

Reserve & Replenish: Retirement Planning in a Volatile Market

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Reserve & Replenish: Retirement Planning in a Volatile Market

In the last 30 years of the twentieth century, financial planning for retirement changed dramatically. Of the many factors that contributed to these changes, two were fundamental:

- **Inflation.** Retirees in the United States witnessed firsthand the insidious effects of inflation on the cost of maintaining their lifestyles. Particularly during the first 15 years of this period (1970–1985), inflation at the consumer level made a serious dent in what type of lifestyle could be purchased with fixed sources of retirement income such as pensions and annuity payments. By 1985, more than \$2.75 was required to purchase the same basket of goods that cost \$1.00 in 1970. The retiree living on \$60,000 after taxes in 1970 needed more than \$165,000 entering 1985 to remain even in terms of lifestyle.
- **Structure of benefits.** The structure of retirement benefits and savings saw unprecedented changes in the 30 years before the millennium. According to *Watson Wyatt Worldwide*, 89% of Fortune 100 companies offered a traditional defined benefit pension plan to new employees in 1972. Defined benefit plans promise a specific level of lifetime pension (typically calculated as a percentage of final pay based upon years of service) funded by the employer's contributions, insulating employees from the effects of specific investment decisions and fluctuations in market performance. By 2007, the percentage of Fortune 100 companies offering such plans was 28%. The retirement planning vehicle of choice in the 21st century is clearly the 401(k) plan, funded by a combination of employee contributions and company matching dollars. This plan structure leaves the risk (and any potential benefits) of investment decisions and market returns resting squarely on the shoulders of the employee participants.

As a result of these basic changes in retirement planning in the United States, sound financial planning for a secure retirement becomes even more important. The second contributor, the shift to 401(k) retirement vehicles, reassigns the risk of poor (or no) planning to the employee and plan participant, rather than the employer and plan sponsor. The first contributor, inflation, greatly complicates the challenges posed by the planning exercise itself.

The purpose of this paper is to assist employee plan participants and their financial advisors in successfully adapting to these changes in order to formulate a sound plan for retirement security. In our approach, we build upon the work of other financial professionals who have made significant contributions to this endeavor, with the intention of advancing the discussion further.

The Basic Question Behind Financial Planning for Retirement

There has been much research done on **safe withdrawal rates** by professionals in both the financial planning industry and academic circles. Generally, this work shares one similar goal, which is to answer the question all new retirees should confront as part of their planning: “How much can I regularly withdraw from my retirement savings so that my funds will be sustained on an inflation-adjusted basis and not run out in my lifetime?” Behind this basic question are some underlying assumptions, either explicit or implicit:

1. **There must be some assumption about the portfolio and investment policy that will be applied to the retirement savings.** In other words, it is recognized that the retirement savings will be invested in one or more asset classes, and returns will fluctuate from year to year as money is withdrawn. This means the effect of withdrawals on the portfolio when markets are bad and asset values decline are more punitive, causing the total investment balance on hand to decline. This is because in bad times, more shares of the various asset classes must be liquidated at lower prices to supply the cash needed for withdrawals. Therefore, the outcome of the analysis will be quite different in a favorable market period (of generally positive investment returns) from an unfavorable market period (one marked by negative or poor returns). This difference will be particularly evident in a scenario where such poor results are concentrated early in the retirement period.

2. **There must be some presumption about changes in the cost of living, which will affect the retiree's withdrawals.** The general goal of analysis regarding safe withdrawal rates is to maintain a constant standard of living for the retiree in the face of continuing inflation. (As posed in the introduction, the retiree in 1970 who requires a portfolio withdrawal of \$60,000 per year would like to know that a withdrawal of slightly more than \$165,000 would be possible in 1985, so as to maintain his or her identical living standard.) In virtually all analytical approaches, it is assumed the retiree would desire to increase withdrawals annually by an amount sufficient to offset the inflation rate as measured by the Consumer Price Index.

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The work of the past 10–15 years shares a common analytical technique. It attempts to give insight into the realistic probabilities of success for various initial withdrawal rates. By using Monte Carlo-type testing of particular strategies, advisors attempt to give clients an answer to their basic question. Essentially, the answer sounds something like this: *“Since we do not know the future, it is impossible to answer your question accurately. However, based on extensive analysis of data from the past, we can say there is a BLANK percent probability you will not outlive your savings if you start withdrawing at X dollars per year.”*

Research by Other Professionals

There have been a number of studies by various academics and financial professionals in the past 35 years that have homogenized into a popular rule of thumb known as “the 4% rule.” Simply, the 4% rule suggests a 65-year-old retiree can safely withdraw an initial 4% of the value of a well-diversified portfolio in year one of retirement. If the retiree then increases the dollar amount of this withdrawal by the annual change in the Consumer Price Index each year of retirement, the probability (based upon historical modeling) is high that the capital will not be exhausted in a retirement period of 25-30 years.



