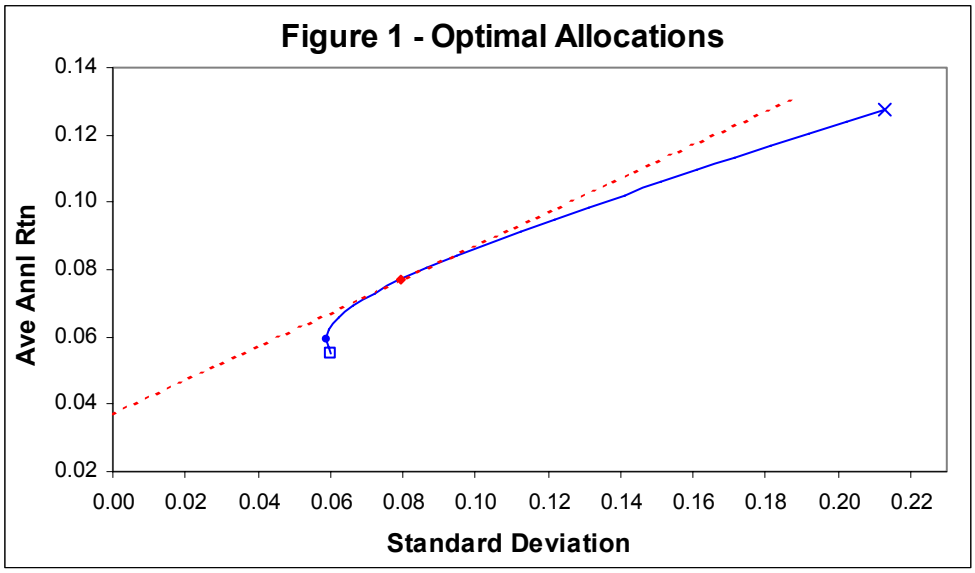
A unitary time horizon is typically assumed in the literature. This is a simplifying assumption that is often used without a great amount of analysis being afforded to it. In practice, individual investors and institutionals will often operate across several different time horizons simultaneously. Investment policies should account for the actual practices of investors, instead of merely relying upon simplifying conventions that do not consider the circumstances of particular investors.

This paper explores the changing nature of risk and return over varying time horizons. The theoretical and practical impacts of time upon portfolio composition are considered. Three commonly used time horizons are sequentially evaluated, and investment policies are proposed for each period.

In the Short-Run

In short to near-term time frames, volatility risk looms large while returns are invariably pricing related. Investors with shorter holding periods should be critically concerned with the distinct possibility of a sudden and unexpected variation occurring to asset pricing. Traditionally, the Modern Portfolio Theory and the Capital Asset Pricing Model have been used to establish an optimal mix of assets for the given risk and return. Recent academic research of Fama and French (1992, 1993) has suggested that a three-factor risk model incorporating value, size, and volatility risks may be a good supplement to the

CAPM. With either the single-factor risk model of the CAPM or a three-factor model, the definitions of risk and return are still largely focused on asset pricing. Such definitions are mostly suited for short to near-term time frames, where pricing volatility is a huge problem. Risk and return concepts are aptly demonstrated in the following graph:



The risk-return trade-off can be clearly seen in Figure 1, with the annualized expected return shown on the y–axis and the standard deviation of the expected return displayed on the x-axis. The curve is the efficient frontier, and represents the best available risk-return combinations possible for a two-asset class portfolio. The analysis can be expanded to "n" assets. A portfolio composed of 100% bonds is noted as a box at the bottom of the frontier, while 100% equities is marked with an x. The small blue dot on the frontier is the minimum variance point. The dashed red line is the Capital Market Line (CML), which postulates a linear relationship between risk and return of assets. The red dot is the tangency of the CML and the frontier. This comprises the optimal allocation of equities to bonds, for the assumed risk-return characteristics of the two asset classes.

Optimality was calculated by the author to be around 30% equities, using historical data between 1926 and 2005 for spliced indices composed of broad-based domestic equities and bonds. Optimal allocations will vary substantially however, depending upon the assumed risk-free rate of return, types of assets contained in the portfolio, the rates of return, variance of return, and correlations between assets. The important point is that asset allocation balances or optimizes the risks and returns of the asset stream. In short-term time frames, bonds will typically make up a significant percentage of an investor's portfolio at optimality.

The exact point of optimality is referred to as the market portfolio, since a mix of only two index funds (equities and bonds) will generate optimal allocations. Theoreticians will often recommend the broad diversification of assets, so as to emulate the market portfolio

at optimality. With either the special or general case of utility, diversification of assets will be favored by all risk-averse investors (Gollier, 2001). With proper diversification, firm-specific risk can be eliminated, leaving only market-level, systematic risk to face.

