RISKS and REWARDS

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Swap It! Variable M&E Revenue for Fixed M&E Revenue

by Marshall Greenbaum & Adam Zivitofsky

Insurers who issue variable life and annuity products are currently rethinking their risk management practices. As equity markets decline and become more volatile, the likelihood of significant guaranteed benefit claims increases, while the anticipated revenue from mortality and expense (M&E) fees declines. Current market conditions are leading to undesirable earnings volatility on both Statutory and GAAP accounting statements for companies with large in-force blocks of variable policies. This paper illustrates how to use a derivative contract, a properly structured *total return swap,* to turn a company's uncertain M&E revenue patterns into predictable revenue.

M&E Fee Basics

Insurers assess M&E fees against their policyholders' current account balances as the primary source of revenue to cover their servicing and benefit costs, and to provide a source of profit. They are collected as a fixed percentage rate (basis point charge) of the current account balances over the life of the contract. Typically, policyholders allocate most of their premiums to the equity-based subaccounts. Any percentage decline in account balances driven by equity markets leads to a corresponding percentage decline in the level of M&E fees

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30-Year Treasury Rates and Defined Benefit Pension Plans

by Victor Modugno

Editor's Note: This report is one of two reports prepared on commission for the Society of Actuaries with the objective of identifying one or more indices designed to approximate the interest assumption underlying group "close out" annuity quotes for terminating pension plans. The opinions expressed and conclusions reached by the author are his own and do not represent any official position or opinion of the Society of Actuaries or its members. This report can also be found on the SOA Web site at: http://www.soa.org/sections/dbpp.pdf.

Abstract

This paper concludes that there are two index rates that could best replace the 30-year Treasury in the calculation of the Current Liability[1] of a pension plan—either the 30-year swap rate, as published in Federal Reserve Board Statistical Release H.15 or the benchmark 30-year FNMA[2]

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General Topics

by Peter D. Tilley

Peter Tilley

The year 2001 was a challenging one for all of us both personally and professionally. We all know of someone affected by the events of September 11th. Many others have already put it more eloquently, but my thoughts and prayers go out to all of the families and friends of the victims.

Professionally, we now see times that will require all of our skills and expertise to help our employers and clients to deal with investment risk. Interest rate guarantees are no longer just a bell or a whistle. Variable fund guaranteed benefits might be "in the money" now. Management fee collections on variable products have fallen with the market; will these fees still cover expenses that are relatively fixed? Do we have enough provisions for credit risk in our fixed income portfolios? Do we have enough liquidity to meet customer demands under unusually stressed scenarios?

The Investment Section Council has been working to develop meeting sessions and seminars to help you answer these questions. The meetings in Dallas, Toronto, and New Orleans provided over 20 panel discussions and workshops on these and other topics. The Wharton seminar on ALM last summer was well attended and will be repeated in 2002. Dave Ingram organized three seminars on risk management last year.

Rick Jackson organized a seminar on credit risk, but unfortunately circumstances caused low signup and the session was cancelled. The council will work on alternatives to get this information to the membership. Max Rudolph and Frank Sabatini co-chaired last year's Investment Actuary's Symposium as a follow-up to the prior year's IAS. The *Risks and Rewards* newsletter continued its usual high standard of keeping our section members informed with news and articles.

I have now finished my term on the council. Over the last three years I have enjoyed making new friends with many council members and SOA staff. I have

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Photocopies of back issues may be requested for a nominal fee.

come to truly understand and appreciate all of the work that goes into helping in the continuing education of our membership. I'd like to thank Rick Jackson and David Li, whose terms on the council also finished last year. They brought a valuable perspective from the investment banking community, and I am pleased that Larry Rubin will be able to fill this role as a new council member. I'd also like to thank Max Rudolph for his support and ideas last year as vice-chair. The section council is under good leadership for 2002 with Max as chairperson and Doug George as vice-chair.

Finally, my last "bully pulpit" comment as chair. A few years ago, Dave Becker gently twisted my arm to speak at a Valuation Actuary Symposium session. He continued to encourage my volunteer activities in various SOA roles. I'd like to thank Dave publicly for getting me to broaden my horizons and be actively involved with terrific people in the number one profession.

A Word From Max Rudolph on 2002

While the world changed forever on September 11, I don't believe that the skill set and tools that actuaries working as risk managers and investment professionals use need to be tossed overboard. I think that the person or company with a long time horizon and contrarian views is more likely to survive and win than someone following the flavor of the month, whether it be alternative investment vehicles or the latest business "strategy" touted by a best-selling author. It is with this in mind that the Investment Section Council is positioning itself to support its members into the future.