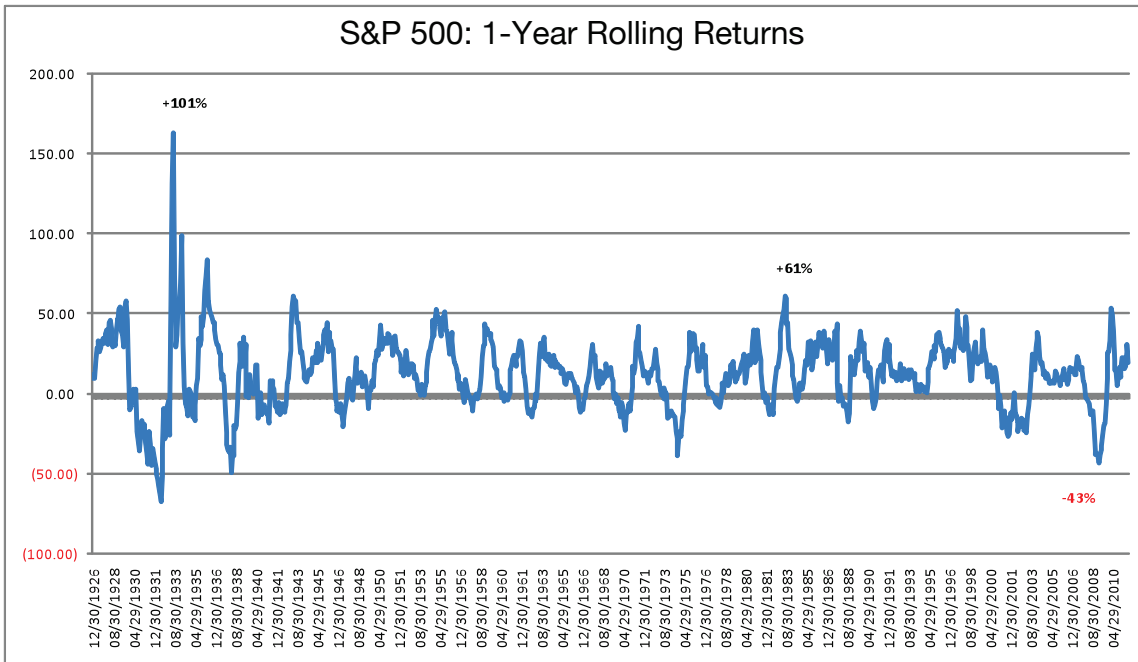
One of the earliest works in this regard was done by **Harvard University**. Their approach was slightly varied because they were applying the question to withdrawals from the Harvard Endowment Fund and what could be sustained over the long term. The work evaluated a portfolio consisting of 50% stocks, with the balance in bonds and cash. Harvard's conclusion was that an initial withdrawal of 4% could successfully be maintained for a long period of years without eroding principal. Done in the early 1970's, the study considered market volatility during the Great Depression, but did not consider the effects of the significant bear markets of 1973-1974, 2000-2002, and 2008-2009. Moreover, the effect of double-digit inflation years such as those experienced in the late 1970's was not included in the data. However, as a counterpoint, the standard of success for a permanent endowment is higher than that of most retirees. An endowment fund's goal to never erode principal (in real inflation-adjusted terms) is a higher hurdle than the retiree's goal of simply not running out of money before life expectancy.

The work of California financial planner **William Bengen, CFP®**, as reported in *The Wall Street Journal* (2/25/1997), concluded that for a portfolio divided equally between stocks and bonds, an initial withdrawal rate of 4.1% would have survived the worst scenarios since 1925. Bengen's data obviously included the bear market of 1973-1974 and the high inflation of the late 1970's.

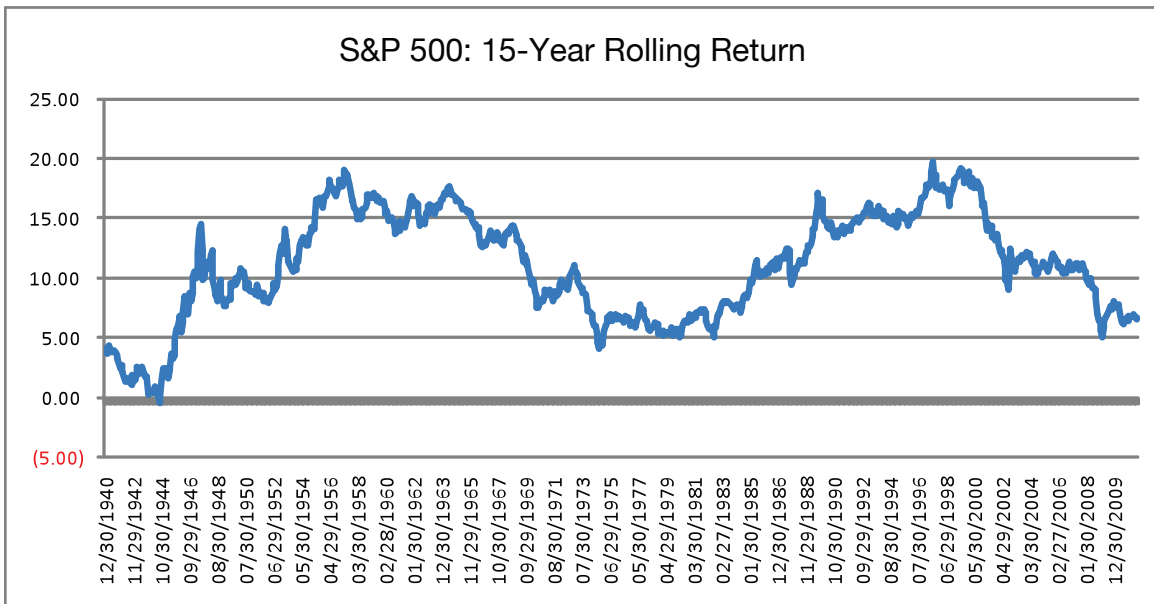
A **Trinity University study** (authored by professors, Philip Cooley, Carl Hubbard and Daniel Walz) completed around the same time evaluated the success rate (i.e., not running out of money during a 30-year retirement) for various portfolio allocations from 1926 to 1995. The study concluded that a 4% initial withdrawal rate had "worked" 98% of the time. The authors recently updated their research in 2011 and generally confirmed their earlier conclusion by saying, "The sample data suggest that clients who plan to make annual inflation adjustments to withdrawals should also plan lower initial withdrawal rates in the 4 percent to 5 percent range, again, from portfolios of 50 percent or more large-company common stocks, in order to accommodate future increases in withdrawals."

The 4% rule has remained generally accepted in financial planning circles throughout the first decade of the 21st century, despite the fact that equity markets have provided one of the worst decades of returns in recorded market history. Nonetheless, other studies and papers have raised questions about the merits of the 4% rule. The most thought-provoking, in our judgment, is a paper by Jason S. Scott, William F. Sharpe, and John G. Watson, published in April 2008, entitled ***The 4% Rule—At What Price?*** (referred to henceforth as *At What Price?*). In this study, the authors use statistical analysis to argue that attempting to finance a stable and predictable spending plan with a consistently allocated mix of risky, volatile investments is inherently inefficient. Retirees experience this inefficiency in one of two ways: 1) through accumulation of unspent surplus assets at life expectancy, suggesting a more efficient strategy could have supported higher spending; or, 2) despite the probabilities based upon historical testing, the actual outcome is not assured, meaning there always remains some probability that capital will nonetheless be exhausted prior to predicted life expectancy. It appears the inefficiencies are rooted ultimately in the systematic re-balancing decision that brings the investment portfolio back to its desired target allocations at least annually. This discipline, which has some significant advantages in a portfolio that is accumulating, may actually contribute to the inefficiencies in a portfolio that is distributing assets since it leads to selling the most volatile assets even when they are down in price (and therefore cheap) and curtails the opportunity to let profits "run" when the volatile assets are in a recovery mode that might stretch over several years.