While many portfolio texts normally use the 90-day Treasury bill as the risk-free rate of return, many long-term investors who shorten their time horizons for near-term funding needs will view the risk-free asset from a different perspective. Campbell and Viceira (2002) argue that cash instruments, such as T-bills, will not be riskless, as there will be reinvestment risk to contend with from interest rate shocks and inflationary pressures in the economy. Inflation-indexed bonds will provide a much lower risk, stated in real terms, than will cash or near-cash instruments. These types of bonds generate stable, real returns that can match short-term liability needs. This generally supports the above findings of high bond allocations in the shorter time frames, only with TIPS types of bonds constituting the cash portions of the portfolio. The use of bonds and inflation-indexed instruments is consistent with long-standing financial practice recommendations to increase bond allocations as time horizons shorten.

In the Longer Time Horizons

By as little as a five-year holding period, standard deviation is reduced by 50% from that of a one-year hold. This does not mean however that all forms of risk dissipate in longer time frames. It would be a huge mistake, in fact, to suggest that risk is reduced merely because standard deviation goes down in the longer time frames. When annualized returns are used with an assumption of independent returns (IID), variance of return will remain constant over time, even though standard deviation is reduced in proportion to the square root of the holding period. Thus, standard deviation should only be used to compare risks between assets in the same holding period. (Campbell and Vicera, 2002).

With traditional measures of risk not being overly useful for long horizon investing, other measures come to the forefront. Multiple-horizon investors will not be so concerned with single-period returns as they are with returns to cumulative wealth. The rate of return in any one year gives way to the return on wealth over all periods of time.

Moving towards risk and return parameters that are compounded across time is consistent with these thoughts. Ibbotson (2005) believes that risk and return across time should be analyzed through notions of cumulative wealth. This is done by calculating the optimal portfolio rates of return in any one time frame, and then compounding lognormal return data over successive periods of time. Pricing volatility risk is still important, but only as one variable of a cumulative wealth calculation.

Cumulative wealth is visually described in the following graph:

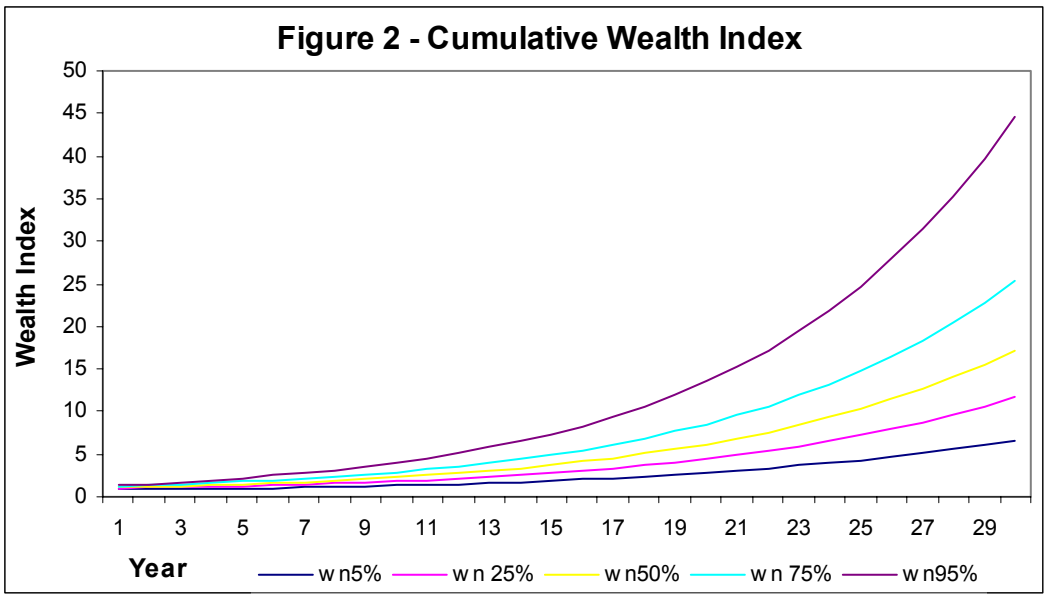
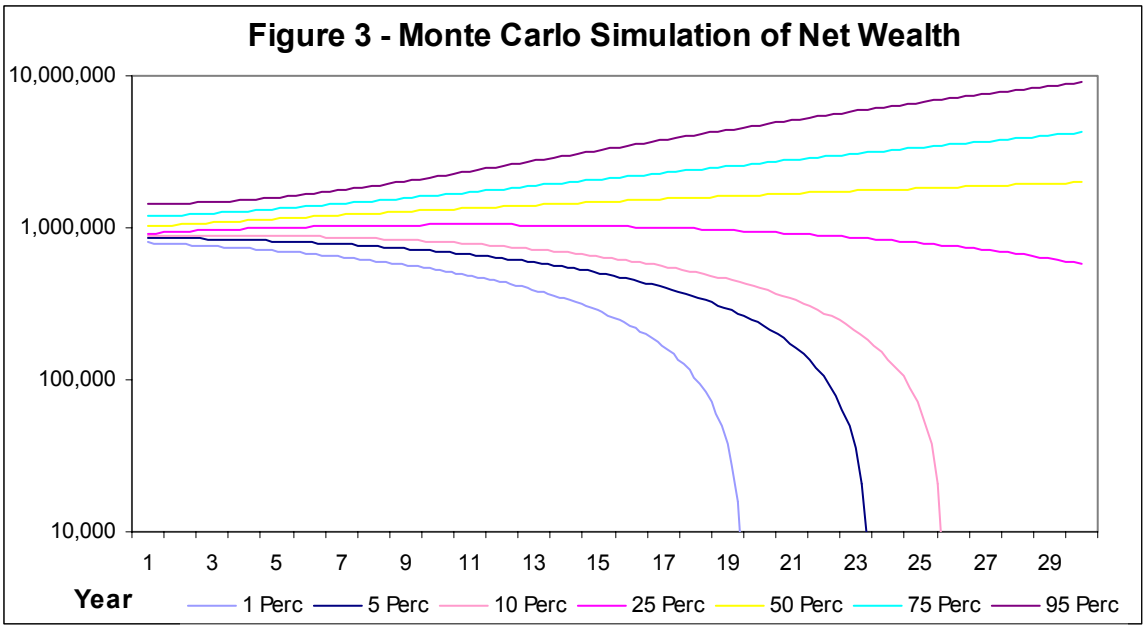