We have a very strong team of nine members in place for this year. Each year three members drop off and three new members are added. Our new members are Mark Bursinger, Joe Koltisko and Larry Rubin. All three are already active members of the council, volunteering for spring meeting coordinator, annual meeting coordinator and risk management seminar co-chair, respectively. Doug George, Craig Fowler and Charles Gilbert make up the section's 2003 class and are now in their second year. Doug is an exception, in that he filled out the final year of someone else's term and won re-election. He has already served as section secretary and treasurer and this year will be vice-chair. Craig will be treasurer this year and Charles will serve as co-secretary and web liaison. In addition to me, other council members in their home stretch include Dave Ingram and Vic Modugno. Dave brings his Finance Practice Area experience with him and has run several very successful seminars. Vic is co-secretary and is known for meeting all his deadlines well in advance for sessions he is responsible for. The council did a much better job this past year, following Vic's example, and hopes to build on that this year to bring some informative sessions to the spring meetings and the annual meeting. We are especially pleased to be co-sponsoring a lunch at the health/pension meeting with the Pension Section. I join Peter Tilley in thanking outgoing members Rick Jackson and David Li for their contributions to the council. As last year's trainee while Peter was chair, I feel privileged to have gotten to know him as a friend and colleague. As a newly elected member of the Board of Governors, Peter will be heading up the Finance Practice Area, so we will still be working with him quite a bit. One of the nice side benefits to volunteering for SOA activities is the quality of people you get to work with, both volunteers and staff.

From a financial perspective, the Investment Section is very sound. So sound, in fact, that several initiatives are underway to lower our surplus. Dues will reduce from $15 to $10 for 2002, we are accepting more financial risk for seminar sponsorship and we are actively seeking quality research projects. If you are aware of any projects out there that we should consider or have any other ideas, please let us know.

Congratulations to Yong Yao, winner of this year's Redington Prize. We hope to add a separate award going forward to recognize an *R&R* article. Watch for details. Many thanks to Luke Girard, who has headed up the Redington review group in the past and has "retired" from the committee.

Many seminars, including those sponsored by the Investment Section, were altered or cancelled this fall due to changed travel behaviors following the terrorist attacks. We will continue to work with the SOA to provide alternative methods of continuing education.

I am very pleased to have the opportunity to serve as Chair of this year's Investment Section Council. Let me know how we can better serve our membership by calling or emailing me at my yearbook address.

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Editor's Note

Will The Fed Someday Run Out Of Easing Room?

by Nino J. Boezio

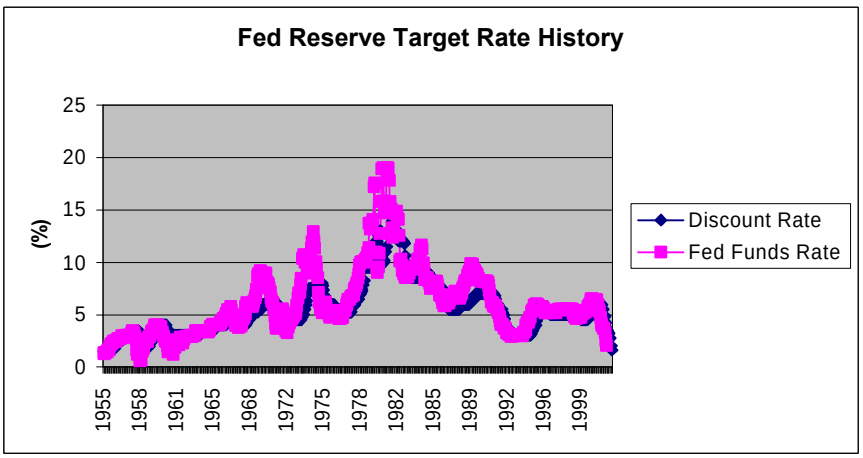
The U.S. Federal Reserve has cut interest rates aggressively in 2001, chopping rates by 4.75% to December, putting the Fed funds rate at 1.75%. It was widely anticipated that the economy was going to respond to the monetary stimulus provided only up to the end of summer (which included increases in the money supply), by roaring back with a vengeance. Since the September 11th terrorist attacks, it has become more questionable as to how fast the U.S. economic recovery will occur. Given that the global economy is still weak, and consumer confidence has dropped—the economy should recover nonetheless, especially with the additional cuts in interest rates.