The following chart depicts the fluctuation in 12-month returns for the S&P 500 Stock Index over the last 85 years. The movement from positive to negative graphically depicts the challenge of utilizing equities in a portfolio that is to provide regular withdrawals for spending. Withdrawals that are close together in time (i.e., 1 to 5 years) present a high risk that, if funded from equities, will sometimes require liquidation of assets resulting in a loss of principal.



Conversely, investing in stocks to fund the withdrawals that are further in the future becomes much less risky. The chart below, which depicts the 15-year rolling returns for the S&P 500 Stock Index illustrates the rarity of stocks to deliver a return of less than 5% per year compounded given a 15-year time frame.



The classic approach to retirement portfolio planning has been to combine stocks (a volatile asset class over shorter periods of time) with bonds (a more stable asset class over short periods). These two asset classes are re-balanced to a constant ratio on a systematic basis, such as annually. Sharpe and his co-authors argue that this consistently allocated mix of risky, volatile investments is inherently inefficient.



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While we find the *At What Price?* paper a challenging read for the average retiree wrestling with the retirement question, the mathematical presentation nonetheless makes a convincing case that all the work that needs to be done with respect to the 4% rule has yet to be accomplished. In their conclusion, the authors write:

"Many practical issues remain to be addressed before advisors can hope to create individualized retirement financial plans that maximize expected utility for investors with diverse circumstances, other sources of income, and preferences. While we still may be far away from such an ideal, there appears to be no doubt that a better approach can be found than that offered by combinations of desired constant real spending and risky investment. Despite its ubiquity, it is time to replace the 4% rule with approaches better grounded in fundamental economic analysis."

Our Work in this Area

After the market meltdown of 2008-2009, we recognized from our regular work with retired clients that extreme market volatility tests the risk tolerance of even those retirees who are familiar with the studies surrounding

safe withdrawal rates. This phenomenon became most evident in the early months of 2009, just prior to the commencement of the equity market rebound. No matter how studied one might be on the historically simulated success rates of a given withdrawal strategy, near the end of a 50%+ equity market contraction, it is emotionally difficult to sell bonds in one's portfolio (the only component that has not been blistered over the preceding 18 months) in order to obtain cash for re-balancing so as to buy more stocks (which, for all intents and purposes, seem destined to bust). Moreover, it feels highly risky to continue withdrawing the same amount of inflation-adjusted dollars from a portfolio that is 25% lower in value than it was a year earlier. At these points of maximum pressure, many retirees find themselves questioning whether they even want to stay in the game.

Recent work by **Michael Kitces, CFP®**, addressed some of the issues raised in the *At What Price?* paper. Kitces' work using the Shiller P/E ratios provides guidance to the newly retired that should prove useful in better establishing a sustainable withdrawal rate. Our desire was to draw from this approach to see if we could establish a framework for clients to withdraw from their portfolios with greater confidence and perhaps also improve on the *efficiency* of the drawdown—the real issue raised by *At What Price?*. For most retirees, this would be important since it might mean they would be comfortable establishing a higher initial withdrawal without greatly increasing the probability of failure (running out of funds before life expectancy).

Methodology for the Testing

To address this issue, we utilized an historical simulation tool we developed to show clients the practical effects of varying asset allocation strategies for different spending levels over a projected retirement period. The tool is historical in that it creates the simulated result based upon actual historical strings of years from 1926 to 2009. For the purpose of our analysis, we constructed a hypothetical couple, both age 65, retiring today and desiring cash flow security:

- Retirement Portfolio Value today = \$1,000,000
- Desired Initial Withdrawal (adjusted annually for inflation) = 4.5%, or \$45,000
- Time frame = 30 years, to projected age of 95
- Portfolio Allocation options are a mix of equity and bond investments
 - a. Equities
 - 70% of equities are based upon the S&P 500 Stock Index
 - 30% of equities are based upon the U.S. Small Stock dataset from Ibbotson
 - b. Bonds
 - 60% of bonds are based upon the Intermediate Bond Index
 - 20% of bonds are based upon the U.S. Long-term Government Bond Index
 - 20% of bonds are based upon the U.S. Long-term Corporate Bond Index
- The actual historical returns based upon this mix of indices are reduced in our analysis by 100 basis points per year to illustrate the likely real-world effect of investment expenses that might be incurred by the typical client for investment advice and expenses of portfolio management. Thus, if the indicated blend of index returns in a given year was 7.0%, an actual net return of 6.0% was utilized for that year in the testing.

Historical simulations are attractive tools for planners because they allow description of hypothetical portfolio results using an illustration drawn from an actual historical string of years. For many clients approaching retirement, many of these years are part of their own recollection of historical events. In other cases (such as the events of the Great Depression of the 1930's) clients many times have recollections of events that were described to them by their parents or grandparents. This makes historical simulations more useful than Monte Carlo simulations in the education process of comparing alternative strategies. While Monte Carlo simulations are based upon the same data series utilized in the historical method, they are somewhat more theoretical to describe to clients.

One limitation of historical simulation modeling, however, is that in a 30-year simulation drawn from market data spanning 90 years, the first 30 individual calendar years and last 30 individual calendar years will not be utilized in the testing as often as the middle 30 years. In recognition of this limitation, we prepared the analysis described here using historical market and inflation data for the years 1926 to 2009. However, we added the years 1926 through 1954 to the end of the data to create an additional 29 hypothetical years that extend the data set from 2009 to 2038. By making this alteration, each calendar year appears in the testing the same number of times. This is somewhat significant since the very poor market years of the early 1930's would otherwise not be counted as heavily in historical simulation testing if this hypothetical addition of years was not made.