Figure 2 sketches out a cumulative wealth index across time, for five different levels of confidence. Note the ever-expanding range of wealth over time. Liability-related items are thereby introduced into an analysis that up until now has focused solely on the asset streams. As the range of terminal, end-period increases, the risk of not being able to fully fund investment objectives also increases. Standard deviation may be stamped out across time, but another menacing risk emerges to takes its place: that of the probability of shortfall from attaining investment objectives.

Shortfall risk can be modeled by a variety of ways. A.D. Roy (1952) was the first person to propose a liability type of measure with his safety-first criterion. Rather than optimizing assets in isolation of liability streams, a point along the frontier was selected which corresponded to a threshold rate of return necessary to fund the liabilities. Another method is Asset-Liability Modeling (ALM). Actuaries and accountants have been very active since the 1970's using ALM to match assets with liabilities for each time frame. Currently, ALM is required in many defined benefit situations to ascertain the economic well-being of pension funds.

Econometric methods, such as Monte Carlo simulations, have also been devised to estimate the abilities of the asset stream to sufficiently fund the liability stream. The following graph is of a hypothetical $1,000,000 portfolio having an annual withdrawal of $50,000 plus a 3% cost of living adjustment. 500 trial runs were conducted by the author on the assumed facts, using a constant 40 / 60 allocation of stocks / bonds. The hypothetical generally follows a Monte Carlo example given in Ibbotson (2005), only with some assumptions and procedures being modified somewhat.



For the given hypothetical, the probability of shortfall from stated investment objectives is displayed in the above graph, to various degrees of confidence. Note that complete portfolio failure occurs by year 19 at the 1 percent level, by year 23 at the 5 percent confidence level, and by year 36 for the 10th percentile. Failure will occur even at the 25th percentile, if given enough time. This type of economic projection provides an excellent way in which to evaluate funding risks at the extremes.

With the above hypothetical, if portfolio sponsors want to lower the probability of shortfall, investment policies could be changed. Specifically:

- Stock to bond allocations could be adjusted to increase expected returns;
- Certain assets could be added to the portfolio (i.e. international; alternative) to increase portfolio expected return and possibly reduce portfolio volatility.
- Downside risk could be battled with the addition of defensive assets to the portfolio, or through the use of hedged positions and financial derivatives.
- If all else fails, additional assets (contributions) may be needed; and / or:
- Liabilities (benefits) may have to be reduced.

As time horizons are lengthened, investment policies should reflect the changing nature of the risks involved. No longer is the investor exclusively concerned with an asset's mean average rate of return and variance of return. The probability of shortfall, within stated confidence levels, becomes the relevant risk facing investors. Allocations are dependent upon both the assets and the liabilities. While equity allocations may be increased to lower the likelihood of shortfall, this is not an inevitable result: equities may decrease in order to reduce the range of cumulative wealth. This would occur in situations where sufficient assets already exist to cover the anticipated liability stream,

with the investor being more concerned about capital preservation issues rather than capital accumulation goals.

