



C A M B R I D G E A S S O C I A T E S L L C

ENDOWMENT RISK, RETURN AND SPENDING

1994

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ABSTRACT

1. The extraordinary returns of the past decade may have lulled endowment fund trustees into thinking that the steady growth in spending that they have enjoyed during this bull market is sustainable. In fact, history suggests that it is not, and that many endowment funds are vulnerable to significant spending shortfalls for which they may be ill-prepared. For example, an endowment invested 70% in stocks and 30% in bonds would have realized annual increases in **real** spending averaging 6.8% over the past ten years. Even with rather optimistic assumptions about stock and bond returns over the next decade, real spending growth will decline significantly, and if we assume a regression to the mean in capital market returns, absolute reductions in spending may well ensue.
2. Virtually all endowments have the common objectives of maintaining the real value of their principal while making distributions to the operating budget that are as large, sustainable, and predictable as possible. "Risk" should therefore be seen as the possibility of failing to realize one or more of these objectives, and for this purpose the conventional definition of risk as variability of monthly or quarterly returns is not very useful. For example, the variability of quarterly returns is irrelevant to an endowment fund with a policy of spending x % of a three-year moving average of market value. For such a fund, a better measure of risk is the probability of spending cuts triggered by a decline in market value over three years; consequently, its concern should be with the variability of *rolling three-year* returns.
3. Conventional measures of variability used in the modeling of "optimal" portfolios also assume that variability is symmetrical; that is, the same on the upside as on the downside. In fact, this is not the case: since 1946, the standard deviation of returns for stocks has been greater for negative than for positive quarters, while the opposite has been true of bonds. In addition to incorporating the time horizon most relevant to a given institution, risk modeling should also focus exclusively on downside variability.
4. If an endowment fund sticks to a policy of spending 5% of a three-year moving average of market value, what is the probability of a decline in real spending in any given year? This obviously depends on asset allocation and returns, but it is startling to note that for the period 1946-93, a fund invested 70% in the S&P 500 and 30% in fixed income indexes would have had to cut real spending in 20 (or 43%) of the 47 total years. Moreover, real spending would have had to be cut by more than 5% in 8% of those 47 years. For a fund with the same allocation of assets, but a policy of spending 5% of a *five-year* moving average of market value, real spending cuts would have been required in 40% of the years during this period—not much better.

5. In order to attain greater stability and predictability in spending, endowment funds should attempt to divorce their spending from dependence on relatively short (three- or five-year) changes in market values, and link it instead to expected long-term returns through the adoption of a "constant growth" policy. The intent of this approach is to grow spending each year, from a base amount, by a sustainable percentage (e.g., inflation plus something). The danger here is that the return assumptions on which the growth rate is based prove overly optimistic, resulting in overspending that permanently erodes the purchasing power of the fund. In addition, it may be impolitic for an institution like a university to be seen spending only a small fraction of its endowment wealth at a time when those assets are growing rapidly as a result of extraordinary investment returns (as during the past decade). In practice, most institutions with constant growth spending policies also impose a ceiling and a floor on the annual spending rate so that even over short periods spending does not deviate too dramatically from the long-term target.

6. Spending reductions are obviously triggered by sustained or significant declines in market value. For this reason, the desire to maximize returns must be tempered by the need to hedge against economic conditions likely to cause such damage. Most funds are hedged against deflation through their ownership of fixed income securities, but few are adequately hedged today against the possibility of unexpected inflation, which would simultaneously raise their costs and precipitate a decline in the value of their stocks and bonds. When a fund changes from a policy of spending $x\%$ of a y -year moving average to a policy of increasing spending each year by an amount dictated by the rate of inflation, the link between spending and market value is replaced by a link to inflation. As a result, institutions adopting such a change in policy are particularly vulnerable to inflation and should ensure that their long-term asset allocation policies include investments designed to protect the portfolio, even if, as today, the dominant force in the economy is *disinflation*.

SUMMARY

"Take calculated risks. That is quite different from being rash."

General George Patton

Risk

The trouble is that not all risks are calculable, neither are their natures constant nor their effects uniform among all investors. Perhaps one reason the versions of risk propounded by Markowitz, Modigliani, Miller, Sharpe, and others have proved so influential is that they **do** provide a mathematical solution—risk expressed as a single number (e.g., standard deviation, beta) available to all. As sophisticated investors first learned and then embraced these formulations (whose value is indisputable), they tended to forget that the formulations are designed to answer very specific questions, and often failed to consider whether those are always the questions most urgently in need of answers.

Markowitz himself did **not** use the term "risk" throughout his revolutionary 1952 paper, "Portfolio Selection." At one point, he digresses briefly to remark that "The concepts 'yield' and 'risk' appear frequently in financial writings. Usually if the term 'yield' were replaced by 'expected yield' or 'expected return,' and 'risk' by 'variance of return,' little change of apparent meaning would result."¹ Thereafter, however, "variance of return" is the term he continues to use throughout his argument. Today, his approach to portfolio construction is embedded in virtually every document designed to persuade investors that they will reduce portfolio "risk" by diversifying into venture capital, small-company stocks, foreign stocks, real estate, managed futures—whatever the vendor has to offer. Certainly, as Markowitz pointed out, a portfolio composed of diverse investments whose returns are poorly correlated should have a lower variability of returns than one with greater exposure to fewer (and/or more highly correlated) investments. But why is low variability desirable? Because the greater the variability of returns, the greater the probability that the portfolio will not fulfill the investor's objectives at any given point in time. Low variability is not an end in itself, but a means to the realization of an end that must be defined in relation to the investor's time horizon.

For example, if an investor's assets are earmarked for a down payment on a house six months from now, the variability of monthly returns on those assets is acutely relevant. For an institutional investor with an infinite time horizon, however, the relevant time frame is a great deal longer than a month or a quarter—but when have any of us seen a portfolio analysis based on standard deviations of rolling three-year, five-year, or ten-year returns? In other words, although variability certainly matters to

¹ Quoted in *Classics: An Investor's Anthology*, Charles D. Ellis, ed. Dow Jones-Irwin, 1989, p. 289

all investors, the time frames that are relevant to them depend on their differing circumstances; among institutional investors, for example, an immature pension fund may have a different time horizon from one that must already support a large number of retirees, which may differ in turn from that of an endowment which is the source of a foundation's grants. Variability is therefore only one-half of an equation of which the other half is time—but too many analyses simply assume the relevance of a random slice of time (usually quarterly or monthly), regardless of its applicability to the investor.

Also implicit in analyses that define risk in terms of variability of returns is the assumption that variability is equally distributed to the upside and the downside; in fact we would all happily embrace a high variability of returns on the upside if we were convinced it would not be mirrored on the downside. However, for most asset classes, the distribution of variability is **not** symmetrical. For example, for the period 1946-93, the annualized standard deviation of quarterly returns for domestic common stocks for **positive** quarters is 9.2%, while for **negative** quarters it is 11.3%. Similarly, for bonds the standard deviation of quarterly returns for **positive** quarters during this period is 6.0%, and for **negative** quarters, 4.2%. Note that while stock returns have been more variable on the downside than the upside, the opposite has been true of bonds. It follows that an allocation of assets designed to "optimize" a portfolio in the conventional sense may be suboptimal if the objective is in fact to attain the highest returns compatible with insulation against unacceptable levels of loss.

"Unacceptable" Loss or "Shortfall" Risk

It is axiomatic that risk of loss is the price investors pay for returns—even "risk-free" Treasury bills can at times produce negative **real** returns. However, each investor must determine what level of loss—whether for a specific investment or for a total portfolio—is unacceptable. For investment officers, investment committees, or investment managers hired to manage the portfolio, even short-term underperformance relative to their peers may be considered unacceptable, but for the institution itself an unacceptable loss is one that impairs its ability to realize its fundamental investment objectives. Since the *raison d'etre* of an endowment fund is to provide financial support to the operating budget, any loss that results in an involuntary diminution of this support may be deemed unacceptable. In other words, an unacceptable loss is one that obliges an endowment fund either to cut spending unexpectedly or to spend at a rate that depletes its real value.

The probability of sustaining an unacceptable loss may be termed **shortfall risk**² and its distinguishing characteristic is that it can only be measured in relation to the investment objectives of a specific investor.³

Measuring Shortfall Risk

At the heart of endowment fund investment planning is the attempt to mediate among conflicting objectives. Typically, these are:

- Maximize long-term total return.
- Maximize annual spending from endowment.
- Preserve the long-term purchasing power of the fund's principal and of its spending distributions.
- Maximize the stability and predictability of spending distributions. In other words, minimize spending shortfall risk.

Although an endowment fund's long-term asset allocation and spending policies should be designed to realize all four objectives, most endowment fund spending policies currently fail to minimize spending shortfall risk. In part, this is attributable to the long bull market in stocks and bonds, which has resulted in steady growth in endowment market values and spending distributions, but it may also be an inadvertent consequence of the tendency to think in terms of average annual returns—which leads to our forgetting how irregularly distributed those returns can be.⁴ Exhibit 1 shows the growth in spending distributions over the ten calendar years from 1984-93 for four hypothetical funds, each with different stocks/bonds/

² Throughout the discussion that follows, the most consistent use of the term "shortfall risk" is the probability of a decline in nominal or real endowment spending dictated by strict adherence to a predetermined spending policy. This should not be confused with *budget* shortfall, which is an entirely different matter. Spending shortfall risk may also be used to mean the probability of spending falling short of an expected target amount, and is occasionally used here in that sense.

³ "In an era of standardization, it may be uncomfortable for some to consider that the best measure of true risk is an individualized formula. Until the [investment] industry considers individual objectives, however, and comes to the reality that the same investment has different risk for different investors, we are destined to perpetuate the myth that risk is an attribute of the investment rather than a measure of its ability to fulfill a goal." Neil Wolfson, "Objective Deviation: An Individualized Measure of Risk," *The Journal of Investing*, Spring 1994.

⁴ For example, although the average annual compound real return on stocks is 6.4% this century, 30% of all rolling 25-year periods had real returns in excess of 8.0% and 35% of all rolling 25-year periods had returns of less than 5.0%. Consequently, even if we assume that future returns will correspond more or less to past returns, there is only a 35% probability that the average annual real return for a given 25-year period will fall between 8.0% and 5.0%.

cash asset allocations, but a common policy of spending 5% of a three-year moving average of endowment market value (which is entirely typical of endowment funds today). Even for the least successful of these four funds (with an asset allocation of 60% in stocks, 30% in bonds, and 10% in cash), **real** spending increased by an average of 6.0% annually during this decade, while the most successful asset allocation (100% in stocks) resulted in an annual increase in real spending of 7.7%.

More significantly, none of these endowment funds suffered significant or prolonged declines in nominal or real spending during this period. In addition, stock and bond market returns were so much higher than their long-term averages that the funds also experienced significant increases in their real market values, from 7.1% annually (100% invested in stocks) to 5.3% annually (invested 60%/30%/10% in stocks/bonds/cash).

Shortfall Probability. But is this typical? Over longer periods what is the probability that, in any given year, such a spending policy may require an absolute reduction in the real (or, more liberally, nominal) dollars an endowment can distribute? Exhibit 2 measures this probability, for the period 1946-93, for a range of asset allocations between domestic stocks and bonds and between domestic stocks and cash equivalents, for an institution whose policy is to spend 5% of a three-year moving average of endowment market value. The results are startling: even with the optimum allocation (which for this period was 100% invested in stocks), real spending *declined* in 17 (i.e., 36.2%) of the 47 total years, while nominal spending declined in five (or 10.6%) of the years. Of course, only one of these 17 years during which real spending declined occurred during the past decade—an insignificant decline of 1.5% in 1990—which may be why endowment funds trustees may have become complacent about this risk.

Exhibit 3 details both nominal and real spending, and the changes in endowment market value, for the period 1946-93, for a fund invested 70% in stocks and 30% in bonds, and spending 5% of a three-year moving average of market value. Note that real spending more than doubles (from \$3.63 to \$7.44) during the period 1946-66, but then declines steadily over the next 14 years by a total of 63%. By the end of 1993, despite the great bull market of the previous decade, real spending remains 24% below its 1966 high water mark.

Of course, one should be cautious about extrapolating policy generalizations from any such reconstructions, which always reflect the particular economic conditions of the given time period—and in this case includes a long, secular bear market in bonds. Nevertheless, during the inflationary years 1966-80, most endowments endured shortfalls comparable to that illustrated in Exhibit 3, although increases in endowment market values as a result of gift flows often served to conceal the erosion in purchasing power which they were suffering. Nor could the spending shortfall problem have been solved simply by adding to the spending policy a provision that real spending should never be less than that of the previous

year—such a policy would have resulted in this fund spending itself out of existence by 1987 (Appendix A). (However, a similar provision of maintaining **nominal** spending would not have bankrupted the fund.) These illustrations, and analyses for other stock/bond and stock/cash allocations, 1946-93, are included in the data tables in Appendix A.

It is no great surprise that in this model the optimum allocation between stocks and bonds is 100% stocks—for most of the period since World War II, the United States has enjoyed strong economic growth, but has also experienced higher rates of inflation than in most earlier decades this century. The great surprise of these analyses is that a combination of stocks and **cash** proved as effective as any combination of stocks and bonds. The stock/bond and stock/cash allocations in the table below (extracted from Exhibit 2) show that any combination of stocks and bonds within a range of 100% stocks/0% bonds to 90% stocks/10% bonds gives a nominal shortfall risk of 10.6% and a real shortfall risk of 36.2%—in other words, varying the stock/bond allocation within that range does not affect the number of years during the period 1946-93 in which nominal and real spending should have been cut.

Exactly the same nominal and real shortfall risk is incurred with an allocation of 70% stocks/30% cash as with an allocation of 70% stocks/30% bonds. This is because the average annual real returns to cash during this period (0.5%) are close to those of government bonds (0.7%), while the greater stability of cash returns during periods of high inflation helped minimize shortfall risk without any great reduction in the real value of the fund, after spending: for the period 1946-93, a portfolio invested 70% in stocks and 30% in bonds, spending 5% of a three-year moving average of market value, would have

Stock/Bond %	Nominal Shortfall Risk	Real Shortfall Risk	Stock/Cash %	Nominal Shortfall Risk	Real Shortfall Risk
100/0	10.6%	36.2%	100/0	10.6%	36.2%
95/5	10.6%	36.2%	95/5	10.6%	36.2%
90/10	10.6%	36.2%	90/10	10.6%	38.3%
85/15	12.8%	38.3%	85/15	10.6%	38.3%
80/20	12.8%	38.3%	80/20	12.8%	38.3%
75/25	14.9%	40.4%	75/25	12.8%	40.4%
70/30	19.1%	42.6%	70/30	12.8%	42.6%

experienced virtually the same real growth rate in capital (approximately 1.0%) as a portfolio invested 70% in stocks and 30% in cash equivalents.

Shortfall Severity. With shortfall risk (as with risk of all sorts), we want to know not just the *probability* of a negative outcome, but also the likely *severity* of possible outcomes. If we learn, for example, that there is a 35% probability of suffering a 2% shortfall in spending (i.e., having to cut real

spending by 2%), we may not be concerned; on the other hand, if we learn that there is a 20% probability of a spending shortfall of 10% or more, that risk may be more than we can tolerate. The severity analyses in Exhibit 4 show the average annual, the worst one-year, and the worst cumulative decline in real spending for different stock/bond and stock/cash allocations (again, for a fund spending 5% of a three-year moving average of endowment market value during the period 1946-93). As one might expect, the higher the allocation to stocks, the more severe are the average and the worst-case one-year declines (5.8% average and 17.8% worst one-year declines for a portfolio invested 100% in stocks). It is notable, however, that although the addition of bonds to the portfolio results in a reduction in both the average and the worst-case severity of declines, the addition of cash results in greater reductions in average and absolute severity. Portfolios invested in some combination of stocks and cash also experienced a smaller (although still traumatic) cumulative decline in real spending than portfolios invested in equivalent combinations of stocks and bonds.

What conclusions should and should not be drawn from these analyses? First, one should **not** conclude that endowment funds should dump their bonds and hold cash instead. During long stretches of the period 1946-93, the rate of inflation was worse than investors had anticipated, resulting in persistent losses in bonds. On the other hand, this period does not include any instances of deflation, when stocks might be expected to decline precipitously, cash to perform poorly, and bonds to soar in value. Although the analyses are somewhat skewed by the economic conditions of the period they cover (as would be the case for any period), they do quantify inflation's malign effects, suggesting that if long-term asset allocation policies do not include investments designed to provide some insulation against unexpected inflation, the consequences may be an unpleasant variability in the amount available for spending distribution. In addition, they highlight the relatively unusual and extraordinarily benign character of the past decade, during which nominal and real spending has risen steadily (with a minor blip in 1990), along with increasing market values.

Indeed, the motivation for these analyses is our suspicion that although many endowment fund trustees have accepted the idea that capital market returns over the next decade are unlikely to match those of the decade just past, they may have failed to recognize what this implies for endowment spending and, by extension, for budget planning. For example, it is unrealistic to incorporate in budget planning models the assumption that financial support from the endowment will continue to grow at rates similar to those of the past decade, and (for certain spending policies) it may even be unrealistic to assume that it can be maintained (in real terms) at the current level.

Modeling Shortfall Risk

Can we estimate future shortfall risk? That is, can we model the future probability of a negative real return over any rolling three-year period (if we continue to assume a spending policy of 5% of a

three-year moving average of market value)? Forecasting future capital market returns is always hazardous, but to model shortfall risk, we also have to forecast the *dispersion* of future returns around the mean, which complicates matters greatly.

Before addressing this question of dispersion, however, we should first look at likely growth in spending, predicated on normal distributions of returns under various scenarios. After all, it may be more accurate in some instances to characterize shortfall risk not only as the probability of an absolute decline in real or nominal spending, but also as the probability that *expectations* for endowment spending may not be met—especially if these constitute a key variable in the institution's budget planning.

Modeling Normal Distributions. Exhibit 5 shows spending and market value growth over the next ten years under various assumptions about capital market returns, for the same four hypothetical endowment funds for which Exhibit 1 illustrated spending growth over the past decade. The first scenario assumes an average annual return on stocks equivalent to their long-term average this century (10.3%), a return on bonds equivalent to the current yield on long Treasuries (7.25%), and a return on cash equivalent to its long-term average real rate. The key to the second scenario is the assumption that stock returns tend to regress to their long-term mean over time; in other words, that periods of above-average returns tend to be followed by periods of below-average returns. Finally, the third scenario is predicated on the assumption that stock returns over the next decade match the average ten-year return following periods when the dividend yield is below 3.0%. None of these scenarios incorporate a high inflation assumption.

For a fund invested 70% in stocks and 30% in bonds, and spending 5% of a three-year moving average, the optimistic scenario generates annual increases in real spending of 0.8%, while the less optimistic scenarios indicate annual increases in real spending of -2.4% and -4.5%, respectively. This compares to annual increases of 6.9% during the decade 1984-93.