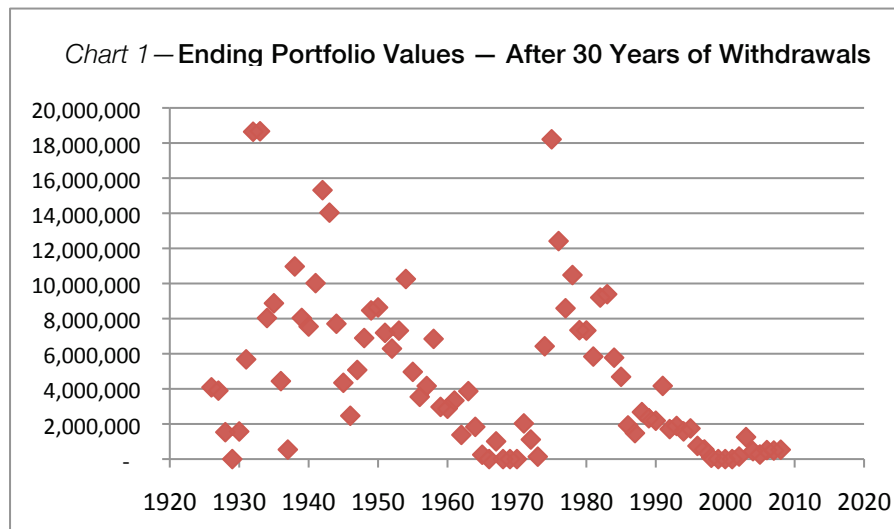
The Base Case – For Comparison

To create a benchmark for comparison alterations in the traditional strategy, we created an historical simulation similar in methodology to those used for reporting in the financial literature. In this case, our retired couple withdraws the required spending amount of \$45,000 (adjusted for the preceding year's inflation rate) from their \$1,000,000 portfolio on January 1, 1926. They then allow their remaining portfolio assets (\$955,000) to remain invested for one year in various investment allocations as described above. The net investment return, for example, in the 60% equities/40% bond mix for calendar year 1926 was +6.32%, thus the portfolio was worth more than \$1,000,000 on December 31, 1926. At the end of the year, the portfolio is re-balanced to the intended allocation of 60/40, and a withdrawal is made for required spending in the next calendar year, 1927. The withdrawal on January 1, 1927 is the 1926 amount adjusted by the ending Consumer Price Index factor for 1926. (In 1926, the CPI was actually negative for the year, meaning the withdrawal in the second year decreased.) In most years of the analysis, other than several years in the late 1920's and early 1930's, the CPI factor is positive. The process is repeated for 1927 and each subsequent year until 30 full years have been tested. This completes one historical simulation from 1926 through the end of 1955. Next, a new starting point of 1927 is used for Year One, and the entire 30-year exercise is repeated creating historical simulation number two. This is followed by 1928, 1929, and so forth.

The goal of the historical simulation is to examine each 30-year period available and then determine several things:

- How many times did the 30-year test fail? In other words, how often did our couple fail to sustain their desired retirement spending level for the full 30 years?
- When the strategy *did* fail, how severe was the failure? A scenario that falls short by 1 year is probably not as great a concern to our retiree as one that falls short by 10 years. This is because retirees intuitively know that with a bit of belt tightening along the way, they can probably overcome a 1-year shortfall. Overcoming a shortfall of 10 years is a different matter. (Other professionals, such as Jonathan Guyton, CFP®, have examined this belt tightening in their research.)
- When the strategy *worked*, how much money remained at the end of 30 years? This number provides some insight into how much *cushion* might be available to increase spending along the way. It also depicts the most significant inherent inefficiency in the 4% rule that is the subject of *At What Price?*.

Our benchmark simulation results are shown in *Chart 1*:



1. Our benchmark simulation included 83 historical 30-year periods. The earliest begins in 1926. The last begins in 2008 and continues through the hypothetical years beyond 2008 (which for reasons described above are actually assumed to be a repeat of the years 1926 to 1954).
2. In 75 of the 83 periods (90% of the time) when using the 60% equity mix, our retired couple was able to sustain spending to the final year. For purposes of our testing, we considered a “success” to be any simulation scenario with a positive capital balance entering the final year (i.e., a failure of less than one full year is ignored).
3. Considering these 75 successful periods, our couple on average ended up with \$2,886,081 in capital at the end of 30 years. This is a non-inflation-adjusted number and would therefore be a lower figure if expressed in constant dollars. The median ending capital result for these 75 trials is \$2,126,951 (also non-inflation-adjusted).
4. As expected, the starting point has a significant impact on the results. Starting retirement in 1975 (near the beginning of a long-term, secular bull market) results in a great deal of surplus capital at the end—more than \$10,000,000. In contrast, starting near the beginning of a major market downturn (witness 1929 and 1972) might mean failure or barely “squeaking by”. The worst scenario is retiring on January 1, 1969, the front end of a decade of poor market returns combined with accelerating inflation. In this case, the couple’s money was exhausted in just 19 years.
5. There were 8 failures of the 83 historical simulations (a failure was a scenario where capital was exhausted on or before the beginning of the final year.) Of these, the average case failed in the 26th year; the median failed in the 27th year, and as previously mentioned, the worst failure ran out of money in the 19th year. To facilitate comparison in this study, we created a metric (the “failure severity metric”) intended to represent the severity of the failures by adding the average year at which the failures occurred to the year in which the worst failure occurred. (For example, in the 60% equity portfolio, the average failure ran short of money in year 26, and the worst failure ran out of money in year 19, thus the failure severity metric would be 26 + 19, or 45.) Therefore, in the case of the failure severity metric, a lower number represents a more severe magnitude of failure compared to a higher number.

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In the following table, we present the results of the same simulation under 7 varying asset allocation assumptions. The sole change between cases is the percentage of equities in the retiree’s investment portfolio—varying from 40% to 100%. The results are consistent with other studies. For a given initial spending level (in this case, \$45,000 or 4.5%), the success rate increases as equities are added to the portfolio to a point, and then begin to decrease. That point is between 70% and 80%, consistent with other studies. Likewise, the severity of the failures, when they do occur, continues to increase as the equity exposure in the portfolio increases.