What is notable however, is the overall level of interest rates, including Fed-controlled rates. The United States has had a very strong economy over the past decade, and in a period where interest rates were relatively low in historic terms. However, every time the economy slowed, central-bank-controlled rates were brought down to a level near or lower than where they were under the previous slowing cycle. Can there be a point where interest rates may come down so low that we may face a situation someday like Japan, where interest rates have reached a rate of return that is zero or negative?

Inflation Fears Have Driven Rates Lower

Throughout the world, inflation has been a fear to central banks. Banks such as the European Central Bank, has often focused on inflation concerns over economic growth as the primary determinant of monetary policy. Overall, central banks in recent history have tended to view their policy as successful, if interest rates and levels of inflation have remained stable or decreased. The net result is that interest rates have been falling in absolute terms over time.

The notable thing about this development is that interest rates worldwide are getting closer to a 'zero' level. For example, with the Fed funds rate currently at 1.75%, it would not require much to take the rate close to zero if the economy slumps further (in real terms, the rate is already around 0% after one factors inflation). Stimulative interest rate policy could therefore one day become unavailable—an interesting phenomena, and an issue the Japanese have had to wrestle with for much of the past decade. One of the solutions put forward in Japan (that has not been seriously tried so far), is to bring inflation back to the Japanese economy by aggressively increasing the supply of money.



The Japanese Situation—What Some Say Went Wrong

Japan had a very hot economy into the late 1980s, and its stock market was booming. It was one of the most dominant economies of the time, and in comparison, there were concerns that the United States was in a perpetual decline. The Japanese economy had grown strongly for over 30 years, partly due to domestic rebuilding after the second world war. Technological advancements in the world were primarily driven via Japan, with imports to the U.S. and other countries consisting of the latest computers and electronics. U.S. exports in the 1980s were primarily of the low-tech or agricultural variety. Notably, the U.S. had lost its edge not only in technology, but also in banking. In addition, with Europe 1992 fast approaching, many felt that the U.S. was in such a globally weak position, that it would take nothing short of a miracle for it to recover. There were also concerns that the U.S. would lose its status as a world power, since economic weakness usually leads to military weakness if such a trend persists too long.

Ironically and for many unexpectedly, Japan's boom went bust, primarily some concluded from excessive over-optimism, inflated asset values, problems in the banking system, and a failure of government agencies to address the deflationary issues until much too late.

Japan's fading dominance from the economic scene was not isolated. Europe also sank into malaise. Despite all of the fanfare of EU 1992, Europe still had too many structural problems, could not

foster strong economic growth, was hit by a recession, and its socialistic tendencies and strong union influences were insurmountable.

In contrast, through technological breakthroughs and re-organization, and through its lack of relative overindulgence and over-optimism, the U.S. avoided being dragged down by the same problems, and faced only upside momentum once it got its act together. The U.S. however was considered brutal by Japanese standards—its companies were not afraid to downsize and lay off thousands of employees, with apparent emotional indifference.

Japan spent money through fiscal policy to make up for the absent consumer, but to little avail, and only put itself into substantial debt. Japan continued to cut interest rates until they reached a rate of almost 0% in both real and nominal terms. There were some half-hearted attempts to dramatically increase the money supply, with an implicit intent to produce some inflation and thus scare consumers into spending. However, any surge in spending became temporary. Concerns also existed over creating an inflationary spiral that could run out-of-control. Some blamed changes in demographics as one reason for a disinterest from consumers to buy. Others blamed banks, which already a substantial portfolio of bad loans, and thus were reluctant to lend further to private companies. Blame was also attached to domestic policies in the early 1990s aimed at deflating stock market and real estate excesses. Growth was 10% on average in the 1960s, a 5% average in the 1970s, and a 4% average in the 1980s (CIA The World Factbook 2000), but now hovered at or near 0% much of the time. It was always rather discouraging to see the only hope being countries such as the U.S. willing to import enough to keep the domestic Japanese economy churning, suggesting that the country had run out of ideas for possible solutions. Japan's consumers as a whole seemed to have simply run out of gas.

Can It Happen In North America?

One of the things that investors often fail to notice is that interest rate policy by the U.S. Federal Reserve has often been applied in conjunction with changes in the money supply. Hence changes in interest rates are not done in isolation, even though the media in particular focuses mainly on interest rate policy. The money supply for example, was increasingly rapidly in anticipation of Y2K problems, and was severely curtailed thereafter when no real problems materialized—coincidentally U.S. stock markets both popped and flopped (with some lag) in conjunction with money supply changes.