The projected annual increase in market value of such a fund over the next decade is 0.9% for the optimistic scenario, but -2.7% and -5.1% for scenarios 2 and 3.⁵

Modeling Abnormal Distributions. The analyses illustrated in Exhibit 5 oversimplify by assuming a normal distribution of returns, which we know never occurs in the capital markets, especially in the case of stocks. The assumption of a normal distribution is not particularly damaging when the objective is to model expected returns, but it does become a critical issue when the objective is to model shortfall risk. Consequently, we have employed Monte Carlo simulations to model portfolios in which stock returns are abnormally distributed in order to gauge the potential effect on spending.

Exhibit 6 shows the changes in real and nominal spending and endowment market value over the next decade (for a fund invested 70% in stocks/30% in bonds and spending 5% of a three-year moving average), for three representative portfolios produced by Monte Carlo simulations, including an inflation assumption of 3.5%. As the labels imply, these three portfolios have been selected from the range of portfolio returns produced by a model whose primary input is quarterly stock returns from the period 1926-93 (see Appendix C). Unlike the simple illustrations graphed in Exhibit 5, these portfolios do not incorporate assumptions about future returns on the basis of current valuations. Rather, the model is constrained only by the assumption that future quarterly stock returns will fall within the range of returns already experienced during the past 67 years (excluding outliers). For the "Mid-Range" portfolio, the worst annual decline in nominal and real spending is -3.3% and -6.6%, respectively. However, in seven of the ten years, real spending declines to a greater or lesser extent, and does so for three consecutive years on two occasions. For the portfolio based on the lowest distribution of returns in the range, it is notable that real spending declines in *every* year of the decade except the last.

Whether the severity of such declines is consequential or not is largely a function of the dependence of the operating budget (particularly that portion which is unrestricted) on the endowment. **At an institution where transfers from endowment constitute only 5% of the budget, a reasonable probability of a 10% cut in real spending may be perfectly tolerable. On the other hand, any such possibility might instill panic in the hearts of those whose endowments are the mainstay of their operations.**

Spending Policy

Of course, actual endowment funds are invested in all sorts of ways that are quite different from the simple stock/bond allocation of these hypothetical constructs. Nevertheless, the portfolios derived from Monte Carlo simulations forcefully illustrate the point that when spending distributions are dependent on endowment fund market values, the probability of shortfall is very high, even when capital market returns are "average." The reason for this is that capital market cycles are far longer than the number of years—three or five—typically written into most spending policies for smoothing purposes.⁶

⁵ These (or similar) dismal projections are, of course, the driving force behind the accelerating diversification of endowment funds in recent years into asset classes and investment strategies other than domestic stocks and bonds. The result is a diversification of the kinds of risk these portfolios incur; systematic risk may have been reduced, but other kinds of risk have been assumed. For example, where endowments have hired hedge fund or other managers whose portfolios bear little relation to the stock market as a whole, systematic risk has been replaced with manager-specific, or alpha, risk.

⁶ **Decades** of above-average stock returns have typically been followed by decades in which returns have been lower than average, but history suggests that returns in any given **five-year** period are not influenced by the superiority or inferiority of returns during the preceding five years. In other words, regression to the mean operates over a longer time frame than five years.

We have based our analyses on a policy of spending 5% of a three-year moving average because this is typical of many endowment funds and corresponds closely to the annual spending requirement for foundations.⁷ However, by tying spending to endowment fund market values in this way, institutions opt for a low variability in their **spending rate**, at the expense of stability and predictability in spending itself. That is, they sacrifice one of the fundamental investment objectives outlined above, "Maximize the stability and predictability of spending distributions."

The shortfall risk endowments incur with such a policy can obviously be mitigated by reducing the spending rate or by extending the number of years included in the calculation of the moving average of endowment market values. For many endowments today, however, reducing the rate of spending is not a practical option; in addition, even with a policy of spending only 4% of a three-year moving average, an endowment fund invested 70% in stocks and 30% in bonds would have been obliged to reduce real spending in 16 of the 47 years since 1946—in other words, a shortfall risk of 34.0%. By extending the number of years included in the moving average calculation, an endowment effectively reduces its spending *rate* (without having to reduce the number cited in the spending *policy*). However, for an endowment invested 70% in stocks and 30% in bonds, and spending 5% of a **five**-year moving average of its market value, shortfall risk was still 40.4% during the period 1946-93 (when shortfall risk is defined as a cut in real spending). In other words, real spending declined in 19 of the 47 years during this period—an insignificant improvement over the 42.6% shortfall risk incurred with a three-year moving average.

Extending the moving average time frame provides no solution: if spending is tied to capital market returns that fluctuate broadly over long periods of time (the average annual real return on the S&P 500 was 2.2% for 1974-83 and 11.0% for 1984-93), then spending itself must inevitably fluctuate also. The solution is to divorce spending from current (or three- or five-year trailing) endowment market values, and to tie it instead to the portfolio's expected *long-term* return. In this way, the spending **rate** is allowed to fluctuate, as capital market returns wax and wane over time, but spending distributions can be stabilized.

The obvious way to implement such a policy is to grow spending each year, from a base amount, by a sustainable percentage (e.g., by CPI plus 1%, which approximates the assumed rate of growth of the Higher Education Price Index, or by an amount that corresponds to the institution's own inflation rate). The great advantage of this approach is the predictability of spending—short-term inflation becomes the only unknown variable. During boom years, the fund will presumably earn returns well in excess of the long-term average, and the rate of spending expressed as a percentage of current market value will drop

⁷ Among the endowment funds we survey for such data—and excluding foundations, whose spending rate is effectively mandated by the tax code—66% have a policy of spending $x\%$ of a y -year moving average of endowment market value, while only 24% have a policy of growing spending at a constant rate from an initial base amount.

significantly; if the long-term rate of return on the portfolio has been correctly estimated, however, trustees must assume that bust will follow boom and that any surplus built up during fat years may be dissipated when times are lean.

There are several dangers to be noted in the implementation of such a policy. First, if the initial base rate is set too high and capital market returns are weak in the early years, the spending rate may quickly deplete so much of the fund's principal that it takes decades to recover. Second, if the projections of long-term returns prove unduly optimistic, the purchasing power of the fund may be steadily eroded by excessive spending.⁸ Finally, it may be profoundly impolitic for an institution like a university, which must answer to a varied and hungry constituency, to be seen spending only a small fraction of its endowment wealth at a time when those assets are growing rapidly as a result of extraordinary investment returns (as during the past decade). **In practice, most institutions with constant growth spending policies mitigate these concerns by constraining the free floating of their spending rate with a provision that it not exceed or fall below predetermined levels (e.g., not exceed 6.5% of current market value nor fall below 3.5%).**

Asset Allocation Implications

We have suggested that spending rates be less closely dependent on endowment market value because conventional spending policies ($x\%$ of a multi-year moving average) appear to expose institutions to considerable shortfall risk. However, spending and asset allocation are interdependent variables (the chicken and the egg of investment planning), and so the focus on shortfall risk also has implications for long-term asset allocation. What long-term allocation of assets is most likely to generate the highest total return with the lowest probability of a spending shortfall while enabling the institution to spend as much as is consistent with the maintenance of the fund's purchasing power?

⁸ In projecting future returns, it may be dangerously naive simply to extrapolate historical averages for the major asset classes. First, the average annual long-term real return on stocks this century is 6.4%, but even over very long periods there is considerable dispersion of returns around this average: the range of average annual real returns on stocks for every rolling 50-year period this century is 9.0% to 4.8%; for rolling 25-year periods the range of average annual real returns is 11.5% to 2.8%. Second, when investors perceive stocks as very risky, they insist on being highly compensated for owning them—which explains why the dividend yield on stocks always exceeded that on bonds during the period 1932-58. Conversely, when investors perceive bonds as a low-risk investment, they are less demanding of borrowers. Today, however, everyone "knows" that stocks are the better investment over the long term and therefore perceives them as less risky than was the case forty years ago. On the other hand, bonds are seen as more risky than they were 40 years ago. Logically, this suggests that going forward stock investors may be implicitly prepared to accept a lower return, while bond investors may insist on a higher return, than was the case decades ago.

The desire to maximize returns obviously leads one to equities, while the need to minimize shortfall risk forces one to look for ways to hedge against the two economic scenarios that precipitate large declines in equity values: deflation and severe inflation (as discussed in our paper *Investment Planning*). Today, most institutions maintain significant fixed income holdings (although not always primarily for deflation-hedging purposes), but have far less protection against renewed inflation. Because it destroys people's income as well as the value of equity assets, deflation may represent the greater threat to educational institutions, whose operating budget is typically dependent more on tuition than on any other single source of revenue. However, from the narrower view of the endowment fund alone, inflation may be considered at least as dangerous because it packs a double whammy, increasing the need for higher spending while simultaneously depressing stock and bond valuations. Indeed, for an endowment fund with a constant growth spending policy designed to ensure the stability of real spending distributions, inflation is the wolf at the door. If the link between spending and endowment fund market value is replaced by linking spending to inflation, then protection against the predations of unanticipated inflation becomes indispensable.

Conclusions

The extraordinary returns provided by the capital markets during the past decade have enabled most endowment funds to increase very significantly the dollars they distribute to their institutions' operating budgets. There is a danger that institutions have started assuming that such annual increases are sustainable, when in fact capital market history suggests they are not.

If the most relevant definition of "risk" for an endowment fund is the probability of its failing to earn sufficient returns to meet spending expectations, then the variability of quarterly returns is not a useful measure of such risk. For institutions with a spending policy of $x\%$ of a y -year moving average of endowment market value, the relevant time period for the calculation of spending shortfall risk is y years. However, any such policy results in the linking of spending to relatively short-term fluctuations in capital market returns, virtually ensuring that spending will be subject to periodic declines. If an institution wishes to improve the stability and predictability of spending (i.e., to minimize the probability of shortfall), the spending rate should be divorced from short-term capital market fluctuations and become an irrelevant residual of a "constant growth" policy that is predicated on the long-term expected returns of the portfolio.

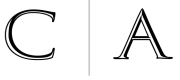
In practice, there are three principal impediments to implementing this type of spending policy:

- Portfolio returns in the early years of the policy prove so poor as to result in a level of spending that effectively cripples the fund;

- The long-term return projections prove unduly optimistic, resulting in a gradual erosion of the value of the fund because of excessive spending;
- The endowment fund's constituency is outraged because it perceives the fund to be grossly underspending at a time when it has been earning exceptional returns.

To address these concerns, most institutions with a constant growth spending policy place a collar on the annual spending rate to ensure that it neither exceeds nor falls below a predetermined percentage of endowment market value.

When a fund changes from a policy of spending $x\%$ of a y -year moving average to a policy of increasing spending each year by an amount dictated by the rate of inflation, the link between spending and market value is replaced by a link to inflation. All endowment funds are vulnerable to unexpected inflation: if gift flow additions to endowment are removed from the calculation, a fund invested 70% in stocks and 30% in bonds and spending 5% of a three-year moving average would have spent about 24% less in real dollars in 1993 than it did in 1966. However, a fund with a constant growth spending policy is particularly vulnerable to inflation and should ensure that its long-term asset allocation policy includes investments designed to protect the portfolio against unanticipated inflation even if, as today, the dominant force in the economy is *disinflation*.

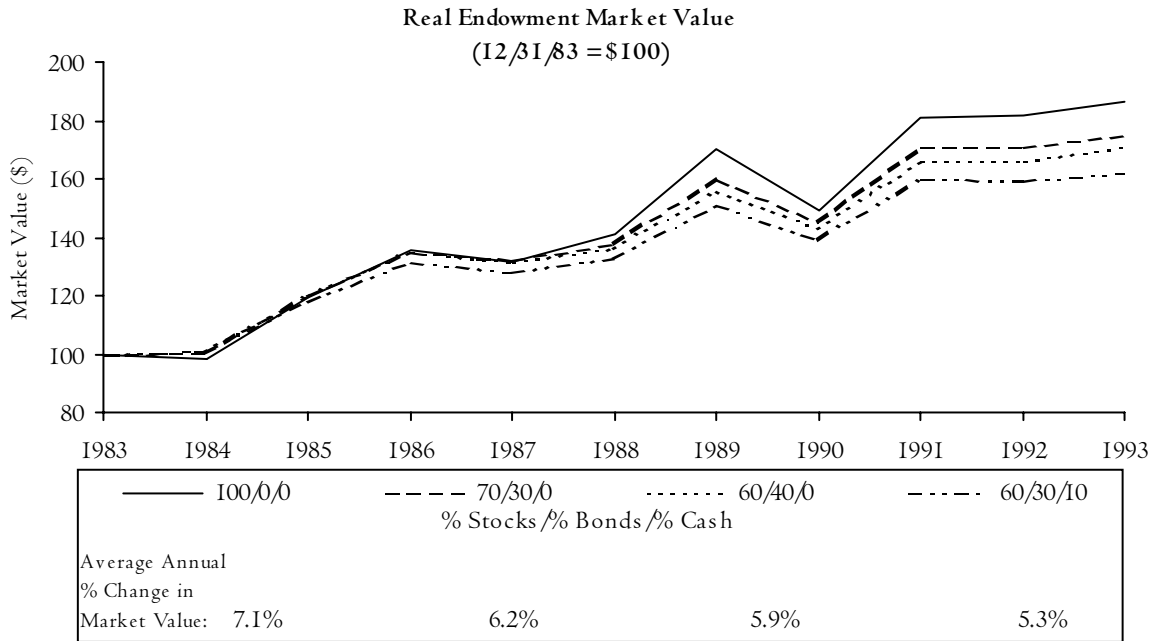
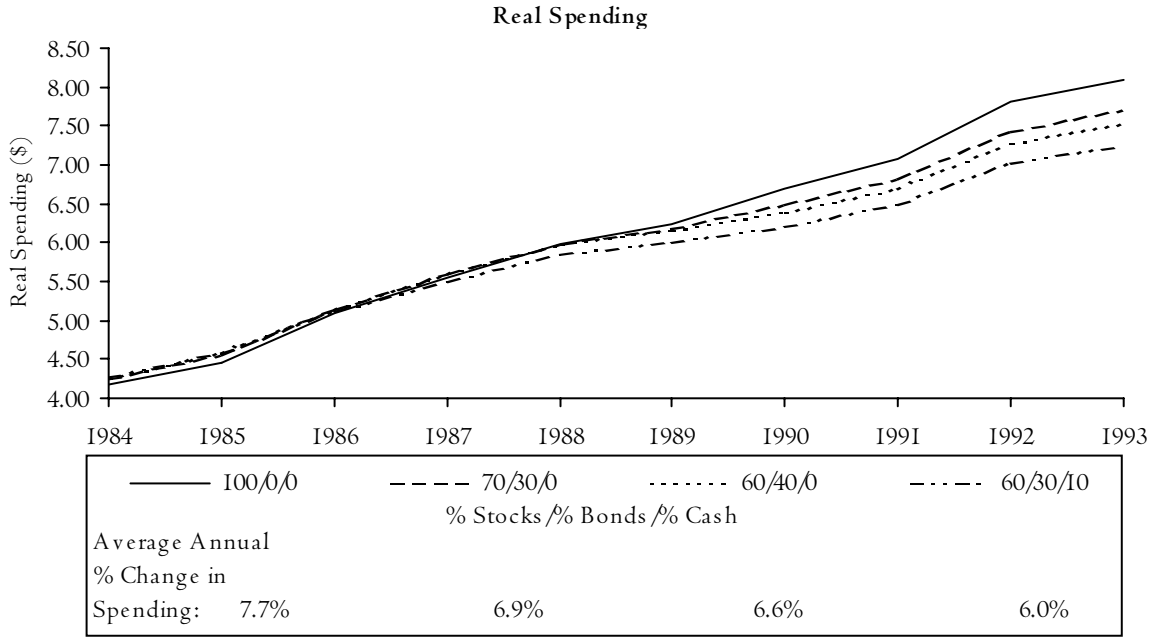


C A M B R I D G E A S S O C I A T E S L L C

EXHIBITS

Exhibit I

REAL GROWTH IN SPENDING AND ENDOWMENT MARKET VALUES
1984 - 93

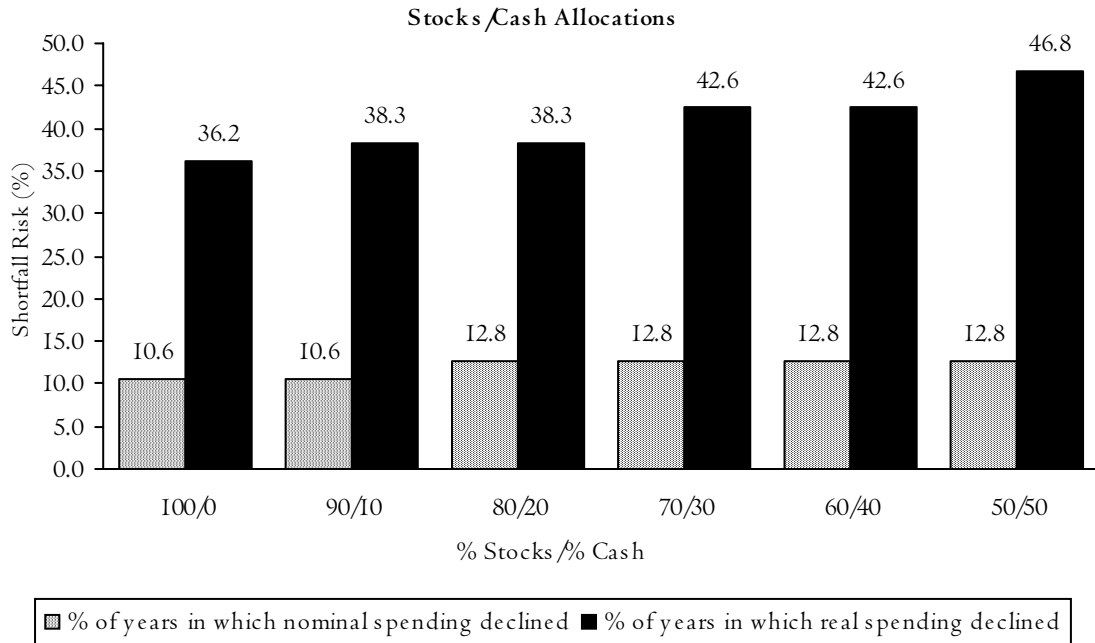
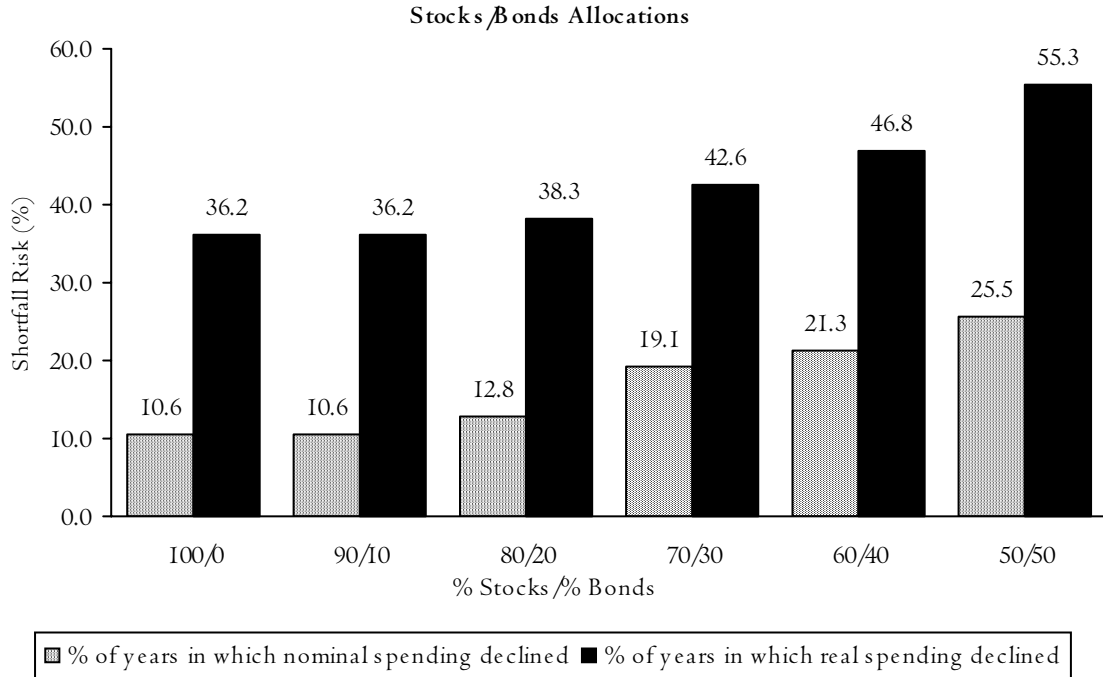


Notes: Spend 5% of prior three-year average ending market value. Market value is based on annual spending and weighted average capital market returns. Stock returns are from the S&P 500; bond returns from Lehman Brothers Aggregate Bond Index; and cash returns from U.S. 91-day Treasury bill yields.