Table 1 – Recap of 30-Year Historical Simulation Testing
 \$1,000,000 Portfolio
 \$45,000 Inflation-Adjusted Withdrawal (No Reserve, Annual Rebalance)

Portfolio Equity Pct.	Withdrawal Success Rate	Median Ending Capital	Magnitude of the “Failures”		
			Avg Failure Year	Worst Failure Year	Failure Severity Metric
40%	81%	\$1,039,827	26	20	46
50%	87%	\$1,686,954	26	20	46
60%	90%	\$2,126,951	26	19	45
70%	93%	\$3,028,166	25	19	44
80%	93%	\$4,086,370	24	18	42
90%	92%	\$4,768,218	23	17	40
100%	92%	\$6,158,021	23	16	39

Adding the Risk-free “Reserve” Component to the Portfolio

The benchmark results in *Table 1* illustrate a fact most financial professionals (and even relatively uninformed investors) intuitively understand: the funding risk associated with the fact that stocks are volatile decreases over time. The risk of funding the 30th-year cash withdrawal with a stock-rich portfolio is exceedingly small, while the risk of funding the 2nd-year cash withdrawal is quite significant. This is why financial advisors spend time with clients discussing **time horizon**, which is critical in the determination of appropriate investment policy.

In *At What Price?*, Sharpe and his co-authors point out that, theoretically, an investor “can guarantee a real dollar every year for thirty years by purchasing a series of zero-coupon, risk-free bonds.” The authors go on to point out by example that “a 2% risk-free real rate is broadly consistent with the historic record for U.S. Treasury STRIPS and TIPS (U.S. Treasury Inflation-Protected Securities) investment returns.” (The paper was written in 2008; while the preceding statement is still substantially accurate looking back through market history, we note that in the current 2011 market, real rates on TIPS Bonds are at lower levels than 2.0%.) Nonetheless, by way of example, the authors’ example of assembling 30 successively maturing TIPS bonds is presented as a possible way in which an investor can guarantee his or her inflation-adjusted withdrawals for 30 years in advance. If the markets are pricing in a 2.0% real return on these bonds at commencement of retirement, the retiree could purchase bonds to cover the entire 30-year-period sufficient to provide for inflation-adjusted portfolio withdrawals of 4.46% (just a bit less than our 4.5% shown in the benchmark case above) and have no risk of a shortfall. Likewise, the investor is assured of no money left over at the end of the 30 years (i.e., no “inefficiency”). Although not directly addressed in *At What Price?*, this begs the question: *Why don’t retirees do this?* From our experience, we would judge there are four practical reasons:

1. While most retirees place the goal of cash flow sustainability at the top of their personal hierarchy, it is true that in most cases, leaving some legacy for the next generation is also a goal, albeit secondary. Many retirees meeting with us for the first time to discuss objectives joke about wanting to spend every bit (having the final check “bounce”). We find, however, after working

through the planning process with them, they indeed desire to sustain some legacy in the vast majority of cases. Therefore the “inefficiency” of assets remaining at life expectancy is not entirely inefficient. It may satisfy a secondary objective.

2. A portfolio comprised of 100% TIPS bonds is tax inefficient, compared to some alternative investments. While our model was built without considering tax consequences (i.e., our hypothetical retiree is assumed to have the entire portfolio inside a tax-deferred retirement account), most retirees have a combination of tax-deferred and taxable assets in their portfolio, which means a portfolio of 100% TIPS Bonds would of necessity, be at least partially taxable on a current annual basis.
3. A portfolio comprised of 100% TIPS bonds is boring. It leaves very little for our retirees to talk about with their friends when the conversation turns to the economy and the markets. While this may seem a bit trivial in a discussion of pursuing a more “efficient” portfolio management structure, our experience suggests this is a relevant factor in the real world.
4. Ultimately, the possibility of higher real returns associated with adding more volatile, non-guaranteed assets (stocks) increases the possibility that initial and long-term spending can be sustained at higher levels. The second half of the fundamental economic problem (unlimited human wants and needs) is at work here.

In light of these reasons, it is desirable to make a judgment regarding whether there exists some optimum amount of risk-free reserve to add to the portfolio that would cover planned withdrawals in the near-term time horizon, where volatility associated with equity investments poses the greatest threat to portfolio success. For purposes of our analysis, we assume this risk-free reserve to be a laddered portfolio of annually-maturing TIPS Bonds in face amounts sufficient to cover the desired inflation-adjusted spending level for each year of maturity. (In the real world there might be times, and 2011 could well be an example, when non-inflation adjusted bonds might be substituted for some of the TIPS Bonds, based on one’s judgment about the market’s comparative pricing of fixed versus inflation-adjusted, fixed-income instruments.) We constructed our model assuming the retiree would establish this “Reserve Component” at the start of retirement, covering some initial period of years of projected withdrawals. At the time we initially created the model, we made an educated guess that a suitable minimum ladder length for this component might be 3-4 years of the projected withdrawals. The Reserve Component would be drawn down to cover portfolio withdrawals, leaving the balance of the portfolio (the Accumulation Component) to compound. In all cases, the Reserve Component is something less than the full length of the projection period of 30 years, for the reasons noted in the preceding points 1-4.

The Need for a “Replenishment Rule”

An approach such as this (creating a risk-free Reserve Component) demands some rule for deciding when to withdraw money from the Accumulation Component for purposes of replenishing the Reserve Component and restoring it to its desired length. (If this is not done periodically, then the Reserve Component is exhausted and our retiree is right back where he started—with a portfolio mix intended to fund near-term needs with volatile investments.) Essentially, therefore, this question might be stated by our hypothetical retiree like this: “Okay, I see the possible merits of having this Withdrawal Component to provide for my near-term spending while the equity market is not being cooperative. However, during



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those bad market periods when I spend it down, how should I decide when to make a liquidation of assets in the Accumulation Component to replenish and restore my lower-risk Reserve Component?"