It is possible that consumers can become so exhausted that any interest rate or monetary stimulus can have little impact. At other times, a tight interest rate and monetary stance may have little impact if consumers have strong confidence in the economy and spend aggressively. That is why monetary and fiscal policy can be very tricky. The level of interest rates will also be impacted by the size of deficits, and hence balances the demand versus supply of investment capital. Consumers can become exhausted in their spending if they have bought all they need and their needs are saturated, e.g., computers.

My suspicion is that there is a danger that the Japanese-style problems can one day afflict the United States and other parts of the world, even though it likely will not happen this time. It is not expected that the U.S. under its current scenario will succumb to such a problem, but it could also not be said that Japan's dilemma of the past decade is not an isolated incident. It afflicted a country that had tremendous prosperity for a long period of time, and no longer needed or had the inner ability to grow at such a fast pace. On the other hand, the European Community has one prime advantage that both the United States and Japan no longer have—it contains a number of regions that have been deprived for decades of goods and services due to politics, economic mismanagement, and dislocation. There is a latent consumer demand that will one day be unleashed, and will keep the European economy churning ahead for several decades. The U.S. and Japan on the other hand, may have to hope that some of its less prosperous neighbours can help stimulate the demand which may no longer exist internally. Some say that one of the reasons that the U.S. has had such a strong economy for decades relative to the rest of the world is its heavy reliance on advertising, but one day this added advantage may also disappear.

It would be interesting to see how policy makers would react if interest rate policy disappears as an option. Will they try to bring back inflation or at least risk it? Will they take the Japanese example of the 1990s as a warning of what does not work, or will they think their own country is different? The current economic decline in North America is probably a healthy one in the sense that many of the bubbles that were developing have been deflated relatively painlessly to what had occurred in Japan, and there are still opportunities for growth in the U.S. But one day we could face a totally different climate and dilemma, which will not be covered in the textbooks of the last century.

I think that in the next business cycle, central banks including the Fed need to risk bringing back at least some inflation, by allowing the economy to grow at a higher level than they may feel comfortable with, based on their old paradigms. And if interest rates inch up, that could be a positive thing, and allow the interest rate tool to once again be substantially available in the next down cycle.

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Exploring C1 Risk

by Thomas Merfeld

Editor's Note: This is part two of a two-part article. The previous part ran in the July 2001 issue of Risks and Rewards.

The first part of this article provided an overview of an excess return-based C1 model. This second part provides richer discussion of C1 risks in five areas: 1) the economics of C1 risk, 2) portfolio optimization, 3) policy, 4) risk interaction and 5) institutional aspects of C1 risk. It has no more than a loose organization and you don't need to read it in sequence.

Economics of C1 Risk

Difficult markets

Asset classes become more correlated to one another during difficult markets. As a result, some of the portfolio's diversification slips away and C1 risk increases. It is a good idea to have several sets of correlations at hand; these indicate the amount of C1 risk in different economic environments.

Derivative contracts

Imagine that all derivatives are one of two types. The first is interest rate-based contracts, such as futures, options, caps, floors, and swaps with LIBOR or treasury indexes. These contracts all have different payoff profiles depending on the course of the underlying interest rates. That is, they may have substantial C3 variability and may net with other asset and liability variability to produce C3 risk. But they do not have material C1 variability.

The second type of derivative is asset-based contracts, such as futures, options and swaps with S&P 500, Lehman corporate and Merrill Lynch high yield bond indexes (along with many others). These contracts have payoff profiles that may depend on the course of risk-free rates and always depend on the risk premium for the asset class. They can provide or reduce exposure to an asset class without using cash. In effect, derivatives use debt to provide the exposure—they are naturally leveraged instruments. Since debt imposes a non-contingent claim on the assets of the company, it effectively reduces the proportion of the only non-contingent asset on the company's balance sheet. That is, debt effectively reduces cash. Table 3 increases the Table 2 portfolio by .36% by adding 20% to the bond class by means of a derivative contract. Equation 1 measures portfolio variance without regard to the signs of asset class weights.