January 1, 1984 dollars.

Exhibit 2

SPENDING SHORTFALL RISK
1946 - 93



Note: Spend 5% of prior three-year average ending market value.

Exhibit 3

SIMULATED ENDOWMENT SPENDING

Calendar Year	Beginning Mkt Value	Nominal Spending	% Change in Nominal Spending	Spending as % of Beg Mkt Value	Real Spending ²	Annual % Chg in Real Spending	Nominal Ending Mkt Value ¹	Annual % Chg in Nom Mkt Value	Real Ending Mkt Value ²	Annual % Chg in Real Mkt Value ²
1946	\$100.00	\$4.28		4.3%	\$3.63		\$90.51		\$76.59	
1947	\$90.51	\$4.54	6.0%	5.0%	\$3.52	-2.8%	\$88.79	-1.9%	\$68.93	-10.0%
1948	\$88.79	\$4.66	2.5%	5.2%	\$3.52	-0.2%	\$88.60	-0.2%	\$66.97	-2.8%
1949	\$88.60	\$4.47	-4.1%	5.0%	\$3.44	-2.3%	\$97.17	9.7%	\$74.80	11.7%
1950	\$97.17	\$4.58	2.5%	4.7%	\$3.33	-3.1%	\$113.14	16.4%	\$82.32	10.1%
1951	\$113.14	\$4.98	8.9%	4.4%	\$3.42	2.8%	\$124.94	10.4%	\$85.86	4.3%
1952	\$124.94	\$5.59	12.2%	4.5%	\$3.81	11.1%	\$135.31	8.3%	\$92.15	7.3%
1953	\$135.31	\$6.22	11.4%	4.6%	\$4.21	10.7%	\$129.46	-4.3%	\$87.61	-4.9%
1954	\$129.46	\$6.50	4.4%	5.0%	\$4.42	4.9%	\$170.93	32.0%	\$116.26	32.7%
1955	\$170.93	\$7.26	11.8%	4.2%	\$4.92	11.4%	\$198.97	16.4%	\$134.85	16.0%
1956	\$198.97	\$8.32	14.6%	4.2%	\$5.48	11.4%	\$196.42	-1.3%	\$129.41	-4.0%
1957	\$196.42	\$9.44	13.4%	4.8%	\$6.04	10.1%	\$177.07	-9.9%	\$113.25	-12.5%
1958	\$177.07	\$9.54	1.1%	5.4%	\$6.00	-0.7%	\$214.32	21.0%	\$134.68	18.9%
1959	\$214.32	\$9.80	2.7%	4.6%	\$6.07	1.2%	\$220.53	2.9%	\$136.53	1.4%
1960	\$220.53	\$10.20	4.1%	4.6%	\$6.22	2.6%	\$220.05	-0.2%	\$134.24	-1.7%
1961	\$220.05	\$10.91	7.0%	5.0%	\$6.61	6.3%	\$249.74	13.5%	\$151.34	12.7%
1962	\$249.74	\$11.51	5.4%	4.6%	\$6.89	4.1%	\$228.77	-8.4%	\$136.97	-9.5%
1963	\$228.77	\$11.64	1.2%	5.1%	\$6.86	-0.5%	\$253.04	10.6%	\$149.03	8.8%
1964	\$253.04	\$12.19	4.7%	4.8%	\$7.10	3.5%	\$272.07	7.5%	\$158.33	6.2%
1965	\$272.07	\$12.56	3.1%	4.6%	\$7.17	1.1%	\$283.18	4.1%	\$161.66	2.1%
1966	\$283.18	\$13.47	7.2%	4.8%	\$7.44	3.7%	\$252.60	-10.8%	\$139.53	-13.7%
1967	\$252.60	\$13.46	-0.1%	5.3%	\$7.22	-3.0%	\$272.34	7.8%	\$146.00	4.6%
1968	\$272.34	\$13.47	0.0%	4.9%	\$6.90	-4.5%	\$279.51	2.6%	\$143.09	-2.0%
1969	\$279.51	\$13.41	-0.5%	4.8%	\$6.47	-6.2%	\$245.78	-12.1%	\$118.59	-17.1%
1970	\$245.78	\$13.29	-0.8%	5.4%	\$6.08	-6.0%	\$247.86	0.8%	\$113.37	-4.4%

Notes: Spend 5% of prior three-year average ending market value. Assumes a constant asset allocation of 70% stocks and 30% bonds, rebalanced annually.

¹ Market value based on annual spending and weighted average capital market returns.

² January 1, 1946 dollars.

Exhibit 3 (continued)

SIMULATED ENDOWMENT SPENDING

Calendar Year	Beginning Mkt Value	Nominal Spending	% Change in Nominal Spending	Spending as % of Beg Mkt Value	Real Spending ²	Annual % Chg in Real Spending	Nominal Ending Mkt Value ¹	Annual % Chg in Nom Mkt Value	Real Ending Mkt Value ²	Annual % Chg in Real Mkt Value ²
1971	\$247.86	\$12.89	-3.1%	5.2%	\$5.70	-6.2%	\$269.92	8.9%	\$119.44	5.4%
1972	\$269.92	\$12.73	-1.2%	4.7%	\$5.45	-4.5%	\$296.47	9.8%	\$126.86	6.2%
1973	\$296.47	\$13.57	6.6%	4.6%	\$5.34	-2.0%	\$251.54	-15.2%	\$98.93	-22.0%
1974	\$251.54	\$13.63	0.5%	5.4%	\$4.78	-10.5%	\$194.45	-22.7%	\$68.16	-31.1%
1975	\$194.45	\$12.37	-9.2%	6.4%	\$4.05	-15.2%	\$237.67	22.2%	\$77.85	14.2%
1976	\$237.67	\$11.39	-7.9%	4.8%	\$3.56	-12.1%	\$276.29	16.3%	\$86.35	10.9%
1977	\$276.29	\$11.81	3.6%	4.3%	\$3.46	-2.9%	\$252.53	-8.6%	\$73.92	-14.4%
1978	\$252.53	\$12.77	8.2%	5.1%	\$3.43	-0.8%	\$252.22	-0.1%	\$67.71	-8.4%
1979	\$252.22	\$13.02	1.9%	5.2%	\$3.08	-10.1%	\$272.14	7.9%	\$64.45	-4.8%
1980	\$272.14	\$12.95	-0.5%	4.8%	\$2.73	-11.6%	\$320.48	17.8%	\$67.48	4.7%
1981	\$320.48	\$14.08	8.7%	4.4%	\$2.73	0.1%	\$300.82	-6.1%	\$58.30	-13.6%
1982	\$300.82	\$14.89	5.8%	4.9%	\$2.78	1.8%	\$358.30	19.1%	\$66.84	14.7%
1983	\$358.30	\$16.33	9.6%	4.6%	\$2.95	6.2%	\$406.55	13.5%	\$73.45	9.9%
1984	\$406.55	\$17.76	8.8%	4.4%	\$3.10	5.1%	\$423.30	4.1%	\$73.86	0.6%
1985	\$423.30	\$19.80	11.5%	4.7%	\$3.34	7.6%	\$523.39	23.6%	\$88.16	19.4%
1986	\$523.39	\$22.55	13.9%	4.3%	\$3.77	13.1%	\$593.28	13.4%	\$99.23	12.6%
1987	\$593.28	\$25.67	13.8%	4.3%	\$4.11	8.9%	\$605.28	2.0%	\$96.92	-2.3%
1988	\$605.28	\$28.70	11.8%	4.7%	\$4.40	7.1%	\$660.01	9.0%	\$101.26	4.5%
1989	\$660.01	\$30.98	7.9%	4.7%	\$4.55	3.3%	\$800.96	21.4%	\$117.56	16.1%
1990	\$800.96	\$34.44	11.2%	4.3%	\$4.76	4.8%	\$771.00	-3.7%	\$106.65	-9.3%
1991	\$771.00	\$37.20	8.0%	4.8%	\$5.01	5.1%	\$932.01	20.9%	\$125.45	17.6%
1992	\$932.01	\$41.73	12.2%	4.5%	\$5.46	9.1%	\$958.84	2.9%	\$125.46	0.0%
1993	\$958.84	\$44.36	6.3%	4.6%	\$5.66	3.7%	\$1,009.02	5.2%	\$128.78	2.6%
Average:			5.3%	4.8%		1.2%		5.9%		1.9%

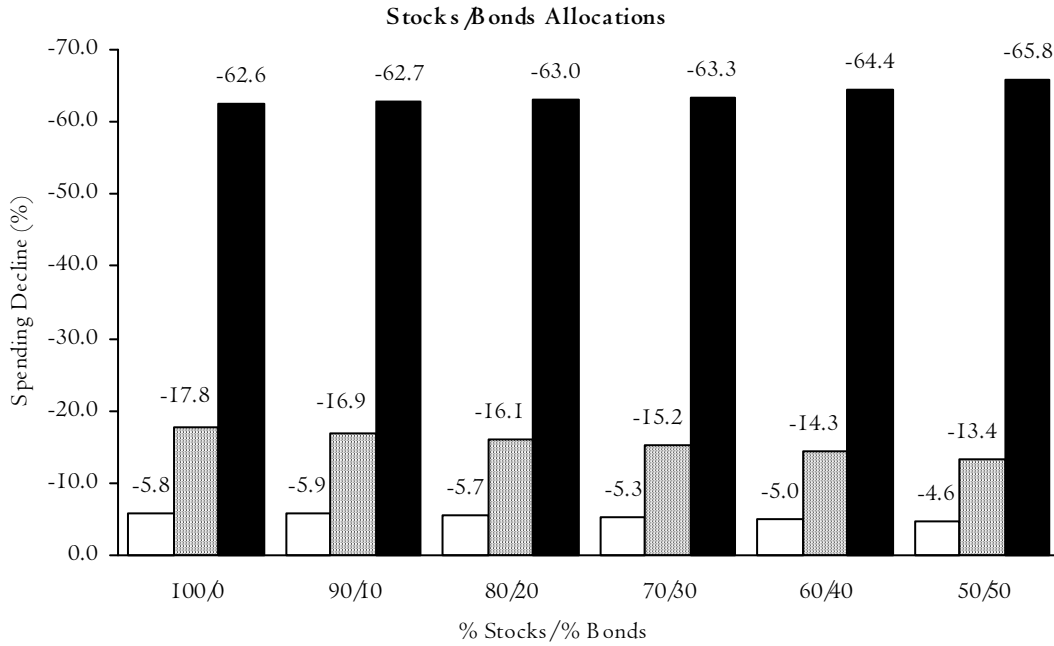
Notes: Spend 5% of prior three-year average ending market value. Assumes a constant asset allocation of 70% stocks and 30% bonds, rebalanced annually.

¹ Market value based on annual spending and weighted average capital market returns.

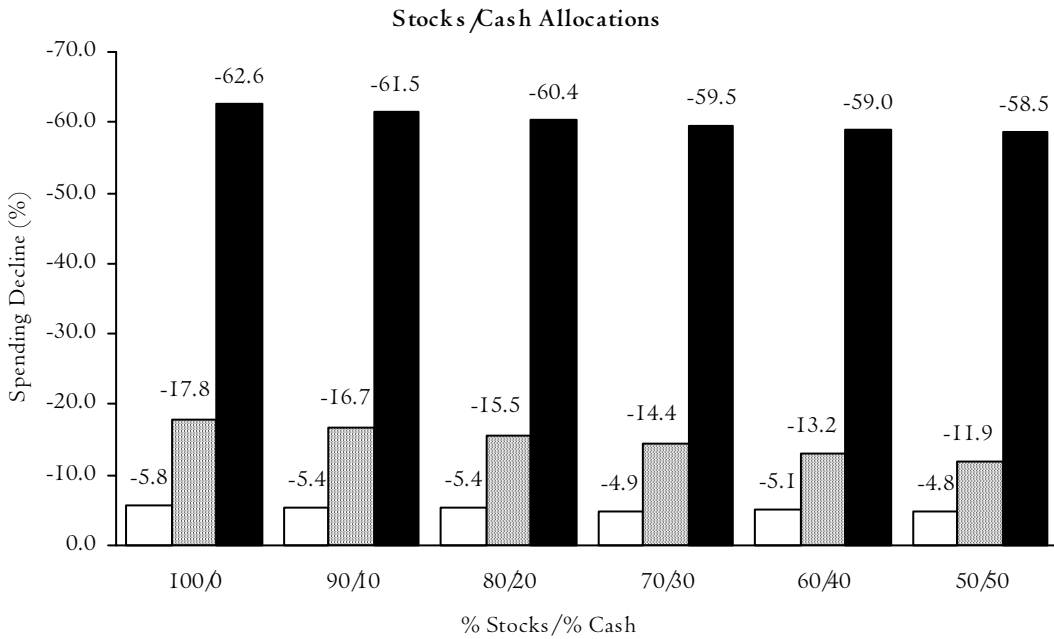
² January 1, 1946 dollars.

Exhibit 4

REAL SPENDING DECLINES
1946 - 93



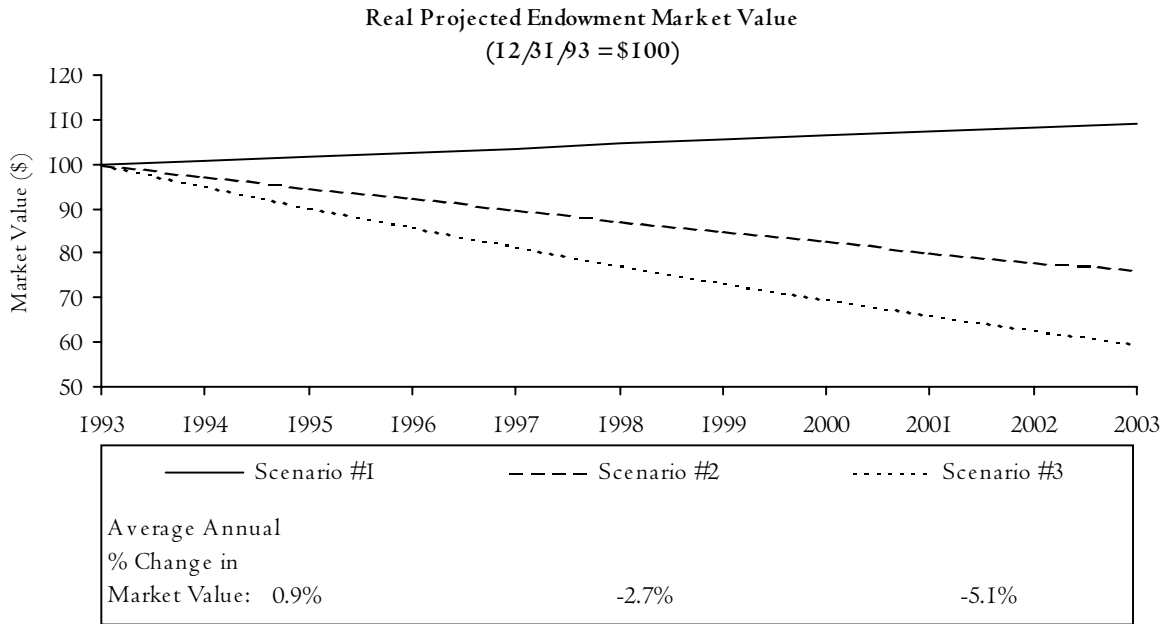
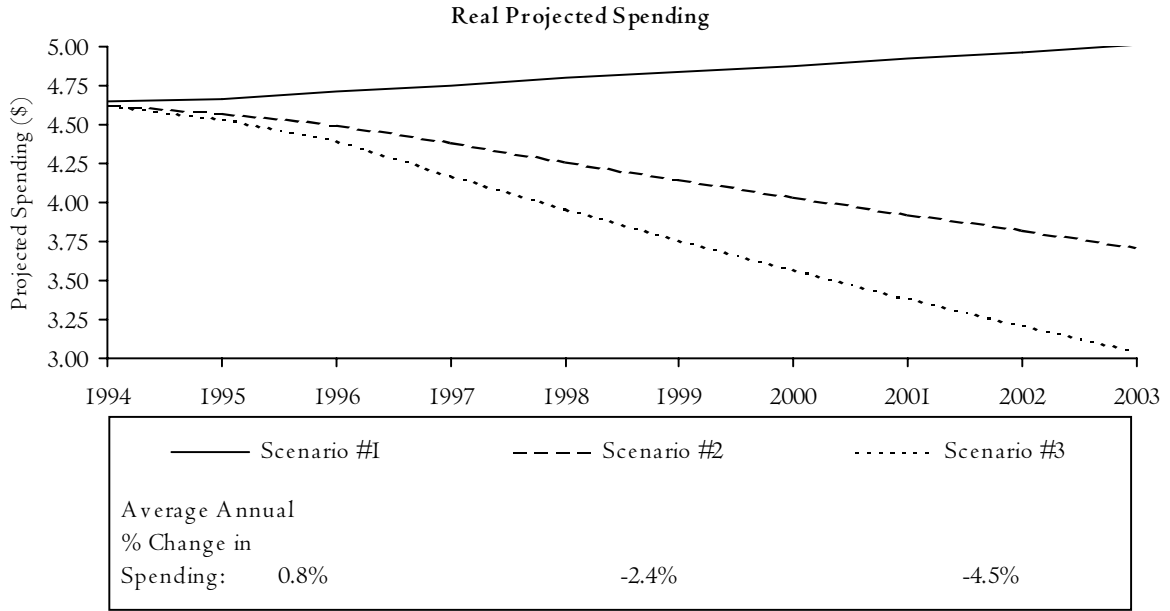
□ Average Annual Declines ▨ Worst Case (1 Year) ■ Largest Cumulative Decline



□ Average Annual Declines ▨ Worst Case (1 Year) ■ Largest Cumulative Decline

Exhibit 5

REAL PROJECTED GROWTH IN SPENDING AND ENDOWMENT MARKET VALUES



Notes: Spend 5% of prior three-year average ending market value. Assumes a constant asset allocation of 70% stocks and 30% bonds, rebalanced annually.