Work done by Michael Kitces was oriented around commencement of retirement. It essentially rooted its conclusions in the premise that what happens in the early years to the volatile investments has the greatest impact on the ultimate success of the withdrawal strategy. His conclusion was that using the Shiller P/E Ratio (a price-to-earnings valuation ratio for the market utilizing 10 years of inflation-adjusted corporate earnings) was a useful guide for the retiree determining an initial withdrawal rate at commencement of retirement. In essence, if the Shiller P/E ratio is relatively low in an historical context, the market is undervalued, indicating a likelihood of higher subsequent returns and therefore

permitting a higher starting withdrawal percentage. If the Shiller P/E ratio is relatively high in an historical context, the market is already fully valued, suggesting more moderate or even poor subsequent returns and therefore suggesting the initial withdrawal percentage should not be pushed to the limit.

Our instinct was that using this same measurement as a guide for making the periodic replenishment liquidations of assets from the Accumulation Component might prove worthwhile. Based upon the work done by Michael Kitces, we thought the Shiller P/E ratio might serve as the "fundamental economic analysis" factor that the authors of *At What Price?* surmised was missing from the studies thus far of safe withdrawal rates. Kitces applied the rule to the front-end decisions regarding withdrawal rate. Why not consider extending the use of the Shiller P/E ratio throughout the drawdown period of retirement to affect all re-balancing decisions throughout retirement. In other words, when the Shiller P/E Ratio is at the high end of the historical range (the equity market appears fully or richly valued) it would appear desirable to liquidate assets in the Accumulation Component so as to replenish the Reserve Component to its desired length of years. When the Shiller P/E Ratio is at the low end of the historical range (the equity market is undervalued, as might be typical after a market decline), it would be desirable to avoid liquidations from the Accumulation Component. In years where the Shiller P/E Ratio is low, the Reserve Component would therefore simply be allowed to shrink in size (the number of withdrawal years covered shortening by one year). Ideally, by the following year, the equity market may have rebounded, affording a more desirable time for replenishment of the Reserve Component back to its original length.

While this describes the ideal result, it is necessary to acknowledge that during an extended market downturn, the equity market may not always cooperate by providing a timely rebound to a higher Shiller P/E level that would permit replenishment of the Reserve Component before the component might be itself exhausted by the annual withdrawals. Clearly, in such a case, the annual withdrawals must be continued by liquidation from the equity component (the Accumulation Portfolio), since there is no other place for the needed funds to come from. For purposes of this discussion, we refer to a liquidation from the Accumulation Portfolio during a time of extended low Shiller P/E ratios as an "emergency liquidation". By way of example, assume our benchmark retiree plans an initial withdrawal from his \$1,000,000 portfolio of \$45,000 per year and establishes a 3-year Reserve Component of TIPS Bonds sufficient to cover the withdrawals. (In actuality, this retiree would escrow the Year One withdrawal in a money market fund, Year

Two in a TIPS Bond maturing 12 months later, and Year Three in a TIPS bond maturing 24 months later.) Assume the market declines during Year One to a level where the Shiller P/E measurement is below the minimum trigger point permitting replenishment of the Reserve Component from the Accumulation Portfolio. Assume further, that the market remains at those undervalued levels through Years Two and Three. At the beginning of Year Four, there is no maturing TIPS Bond to fund the required withdrawal for the coming year. Liquidation of assets from the Accumulation Portfolio (an “emergency liquidation”) is the only option available at this point to provide funds. To continue the illustration, if the equity market rebounded during Year Four and the minimum trigger point for the Shiller P/E ratio were then exceeded, a liquidation would be made at the end of Year Four to fully restore the Reserve Component to its desired level of 3 years. This discipline of combining a Reserve with a Replenishment Rule is the foundation for determining if a more efficient structure can be created to support a stable and predictable withdrawal plan with a portfolio that includes volatile asset classes such as stocks. We refer to this strategy as “Reserve and Replenish” in contrast to “Conventional Rebalancing”. The essence of Reserve and Replenish is to better permit the volatile equity component to produce dollars for the withdrawals that are further out in the future and avoid using the equities to fund near-term withdrawals. It becomes the alternative to Conventional Rebalancing common in wealth management today.

Testing the Reserve & Replenish Strategy

In order to test this concept, it would be necessary to use our simulation model to test varying combinations of ladder length (number of years) for the Reserve Component with varying trigger points in the Shiller P/E Ratio for the replenishment decision during the 30-year scenario. The variables in question:

1. How large (how many years in bond-ladder length) should the Reserve Component be?
2. What is the optimal “floor” to set for the Shiller P/E ratio that establishes a minimum level for liquidations under the Replenishment Rule (i.e. – we do not liquidate assets in the Accumulation Component for replenishment if the Shiller P/E is below this level)?

A review of the Shiller P/E levels at year-end from 1926 through 2008 indicates the measurement has ranged from a low of 7.8 (December, 1982) to a high of 44.2 (December, 2000). The median year-end level was 15.9, with a standard deviation of 7.4. For testing various levels, we decided to test setting the floor for the Shiller P/E in a range between 11 and 21.

For each of these variations in the Shiller P/E Floor level, we varied the size of the Reserve Component from 4 to 12 years. Obviously, it would be feasible to set the size of the Reserve Component at a shorter level than 4 years. However, our judgment of the typical risk tolerance of most retirees was that few would have the stomach to commence retirement with a portfolio that was 100% equities, save and except a spending reserve that was less than about 5 years worth of anticipated withdrawals. In all cases we tested, the Accumulation Component was assumed to be a 100% equity portfolio with the sectors described earlier. In actuality, more asset classes than equities could be included in the Accumulation Component, but we did not test this further variation in strategy.

We have presented the tables summarizing the historical simulation in Appendix A to this paper. It appears some conclusions can be drawn from a review of the results presented in these tables. It appears that for portfolios in the distribution phase, the division of portfolio assets into a Reserve Component and Accumulation Component, re-balanced by a Replenishment Rule does indeed result in some



improvements in efficiency for the retiree drawing down assets over an extended time period (compared to portfolios annually re-balanced to a roughly equivalent static mix of bonds and equities). Our observations are summarized below:

- Recall that our hypothetical retiree spending at an initial rate of \$45,000 per year from \$1,000,000 (invested in the 60% equity mix) enjoyed a 90% success rate in the simulation of a 30-year retirement under the benchmark assumptions. When the portfolio allocation failed to sustain the 30 years, the average failure occurred in Year 26, the worst failure occurring in Year 19, a failure severity metric of 45. When there was money left over at life expectancy, the median result was \$2,126,951.
- Now, assume the same retiree instead chose to structure his portfolio as a 9-year Reserve Component paired with an Accumulation Component invested 100% in equities. He starts retirement with virtually identical asset class exposure and volatility risk in his portfolio (9 years at 4.5% means the Reserve Component is 40.5% of the total assets, almost identical to his 40% bond position in the conventionally rebalanced portfolio). This retiree sets a Floor Trigger for the Shiller P/E ratio at 16, roughly the median over the past 80 years, meaning replenishment of the Reserve Component only occurs if the year-end Shiller P/E ratio for the market is 16 or higher. In Table 2 below, we show the comparison of conventional rebalancing on the 60% portfolio to the 9-year Reserve Component strategy.