Inter-Generational Views of Investing

As time horizons extend into decades, the investing landscape again shifts to reflect the changing economic choices. Institutionals, pension plans, and corporations will routinely plan for these time frames. Individuals accustomed to regular investing over the course of their economic livelihood can also have very long horizons.

With very long holding periods, investors may see the various investment institutions, customs and practices in sociological as well as economic terms. Investment is no longer just an economic undertaking – it is a way of life for these investors. Complex Adaptive Behavior may better describe the way in which long-term investors relate to the world (Hagstrom, 1999). The capital markets and investment arenas are seen as a complex mix of economic and social entities that change and adapt in response to the shifting attitudes of the general population of investors.

Deferral of capital gain taxes becomes a critical component of a long-term investor's policies and views. An investor may be loath to ever sell, for he or she will be taxed on the gain, thereby lowering the ability of assets to compound and grow over time. A sale may also come at an inopportune time prior to the full reversionary tendency of assets becoming evident. Buys may become infrequent as well, since the investor is only interested in the best firms within each industry, and then only if the companies can be purchased for reasonable valuation levels.

This may explain why many investment managers will have either concentrated holdings of private businesses, or focused value-oriented portfolios of publicly traded assets. The emphasis will be on quality, growth, and value of business activity, rather than sheer quantity. Academic research as far back as the 1960's found that a limited number of equities – as few as 10 to 15 - provided virtually all the benefits of diversification (Evans and Archer, 1968). A relatively small number of equities in a mix of international and domestic equities could lower systematic risk levels while also being fully diversified (Solnik, 1976). Currently, a somewhat greater number of assets may be needed to combat firm-level risk. This is due to higher volatility and correlation levels among many assets, but 50 to 75 equities may possibly be sufficient for diversification purposes in today's market environment.

The chief danger for investors with very long horizons becomes the fluctuation in their net worth positions. The investing experience is seen in terms of consumption choices, with the investor maximizing his or her lifetime consumption. Instead of the principal choice being between pricing risk versus return, the primary economic decision is one of consumption today versus consumption tomorrow. Investors will want to smooth their current consumption to stable and predictable amounts while also maximizing

consumption over their entire economic lives. The relevant risk is the variability of lifetime consumption.

Dynamic programming, which was initially developed by Richard Bellman (1953), can model these types of economic choices and preferences. Many scholars, such as Eeckhoudt, Gollier, and Schlesinger (2005), as well as Gollier (2001), feel that the method presents a significant advantage for long-term investors. The objective is no longer to secure a high return in every single time period. The focus is now on lifetime investment goals. The investor can be more flexible in asset allocations, shifting risk aversion preferences according to changing economic conditions at the aggregate and individual levels.

Backward induction is generally used to solve dynamic problems, whereby the second period problem is solved first, for each possible outcome that could exist at the start of period two. This makes the static situation into a dynamic one, where an investor can adjust strategies over time. The investor will change the optimal risk exposure in the second period based on the outcome in the first. This allows the agent to keep his projected, end-period wealth on target with investor objectives and goals. Dynamic portfolio management thus becomes a sequence of static, single period problems designed to maximize end-period utility. The following graph depicts the economic choices involved:

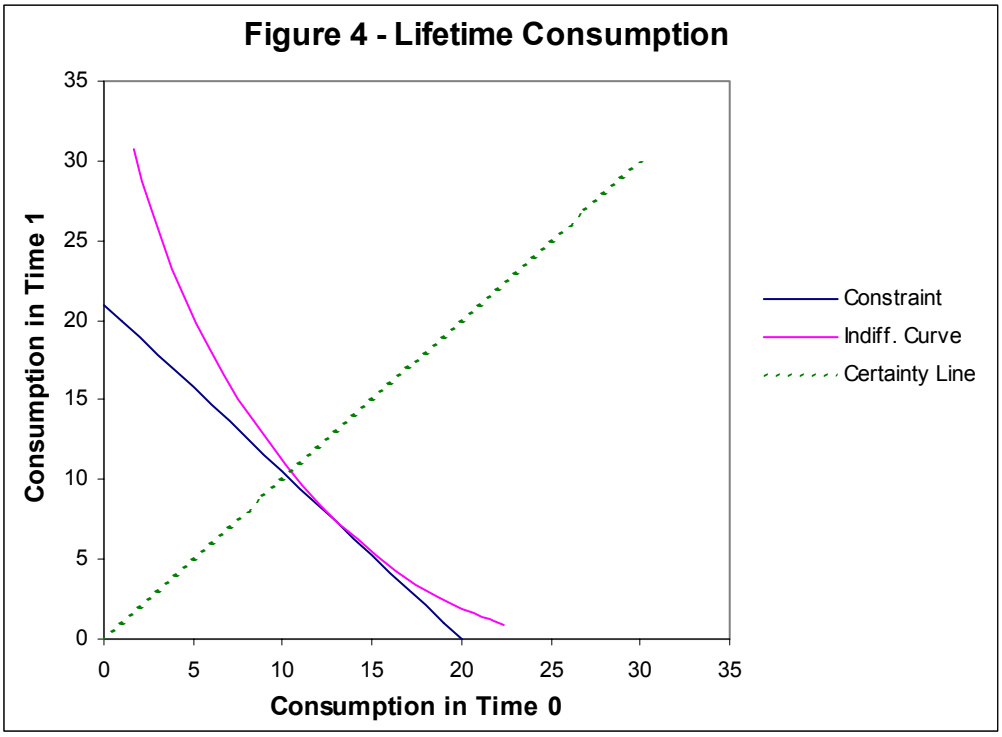


Figure 4 displays a two-period consumption choice. The economic decision can be expanded to "n" choices. The curve (in pink) sketches out the consumption choices that the investor is indifferent to, while the blue line depicts the budget constraint. The dashed green line is referred to as the certainty line, which would result if consumption choices are equally preferred between the different time periods. The point of optimality or equilibrium occurs at the tangency of the indifference curve and the budget constraint. Note the similarity of analysis with the point of tangency of the efficient frontier and the CML.

Power utility, decreasing absolute and relative risk aversion, and IID were assumed in the above graph, with a preference for current consumption at 57.5% and deferred consumption at 42.5%. This resulted in a shift in the indifference curve towards current consumption. If consumption were the same for both time periods, then the tangency of the budget constraint and the indifference curves would occur at the certainty line.

When time periods are made part of the process, the basic choice of immediate consumption versus deferred consumption becomes more evident than with Modern Portfolio Theory. The advantage of a long-term investment perspective comes from the investor being able to break up the risks on lifetime consumption into smaller, discrete components of shorter holding periods. The investor can then adjust exposure to risky assets in these shorter time frames in order to maximize lifetime consumption.

Dimensional Investment Policies

A time-referenced view of the investment universe is summarized in the following table.

Table 1 – Investment Policies over Time

	ST / NT	LT	VLT
Utility	Special Case	Special / General	General Case
Model	MVO / CAPM	Asset-Liability	Adaptive / Dynamic
Mathematical Space	Means-Variance	Probability-Time	Consumption-Time
Risk	Pricing Volatility	Shortfall	Var. in Life Consump.
Return	Pricing Return	Return on Wealth	Lifetime Consumption
Asset Allocation	Equity / Bonds	More Equities ?	Active / Passive
Diversification	Broad Diversification	Some Concentration	Greater Focus

A short review of Table 1 is illustrative. Investors operating in short to near-term time frames will largely be concerned with asset pricing. The special case of utility and asset pricing models reasonably explains the investment choices facing such agents. Investment policies can combat pricing volatility through the broad diversification of assets. Significant bond and inflation-indexed allocations should exist, as well.

For long-term holding periods, investment policies should incorporate liability considerations into the management of wealth, as an investor's principal economic goal will now be the full funding of retirement and other investment objectives. Various accounting and econometric methods should be employed to gauge the probability of shortfall from the stated objectives, as the likelihood of portfolio failure becomes the relevant risk for investors with longer horizons.

Longer holding periods allow more time for assets to revert to their mean. Returns of most asset classes are predictable in that reversion, with serial correlation in historical return data being shown in a number of studies. A few of the many articles on the subject include: Barberis (2000); Shefrin and Statman (2000); Reichenstein & Dorsett (1995). Many of the papers have found huge effects from mean reversion and return predictability.

High equity allocations have been found to be optimal in some theoretical studies using dynamic models (Campbell and Viceira, 2002), as well as efforts using mean-variance procedures (Siegel, 1998). Such findings generally coincide with financial planning recommendations to increase equity portfolio components as time horizons lengthen. Higher equity allocations must be tempered by the matching of asset and liability streams for each respective holding period. Once assets are aligned with liabilities on a present value basis, allocations could very possibly become more conservative, reflecting the need for greater return stability in the portfolio structure.

By the very long-term, the economic choices revolve around the preservation of capital wealth. Diversification of assets continues to be important, but the actual pattern of long-term investors as well as theoretical studies suggests that a relatively focused portfolio could still be consistent with diversification precepts. Broad diversification continues to be viable across all time frames, however. For those investors desiring a portfolio of individually chosen assets, efforts must be undertaken to ensure the elimination of unique, firm-specific risk.