Ten-year average annual nominal return assumptions:

	<u>Stocks</u>	<u>Bonds</u>	<u>CPI</u>	<u>Cash</u>
Scenario 1:	10.30% (long-term average)	7.25% (current yield)	3.50%	4.50%
Scenario 2:	5.91% (regression to long-term mean)	7.00%	4.00%	5.00%
Scenario 3:	3.33% (based on current valuations)	5.00%	4.00%	5.00%

January 1, 1994 dollars.

Exhibit 6

PROJECTED SPENDING BASED ON MONTE CARLO SIMULATIONS

Calendar Year	Beginning Mkt Value	Nominal Spending	% Change in Nominal Spending	Spending as % of Beg Mkt Value	Real Spending ^I	Annual % Chg in Real Spending	Nominal Ending Mkt Value	Annual % Chg in Nom Mkt Value	Real Ending Mkt Value ^I	Annual % Chg in Real Mkt Value
Highest AACR										
1994	\$100.00	\$4.81		4.8%	\$4.65		\$106.12		\$102.54	
1995	\$106.12	\$5.03	4.4%	4.7%	\$4.69	0.9%	\$120.95	14.0%	\$112.91	10.1%
1996	\$120.95	\$5.45	8.4%	4.5%	\$4.92	4.8%	\$116.76	-3.5%	\$105.31	-6.7%
1997	\$116.76	\$5.73	5.1%	4.9%	\$4.99	1.6%	\$116.17	-0.5%	\$101.23	-3.9%
1998	\$116.17	\$5.90	2.9%	5.1%	\$4.97	-0.6%	\$120.60	3.8%	\$101.54	0.3%
1999	\$120.60	\$5.89	-0.1%	4.9%	\$4.79	-3.5%	\$135.85	12.6%	\$110.51	8.8%
2000	\$135.85	\$6.21	5.4%	4.6%	\$4.88	1.8%	\$129.72	-4.5%	\$101.96	-7.7%
2001	\$129.72	\$6.44	3.6%	5.0%	\$4.89	0.1%	\$146.24	12.7%	\$111.05	8.9%
2002	\$146.24	\$6.86	6.6%	4.7%	\$5.04	3.0%	\$165.05	12.9%	\$121.10	9.0%
2003	\$165.05	\$7.35	7.1%	4.5%	\$5.21	3.5%	\$171.56	3.9%	\$121.62	0.4%
Average:			4.8%	4.8%		1.3%		5.7%		2.1%
Mid-Range AACR										
1994	\$100.00	\$4.81		4.8%	\$4.65		\$99.37		\$96.01	
1995	\$99.37	\$4.92	2.1%	4.9%	\$4.59	-1.4%	\$107.03	7.7%	\$99.91	4.1%
1996	\$107.03	\$5.11	3.9%	4.8%	\$4.61	0.4%	\$98.06	-8.4%	\$88.44	-11.5%
1997	\$98.06	\$5.07	-0.6%	5.2%	\$4.42	-4.0%	\$103.42	5.5%	\$90.12	1.9%
1998	\$103.42	\$5.14	1.3%	5.0%	\$4.33	-2.1%	\$117.28	13.4%	\$98.75	9.6%
1999	\$117.28	\$5.31	3.3%	4.5%	\$4.32	-0.2%	\$112.10	-4.4%	\$91.20	-7.6%
2000	\$112.10	\$5.55	4.4%	4.9%	\$4.36	0.9%	\$110.51	-1.4%	\$86.86	-4.8%
2001	\$110.51	\$5.66	2.1%	5.1%	\$4.30	-1.3%	\$106.08	-4.0%	\$80.56	-7.3%
2002	\$106.08	\$5.48	-3.3%	5.2%	\$4.02	-6.6%	\$115.77	9.1%	\$84.95	5.4%
2003	\$115.77	\$5.54	1.1%	4.8%	\$3.93	-2.3%	\$125.98	8.8%	\$89.31	5.1%
Average:			1.6%	4.9%		-1.8%		2.9%		-0.6%
Lowest AACR										
1994	\$100.00	\$4.81		4.8%	\$4.65		\$99.00		\$95.65	
1995	\$99.00	\$4.91	2.0%	5.0%	\$4.58	-1.5%	\$98.75	-0.3%	\$92.18	-3.6%
1996	\$98.75	\$4.96	1.1%	5.0%	\$4.48	-2.3%	\$89.62	-9.2%	\$80.83	-12.3%
1997	\$89.62	\$4.79	-3.5%	5.3%	\$4.17	-6.7%	\$89.15	-0.5%	\$77.69	-3.9%
1998	\$89.15	\$4.63	-3.4%	5.2%	\$3.89	-6.7%	\$93.47	4.8%	\$78.70	1.3%
1999	\$93.47	\$4.54	-1.9%	4.9%	\$3.69	-5.2%	\$88.38	-5.4%	\$71.90	-8.6%
2000	\$88.38	\$4.52	-0.5%	5.1%	\$3.55	-3.8%	\$87.63	-0.9%	\$68.87	-4.2%
2001	\$87.63	\$4.49	-0.6%	5.1%	\$3.41	-3.9%	\$96.98	10.7%	\$73.64	6.9%
2002	\$96.98	\$4.55	1.3%	4.7%	\$3.34	-2.1%	\$109.97	13.4%	\$80.69	9.6%
2003	\$109.97	\$4.91	7.9%	4.5%	\$3.48	4.3%	\$101.66	-7.6%	\$72.07	-10.7%
Average:			0.3%	5.0%		-3.1%		0.6%		-2.8%

Notes: Derived from the actual distribution of quarterly stock returns (1926-93). Spend 5% of prior three-years' average ending market value. Assumes a constant asset allocation of 70% stocks and 30% bonds, rebalanced annually.

^I January 1, 1994 dollars.

APPENDIX A
Simulated Endowment Spending Tables

Appendix A-I

SIMULATED ENDOWMENT SPENDING

Calendar Year	Beginning Mkt Value	Nominal Spending	% Change in Nominal Spending	Spending as % of Beg Mkt Value	Real Spending ²	Annual % Chg in Real Spending	Nominal Ending Mkt Value ¹	Annual % Chg in Nom Mkt Value	Real Ending Mkt Value ²	Annual % Chg in Real ² Mkt Value
1946	\$100.00	\$4.08		4.1%	\$3.45		\$88.09		\$74.54	
1947	\$88.09	\$4.42	8.4%	5.0%	\$3.43	-0.6%	\$88.56	0.5%	\$68.75	-7.8%
1948	\$88.56	\$4.61	4.3%	5.2%	\$3.48	1.6%	\$88.83	0.3%	\$67.14	-2.3%
1949	\$88.83	\$4.42	-4.0%	5.0%	\$3.41	-2.3%	\$100.52	13.2%	\$77.38	15.2%
1950	\$100.52	\$4.63	4.7%	4.6%	\$3.37	-1.1%	\$127.17	26.5%	\$92.52	19.6%
1951	\$127.17	\$5.28	13.9%	4.1%	\$3.63	7.6%	\$151.94	19.5%	\$104.42	12.9%
1952	\$151.94	\$6.33	19.9%	4.2%	\$4.31	18.9%	\$172.96	13.8%	\$117.80	12.8%
1953	\$172.96	\$7.53	19.1%	4.4%	\$5.10	18.3%	\$163.43	-5.5%	\$110.60	-6.1%
1954	\$163.43	\$8.14	8.0%	5.0%	\$5.54	8.6%	\$239.70	46.7%	\$163.03	47.4%
1955	\$239.70	\$9.60	18.0%	4.0%	\$6.51	17.6%	\$304.61	27.1%	\$206.44	26.6%
1956	\$304.61	\$11.80	22.9%	3.9%	\$7.77	19.4%	\$312.67	2.6%	\$206.00	-0.2%
1957	\$312.67	\$14.28	21.1%	4.6%	\$9.13	17.5%	\$265.54	-15.1%	\$169.83	-17.6%
1958	\$265.54	\$14.71	3.0%	5.5%	\$9.25	1.2%	\$363.41	36.9%	\$228.37	34.5%
1959	\$363.41	\$15.69	6.7%	4.3%	\$9.72	5.1%	\$390.42	7.4%	\$241.70	5.8%
1960	\$390.42	\$16.99	8.3%	4.4%	\$10.36	6.7%	\$374.34	-4.1%	\$228.37	-5.5%
1961	\$374.34	\$18.80	10.7%	5.0%	\$11.39	9.9%	\$454.63	21.4%	\$275.51	20.6%
1962	\$454.63	\$20.32	8.1%	4.5%	\$12.17	6.8%	\$393.41	-13.5%	\$235.55	-14.5%
1963	\$393.41	\$20.37	0.2%	5.2%	\$12.00	-1.4%	\$461.06	17.2%	\$271.54	15.3%
1964	\$461.06	\$21.82	7.1%	4.7%	\$12.70	5.8%	\$514.44	11.6%	\$299.37	10.2%
1965	\$514.44	\$22.82	4.6%	4.4%	\$13.02	2.6%	\$554.25	7.7%	\$316.41	5.7%
1966	\$554.25	\$25.50	11.7%	4.6%	\$14.08	8.1%	\$473.38	-14.6%	\$261.49	-17.4%
1967	\$473.38	\$25.70	0.8%	5.4%	\$13.78	-2.2%	\$560.06	18.3%	\$300.24	14.8%
1968	\$560.06	\$26.46	3.0%	4.7%	\$13.55	-1.7%	\$593.96	6.1%	\$304.07	1.3%
1969	\$593.96	\$27.12	2.5%	4.6%	\$13.09	-3.4%	\$517.68	-12.8%	\$249.78	-17.9%
1970	\$517.68	\$27.86	2.7%	5.4%	\$12.74	-2.6%	\$507.11	-2.0%	\$231.94	-7.1%

Notes: Spend 5% of prior three-year average ending market value. Assumes a constant asset allocation of 100% stocks, rebalanced annually.

¹ Market value based on annual spending and weighted average capital market returns.

² January 1, 1946 dollars.

Appendix A-I (continued)

SIMULATED ENDOWMENT SPENDING

Calendar Year	Beginning Mkt Value	Nominal Spending	% Change in Nominal Spending	Spending as % of Beg Mkt Value	Real Spending ²	Annual % Chg in Real Spending	Nominal Ending ¹ Mkt Value	Annual % Chg in Nom Mkt Value	Real Ending ² Mkt Value	Annual % Chg in Real ² Mkt Value
1971	\$507.11	\$26.98	-3.2%	5.3%	\$11.94	-6.3%	\$553.14	9.1%	\$244.77	5.5%
1972	\$553.14	\$26.30	-2.5%	4.8%	\$11.25	-5.7%	\$629.34	13.8%	\$269.30	10.0%
1973	\$629.34	\$28.16	7.1%	4.5%	\$11.08	-1.6%	\$509.99	-19.0%	\$200.58	-25.5%
1974	\$509.99	\$28.21	0.2%	5.5%	\$9.89	-10.7%	\$349.55	-31.5%	\$122.53	-38.9%
1975	\$349.55	\$24.81	-12.0%	7.1%	\$8.13	-17.8%	\$453.60	29.8%	\$148.58	21.3%
1976	\$453.60	\$21.89	-11.8%	4.8%	\$6.84	-15.9%	\$537.81	18.6%	\$168.08	13.1%
1977	\$537.81	\$22.35	2.1%	4.2%	\$6.54	-4.4%	\$475.77	-11.5%	\$139.26	-17.1%
1978	\$475.77	\$24.45	9.4%	5.1%	\$6.56	0.4%	\$481.08	1.1%	\$129.16	-7.3%
1979	\$481.08	\$24.91	1.9%	5.2%	\$5.90	-10.1%	\$542.64	12.8%	\$128.52	-0.5%
1980	\$542.64	\$24.99	0.3%	4.6%	\$5.26	-10.8%	\$688.50	26.9%	\$144.97	12.8%
1981	\$688.50	\$28.54	14.2%	4.1%	\$5.53	5.1%	\$625.74	-9.1%	\$121.26	-16.4%
1982	\$625.74	\$30.95	8.4%	4.9%	\$5.77	4.4%	\$722.74	15.5%	\$134.83	11.2%
1983	\$722.74	\$33.95	9.7%	4.7%	\$6.13	6.2%	\$849.59	17.6%	\$153.50	13.8%
1984	\$849.59	\$36.63	7.9%	4.3%	\$6.39	4.2%	\$862.80	1.6%	\$150.54	-1.9%
1985	\$862.80	\$40.59	10.8%	4.7%	\$6.84	6.9%	\$1,089.60	26.3%	\$183.53	21.9%
1986	\$1,089.60	\$46.70	15.1%	4.3%	\$7.81	14.3%	\$1,244.40	14.2%	\$208.13	13.4%
1987	\$1,244.40	\$53.28	14.1%	4.3%	\$8.53	9.2%	\$1,261.77	1.4%	\$202.04	-2.9%
1988	\$1,261.77	\$59.93	12.5%	4.7%	\$9.19	7.8%	\$1,408.61	11.6%	\$216.12	7.0%
1989	\$1,408.61	\$65.25	8.9%	4.6%	\$9.58	4.2%	\$1,783.39	26.6%	\$261.76	21.1%
1990	\$1,783.39	\$74.23	13.8%	4.2%	\$10.27	7.2%	\$1,653.24	-7.3%	\$228.69	-12.6%
1991	\$1,653.24	\$80.75	8.8%	4.9%	\$10.87	5.9%	\$2,068.91	25.1%	\$278.48	21.8%
1992	\$2,068.91	\$91.76	13.6%	4.4%	\$12.01	10.5%	\$2,129.38	2.9%	\$278.63	0.1%
1993	\$2,129.38	\$97.53	6.3%	4.6%	\$12.45	3.7%	\$2,243.38	5.4%	\$286.32	2.8%
Average:			7.3%	4.7%		3.1%		8.3%		4.2%

Notes: Spend 5% of prior three-year average ending market value. Assumes a constant asset allocation of 100% stocks, rebalanced annually.

¹ Market value based on annual spending and weighted average capital market returns.

² January 1, 1946 dollars.

Appendix A-2

SIMULATED ENDOWMENT SPENDING

Calendar Year	Beginning Mkt Value	Nominal Spending	% Change in Nominal Spending	Spending as % of Beg Mkt Value	Real Spending ²	Annual % Chg in Real Spending	Nominal Ending ¹ Mkt Value	Annual % Chg in Nom Mkt Value	Real Ending ² Mkt Value	Annual % Chg in Real ² Mkt Value
1946	\$100.00	\$4.21		4.2%	\$3.57		\$89.74		\$75.94	
1947	\$89.74	\$4.50	6.8%	5.0%	\$3.49	-2.0%	\$88.76	-1.1%	\$68.90	-9.3%
1948	\$88.76	\$4.64	3.2%	5.2%	\$3.51	0.4%	\$88.74	0.0%	\$67.07	-2.7%
1949	\$88.74	\$4.45	-4.0%	5.0%	\$3.43	-2.3%	\$98.37	10.8%	\$75.72	12.9%
1950	\$98.37	\$4.60	3.2%	4.7%	\$3.35	-2.4%	\$117.77	19.7%	\$85.69	13.2%
1951	\$117.77	\$5.08	10.5%	4.3%	\$3.49	4.4%	\$133.55	13.4%	\$91.78	7.1%
1952	\$133.55	\$5.83	14.7%	4.4%	\$3.97	13.7%	\$147.08	10.1%	\$100.17	9.1%
1953	\$147.08	\$6.64	13.9%	4.5%	\$4.49	13.2%	\$140.15	-4.7%	\$94.85	-5.3%
1954	\$140.15	\$7.01	5.6%	5.0%	\$4.77	6.1%	\$191.72	36.8%	\$130.39	37.5%
1955	\$191.72	\$7.98	13.8%	4.2%	\$5.41	13.4%	\$229.86	19.9%	\$155.78	19.5%
1956	\$229.86	\$9.36	17.3%	4.1%	\$6.17	14.0%	\$229.93	0.0%	\$151.49	-2.8%
1957	\$229.93	\$10.86	16.0%	4.7%	\$6.94	12.6%	\$203.31	-11.6%	\$130.03	-14.2%
1958	\$203.31	\$11.05	1.8%	5.4%	\$6.95	0.0%	\$256.51	26.2%	\$161.20	24.0%
1959	\$256.51	\$11.50	4.0%	4.5%	\$7.12	2.5%	\$267.81	4.4%	\$165.80	2.9%
1960	\$267.81	\$12.13	5.5%	4.5%	\$7.40	4.0%	\$263.80	-1.5%	\$160.94	-2.9%
1961	\$263.80	\$13.14	8.3%	5.0%	\$7.96	7.6%	\$306.30	16.1%	\$185.62	15.3%
1962	\$306.30	\$13.97	6.3%	4.6%	\$8.36	5.0%	\$275.54	-10.0%	\$164.98	-11.1%
1963	\$275.54	\$14.09	0.9%	5.1%	\$8.30	-0.7%	\$310.75	12.8%	\$183.02	10.9%
1964	\$310.75	\$14.88	5.6%	4.8%	\$8.66	4.3%	\$338.30	8.9%	\$196.87	7.6%
1965	\$338.30	\$15.41	3.6%	4.6%	\$8.80	1.6%	\$356.23	5.3%	\$203.37	3.3%
1966	\$356.23	\$16.75	8.7%	4.7%	\$9.26	5.2%	\$313.24	-12.1%	\$173.03	-14.9%
1967	\$313.24	\$16.80	0.2%	5.4%	\$9.00	-2.7%	\$348.43	11.2%	\$186.79	8.0%
1968	\$348.43	\$16.97	1.0%	4.9%	\$8.69	-3.5%	\$361.62	3.8%	\$185.12	-0.9%
1969	\$361.62	\$17.05	0.5%	4.7%	\$8.23	-5.3%	\$317.06	-12.3%	\$152.98	-17.4%
1970	\$317.06	\$17.12	0.4%	5.4%	\$7.83	-4.9%	\$316.81	-0.1%	\$144.90	-5.3%

Notes: Spend 5% of prior three-year average ending market value. Assumes a constant asset allocation of 80% stocks and 20% bonds, rebalanced annually.