Table 2— Comparison of 60% Conventional to 9-Year Reserve Strategy

\$1,000,000 Portfolio
\$45,000 Inflation-Adjusted Withdrawal

Initial Ladder Length	Floor P/E Trigger	Accumulation Portfolio Equity Pct	Withdrawal Success Rate	Median Ending Capital	Magnitude of the “Failures”		
					Avg Failure Year	Worst Failure Year	Failure Severity Metric
0	0	60%	90%	\$2,126,951	26	19	45
9	16	100%	93%	\$2,903,777	25	20	45

- His success rate in the simulations increases to 93% in the 30-year retirement simulations.
- Though there were fewer instances of a failure, it is relevant to make a judgment regarding whether the magnitude of those failures was similar, less severe, or worse than suffered under the benchmark assumptions. With the 9 year Reserve Component, when the portfolio did fail, the failure metric was identical (45). The money left over at the end when the strategy succeeded was a median of **\$2,903,777**, about \$750,000 higher than the benchmark. This higher ending balance suggests it might well be possible to increase the withdrawal rate if the distribution of assets from the portfolio has actually become more economically efficient. We will come back to this in a later observation.
- Can our hypothetical retiree improve his position by adjusting his Floor Trigger for the Shiller P/E ratio to something other than 16? In Table 3 below, we present the results of simulation testing of a withdrawal of \$45,000 per year, using a 9-year Reserve Component. The only variable in the table is the level of the Floor Trigger for the Shiller P/E ratio. Note that as the Floor Trigger ratio is increased by

one in each simulation from 16, to 17, and then to 18, the success rate of the simulation increases by one percentage point, to a high of 95%. Further increases beyond 18 (to 19, then 20, then 21) do not provide any incremental improvement in the success rate. Note however, that the magnitude of those scenarios which fail becomes somewhat more unfavorable as the success ratio reaches 95% (a Shiller P/E level of 18). At this level, the failure metric was one year worse than the benchmark case at 44. Interesting to note is that further increases in the Floor Trigger above 18 preserve the success rate at 94% but actually improve the Failure Severity Metric to 46, a level superior to the median level of 16. While there might be several possible explanations for this effect, it suggests that setting the Floor Trigger for the Shiller P/E ratio to favor liquidations only when the equity market is near the upper end of the valuation band allows the higher return potential of equities to work more effectively to support the sustaining of withdrawals over time.

Table 3—Varying the Shiller P/E Ratio Level for the Floor Trigger

\$1,000,000 Portfolio
\$45,000 Inflation-Adjusted Withdrawal

Initial Ladder Length	Floor P/E Trigger	Accumulation Portfolio Equity Pct	Withdrawal Success Rate	Median Ending Capital	Magnitude of the “Failures”		
					Avg Failure Year	Worst Failure Year	Failure Severity Metric
Conventional		60%	90%	\$2,126,951	26	19	45
9	11	100%	81%	\$2,897,199	24	19	43
9	12	100%	87%	\$2,613,162	24	19	43
9	13	100%	90%	\$2,417,153	24	19	43
9	14	100%	90%	\$2,700,975	25	19	44
9	15	100%	92%	\$2,828,501	25	19	44
9	16	100%	93%	\$2,903,777	25	20	45
9	17	100%	94%	\$2,903,777	25	20	45
9	18	100%	95%	\$3,039,997	24	20	44
9	19	100%	94%	\$3,307,672	25	21	46
9	20	100%	94%	\$3,399,726	25	21	46
9	21	100%	94%	\$3,517,086	25	21	46

- What about a higher spending rate than \$45,000? After all, this may be the question of most interest to retirees. To test this question, we prepared a revised set of simulation scenarios using spending of \$50,000 inflation-adjusted, a 5% initial withdrawal rate. Reference to *Table 4* will illustrate the success rates and other measurements associated with this higher level of spending under the benchmark assumptions of conventional re-balancing. Again, using the 60/40 equity-bond mix, the table of results indicates our retiree can attempt to spend \$50,000 per year inflation-adjusted, but only can expect a success rate of about 83%, perhaps a bit too marginal to inspire confidence. The failure metric was 40, considerably worse than the level associated with spending of \$45,000, as might be expected. Median ending assets on the successful cases at a 60% equity allocation was \$1,748,815. Moreover, attempting to increase equity exposure to support the higher spending does not yield re-assuring results. At 70-80% equities, the success rate remains at 82-83% and the failure severity metric



worsens. Ending capital at 30 years in the successful cases improves as might be anticipated. *Bottom line:* our retiree might feel considerable trepidation at commencement of retirement if contemplating this strategy of initial spending at a 5% withdrawal rate.

Table 4—Recap of 30-Year Historical Simulation Testing

\$1,000,000 Portfolio
\$50,000 Inflation-Adjusted Withdrawal (No Reserve, Annual Rebalance)

Portfolio Equity Pct.	Withdrawal Success Rate	Median Ending Capital	Magnitude of the “Failures”		
			Avg Failure Year	Worst Failure Year	Failure Severity Metric
40%	66%	\$ 865,726	24	17	41
50%	75%	\$1,270,101	24	17	41
60%	83%	\$1,748,815	23	17	40
70%	82%	\$2,799,252	24	16	40
80%	83%	\$3,960,812	24	15	39
90%	83%	\$5,138,551	23	15	38
100%	82%	\$6,097,045	21	14	35

- Now, assume the same retiree instead chose to structure his portfolio as an 8-year Reserve Component paired with an Accumulation Component invested 100% in equities. This 8-year Reserve Component means he starts retirement with identical asset class mix and volatility in his portfolio (8 years at 5.0% means the Reserve Component is 40.0% of the total assets, identical to his 40% bond position in the conventional portfolio). This retiree sets his Floor Trigger for the Shiller P/E ratio at 17, which biases the replenishment rule to the upper end of the equity market valuation band. His success rate in the simulations improves noticeably to 87% in the 30-year retirement simulations. When the portfolio did fail, the failure metric was improved by 3 years to 43. The money left over at the end when the strategy succeeded was a median of \$3,275,575, approaching double the benchmark. This higher ending balance suggests the distributions were more efficiently funded from the higher return equity asset classes, allowing greater accumulation over life expectancy.