The variability of lifetime consumption and wealth is the most pressing risk facing long-term investment decisions, and investment policies should be designed to minimize that variability. For instance, labor income shocks can have a large impact on long-term consumption. In the presence of labor income variability, investment allocation policies should become more conservative, since exogenous risks as well as portfolio variability are both now affecting consumption and investment decisions.

Complex adaptive behavior describes many economic and sociological activities of such investors. Dynamic portfolio management provides an ideal theoretical model in which to make economic decisions under conditions of uncertainty. Indeed, dynamic general utility models could be used across all time horizons since investor utility of wealth can be maximized in the process. The same allocations as short-term investment decisions may be generated, however, when dynamic methods are used with certain assumptions (i.e. power utility, constant relative risk, and IID). Overall, short-run economic positions

can be deliberately altered to increase long-term net wealth and the enjoyment of that wealth.

A more complete analysis of dynamic methods goes well beyond the scope of this article, and would include extensive considerations of many other investor and aggregate level economic factors. Some of these items are: the choice of utility function, absolute and relative risk aversion, return predictability, the relevant discount rate, the savings rate, labor income shocks and correlation to market risk, liquidity constraints, the existence of macro-level exogenous risks, parameter uncertainty, work habits, the ability to learn investment-related matters, and households attitudes towards a variety of economic choices. Each of these factors, considered to be part of an investor's opportunity set, could affect lifetime consumption. A full model of very-long horizon investment decisions should evaluate the entire opportunity set.

Professional-Level Policies and Guidelines

The following items should be treated as a set of guidelines for professional-level portfolio managers to use in the coming years. They are essentially a continuation of the Investment Policies and Practices note above, only now meant for the primary consideration of investment managers and finance theoreticians.

Fundamentals of Personal Finance. Many principles of finance are still as relevant today as when they were initially developed many decades ago. The preservation of capital assets, for instance, is a pressing concern for investors. The minimization of tax impacts from investing and the reduction in costs of investment research and trading are also very important for investors having a long-term outlook. Investing could become a way of life for successful investors. Regular, systematic investing behavior produces phenomenal results if done over an entire work life. Dividend reinvestment also allows interest to compound on itself as new principal. Being aware of the probabilities of return and of investing behavior furthers an investor's objectives, too.

Developing asset allocations makes very good sense for an investor, since the vast bulk of a portfolio's return can be traced to the basic allocation decision, with little of the return being attributable to the selection of individual assets within the portfolio. Maintaining the allocations by periodic rebalancing of assets is also a very good exercise, since it provides an automatic and powerful tool in which to enhance wealth. In this way, no great market timing skills or tremendous knowledge of macro events are necessary for the investor to take full advantage of market fluctuations.

Keeping an investment plan and portfolio simple and straight-forward should always be an important objective. The complicated items of finance can be developed as a plan matures, but even then, may not be overly necessary. For example, investing an appropriate mix of assets in only three index funds – the Wilshire 5000, the Lehman Bond Aggregate, and an International equity fund of fund may serve the better interests

of many investors, especially if they also engage in regular investing with dividend reinvestment.

Time. Directly put, time horizons should be an integral part of standard portfolio analysis and management. While relaxation of many classical economic assumptions does not overly affect or modify the MPT or the CAPM, adding time horizons to the analysis results in a dramatic change of perspective. Investors with long time horizons are critically concerned with the variability of net worth positions. Since MVO and most of current portfolio theory caters to only the asset side of the investment process, the special case of utility maximization by itself is ill-suited at analyzing the variability of long-term capital wealth.

The long-term investor has no theoretical place to go when the unitary time assumption is deployed. No wonder great investors such as Buffett and others openly ridicule the financial statisticians and their theories. For example, in *The Warren Buffett Portfolio,* Robert Hagstrom sarcastically refers to financial scholars as "the high priests of modern finance". By extending the analysis to include time, investors operating across all time periods can be included in the theoretical construct. This makes theory a closer fit to the practice of finance, accounting for all investors operating across all time frames.

Liability. Without a doubt, liability streams should be considered as important as the asset streams. It is simply time for A.D. Roy to jump out of the footnotes of the portfolio texts, and for liabilities to attain an equal place and status alongside assets in the management of wealth. Assets mean little or nothing by themselves. Assets mean a great deal when used to finance the liabilities of retirement. Investment management should principally be concerned with balancing assets against liabilities, instead of compulsively seeking out the highest asset return in the last twelve months (or less). Managers should therefore become well versed on liability issues. Managers do not need to out-run and out-gun the indexes. They critically need to maintain and add to cumulative wealth for purposes of eventual use by the investor.