¹ Market value based on annual spending and weighted average capital market returns.

² January 1, 1946 dollars.

Appendix A-2 (continued)

SIMULATED ENDOWMENT SPENDING

Calendar Year	Beginning Mkt Value	Nominal Spending	% Change in Nominal Spending	Spending as % of Beg Mkt Value	Real Spending ²	Annual % Chg in Real Spending	Nominal Ending Mkt Value ¹	Annual % Chg in Nom Mkt Value	Real Ending Mkt Value ²	Annual % Chg in Real ² Mkt Value
1971	\$316.81	\$16.59	-3.1%	5.2%	\$7.34	-6.2%	\$345.22	9.0%	\$152.77	5.4%
1972	\$345.22	\$16.32	-1.6%	4.7%	\$6.98	-4.9%	\$383.69	11.1%	\$164.19	7.5%
1973	\$383.69	\$17.43	6.8%	4.5%	\$6.85	-1.8%	\$320.65	-16.4%	\$126.11	-23.2%
1974	\$320.65	\$17.49	0.4%	5.5%	\$6.13	-10.5%	\$238.40	-25.6%	\$83.57	-33.7%
1975	\$238.40	\$15.71	-10.2%	6.6%	\$5.15	-16.1%	\$297.47	24.8%	\$97.44	16.6%
1976	\$297.47	\$14.28	-9.1%	4.8%	\$4.46	-13.3%	\$348.14	17.0%	\$108.80	11.7%
1977	\$348.14	\$14.73	3.2%	4.2%	\$4.31	-3.3%	\$314.79	-9.6%	\$92.14	-15.3%
1978	\$314.79	\$16.01	8.6%	5.1%	\$4.30	-0.4%	\$315.75	0.3%	\$84.77	-8.0%
1979	\$315.75	\$16.31	1.9%	5.2%	\$3.86	-10.1%	\$345.80	9.5%	\$81.90	-3.4%
1980	\$345.80	\$16.27	-0.2%	4.7%	\$3.43	-11.3%	\$417.65	20.8%	\$87.94	7.4%
1981	\$417.65	\$17.99	10.5%	4.3%	\$3.49	1.7%	\$387.87	-7.1%	\$75.16	-14.5%
1982	\$387.87	\$19.19	6.7%	4.9%	\$3.58	2.7%	\$457.39	17.9%	\$85.33	13.5%
1983	\$457.39	\$21.05	9.7%	4.6%	\$3.80	6.2%	\$525.21	14.8%	\$94.89	11.2%
1984	\$525.21	\$22.84	8.5%	4.3%	\$3.99	4.8%	\$542.35	3.3%	\$94.63	-0.3%
1985	\$542.35	\$25.42	11.3%	4.7%	\$4.28	7.4%	\$675.43	24.5%	\$113.77	20.2%
1986	\$675.43	\$29.05	14.3%	4.3%	\$4.86	13.5%	\$767.67	13.7%	\$128.39	12.9%
1987	\$767.67	\$33.09	13.9%	4.3%	\$5.30	9.1%	\$782.88	2.0%	\$125.36	-2.4%
1988	\$782.88	\$37.10	12.1%	4.7%	\$5.69	7.4%	\$860.47	9.9%	\$132.02	5.3%
1989	\$860.47	\$40.18	8.3%	4.7%	\$5.90	3.6%	\$1,059.23	23.1%	\$155.47	17.8%
1990	\$1,059.23	\$45.04	12.1%	4.3%	\$6.23	5.6%	\$1,007.21	-4.9%	\$139.32	-10.4%
1991	\$1,007.21	\$48.78	8.3%	4.8%	\$6.57	5.4%	\$1,231.85	22.3%	\$165.81	19.0%
1992	\$1,231.85	\$54.97	12.7%	4.5%	\$7.19	9.5%	\$1,267.54	2.9%	\$165.86	0.0%
1993	\$1,267.54	\$58.44	6.3%	4.6%	\$7.46	3.7%	\$1,334.40	5.3%	\$170.31	2.7%
Average:			5.9%	4.8%		1.9%		6.7%		2.6%

Notes: Spend 5% of prior three-year average ending market value. Assumes a constant asset allocation of 80% stocks and 20% bonds, rebalanced annually.

¹ Market value based on annual spending and weighted average capital market returns.

² January 1, 1946 dollars.

Appendix A-3

SIMULATED ENDOWMENT SPENDING

Calendar Year	Beginning Mkt Value	Nominal Spending	% Change in Nominal Spending	Spending as % of Beg Mkt Value	Real Spending ²	Annual % Chg in Real Spending	Nominal Ending ¹ Mkt Value	Annual % Chg in Nom Mkt Value	Real Ending ² Mkt Value	Annual % Chg in Real ² Mkt Value
1946	\$100.00	\$4.36		4.4%	\$3.69		\$91.26		\$77.22	
1947	\$91.26	\$4.58	5.1%	5.0%	\$3.56	-3.6%	\$88.78	-2.7%	\$68.92	-10.8%
1948	\$88.78	\$4.67	1.9%	5.3%	\$3.53	-0.8%	\$88.40	-0.4%	\$66.82	-3.1%
1949	\$88.40	\$4.47	-4.1%	5.1%	\$3.44	-2.4%	\$95.91	8.5%	\$73.82	10.5%
1950	\$95.91	\$4.55	1.7%	4.7%	\$3.31	-3.8%	\$108.56	13.2%	\$78.99	7.0%
1951	\$108.56	\$4.88	7.2%	4.5%	\$3.35	1.3%	\$116.72	7.5%	\$80.21	1.6%
1952	\$116.72	\$5.35	9.7%	4.6%	\$3.65	8.7%	\$124.27	6.5%	\$84.64	5.5%
1953	\$124.27	\$5.83	8.8%	4.7%	\$3.94	8.1%	\$119.37	-3.9%	\$80.78	-4.6%
1954	\$119.37	\$6.01	3.1%	5.0%	\$4.09	3.6%	\$152.08	27.4%	\$103.43	28.0%
1955	\$152.08	\$6.60	9.8%	4.3%	\$4.47	9.4%	\$171.81	13.0%	\$116.44	12.6%
1956	\$171.81	\$7.39	12.0%	4.3%	\$4.87	8.9%	\$167.35	-2.6%	\$110.26	-5.3%
1957	\$167.35	\$8.19	10.8%	4.9%	\$5.24	7.6%	\$153.73	-8.1%	\$98.32	-10.8%
1958	\$153.73	\$8.21	0.3%	5.3%	\$5.16	-1.4%	\$178.40	16.0%	\$112.11	14.0%
1959	\$178.40	\$8.32	1.3%	4.7%	\$5.15	-0.2%	\$180.88	1.4%	\$111.98	-0.1%
1960	\$180.88	\$8.55	2.7%	4.7%	\$5.22	1.2%	\$182.76	1.0%	\$111.50	-0.4%
1961	\$182.76	\$9.03	5.7%	4.9%	\$5.47	5.0%	\$202.69	10.9%	\$122.83	10.2%
1962	\$202.69	\$9.44	4.5%	4.7%	\$5.65	3.2%	\$188.91	-6.8%	\$113.11	-7.9%
1963	\$188.91	\$9.57	1.4%	5.1%	\$5.64	-0.2%	\$204.91	8.5%	\$120.68	6.7%
1964	\$204.91	\$9.94	3.9%	4.9%	\$5.79	2.6%	\$217.59	6.2%	\$126.62	4.9%
1965	\$217.59	\$10.19	2.5%	4.7%	\$5.82	0.6%	\$223.83	2.9%	\$127.78	0.9%
1966	\$223.83	\$10.77	5.7%	4.8%	\$5.95	2.3%	\$202.51	-9.5%	\$111.87	-12.5%
1967	\$202.51	\$10.73	-0.4%	5.3%	\$5.75	-3.3%	\$211.56	4.5%	\$113.42	1.4%
1968	\$211.56	\$10.63	-0.9%	5.0%	\$5.44	-5.4%	\$214.69	1.5%	\$109.91	-3.1%
1969	\$214.69	\$10.48	-1.4%	4.9%	\$5.06	-7.1%	\$189.31	-11.8%	\$91.34	-16.9%
1970	\$189.31	\$10.26	-2.1%	5.4%	\$4.69	-7.2%	\$192.60	1.7%	\$88.09	-3.6%

Notes: Spend 5% of prior three-year average ending market value. Assumes a constant asset allocation of 60% stocks and 40% bonds, rebalanced annually.

¹ Market value based on annual spending and weighted average capital market returns.

² January 1, 1946 dollars.

Appendix A-3 (continued)

SIMULATED ENDOWMENT SPENDING

Calendar Year	Beginning Mkt Value	Nominal Spending	% Change in Nominal Spending	Spending as % of Beg Mkt Value	Real Spending ²	Annual % Chg in Real Spending	Nominal Ending Mkt Value ¹	Annual % Chg in Nom Mkt Value	Real Ending Mkt Value ²	Annual % Chg in Real Mkt Value ²
1971	\$192.60	\$9.94	-3.1%	5.2%	\$4.40	-6.2%	\$209.57	8.8%	\$92.74	5.3%
1972	\$209.57	\$9.86	-0.9%	4.7%	\$4.22	-4.1%	\$227.46	8.5%	\$97.33	5.0%
1973	\$227.46	\$10.49	6.5%	4.6%	\$4.13	-2.2%	\$195.92	-13.9%	\$77.06	-20.8%
1974	\$195.92	\$10.55	0.5%	5.4%	\$3.70	-10.4%	\$157.29	-19.7%	\$55.13	-28.4%
1975	\$157.29	\$9.68	-8.3%	6.2%	\$3.17	-14.3%	\$188.20	19.7%	\$61.65	11.8%
1976	\$188.20	\$9.02	-6.8%	4.8%	\$2.82	-11.0%	\$217.28	15.5%	\$67.91	10.2%
1977	\$217.28	\$9.38	3.9%	4.3%	\$2.75	-2.6%	\$200.74	-7.6%	\$58.76	-13.5%
1978	\$200.74	\$10.10	7.7%	5.0%	\$2.71	-1.2%	\$199.60	-0.6%	\$53.59	-8.8%
1979	\$199.60	\$10.29	1.9%	5.2%	\$2.44	-10.1%	\$212.15	6.3%	\$50.25	-6.2%
1980	\$212.15	\$10.21	-0.8%	4.8%	\$2.15	-11.8%	\$243.50	14.8%	\$51.27	2.0%
1981	\$243.50	\$10.92	7.0%	4.5%	\$2.12	-1.5%	\$230.99	-5.1%	\$44.76	-12.7%
1982	\$230.99	\$11.44	4.8%	5.0%	\$2.13	0.9%	\$277.81	20.3%	\$51.83	15.8%
1983	\$277.81	\$12.54	9.6%	4.5%	\$2.27	6.1%	\$311.44	12.1%	\$56.27	8.6%
1984	\$311.44	\$13.67	9.0%	4.4%	\$2.39	5.3%	\$326.95	5.0%	\$57.05	1.4%
1985	\$326.95	\$15.27	11.7%	4.7%	\$2.57	7.8%	\$401.30	22.7%	\$67.59	18.5%
1986	\$401.30	\$17.33	13.5%	4.3%	\$2.90	12.7%	\$453.59	13.0%	\$75.86	12.2%
1987	\$453.59	\$19.70	13.7%	4.3%	\$3.15	8.8%	\$462.24	1.9%	\$74.01	-2.4%
1988	\$462.24	\$21.95	11.4%	4.7%	\$3.37	6.8%	\$500.01	8.2%	\$76.71	3.6%
1989	\$500.01	\$23.60	7.5%	4.7%	\$3.46	2.8%	\$598.10	19.6%	\$87.79	14.4%
1990	\$598.10	\$26.01	10.2%	4.3%	\$3.60	3.9%	\$582.64	-2.6%	\$80.59	-8.2%
1991	\$582.64	\$28.01	7.7%	4.8%	\$3.77	4.8%	\$696.03	19.5%	\$93.69	16.2%
1992	\$696.03	\$31.28	11.7%	4.5%	\$4.09	8.6%	\$715.91	2.9%	\$93.68	0.0%
1993	\$715.91	\$33.24	6.3%	4.6%	\$4.24	3.7%	\$753.07	5.2%	\$96.11	2.6%
Average:			4.6%	4.8%		0.5%		5.1%		1.1%

Notes: Spend 5% of prior three-year average ending market value. Assumes a constant asset allocation of 60% stocks and 40% bonds, rebalanced annually.

¹ Market value based on annual spending and weighted average capital market returns.

² January 1, 1946 dollars.

Appendix A-4

SIMULATED ENDOWMENT SPENDING

Calendar Year	Beginning Mkt Value	Nominal Spending	% Change in Nominal Spending	Spending as % of Beg Mkt Value	Real Spending ²	Annual % Chg in Real Spending	Nominal Ending Mkt Value ¹	Annual % Chg in Nom Mkt Value	Real Ending Mkt Value ²	Annual % Chg in Real ² Mkt Value
1946	\$100.00	\$4.27		4.3%	\$3.61		\$89.83		\$76.02	
1947	\$89.83	\$4.53	6.1%	5.0%	\$3.51	-2.7%	\$89.37	-0.5%	\$69.37	-8.7%
1948	\$89.37	\$4.65	2.8%	5.2%	\$3.52	0.1%	\$88.91	-0.5%	\$67.20	-3.1%
1949	\$88.91	\$4.47	-4.0%	5.0%	\$3.44	-2.2%	\$97.52	9.7%	\$75.07	11.7%
1950	\$97.52	\$4.60	2.9%	4.7%	\$3.34	-2.8%	\$116.98	20.0%	\$85.11	13.4%
1951	\$116.98	\$5.06	10.0%	4.3%	\$3.48	3.9%	\$134.12	14.7%	\$92.17	8.3%
1952	\$134.12	\$5.81	14.9%	4.3%	\$3.96	13.9%	\$147.91	10.3%	\$100.73	9.3%
1953	\$147.91	\$6.65	14.5%	4.5%	\$4.50	13.7%	\$140.51	-5.0%	\$95.09	-5.6%
1954	\$140.51	\$7.04	5.9%	5.0%	\$4.79	6.4%	\$189.94	35.2%	\$129.19	35.9%
1955	\$189.94	\$7.97	13.2%	4.2%	\$5.40	12.8%	\$228.97	20.5%	\$155.17	20.1%
1956	\$228.97	\$9.32	16.9%	4.1%	\$6.14	13.7%	\$232.80	1.7%	\$153.38	-1.2%
1957	\$232.80	\$10.86	16.5%	4.7%	\$6.95	13.1%	\$203.86	-12.4%	\$130.38	-15.0%
1958	\$203.86	\$11.09	2.1%	5.4%	\$6.97	0.4%	\$260.81	27.9%	\$163.90	25.7%
1959	\$260.81	\$11.62	4.8%	4.5%	\$7.20	3.2%	\$275.20	5.5%	\$170.38	3.9%
1960	\$275.20	\$12.33	6.1%	4.5%	\$7.52	4.5%	\$265.21	-3.6%	\$161.80	-5.0%
1961	\$265.21	\$13.35	8.3%	5.0%	\$8.09	7.6%	\$308.46	16.3%	\$186.93	15.5%
1962	\$308.46	\$14.15	5.9%	4.6%	\$8.47	4.7%	\$275.12	-10.8%	\$164.73	-11.9%
1963	\$275.12	\$14.15	0.0%	5.1%	\$8.33	-1.6%	\$311.35	13.2%	\$183.37	11.3%
1964	\$311.35	\$14.92	5.4%	4.8%	\$8.68	4.2%	\$338.94	8.9%	\$197.24	7.6%
1965	\$338.94	\$15.42	3.4%	4.6%	\$8.81	1.4%	\$359.11	5.9%	\$205.01	3.9%
1966	\$359.11	\$16.82	9.1%	4.7%	\$9.29	5.5%	\$316.76	-11.8%	\$174.98	-14.6%
1967	\$316.76	\$16.91	0.5%	5.3%	\$9.07	-2.4%	\$362.24	14.4%	\$194.20	11.0%
1968	\$362.24	\$17.30	2.3%	4.8%	\$8.86	-2.3%	\$380.24	5.0%	\$194.66	0.2%
1969	\$380.24	\$17.65	2.0%	4.6%	\$8.52	-3.8%	\$341.84	-10.1%	\$164.94	-15.3%
1970	\$341.84	\$18.07	2.4%	5.3%	\$8.27	-3.0%	\$339.36	-0.7%	\$155.22	-5.9%

Notes: Spend 5% of prior three-year average ending market value. Assumes a constant asset allocation of 80% stocks and 20% cash, rebalanced annually.

¹ Market value based on annual spending and weighted average capital market returns.

² January 1, 1946 dollars.