Table 5—Comparison of 60% Conventional to 8-Year Reserve Strategy

\$1,000,000 Portfolio
\$50,000 Inflation-Adjusted Withdrawal

Initial Ladder Length	Floor P/E Trigger	Accumulation Portfolio Equity Pct	Withdrawal Success Rate	Median Ending Capital	Magnitude of the “Failures”		
					Avg Failure Year	Worst Failure Year	Failure Severity Metric
Conventional		60%	83%	\$1,748,815	23	17	40
8	16	100%	83%	\$3,522,141	24	18	42
8	17	100%	87%	\$3,275,575	25	18	43
8	18	100%	87%	\$3,339,694	25	18	43

- An interesting comparison for retirees attempting to sustain a higher withdrawal rate relates to portfolio allocations that represent higher degrees of investment risk. For example, assume our same retiree discussed in the previous point intends to consider a portfolio with 70% equities as a means of reaching potentially higher returns that might support the higher required withdrawal rate of 5%. If we refer back to Table 4, we can recall that the benchmark data on conventional re-balancing suggests there is little benefit to be gained from increasing the investment risk with a more aggressive allocation. In fact, the success rate for a 70/30 mix is actually a bit lower at 82% (compared to 83% for the 60/40 mix). The failure severity metric for the 70/30 mix with conventional re-balancing is 40.
- However, assume alternatively that same retiree instead chose to stretch his risk by structuring his portfolio as a 6-year Reserve Component paired with an Accumulation Component invested 100% in equities. This 6-year Reserve Component means he starts retirement with identical asset class exposure and volatility risk in his portfolio as the 70/30 conventional portfolio (6 years at 5.0% means the Reserve Component is 30.0% of the total assets, identical to his 30% bond position in the conventional portfolio). The Floor Trigger for the Shiller P/E ratio could be set at 17 (or perhaps 18). His success rate in the simulations increases from 82% in the benchmark to 89% in the 30-year retirement simulations. On a positive note, the failure metric improves from 40 to 42. The money left over at the end when the strategy succeeded was a median of about \$3.4 million, compared to the benchmark of \$2.8 million. This higher ending balance suggests that the distributions were more efficiently funded from the higher return equity asset classes, allowing greater accumulation over life expectancy. Perhaps most important in this comparison of the higher spending rate is that an 89% success rate in the simulations inspires considerably more confidence to most retirees than a simulation result of only 82%.

Table 6— Comparison of 70% Conventional to 6-Year Reserve Strategy

\$1,000,000 Portfolio
\$50,000 Inflation-Adjusted Withdrawal

Initial Ladder Length	Floor P/E Trigger	Accumulation Portfolio Equity Pct	Withdrawal Success Rate	Median Ending Capital	Magnitude of the “Failures”		
					Avg Failure Year	Worst Failure Year	Failure Severity Metric
Conventional		70%	82%	\$2,799,252	24	16	40
6	16	100%	88%	\$3,383,311	24	18	42
6	17	100%	89%	\$3,348,038	24	18	42
6	18	100%	89%	\$3,423,132	24	18	42

Conclusions and Thoughts on Additional Work

A long-accepted, well-understood concept in the wealth management profession is that the order in which a series of annual investment returns occurs makes no difference in the outcome of a portfolio strategy during the accumulation phase. Conversely, during the distribution phase, order of returns matters greatly. If poor returns occur early in the distribution phase followed by better returns later, the outcome during distribution is quite different than if the reverse pattern holds.



Similarly, our study suggests the way in which the portfolio rebalancing decisions between differing asset classes are approached can make an important difference in the success (or lack thereof) during the distribution phase of a portfolio. In years prior to retirement, when funds are being added and compounded in an accumulating portfolio, Conventional Rebalancing of differing asset classes to a constant ratio enforces a sell high/buy low discipline that should add to portfolio performance. However, the results of our simulation testing suggest that these benefits may work in a somewhat inefficient or even perverse manner once the portfolio enters the distribution phase. Further, the approach we have proposed as an alternative to Conventional Rebalancing, i.e., Reserve and Replenish, appears to offer a more efficient means of adjusting portfolio exposure between varying asset classes during the distribution phase. This improved efficiency may be sufficient to afford retirees the possible benefit of successfully sustaining a higher initial withdrawal rate against their available portfolio assets.

We view this work as a first step toward the challenge posed by the authors of *At What Price?*—to find that “better approach” when utilizing volatile investments as a means of funding the desired constant spending stream needed in retirement. Undoubtedly, there is more that can be done.

Evaluating additional contributions that might be made by behavior modification strategies (i.e., following strategies for reducing withdrawals during unfavorable periods to spare stress on the portfolio) appears to be a promising area for additional examination. Refer to the work of Jonathan Guyton, CFP®, which we respect in this area for portfolios managed by Conventional Rebalancing (“Decision Rules and Maximum Initial Withdrawal Rates”). An appealing area to pursue would be to evaluate whether spending decision rules combined with a Reserve and Replenish approach might enable retirees to commence retirement at more generous withdrawal rates from their portfolios.

In addition, more advanced application of market valuation metrics such as the Shiller P/E ratio might possibly yield better outcomes still than those described in this paper. For example, basing the replenishment on the relationship each year of the Shiller P/E ratio to the market yield offered on bonds might yield superior outcomes. Or alternatively, basing the replenishment decision on the directional movement of the Shiller P/E ratio since the most recent replenishment decision could potentially yield better results.

All of these areas represent potential areas that we hope will be pursued by ourselves or other professionals.



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