Optimality of consumption is likely to exist only at a certain mathematically defined point of matching between the asset and liability streams. With this perspective, results from current MVO methods do not necessarily represent optimal allocations. Different allocations of assets might simply be needed in order to fund the liability stream. Consumption-based general utility equations containing liability-related budget constraints are more useful in ascertaining optimality of lifetime consumption.

Utility. Current portfolio theory maximizes investor marginal utility only within a "timeless" investment setting where there are no considerations of liability, let alone return predictability or varying risk aversion. This is most peculiar, since as far back as 1973, Merton clearly established the importance of time in investment analysis. In that year, Merton demonstrated that the standard CAPM is merely a special case of an intertemporal pricing model. Asset pricing is made up of both the traditional risk premium plus a hedging component on future adverse events affecting the investor's opportunity set. In light of the ICAPM as well as lifetime consumption models, it is most

astonishing that a unitary time horizon is still commonly used in portfolio theory and research. A timeless horizon is only appropriate in the very limited situations of no hedging demand against future uncertain events; no additional state variables occurring; no liabilities existing; and no consideration being given to varying utility functions, investor risk aversion, or return predictability. A timeless view of investing should therefore be considered merely the starting point in the analysis, with the full measure of investment opportunities then being sequentially added to develop time-referenced investment policies.

The overriding mandate of portfolio management should be on the maximization of investor utility across all relevant holding periods. The central investment decision should lay in the identification and selection of competing economic choices under conditions of uncertainty across all time frames. The final choices selected should be the ones that maximize investor utility, with the relevant measures of risk and return being expressed in different fashions across time.

In this regard, the general case of utility has vastly superior (but far more complex) qualities than the special case. To fully integrate time horizons into investment analysis, the dynamic management of assets and the general case of utility maximization is needed. The full impact of time, risk aversion, and return predictability can be evaluated through dynamic programming. This presents a significant advantage over current portfolio theory and Markowitz optimization techniques.

A portfolio manager running through the myriad number of general utility equations and concepts will probably become exasperated with all of the theoretics. Important principles of finance are certainly stated with great mathematical flourish, but nothing of concrete application seems to emerge from the discussion. Unlike MVO techniques that can be solved by any finance professional with an Excel spreadsheet, complex general utility equations appear to only lead to more equations with even more complexity. That is the real challenge for advocates of general utility in the years ahead, to make the subject comprehensible and practical to use at the professional investment level.

Portfolio Management Decisions. A short outline of important portfolio decisions and policies highlight the important issues facing the long-term management of wealth.

- Liability streams should be estimated for all relevant holding periods. This could and perhaps should be done first, as the required asset stream could then be more readily ascertained.

- On the asset stream, investors should be highly encouraged to methodically and regularly invest; to engage in dividend reinvestment; and to develop a long-term view of the world, along with its low-turnover, low cost approach to asset management. Enacting these simple investment philosophies would do more good for investors than most of the complex investment strategies could ever hope to achieve.

- Passive investments are ideally suited as long-term investment vehicles, and arguably, should constitute the core of any portfolio. A simple three-fund index approach of broadly diversified domestic equities, international equities, and domestic bonds is quite eloquent in its simplicity, but is still theoretically consistent with the separation theorem developed by Tobin in the late 1950's. It also is in accord with several studies showing over 90% of the variability of portfolio returns to be the result of the basic asset allocation decision, and not from the selection of individual assets.

- Once the core of the portfolio is established through a long-term, low cost passive strategy, attempts can be taken to enhance returns at the margin. Specialized index funds segmented by style, size, country, industry, sector, etc can augment the portfolio. In this way, a Fama and French styled multi-factor investment world could conceivably be captured without the higher costs traditionally associated with active management.

- Active investments could be contemplated next, with an eye towards enhancing returns while keep downside risk to a minimum. It is critical that costs and tax impacts be kept to an absolute minimum however, or else the active component of the portfolio may be doomed to failure from the outset. The general objective of active management would be to use fundamental methods that generate above average performance over long-time frames, and to do so on a post-cost, post-tax, adjusted risk basis. As noted in earlier chapters, the basic selection style could be a mix of quality, value, and growth.

- Diversification is important across all time horizons. If the effort is done properly with either a broad-based asset selection or a more focused but still diversified portfolio, virtually all firm-specific, diversifiable risk should be eliminated.

- Asset allocation should be properly developed and maintained. This would generate the basic return structure for the asset stream across all relevant time horizons. Allocation decisions should be viewed as a shifting of non-diversifiable risk among willing investors in a decentralized process.