Appendix A-4 (continued)

SIMULATED ENDOWMENT SPENDING

Calendar Year	Beginning Mkt Value	Nominal Spending	% Change in Nominal Spending	Spending as % of Beg Mkt Value	Real Spending ²	Annual % Chg in Real Spending	Nominal Ending Mkt Value ¹	Annual % Chg in Nom Mkt Value	Real Ending Mkt Value ²	Annual % Chg in Real Mkt Value ²
1971	\$339.36	\$17.69	-2.1%	5.2%	\$7.83	-5.3%	\$363.66	7.2%	\$160.92	3.7%
1972	\$363.66	\$17.41	-1.6%	4.8%	\$7.45	-4.8%	\$402.69	10.7%	\$172.32	7.1%
1973	\$402.69	\$18.43	5.8%	4.6%	\$7.25	-2.7%	\$342.29	-15.0%	\$134.62	-21.9%
1974	\$342.29	\$18.48	0.3%	5.4%	\$6.48	-10.6%	\$257.19	-24.9%	\$90.15	-33.0%
1975	\$257.19	\$16.70	-9.6%	6.5%	\$5.47	-15.5%	\$319.59	24.3%	\$104.68	16.1%
1976	\$319.59	\$15.32	-8.3%	4.8%	\$4.79	-12.5%	\$366.92	14.8%	\$114.67	9.5%
1977	\$366.92	\$15.73	2.7%	4.3%	\$4.60	-3.8%	\$333.15	-9.2%	\$97.52	-15.0%
1978	\$333.15	\$16.99	8.0%	5.1%	\$4.56	-0.9%	\$338.06	1.5%	\$90.76	-6.9%
1979	\$338.06	\$17.30	1.8%	5.1%	\$4.10	-10.2%	\$376.03	11.2%	\$89.06	-1.9%
1980	\$376.03	\$17.45	0.9%	4.6%	\$3.68	-10.3%	\$461.77	22.8%	\$97.23	9.2%
1981	\$461.77	\$19.60	12.3%	4.2%	\$3.80	3.3%	\$436.30	-5.5%	\$84.55	-13.0%
1982	\$436.30	\$21.23	8.4%	4.9%	\$3.96	4.3%	\$497.05	13.9%	\$92.73	9.7%
1983	\$497.05	\$23.25	9.5%	4.7%	\$4.20	6.0%	\$570.28	14.7%	\$103.03	11.1%
1984	\$570.28	\$25.06	7.8%	4.4%	\$4.37	4.1%	\$583.10	2.2%	\$101.74	-1.3%
1985	\$583.10	\$27.51	9.8%	4.7%	\$4.63	6.0%	\$708.16	21.4%	\$119.28	17.2%
1986	\$708.16	\$31.03	12.8%	4.4%	\$5.19	12.0%	\$790.96	11.7%	\$132.29	10.9%
1987	\$790.96	\$34.70	11.9%	4.4%	\$5.56	7.1%	\$808.77	2.3%	\$129.50	-2.1%
1988	\$808.77	\$38.46	10.8%	4.8%	\$5.90	6.2%	\$886.67	9.6%	\$136.04	5.0%
1989	\$886.67	\$41.44	7.7%	4.7%	\$6.08	3.1%	\$1,079.11	21.7%	\$158.39	16.4%
1990	\$1,079.11	\$46.24	11.6%	4.3%	\$6.40	5.2%	\$1,024.97	-5.0%	\$141.78	-10.5%
1991	\$1,024.97	\$49.85	7.8%	4.9%	\$6.71	4.9%	\$1,230.55	20.1%	\$165.63	16.8%
1992	\$1,230.55	\$55.58	11.5%	4.5%	\$7.27	8.4%	\$1,256.30	2.1%	\$164.39	-0.8%
1993	\$1,256.30	\$58.53	5.3%	4.7%	\$7.47	2.7%	\$1,305.03	3.9%	\$166.56	1.3%
Average:			5.9%	4.8%		1.8%		6.6%		2.5%

Notes: Spend 5% of prior three-year average ending market value. Assumes a constant asset allocation of 80% stocks and 20% cash, rebalanced annually.

¹ Market value based on annual spending and weighted average capital market returns.

² January 1, 1946 dollars.

Appendix A-5

SIMULATED ENDOWMENT SPENDING

Calendar Year	Beginning Mkt Value	Nominal Spending	% Change in Nominal Spending	Spending as % of Beg Mkt Value	Real Spending ²	Annual % Chg in Real Spending	Nominal Ending Mkt Value ¹	Annual % Chg in Nom Mkt Value	Real Ending Mkt Value ²	Annual % Chg in Real Mkt Value ²
1946	\$100.00	\$4.37		4.4%	\$3.70		\$90.64		\$76.70	
1947	\$90.64	\$4.58	4.9%	5.1%	\$3.56	-3.8%	\$89.69	-1.0%	\$69.63	-9.2%
1948	\$89.69	\$4.67	2.0%	5.2%	\$3.53	-0.7%	\$88.85	-0.9%	\$67.15	-3.6%
1949	\$88.85	\$4.49	-4.0%	5.0%	\$3.45	-2.2%	\$95.91	7.9%	\$73.82	9.9%
1950	\$95.91	\$4.57	2.0%	4.8%	\$3.33	-3.6%	\$111.98	16.8%	\$81.48	10.4%
1951	\$111.98	\$4.95	8.1%	4.4%	\$3.40	2.1%	\$125.73	12.3%	\$86.41	6.1%
1952	\$125.73	\$5.56	12.4%	4.4%	\$3.79	11.4%	\$136.43	8.5%	\$92.92	7.5%
1953	\$136.43	\$6.24	12.1%	4.6%	\$4.22	11.4%	\$129.94	-4.8%	\$87.93	-5.4%
1954	\$129.94	\$6.54	4.8%	5.0%	\$4.44	5.3%	\$168.52	29.7%	\$114.62	30.3%
1955	\$168.52	\$7.25	10.9%	4.3%	\$4.91	10.5%	\$197.76	17.4%	\$134.02	16.9%
1956	\$197.76	\$8.27	14.1%	4.2%	\$5.45	10.9%	\$200.07	1.2%	\$131.82	-1.6%
1957	\$200.07	\$9.44	14.1%	4.7%	\$6.04	10.8%	\$177.83	-11.1%	\$113.73	-13.7%
1958	\$177.83	\$9.59	1.6%	5.4%	\$6.03	-0.1%	\$219.87	23.6%	\$138.17	21.5%
1959	\$219.87	\$9.96	3.8%	4.5%	\$6.17	2.3%	\$229.88	4.6%	\$142.32	3.0%
1960	\$229.88	\$10.46	5.0%	4.5%	\$6.38	3.5%	\$222.03	-3.4%	\$135.45	-4.8%
1961	\$222.03	\$11.20	7.0%	5.0%	\$6.79	6.3%	\$252.63	13.8%	\$153.09	13.0%
1962	\$252.63	\$11.74	4.9%	4.6%	\$7.03	3.6%	\$228.47	-9.6%	\$136.79	-10.6%
1963	\$228.47	\$11.72	-0.2%	5.1%	\$6.90	-1.8%	\$254.02	11.2%	\$149.61	9.4%
1964	\$254.02	\$12.25	4.6%	4.8%	\$7.13	3.3%	\$273.12	7.5%	\$158.94	6.2%
1965	\$273.12	\$12.59	2.8%	4.6%	\$7.19	0.8%	\$286.92	5.1%	\$163.80	3.1%
1966	\$286.92	\$13.57	7.7%	4.7%	\$7.49	4.2%	\$257.13	-10.4%	\$142.04	-13.3%
1967	\$257.13	\$13.62	0.4%	5.3%	\$7.30	-2.6%	\$289.01	12.4%	\$154.94	9.1%
1968	\$289.01	\$13.88	1.9%	4.8%	\$7.11	-2.6%	\$301.75	4.4%	\$154.48	-0.3%
1969	\$301.75	\$14.13	1.8%	4.7%	\$6.82	-4.1%	\$275.48	-8.7%	\$132.91	-14.0%
1970	\$275.48	\$14.44	2.2%	5.2%	\$6.60	-3.2%	\$274.96	-0.2%	\$125.76	-5.4%

Notes: Spend 5% of prior three-year average ending market value. Assumes a constant asset allocation of 70% stocks and 30% cash, rebalanced annually.

¹ Market value based on annual spending and weighted average capital market returns.

² January 1, 1946 dollars.

Appendix A-5 (continued)

SIMULATED ENDOWMENT SPENDING

Calendar Year	Beginning Mkt Value	Nominal Spending	% Change in Nominal Spending	Spending as % of Beg Mkt Value	Real Spending ²	Annual % Chg in Real Spending	Nominal Ending Mkt Value ¹	Annual % Chg in Nom Mkt Value	Real Ending Mkt Value ²	Annual % Chg in Real Mkt Value ²
1971	\$274.96	\$14.20	-1.6%	5.2%	\$6.29	-4.8%	\$291.99	6.2%	\$129.21	2.7%
1972	\$291.99	\$14.04	-1.1%	4.8%	\$6.01	-4.4%	\$318.93	9.2%	\$136.47	5.6%
1973	\$318.93	\$14.76	5.2%	4.6%	\$5.81	-3.3%	\$277.53	-13.0%	\$109.15	-20.0%
1974	\$277.53	\$14.81	0.3%	5.3%	\$5.19	-10.6%	\$217.83	-21.5%	\$76.36	-30.0%
1975	\$217.83	\$13.57	-8.3%	6.2%	\$4.45	-14.4%	\$264.52	21.4%	\$86.65	13.5%
1976	\$264.52	\$12.66	-6.7%	4.8%	\$3.96	-11.0%	\$298.76	12.9%	\$93.37	7.8%
1977	\$298.76	\$13.02	2.8%	4.4%	\$3.81	-3.7%	\$274.75	-8.0%	\$80.42	-13.9%
1978	\$274.75	\$13.97	7.3%	5.1%	\$3.75	-1.6%	\$279.20	1.6%	\$74.96	-6.8%
1979	\$279.20	\$14.21	1.8%	5.1%	\$3.37	-10.2%	\$308.38	10.4%	\$73.04	-2.6%
1980	\$308.38	\$14.37	1.1%	4.7%	\$3.03	-10.1%	\$372.39	20.8%	\$78.41	7.4%
1981	\$372.39	\$16.00	11.3%	4.3%	\$3.10	2.5%	\$358.59	-3.7%	\$69.49	-11.4%
1982	\$358.59	\$17.32	8.3%	4.8%	\$3.23	4.2%	\$405.46	13.1%	\$75.64	8.8%
1983	\$405.46	\$18.94	9.3%	4.7%	\$3.42	5.9%	\$459.47	13.3%	\$83.02	9.8%
1984	\$459.47	\$20.39	7.7%	4.4%	\$3.56	4.0%	\$471.32	2.6%	\$82.24	-0.9%
1985	\$471.32	\$22.27	9.2%	4.7%	\$3.75	5.4%	\$561.09	19.0%	\$94.51	14.9%
1986	\$561.09	\$24.86	11.6%	4.4%	\$4.16	10.9%	\$619.50	10.4%	\$103.61	9.6%
1987	\$619.50	\$27.53	10.7%	4.4%	\$4.41	6.0%	\$634.92	2.5%	\$101.66	-1.9%
1988	\$634.92	\$30.26	9.9%	4.8%	\$4.64	5.3%	\$689.70	8.6%	\$105.82	4.1%
1989	\$689.70	\$32.40	7.1%	4.7%	\$4.76	2.4%	\$822.76	19.3%	\$120.76	14.1%
1990	\$822.76	\$35.79	10.5%	4.3%	\$4.95	4.1%	\$790.53	-3.9%	\$109.35	-9.4%
1991	\$790.53	\$38.38	7.2%	4.9%	\$5.17	4.4%	\$929.30	17.6%	\$125.08	14.4%
1992	\$929.30	\$42.38	10.4%	4.6%	\$5.54	7.3%	\$944.82	1.7%	\$123.63	-1.2%
1993	\$944.82	\$44.41	4.8%	4.7%	\$5.67	2.2%	\$974.53	3.1%	\$124.38	0.6%
Average:			5.2%	4.8%		1.1%		5.7%		1.7%

Notes: Spend 5% of prior three-year average ending market value. Assumes a constant asset allocation of 70% stocks and 30% cash, rebalanced annually.

¹ Market value based on annual spending and weighted average capital market returns.

² January 1, 1946 dollars.

Appendix A-6

SIMULATED ENDOWMENT SPENDING

Calendar Year	Beginning Mkt Value	Nominal Spending	% Change in Nominal Spending	Spending as % of Beg Mkt Value	Real Spending ²	Annual % Chg in Real Spending	Nominal Ending Mkt Value ¹	Annual % Chg in Nom Mkt Value	Real Ending Mkt Value ²	Annual % Chg in Real Mkt Value ²
1946	\$100.00	\$4.48		4.5%	\$3.79		\$91.40		\$77.35	
1947	\$91.40	\$4.64	3.6%	5.1%	\$3.60	-4.9%	\$89.97	-1.6%	\$69.84	-9.7%
1948	\$89.97	\$4.69	1.1%	5.2%	\$3.54	-1.5%	\$88.72	-1.4%	\$67.05	-4.0%
1949	\$88.72	\$4.50	-4.0%	5.1%	\$3.46	-2.2%	\$94.22	6.2%	\$72.53	8.2%
1950	\$94.22	\$4.55	1.0%	4.8%	\$3.31	-4.5%	\$107.06	13.6%	\$77.90	7.4%
1951	\$107.06	\$4.83	6.3%	4.5%	\$3.32	0.4%	\$117.69	9.9%	\$80.88	3.8%
1952	\$117.69	\$5.32	10.0%	4.5%	\$3.62	9.0%	\$125.64	6.8%	\$85.57	5.8%
1953	\$125.64	\$5.84	9.8%	4.6%	\$3.95	9.2%	\$119.94	-4.5%	\$81.17	-5.1%
1954	\$119.94	\$6.05	3.7%	5.0%	\$4.12	4.2%	\$149.17	24.4%	\$101.46	25.0%
1955	\$149.17	\$6.58	8.7%	4.4%	\$4.46	8.3%	\$170.36	14.2%	\$115.46	13.8%
1956	\$170.36	\$7.32	11.3%	4.3%	\$4.83	8.2%	\$171.47	0.7%	\$112.98	-2.1%
1957	\$171.47	\$8.18	11.7%	4.8%	\$5.23	8.5%	\$154.66	-9.8%	\$98.91	-12.4%
1958	\$154.66	\$8.27	1.1%	5.4%	\$5.20	-0.6%	\$184.73	19.4%	\$116.09	17.4%
1959	\$184.73	\$8.51	2.9%	4.6%	\$5.27	1.4%	\$191.36	3.6%	\$118.47	2.1%
1960	\$191.36	\$8.85	3.9%	4.6%	\$5.40	2.4%	\$185.19	-3.2%	\$112.98	-4.6%
1961	\$185.19	\$9.35	5.8%	5.1%	\$5.67	5.0%	\$206.10	11.3%	\$124.90	10.5%
1962	\$206.10	\$9.71	3.8%	4.7%	\$5.81	2.6%	\$188.83	-8.4%	\$113.06	-9.5%
1963	\$188.83	\$9.67	-0.4%	5.1%	\$5.69	-2.1%	\$206.25	9.2%	\$121.47	7.4%
1964	\$206.25	\$10.02	3.6%	4.9%	\$5.83	2.4%	\$219.00	6.2%	\$127.45	4.9%
1965	\$219.00	\$10.23	2.1%	4.7%	\$5.84	0.2%	\$228.11	4.2%	\$130.22	2.2%
1966	\$228.11	\$10.89	6.4%	4.8%	\$6.02	2.9%	\$207.64	-9.0%	\$114.70	-11.9%
1967	\$207.64	\$10.91	0.2%	5.3%	\$5.85	-2.7%	\$229.36	10.5%	\$122.96	7.2%
1968	\$229.36	\$11.09	1.6%	4.8%	\$5.67	-3.0%	\$238.14	3.8%	\$121.91	-0.8%
1969	\$238.14	\$11.25	1.5%	4.7%	\$5.43	-4.3%	\$220.75	-7.3%	\$106.51	-12.6%
1970	\$220.75	\$11.47	1.9%	5.2%	\$5.25	-3.4%	\$221.35	0.3%	\$101.24	-5.0%

Notes: Spend 5% of prior three-year average ending market value. Assumes a constant asset allocation of 60% stocks and 40% cash, rebalanced annually.

¹ Market value based on annual spending and weighted average capital market returns.

² January 1, 1946 dollars.

Appendix A-6 (continued)

SIMULATED ENDOWMENT SPENDING

Calendar Year	Beginning Mkt Value	Nominal Spending	% Change in Nominal Spending	Spending as % of Beg Mkt Value	Real Spending ²	Annual % Chg in Real Spending	Nominal Ending ¹ Mkt Value	Annual % Chg in Nom Mkt Value	Real Ending ² Mkt Value	Annual % Chg in Real ² Mkt Value
1971	\$221.35	\$11.34	-1.2%	5.1%	\$5.02	-4.4%	\$232.91	5.2%	\$103.07	1.8%
1972	\$232.91	\$11.25	-0.8%	4.8%	\$4.81	-4.0%	\$250.92	7.7%	\$107.37	4.2%
1973	\$250.92	\$11.75	4.5%	4.7%	\$4.62	-4.0%	\$223.47	-10.9%	\$87.89	-18.1%
1974	\$223.47	\$11.79	0.3%	5.3%	\$4.13	-10.6%	\$182.96	-18.1%	\$64.13	-27.0%
1975	\$182.96	\$10.96	-7.1%	6.0%	\$3.59	-13.2%	\$216.94	18.6%	\$71.06	10.8%
1976	\$216.94	\$10.39	-5.2%	4.8%	\$3.25	-9.5%	\$240.97	11.1%	\$75.31	6.0%
1977	\$240.97	\$10.68	2.8%	4.4%	\$3.13	-3.7%	\$224.42	-6.9%	\$65.69	-12.8%
1978	\$224.42	\$11.37	6.5%	5.1%	\$3.05	-2.3%	\$228.34	1.7%	\$61.30	-6.7%
1979	\$228.34	\$11.56	1.7%	5.1%	\$2.74	-10.3%	\$250.41	9.7%	\$59.31	-3.3%
1980	\$250.41	\$11.72	1.4%	4.7%	\$2.47	-9.9%	\$297.29	18.7%	\$62.60	5.6%
1981	\$297.29	\$12.93	10.4%	4.4%	\$2.51	1.6%	\$291.67	-1.9%	\$56.52	-9.7%
1982	\$291.67	\$13.99	8.2%	4.8%	\$2.61	4.1%	\$327.17	12.2%	\$61.03	8.0%
1983	\$327.17	\$15.27	9.1%	4.7%	\$2.76	5.7%	\$366.14	11.9%	\$66.15	8.4%
1984	\$366.14	\$16.42	7.5%	4.5%	\$2.86	3.8%	\$376.76	2.9%	\$65.74	-0.6%
1985	\$376.76	\$17.83	8.6%	4.7%	\$3.00	4.9%	\$439.50	16.7%	\$74.03	12.6%
1986	\$439.50	\$19.71	10.5%	4.5%	\$3.30	9.7%	\$479.55	9.1%	\$80.20	8.3%
1987	\$479.55	\$21.60	9.6%	4.5%	\$3.46	4.9%	\$492.02	2.6%	\$78.78	-1.8%
1988	\$492.02	\$23.52	8.9%	4.8%	\$3.61	4.3%	\$529.53	7.6%	\$81.24	3.1%
1989	\$529.53	\$25.02	6.4%	4.7%	\$3.67	1.8%	\$619.08	16.9%	\$90.87	11.8%
1990	\$619.08	\$27.34	9.3%	4.4%	\$3.78	3.0%	\$601.47	-2.8%	\$83.20	-8.4%
1991	\$601.47	\$29.17	6.7%	4.8%	\$3.93	3.8%	\$692.14	15.1%	\$93.16	12.0%
1992	\$692.14	\$31.88	9.3%	4.6%	\$4.17	6.2%	\$700.76	1.2%	\$91.69	-1.6%
1993	\$700.76	\$33.24	4.3%	4.7%	\$4.24	1.7%	\$717.65	2.4%	\$91.59	-0.1%
Average:			4.5%	4.8%		0.4%		4.9%		0.9%

Notes: Spend 5% of prior three-year average ending market value. Assumes a constant asset allocation of 60% stocks and 40% cash, rebalanced annually.

¹ Market value based on annual spending and weighted average capital market returns.

² January 1, 1946 dollars.

Appendix A-7

SIMULATED ENDOWMENT SPENDING

Calendar Year	Beginning Mkt Value	Nominal Spending	% Change in Nominal Spending	Spending as % of Beg Mkt Value	Real Spending ²	Annual % Chg in Real Spending	Nominal Ending Mkt Value ¹	Annual % Chg in Nom Mkt Value	Real Ending Mkt Value ²	Annual % Chg in Real Mkt Value ²
1946	\$100.00	\$4.37		4.4%	\$3.70		\$90.64		\$76.70	
1947	\$90.64	\$4.42	1.2%	4.9%	\$3.43	-7.1%	\$89.86	-0.9%	\$69.75	-9.7%
1948	\$89.86	\$4.45	0.5%	4.9%	\$3.36	-2.1%	\$89.24	-0.7%	\$67.45	-4.0%
1949	\$89.24	\$4.50	1.1%	5.0%	\$3.46	3.0%	\$96.34	8.0%	\$74.16	8.2%
1950	\$96.34	\$4.59	2.1%	4.8%	\$3.34	-3.5%	\$112.50	16.8%	\$81.85	7.4%
1951	\$112.50	\$4.97	8.2%	4.4%	\$3.41	2.2%	\$126.31	12.3%	\$86.80	3.8%
1952	\$126.31	\$5.59	12.4%	4.4%	\$3.80	11.4%	\$137.06	8.5%	\$93.34	5.8%
1953	\$137.06	\$6.26	12.1%	4.6%	\$4.24	11.4%	\$130.53	-4.8%	\$88.34	-5.1%
1954	\$130.53	\$6.57	4.8%	5.0%	\$4.47	5.3%	\$169.29	29.7%	\$115.14	25.0%
1955	\$169.29	\$7.28	10.9%	4.3%	\$4.93	10.5%	\$198.66	17.4%	\$134.64	13.8%
1956	\$198.66	\$8.31	14.1%	4.2%	\$5.47	10.9%	\$200.99	1.2%	\$132.42	-2.1%
1957	\$200.99	\$9.48	14.1%	4.7%	\$6.06	10.8%	\$178.65	-11.1%	\$114.25	-12.4%
1958	\$178.65	\$9.64	1.6%	5.4%	\$6.06	-0.1%	\$220.87	23.6%	\$138.80	17.4%
1959	\$220.87	\$10.01	3.8%	4.5%	\$6.20	2.3%	\$230.94	4.6%	\$142.97	2.1%
1960	\$230.94	\$10.51	5.0%	4.5%	\$6.41	3.5%	\$223.04	-3.4%	\$136.07	-4.6%
1961	\$223.04	\$11.25	7.0%	5.0%	\$6.82	6.3%	\$253.79	13.8%	\$153.80	10.5%
1962	\$253.79	\$11.80	4.9%	4.6%	\$7.06	3.6%	\$229.52	-9.6%	\$137.42	-9.5%
1963	\$229.52	\$11.80	0.0%	5.1%	\$6.95	-1.6%	\$255.16	11.2%	\$150.28	7.4%
1964	\$255.16	\$12.31	4.3%	4.8%	\$7.16	3.1%	\$274.34	7.5%	\$159.65	4.9%
1965	\$274.34	\$12.65	2.8%	4.6%	\$7.22	0.8%	\$288.21	5.1%	\$164.53	2.2%
1966	\$288.21	\$13.63	7.7%	4.7%	\$7.53	4.2%	\$258.28	-10.4%	\$142.67	-11.9%
1967	\$258.28	\$13.68	0.4%	5.3%	\$7.33	-2.6%	\$290.31	12.4%	\$155.63	7.2%
1968	\$290.31	\$13.95	1.9%	4.8%	\$7.14	-2.6%	\$303.10	4.4%	\$155.17	-0.8%
1969	\$303.10	\$14.19	1.8%	4.7%	\$6.85	-4.1%	\$276.71	-8.7%	\$133.51	-12.6%
1970	\$276.71	\$14.50	2.2%	5.2%	\$6.63	-3.2%	\$276.19	-0.2%	\$126.32	-5.0%

Notes: Spend 5% of prior three-year average ending market value with a moving nominal floor. Assumes a constant asset allocation of 70% stocks and 30% cash, rebalanced annually

¹ Market value based on annual spending and weighted average capital market returns.

² January 1, 1946 dollars.

Appendix A-7 (continued)

SIMULATED ENDOWMENT SPENDING

Calendar Year	Beginning Mkt Value	Nominal Spending	% Change in Nominal Spending	Spending as % of Beg Mkt Value	Real Spending ²	Annual % Chg in Real Spending	Nominal Ending Mkt Value ¹	Annual % Chg in Nom Mkt Value	Real Ending Mkt Value ²	Annual % Chg in Real Mkt Value ²
1971	\$276.19	\$14.50	0.0%	5.3%	\$6.42	-3.2%	\$293.05	6.1%	\$129.68	1.8%
1972	\$293.05	\$14.50	0.0%	4.9%	\$6.21	-3.3%	\$319.66	9.1%	\$136.79	4.2%
1973	\$319.66	\$14.82	2.2%	4.6%	\$5.83	-6.1%	\$278.15	-13.0%	\$109.40	-18.1%
1974	\$278.15	\$14.85	0.2%	5.3%	\$5.20	-10.7%	\$218.30	-21.5%	\$76.52	-27.0%
1975	\$218.30	\$14.85	0.0%	6.8%	\$4.86	-6.6%	\$263.81	20.8%	\$86.41	10.8%
1976	\$263.81	\$14.85	0.0%	5.6%	\$4.64	-4.6%	\$295.66	12.1%	\$92.40	6.0%
1977	\$295.66	\$14.85	0.0%	5.0%	\$4.35	-6.3%	\$269.94	-8.7%	\$79.01	-12.8%
1978	\$269.94	\$14.85	0.0%	5.5%	\$3.99	-8.3%	\$273.16	1.2%	\$73.34	-6.7%
1979	\$273.16	\$14.85	0.0%	5.4%	\$3.52	-11.8%	\$300.72	10.1%	\$71.22	-3.3%
1980	\$300.72	\$14.85	0.0%	4.9%	\$3.13	-11.1%	\$362.20	20.4%	\$76.27	5.6%
1981	\$362.20	\$15.60	5.1%	4.3%	\$3.02	-3.3%	\$348.74	-3.7%	\$67.58	-9.7%
1982	\$348.74	\$16.86	8.1%	4.8%	\$3.15	4.0%	\$394.31	13.1%	\$73.56	8.0%
1983	\$394.31	\$18.42	9.3%	4.7%	\$3.33	5.8%	\$446.83	13.3%	\$80.73	8.4%
1984	\$446.83	\$19.83	7.7%	4.4%	\$3.46	4.0%	\$458.35	2.6%	\$79.97	-0.6%
1985	\$458.35	\$21.66	9.2%	4.7%	\$3.65	5.4%	\$545.65	19.0%	\$91.91	12.6%
1986	\$545.65	\$24.18	11.6%	4.4%	\$4.04	10.9%	\$602.45	10.4%	\$100.76	8.3%
1987	\$602.45	\$26.77	10.7%	4.4%	\$4.29	6.0%	\$617.45	2.5%	\$98.87	-1.8%
1988	\$617.45	\$29.43	9.9%	4.8%	\$4.51	5.3%	\$670.72	8.6%	\$102.91	3.1%
1989	\$670.72	\$31.51	7.1%	4.7%	\$4.62	2.4%	\$800.12	19.3%	\$117.44	11.8%
1990	\$800.12	\$34.80	10.5%	4.3%	\$4.81	4.1%	\$768.78	-3.9%	\$106.34	-8.4%
1991	\$768.78	\$37.33	7.2%	4.9%	\$5.02	4.4%	\$903.72	17.6%	\$121.64	12.0%
1992	\$903.72	\$41.21	10.4%	4.6%	\$5.39	7.3%	\$918.83	1.7%	\$120.23	-1.6%
1993	\$918.83	\$43.19	4.8%	4.7%	\$5.51	2.2%	\$947.71	3.1%	\$120.96	-0.1%
Average:			5.1%	4.8%		1.0%		5.7%		0.9%

Notes: Spend 5% of prior three-year average ending market value with a moving nominal floor. Assumes a constant asset allocation of 70% stocks and 30% cash, rebalanced annually.

¹ Market value based on annual spending and weighted average capital market returns.

² January 1, 1946 dollars.

Appendix A-8

SIMULATED ENDOWMENT SPENDING

Calendar Year	Beginning Mkt Value	Nominal Spending	% Change in Nominal Spending	Spending as % of Beg Mkt Value	Real Spending ²	Annual % Chg in Real Spending	Nominal Ending Mkt Value ¹	Annual % Chg in Nom Mkt Value	Real Ending Mkt Value ²	Annual % Chg in Real Mkt Value ²
1946	\$100.00	\$5.14		5.1%	\$4.35		\$90.29		\$76.40	
1947	\$90.29	\$5.61	9.0%	6.2%	\$4.35	0.0%	\$88.49	-2.0%	\$68.69	-10.1%
1948	\$88.49	\$5.76	2.7%	6.5%	\$4.35	0.0%	\$86.52	-2.2%	\$65.39	-4.8%
1949	\$86.52	\$5.66	-1.8%	6.5%	\$4.35	0.0%	\$91.94	6.3%	\$70.77	8.2%
1950	\$91.94	\$5.98	5.8%	6.5%	\$4.35	0.0%	\$105.82	15.1%	\$76.99	8.8%
1951	\$105.82	\$6.33	5.9%	6.0%	\$4.35	0.0%	\$117.14	10.7%	\$80.50	4.6%
1952	\$117.14	\$6.39	0.9%	5.5%	\$4.35	0.0%	\$125.87	7.5%	\$85.73	6.5%
1953	\$125.87	\$6.43	0.6%	5.1%	\$4.35	0.0%	\$119.20	-5.3%	\$80.67	-5.9%
1954	\$119.20	\$6.40	-0.5%	5.4%	\$4.35	0.0%	\$154.10	29.3%	\$104.81	29.9%
1955	\$154.10	\$6.90	7.8%	4.5%	\$4.67	7.4%	\$180.57	17.2%	\$122.38	16.8%
1956	\$180.57	\$8.05	16.7%	4.5%	\$5.30	13.4%	\$182.28	0.9%	\$120.10	-1.9%
1957	\$182.28	\$8.89	10.4%	4.9%	\$5.68	7.2%	\$161.82	-11.2%	\$103.49	-13.8%
1958	\$161.82	\$9.12	2.6%	5.6%	\$5.73	0.9%	\$199.64	23.4%	\$125.46	21.2%
1959	\$199.64	\$9.35	2.5%	4.7%	\$5.79	1.0%	\$208.48	4.4%	\$129.07	2.9%
1960	\$208.48	\$9.69	3.6%	4.6%	\$5.91	2.1%	\$201.21	-3.5%	\$122.76	-4.9%
1961	\$201.21	\$10.30	6.3%	5.1%	\$6.24	5.6%	\$228.82	13.7%	\$138.67	13.0%
1962	\$228.82	\$10.72	4.1%	4.7%	\$6.42	2.8%	\$206.87	-9.6%	\$123.86	-10.7%
1963	\$206.87	\$10.97	2.3%	5.3%	\$6.46	0.7%	\$229.71	11.0%	\$135.29	9.2%
1964	\$229.71	\$11.30	2.9%	4.9%	\$6.57	1.7%	\$246.82	7.5%	\$143.63	6.2%
1965	\$246.82	\$11.81	4.6%	4.8%	\$6.74	2.6%	\$258.95	4.9%	\$147.83	2.9%
1966	\$258.95	\$12.55	6.3%	4.8%	\$6.93	2.8%	\$231.89	-10.4%	\$128.09	-13.4%
1967	\$231.89	\$12.93	3.0%	5.6%	\$6.93	0.0%	\$260.16	12.2%	\$139.47	8.9%
1968	\$260.16	\$13.54	4.7%	5.2%	\$6.93	0.0%	\$270.78	4.1%	\$138.62	-0.6%
1969	\$270.78	\$14.37	6.1%	5.3%	\$6.93	0.0%	\$245.84	-9.2%	\$118.62	-14.4%
1970	\$245.84	\$15.16	5.5%	6.2%	\$6.93	0.0%	\$243.23	-1.1%	\$111.25	-6.2%

Notes: Spend 5% of prior three-year average ending market value with a moving real floor. Assumes a constant asset allocation of 70% stocks and 30% cash, rebalanced annually.

¹ Market value based on annual spending and weighted average capital market returns.

² January 1, 1946 dollars.

Appendix A-8 (continued)

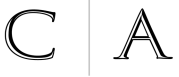
SIMULATED ENDOWMENT SPENDING

Calendar Year	Beginning Mkt Value	Nominal Spending	% Change in Nominal Spending	Spending as % of Beg Mkt Value	Real Spending ²	Annual % Chg in Real Spending	Nominal Ending Mkt Value ¹	Annual % Chg in Nom Mkt Value	Real Ending Mkt Value ²	Annual % Chg in Real Mkt Value ²
1971	\$243.23	\$15.67	3.4%	6.4%	\$6.93	0.0%	\$255.30	5.0%	\$112.97	1.6%
1972	\$255.30	\$16.20	3.4%	6.3%	\$6.93	0.0%	\$274.93	7.7%	\$117.64	4.1%
1973	\$274.93	\$17.63	8.8%	6.4%	\$6.93	0.0%	\$235.05	-14.5%	\$92.45	-21.4%
1974	\$235.05	\$19.78	12.2%	8.4%	\$6.93	0.0%	\$178.30	-24.1%	\$62.50	-32.4%
1975	\$178.30	\$21.16	7.0%	11.9%	\$6.93	0.0%	\$206.65	15.9%	\$67.69	8.3%
1976	\$206.65	\$22.18	4.8%	10.7%	\$6.93	0.0%	\$221.13	7.0%	\$69.11	2.1%
1977	\$221.13	\$23.68	6.8%	10.7%	\$6.93	0.0%	\$189.77	-14.2%	\$55.55	-19.6%
1978	\$189.77	\$25.82	9.0%	13.6%	\$6.93	0.0%	\$177.07	-6.7%	\$47.54	-14.4%
1979	\$177.07	\$29.27	13.4%	16.5%	\$6.93	0.0%	\$175.80	-0.7%	\$41.64	-12.4%
1980	\$175.80	\$32.92	12.5%	18.7%	\$6.93	0.0%	\$185.72	5.6%	\$39.11	-6.1%
1981	\$185.72	\$35.77	8.7%	19.3%	\$6.93	0.0%	\$151.67	-18.3%	\$29.39	-24.8%
1982	\$151.67	\$37.16	3.9%	24.5%	\$6.93	0.0%	\$137.58	-9.3%	\$25.67	-12.7%
1983	\$137.58	\$38.37	3.3%	27.9%	\$6.93	0.0%	\$123.48	-10.3%	\$22.31	-13.1%
1984	\$123.48	\$39.73	3.5%	32.2%	\$6.93	0.0%	\$91.24	-26.1%	\$15.92	-28.6%
1985	\$91.24	\$41.16	3.6%	45.1%	\$6.93	0.0%	\$68.80	-24.6%	\$11.59	-27.2%
1986	\$68.80	\$41.45	0.7%	60.2%	\$6.93	0.0%	\$37.05	-46.2%	\$6.20	-46.5%
1987	\$37.05	\$37.05	-10.6%	100.0%	---	---	\$0.00	-100.0%	\$0.00	-100.0%
1988	---	---	---	---	---	---	---	---	---	---
1989	---	---	---	---	---	---	---	---	---	---
1990	---	---	---	---	---	---	---	---	---	---
1991	---	---	---	---	---	---	---	---	---	---
1992	---	---	---	---	---	---	---	---	---	---
1993	---	---	---	---	---	---	---	---	---	---
Average:			5.0%	13.2%		1.2%		-3.4%		-7.1%

Notes: Spend 5% of prior three-year average ending market value with a moving real floor. Assumes a constant asset allocation of 70% stocks and 30% cash, rebalanced annually.

¹ Market value based on annual spending and weighted average capital market returns.

² January 1, 1946 dollars.