- Relevant utility functions, risk aversion, predictability of returns, labor income, and many other investor-level factors of the opportunity set should be taken into account when developing allocations.

- Assets should be matched to the liabilities across respective holding periods. The investor should be provided with the required amounts of asset formation to reach the stated liability / benefit objectives. This will give the investor a continuing funding target to achieve on a regular basis.

- Optimization efforts should be undertaken to ensure that sufficient assets exist to cover the anticipated liabilities. The manager could use either or both the special or general cases of utility. If the special case is employed, then MVO and some type of

asset-liability modeling would be needed. For the general case, dynamic management equations would be appropriate used for the task.

- With either type of utility maximization, the probability of shortfall and the variability of lifetime consumption should be seen as the primary forms of risk facing investors. Other types of risk, including variance of pricing, should be considered as component parts or variables of an overall risk calculation extending into all relevant holding periods.

- Across successively longer time horizons, return concepts should primarily focus on the maximization of lifetime consumption and the smoothing of consumption.

- Once the probability of shortfall from stated investment objectives is established, a regular feedback loop should be developed to minimize this likelihood. Adjustment to allocations and changes in investor-level utility factors should be contemplated. Adjustments in asset contributions or eventual benefit payments might also be necessary, if no other means of balancing assets and liabilities exists.

Concluding Remarks

The meaning and measure of risk and return changes over the course of the intended holding period, and investment policies should be tailored to reflect those changes. Investment managers should be concerned with pricing risk in the shorter time frames and take measures, largely through diversification and allocation decisions, to combat and shift such risk. In the longer periods, investment policies should focus on shortfall scenarios with liabilities fully being made part of the analysis. In very long time frames, policies should attempt to stabilize annual consumption and ensure that consumption across an investor's entire life (and even across an entire family's life) are protected and maximized.

Benjamin Graham summarized his investment philosophy when he stated:

"Investment occurs in the long-term. Speculation occurs everywhere else".

These investment policies provide an update to Graham, and can summarized as:

"Investing occurs with the maximization of utility across all time frames.
Speculation occurs in all other instances."

When utility assumptions are constrained to constant relative risk and independent return distributions, conclusions of time irrelevance from the classical multi-period models should actually be expected. It is only when these precise assumptions are used, in fact, that time is unimportant to the investing experience. When these theoretically self-

imposed constraints are relaxed, a continuum of economic choices under conditions of uncertainty emerges.

Moving away from quadratic utility and towards power utility allows absolute risk aversion to be better emulated. Varying the relative risk assumption then brings shifting investor-level risk preferences into the portfolio modeling process. Return predictability allows investors to take advantage of reversion to the mean tendencies occurring in most asset classes. By looking at the full opportunity set of utility factors, including income shocks, liquidity constraints, and parameter uncertainty, investment managers can determine the limits that risk aversion and predictability have upon portfolio and net worth composition.

Utility theorists use dynamic programming in the calculations of all of these variables and concepts. The output provides strategies and benefits far in excess of what is available in a timeless setting. The diversification of assets in any one time period and the allocation of assets across all time periods provides tangible advantages for a philosophy of long-term investing. Investors adjust short-term allocations in an effort to smooth consumption over time and maximize lifetime consumption. A coherent, economic theory of risk and return across all time frames finally explains, and is consistent with, the long-standing practices of investment management.

This deliberate adjustment of resources over a person's lifetime is simply not contemplated in the special case of utility. Dynamic portfolio management thus provides a more complete understanding of the possible long-term economic benefits available to investors and consumers. As Gollier (2001) noted, dynamic modeling can certainly mimic MVO output by assuming IRRA. Samuelson's time irrelevance belief can also be simulated with CRRA and IID assumptions. The dynamic management of net wealth merely increases the economic choices of agents. The investor effectively has different relative risk options to choose from; the return probability mass can have varying states of mean reversion, independence, or mean aversion; the intensity of risk aversion and predictability can be estimated; and other utility factors that might limit or reinforce allocation decisions can also be considered. By including all of these variables into a general utility setting, the investor's choices in the face of continuing uncertainty and risk expands considerably from that of the timeless, means-variance environment.

Dynamic efforts have many theoretical advantages over what is described as "modern" portfolio theory. In the coming years, investment professionals would secure a large economic advantage for their clients and beneficiaries by moving to general utility and dynamic processes. To be sure, the methods are more complicated. And so far, Expected Utility has not produced the kinds of uniform and standardized procedures that are available with means-variance optimization. In so many ways however, investing is utility. The finance community would do well by adopting all of the available analytical tools for use in the calculation of utility across all intended holding periods.

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