APPENDIX B
Projected Spending and Market Values

Appendix B-I

PROJECTED SPENDING AND MARKET VALUES
(Scenario #1)

Calendar Year	Beginning Mkt Value	Nominal Spending	% Change in Nominal Spending	Spending as % of Beg Mkt Value	Real Spending ¹	Annual % Chg in Real Spending	Nominal Ending Mkt Value	Annual % Chg in Nom Mkt Value	Real Ending Mkt Value ¹	Annual % Chg in Real Mkt Value
100% Stocks / 0% Bonds										
1994	\$100.00	\$4.81		4.8%	\$4.65		\$105.31		\$101.75	
1995	\$105.31	\$5.01	4.2%	4.8%	\$4.68	0.7%	\$110.95	5.4%	\$103.57	1.8%
1996	\$110.95	\$5.27	5.1%	4.8%	\$4.75	1.6%	\$116.91	5.4%	\$105.44	1.8%
1997	\$116.91	\$5.55	5.3%	4.7%	\$4.84	1.8%	\$123.19	5.4%	\$107.35	1.8%
1998	\$123.19	\$5.85	5.4%	4.7%	\$4.93	1.8%	\$129.80	5.4%	\$109.29	1.8%
1999	\$129.80	\$6.16	5.4%	4.7%	\$5.02	1.8%	\$136.77	5.4%	\$111.27	1.8%
2000	\$136.77	\$6.50	5.4%	4.7%	\$5.11	1.8%	\$144.12	5.4%	\$113.28	1.8%
2001	\$144.12	\$6.84	5.4%	4.7%	\$5.20	1.8%	\$151.86	5.4%	\$115.32	1.8%
2002	\$151.86	\$7.21	5.4%	4.7%	\$5.29	1.8%	\$160.02	5.4%	\$117.41	1.8%
2003	\$160.02	\$7.60	5.4%	4.7%	\$5.39	1.8%	\$168.61	5.4%	\$119.53	1.8%
Average:			5.2%	4.8%		1.7%		5.4%		1.8%
60% Stocks / 40% Bonds										
1994	\$100.00	\$4.82		4.8%	\$4.65		\$104.10		\$100.58	
1995	\$104.10	\$4.99	3.7%	4.8%	\$4.66	0.2%	\$108.38	4.1%	\$101.17	0.6%
1996	\$108.38	\$5.21	4.3%	4.8%	\$4.70	0.7%	\$112.83	4.1%	\$101.76	0.6%
1997	\$112.83	\$5.42	4.1%	4.8%	\$4.72	0.6%	\$117.46	4.1%	\$102.36	0.6%
1998	\$117.46	\$5.64	4.1%	4.8%	\$4.75	0.6%	\$122.29	4.1%	\$102.96	0.6%
1999	\$122.29	\$5.88	4.1%	4.8%	\$4.78	0.6%	\$127.31	4.1%	\$103.56	0.6%
2000	\$127.31	\$6.12	4.1%	4.8%	\$4.81	0.6%	\$132.53	4.1%	\$104.17	0.6%
2001	\$132.53	\$6.37	4.1%	4.8%	\$4.84	0.6%	\$137.98	4.1%	\$104.78	0.6%
2002	\$137.98	\$6.63	4.1%	4.8%	\$4.86	0.6%	\$143.64	4.1%	\$105.40	0.6%
2003	\$143.64	\$6.90	4.1%	4.8%	\$4.89	0.6%	\$149.54	4.1%	\$106.01	0.6%
Average:			4.1%	4.8%		0.6%		4.1%		0.6%
60% Stocks / 30% Bonds / 10% Cash										
1994	\$100.00	\$4.84		4.8%	\$4.68		\$103.79		\$100.28	
1995	\$103.79	\$5.00	3.3%	4.8%	\$4.67	-0.2%	\$107.76	3.8%	\$100.59	0.3%
1996	\$107.76	\$5.19	3.9%	4.8%	\$4.68	0.4%	\$111.87	3.8%	\$100.90	0.3%
1997	\$111.87	\$5.39	3.8%	4.8%	\$4.70	0.3%	\$116.14	3.8%	\$101.21	0.3%
1998	\$116.14	\$5.60	3.8%	4.8%	\$4.71	0.3%	\$120.57	3.8%	\$101.52	0.3%
1999	\$120.57	\$5.81	3.8%	4.8%	\$4.73	0.3%	\$125.17	3.8%	\$101.83	0.3%
2000	\$125.17	\$6.03	3.8%	4.8%	\$4.74	0.3%	\$129.95	3.8%	\$102.14	0.3%
2001	\$129.95	\$6.26	3.8%	4.8%	\$4.76	0.3%	\$134.91	3.8%	\$102.45	0.3%
2002	\$134.91	\$6.50	3.8%	4.8%	\$4.77	0.3%	\$140.06	3.8%	\$102.77	0.3%
2003	\$140.06	\$6.75	3.8%	4.8%	\$4.78	0.3%	\$145.41	3.8%	\$103.08	0.3%
Average:			3.8%	4.8%		0.3%		3.8%		0.3%

Notes: Projections assume a constant allocation of stocks, bonds, and cash. Spend 5% of prior three-year average ending market value. Ten-year average annual nominal return assumptions: stocks, 10.30% (long-term average); bonds, 7.25% (current yield); CPI, 3.50%; cash, 4.50%.

¹ January 1, 1994 dollars.

Appendix B-2

PROJECTED SPENDING AND MARKET VALUES
(Scenario #2)

Calendar Year	Beginning Mkt Value	Nominal Spending	% Change in Nominal Spending	Spending as % of Beg Mkt Value	Real Spending ¹	Annual % Chg in Real Spending	Nominal Ending Mkt Value	Annual % Chg in Nom Mkt Value	Real Ending Mkt Value ¹	Annual % Chg in Real Mkt Value
100% Stocks / 0% Bonds										
1994	\$100.00	\$4.81		4.8%	\$4.63		\$100.99		\$97.11	
1995	\$100.99	\$4.94	2.7%	4.9%	\$4.57	-1.3%	\$101.91	0.9%	\$94.22	-3.0%
1996	\$101.91	\$5.05	2.2%	5.0%	\$4.49	-1.8%	\$102.77	0.8%	\$91.36	-3.0%
1997	\$102.77	\$5.09	0.9%	5.0%	\$4.35	-3.0%	\$103.63	0.8%	\$88.58	-3.0%
1998	\$103.63	\$5.14	0.9%	5.0%	\$4.22	-3.0%	\$104.50	0.8%	\$85.89	-3.0%
1999	\$104.50	\$5.18	0.8%	5.0%	\$4.10	-3.0%	\$105.38	0.8%	\$83.28	-3.0%
2000	\$105.38	\$5.23	0.8%	5.0%	\$3.97	-3.0%	\$106.26	0.8%	\$80.75	-3.0%
2001	\$106.26	\$5.27	0.8%	5.0%	\$3.85	-3.0%	\$107.15	0.8%	\$78.30	-3.0%
2002	\$107.15	\$5.31	0.8%	5.0%	\$3.73	-3.0%	\$108.05	0.8%	\$75.92	-3.0%
2003	\$108.05	\$5.36	0.8%	5.0%	\$3.62	-3.0%	\$108.96	0.8%	\$73.61	-3.0%
Average:			1.2%	4.9%		-2.7%		0.8%		-3.0%
60% Stocks / 40% Bonds										
1994	\$100.00	\$4.82		4.8%	\$4.63		\$101.41		\$97.51	
1995	\$101.41	\$4.95	2.8%	4.9%	\$4.58	-1.2%	\$102.78	1.3%	\$95.03	-2.6%
1996	\$102.78	\$5.07	2.4%	4.9%	\$4.51	-1.5%	\$104.11	1.3%	\$92.55	-2.6%
1997	\$104.11	\$5.14	1.4%	4.9%	\$4.39	-2.5%	\$105.46	1.3%	\$90.14	-2.6%
1998	\$105.46	\$5.21	1.3%	4.9%	\$4.28	-2.6%	\$106.82	1.3%	\$87.80	-2.6%
1999	\$106.82	\$5.27	1.3%	4.9%	\$4.17	-2.6%	\$108.19	1.3%	\$85.51	-2.6%
2000	\$108.19	\$5.34	1.3%	4.9%	\$4.06	-2.6%	\$109.59	1.3%	\$83.28	-2.6%
2001	\$109.59	\$5.41	1.3%	4.9%	\$3.95	-2.6%	\$111.00	1.3%	\$81.11	-2.6%
2002	\$111.00	\$5.48	1.3%	4.9%	\$3.85	-2.6%	\$112.44	1.3%	\$79.00	-2.6%
2003	\$112.44	\$5.55	1.3%	4.9%	\$3.75	-2.6%	\$113.89	1.3%	\$76.94	-2.6%
Average:			1.6%	4.9%		-2.3%		1.3%		-2.6%
60% Stocks / 30% Bonds / 10% Cash										
1994	\$100.00	\$4.84		4.8%	\$4.65		\$101.19		\$97.30	
1995	\$101.19	\$4.96	2.4%	4.9%	\$4.58	-1.6%	\$102.34	1.1%	\$94.62	-2.8%
1996	\$102.34	\$5.06	2.1%	4.9%	\$4.50	-1.9%	\$103.45	1.1%	\$91.97	-2.8%
1997	\$103.45	\$5.12	1.1%	4.9%	\$4.37	-2.8%	\$104.57	1.1%	\$89.39	-2.8%
1998	\$104.57	\$5.17	1.1%	4.9%	\$4.25	-2.8%	\$105.71	1.1%	\$86.88	-2.8%
1999	\$105.71	\$5.23	1.1%	4.9%	\$4.13	-2.8%	\$106.85	1.1%	\$84.45	-2.8%
2000	\$106.85	\$5.29	1.1%	4.9%	\$4.02	-2.8%	\$108.01	1.1%	\$82.08	-2.8%
2001	\$108.01	\$5.34	1.1%	4.9%	\$3.90	-2.8%	\$109.18	1.1%	\$79.78	-2.8%
2002	\$109.18	\$5.40	1.1%	4.9%	\$3.79	-2.8%	\$110.36	1.1%	\$77.54	-2.8%
2003	\$110.36	\$5.46	1.1%	4.9%	\$3.69	-2.8%	\$111.56	1.1%	\$75.36	-2.8%
Average:			1.3%	4.9%		-2.6%		1.1%		-2.8%

Notes: Projections assume a constant allocation of stocks, bonds, and cash. Spend 5% of prior three-year average ending market value. Ten-year average annual nominal return assumptions: stocks, 5.91% (regression to long-term mean); bonds, 7.00%; CPI, 4.00%; cash, 5.00%.

¹ January 1, 1994 dollars.

Appendix B-3

PROJECTED SPENDING AND MARKET VALUES
(Scenario #3)

Calendar Year	Beginning Mkt Value	Nominal Spending	% Change in Nominal Spending	Spending as % of Beg Mkt Value	Real ¹ Spending	Annual % Chg in Real Spending	Nominal Ending Mkt Value	Annual % Chg in Nom Mkt Value	Real Ending Mkt Value ¹	Annual % Chg in Real Mkt Value
100% Stocks / 0% Bonds										
1994	\$100.00	\$4.81		4.8%	\$4.63		\$98.46		\$94.68	
1995	\$98.46	\$4.90	1.8%	5.0%	\$4.53	-2.1%	\$96.79	-1.7%	\$89.48	-5.5%
1996	\$96.79	\$4.92	0.4%	5.1%	\$4.37	-3.4%	\$95.03	-1.8%	\$84.48	-5.6%
1997	\$95.03	\$4.84	-1.7%	5.1%	\$4.14	-5.5%	\$93.30	-1.8%	\$79.76	-5.6%
1998	\$93.30	\$4.75	-1.8%	5.1%	\$3.91	-5.6%	\$91.60	-1.8%	\$75.29	-5.6%
1999	\$91.60	\$4.67	-1.8%	5.1%	\$3.69	-5.6%	\$89.93	-1.8%	\$71.08	-5.6%
2000	\$89.93	\$4.58	-1.8%	5.1%	\$3.48	-5.6%	\$88.29	-1.8%	\$67.10	-5.6%
2001	\$88.29	\$4.50	-1.8%	5.1%	\$3.29	-5.6%	\$86.69	-1.8%	\$63.34	-5.6%
2002	\$86.69	\$4.42	-1.8%	5.1%	\$3.10	-5.6%	\$85.11	-1.8%	\$59.79	-5.6%
2003	\$85.11	\$4.33	-1.8%	5.1%	\$2.93	-5.6%	\$83.56	-1.8%	\$56.45	-5.6%
Average:			-1.1%	5.1%		-4.9%		-1.8%		-5.6%
60% Stocks / 40% Bonds										
1994	\$100.00	\$4.82		4.8%	\$4.63		\$99.11		\$95.30	
1995	\$99.11	\$4.91	2.0%	5.0%	\$4.54	-1.9%	\$98.09	-1.0%	\$90.69	-4.8%
1996	\$98.09	\$4.95	0.9%	5.0%	\$4.40	-3.0%	\$96.98	-1.1%	\$86.22	-4.9%
1997	\$96.98	\$4.90	-1.0%	5.1%	\$4.19	-4.8%	\$95.89	-1.1%	\$81.96	-4.9%
1998	\$95.89	\$4.85	-1.1%	5.1%	\$3.99	-4.9%	\$94.80	-1.1%	\$77.92	-4.9%
1999	\$94.80	\$4.79	-1.1%	5.1%	\$3.79	-4.9%	\$93.72	-1.1%	\$74.07	-4.9%
2000	\$93.72	\$4.74	-1.1%	5.1%	\$3.60	-4.9%	\$92.66	-1.1%	\$70.41	-4.9%
2001	\$92.66	\$4.69	-1.1%	5.1%	\$3.42	-4.9%	\$91.61	-1.1%	\$66.94	-4.9%
2002	\$91.61	\$4.63	-1.1%	5.1%	\$3.26	-4.9%	\$90.57	-1.1%	\$63.63	-4.9%
2003	\$90.57	\$4.58	-1.1%	5.1%	\$3.09	-4.9%	\$89.54	-1.1%	\$60.49	-4.9%
Average:			-0.5%	5.0%		-4.4%		-1.1%		-4.9%
60% Stocks / 30% Bonds / 10% Cash										
1994	\$100.00	\$4.84		4.8%	\$4.65		\$99.09		\$95.27	
1995	\$99.09	\$4.92	1.7%	5.0%	\$4.55	-2.3%	\$98.05	-1.0%	\$90.66	-4.8%
1996	\$98.05	\$4.95	0.6%	5.1%	\$4.40	-3.2%	\$96.95	-1.1%	\$86.19	-4.9%
1997	\$96.95	\$4.90	-1.0%	5.1%	\$4.19	-4.8%	\$95.85	-1.1%	\$81.93	-4.9%
1998	\$95.85	\$4.85	-1.1%	5.1%	\$3.98	-4.9%	\$94.76	-1.1%	\$77.89	-4.9%
1999	\$94.76	\$4.79	-1.1%	5.1%	\$3.79	-4.9%	\$93.69	-1.1%	\$74.04	-4.9%
2000	\$93.69	\$4.74	-1.1%	5.1%	\$3.60	-4.9%	\$92.62	-1.1%	\$70.39	-4.9%
2001	\$92.62	\$4.68	-1.1%	5.1%	\$3.42	-4.9%	\$91.57	-1.1%	\$66.91	-4.9%
2002	\$91.57	\$4.63	-1.1%	5.1%	\$3.25	-4.9%	\$90.53	-1.1%	\$63.61	-4.9%
2003	\$90.53	\$4.58	-1.1%	5.1%	\$3.09	-4.9%	\$89.51	-1.1%	\$60.47	-4.9%
Average:			-0.6%	5.0%		-4.4%		-1.1%		-4.9%

Notes: Projections assume a constant allocation of stocks, bonds, and cash. Spend 5% of prior three-year average ending market value. Ten-year average annual nominal return assumptions: stocks, 3.33% (based on current valuations); bonds, 5.00%; CPI, 4.00%; cash, 5.00%.

¹ January 1, 1994 dollars.

APPENDIX C
Projected Returns: Monte Carlo Simulations

Appendix C

PROJECTED RETURNS: MONTE CARLO SIMULATIONS

Quarter	Forecasted Returns (%)									
	<u>1</u>	<u>2*</u>	<u>3</u>	<u>4*</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8*</u>	<u>9</u>	<u>10</u>
1	3.69	7.63	4.12	-1.02	-4.09	5.00	-4.18	3.88	-4.10	-2.21
2	5.35	-1.11	1.85	1.85	5.39	7.08	4.09	-7.77	-4.89	5.52
3	-9.16	6.34	5.32	4.03	8.33	-8.93	-4.05	0.47	3.66	7.08
4	4.75	-0.48	5.11	-2.34	6.35	5.36	-5.14	6.93	7.32	-0.35
5	6.58	5.36	-5.99	0.93	-5.28	7.39	6.66	6.29	-3.99	3.95
6	-1.04	6.28	4.10	-0.18	4.17	7.23	6.15	5.54	0.41	3.66
7	-7.76	7.69	-5.29	0.33	-7.57	0.23	-0.57	-4.13	0.22	-0.20
8	-2.15	3.10	6.35	2.66	5.05	5.64	4.35	7.08	2.52	4.19
9	7.12	-2.60	8.50	-2.10	7.08	2.97	7.53	-6.97	-2.81	-4.24
10	-2.16	-1.01	-4.05	-9.18	-9.06	-2.89	6.26	8.08	7.10	7.48
11	8.08	0.16	8.36	2.59	4.37	3.67	1.09	-6.21	8.46	1.98
12	-1.99	2.06	5.08	-0.19	8.47	-9.05	3.85	-2.76	7.18	-2.78
13	0.16	7.67	2.63	-2.65	-9.21	2.03	5.15	2.39	6.20	3.89
14	1.39	-2.41	4.13	7.48	5.02	0.61	6.99	4.77	2.39	0.11
15	2.99	-5.61	-2.74	-0.53	-9.07	-8.98	0.06	7.60	-7.60	-8.09
16	6.48	3.91	-0.17	-0.22	1.26	-4.58	4.93	-2.76	-0.81	6.77
17	-4.24	-4.12	0.31	5.35	5.70	3.97	-2.74	6.04	-3.39	2.82
18	-4.79	5.00	8.11	8.65	-2.42	5.35	7.67	5.46	1.49	4.04
19	-3.00	7.32	0.68	-2.31	-1.15	-2.59	6.96	6.28	8.60	-2.67
20	-1.86	1.69	1.85	-0.55	1.76	4.99	8.18	4.21	5.03	8.49
21	5.62	2.39	-0.57	0.16	8.33	5.96	-0.56	-6.94	8.36	5.51
22	1.39	6.04	3.67	6.97	-6.22	1.93	-0.55	1.24	8.51	-0.60
23	3.20	7.05	-2.66	-1.55	1.85	5.07	6.77	3.67	8.53	-2.10
24	1.35	5.55	0.27	-9.22	7.81	1.35	6.07	-0.49	-2.62	-1.65
25	1.48	-0.45	4.13	6.94	6.82	-0.55	-7.52	-2.60	5.94	4.14
26	5.80	4.16	7.31	1.93	5.60	6.11	8.12	0.57	8.44	-2.60
27	-2.88	0.78	5.38	-5.16	0.34	8.25	6.86	-2.52	3.90	-9.13
28	4.03	-7.33	-2.76	-0.56	0.17	-1.93	0.50	6.95	3.89	2.02
29	-2.74	4.80	-4.16	-2.53	6.13	6.26	3.08	-7.50	2.99	7.12
30	3.71	5.05	1.45	6.67	4.16	-4.53	-2.60	3.72	2.65	1.45
31	1.21	7.65	2.61	8.64	-0.60	-6.28	6.28	3.16	6.28	8.19
32	8.37	3.66	-0.55	6.35	-8.79	-9.30	8.15	-0.36	-0.97	2.36
33	3.80	7.49	5.08	4.79	-4.53	4.36	6.34	6.93	3.54	-0.36
34	-0.56	7.27	5.33	0.61	-2.56	-5.16	0.50	7.79	8.10	-5.69
35	6.15	7.43	2.33	8.15	3.93	7.22	-1.17	7.08	4.68	-2.35
36	0.41	-1.20	5.72	8.31	0.45	8.11	-2.76	-4.89	-2.97	5.69
37	5.71	2.63	-1.29	0.34	6.78	3.69	5.36	6.04	3.93	0.24
38	-2.33	-0.15	-2.36	-0.56	3.06	-6.80	6.70	-3.79	-6.23	4.02
39	0.18	0.12	3.40	-6.78	8.61	7.52	-5.20	7.30	-1.17	-2.95
40	-4.73	6.35	8.47	-0.50	0.95	5.33	3.76	6.60	7.65	7.93
AACR:	4.46	11.78	8.88	4.21	5.23	5.62	11.18	7.32	10.61	5.80
Mean:	1.19	2.90	2.23	1.14	1.44	1.53	2.79	1.91	2.66	1.52
Standard Deviation:	4.37	4.08	3.99	4.63	5.59	5.53	4.53	5.14	4.76	4.50

* Quarterly returns for the highest, mid-range, and lowest average annual compound returns are used in spending model (Exhibit 6).