Table 3

Class	Original Weight	Derivative	New Weight	Standard Deviation
Treasury	10%	(20%)	(10%)	0%
Bond	55%	20%	75%	2.41%
Mortgage	25%		25%	3.80%
Stock	10%		10%	14.05%
Total	100%	0%		
Original Portfolio				2.29%
New Portfolio				2.65%

Normal return distributions

Some early studies of stock market total returns, such as the original Mandelbrot article, demonstrated excess kurtosis. That is, they have more probability mass in their tails than a normal distribution. Time-varying levels of volatility can explain this. Usually the stock total return series distribution is normal. But in times of financial crisis, prices of the riskiest portion of the corporate capital structure can fall by much more than a normal distribution would suggest.

It isn't as clear, however, that non-stock total return series are leptokurtotic. And, as it relates to C1 risk, excess return series consistently appear to have less kurtosis than their analogous nominal return series.

I think it is appropriate to assume normality for baseline C1 risk assessment and optimization. And it is prudent to be comfortable with the loss associated with the downside tail coming to bear in sensitive classes.

Investment classes

Ultimately, identifying a set of asset classes to use has an empirical element and a judgment element. If two excess return series are not highly correlated or if they have different liquidity or different RBC characteristics, then they may represent separate investment classes. So the empirical element involves

close review of time series data, after adjusting for C3 variability. It also involves comparing bid-offer relationships and RBC algorithms to determine whether two instruments have similar levels of liquidity and receive similar RBC treatment.

Professional judgment decides how much correlation is enough and how similar liquidity must be to warrant a distinct asset class. You want enough classes to assure diversification. But you don't want so many that the distinctions between classes lose their meaning. In most well-diversified general accounts, I think 8 to 12 classes is appropriate.

New asset classes

Sometimes the capital markets develop new asset classes. You can't perform time series analysis on them because they have no return history.

Usually, however, apparently new classes are merely combinations of existing asset classes for which you have data. An example is the commercial mortgage-backed security. In theory, high quality CMBS are a combination of a risk-free instrument and mortgage whole loans. As you move down in quality, the risk-free portion becomes less and the whole loan portion becomes greater. At some point the risk-free element turns to debt and from that point on, the security becomes more and more leveraged. You can model this class as a combination of mortgage whole loan and treasury, with the treasury piece being either positive or negative.

Truly new asset classes, although rare, force you to make judgments. Even eliminating these from the portfolio is a tacit articulation of their risk parameters.

Investment time horizon

Parameters for risk and correlation can be different depending on the length of time over which you estimate them. One extreme is to measure the parameters over a very long time, since the company has a perpetual life and it rarely needs to liquidate assets. Another extreme is to measure them over the period of time that it takes a product to reprice.

I suggest that two guidelines are useful. First, estimate the parameters over the entire return cycle of the investment class. Real estate cycles tend to be long; high quality corporate cycles tend to be shorter; municipal bond cycles tend to be variable. But at least you allow the data to speak. Second, estimate the parameters over the length of time that you're likely to be holding the funds. For funds associated with a two-year GIC, two years is an appropriate time horizon. For an annuity, it may be until the end of the surrender charge schedule.

As a practical matter, I think five years is about right for most companies. You need to use a consistent time horizon to correlate two time series. Five years is long enough for most series to have gone through a cycle. And most companies have products with different time horizons as well as perpetual capital. So five years is a useful rule of thumb while recognizing the conceptual nuances.

Other analysts have suggested exponential smoothing, which weights more recent data more heavily, or a formal GARCH approach.

Scenario testing

In the general case, you shouldn't need to run special portfolio scenarios, since excess return distributions are assumed to be normal and there are no path dependencies. So closed-form statistical procedures can tell you everything you need to know about portfolio excess return dispersion.

Simulated methods may be useful. For example, you may wonder about a particular path for a macroeconomic variable such as industrial production. After estimating relationships, you could simulate C1 exposure to this environment. Money center banks and dealers have successfully used a Cholesky decomposition process for this purpose.

Extreme events

Unusual market conditions occur every couple of years, for one reason or another. The associated flight to quality quickly lowers the prices on the riskiest classes. That is, markets become more volatile and more correlated at the same time. So portfolio values move by much more than you would estimate under baseline assumptions.

Some professionals express dismay that a "multiple sigma" event would occur within their working lives. But that is a strikingly naive position to take when the data on time-varying return variances in some markets and increased correlation of all risky markets during periods of stress are readily available.

A reasonable approach to address the phenomenon is in Table 4. Note that risks are doubled and correlations set to unity. Portfolio risk is almost triple the base portfolio risk of 2.29%. So this would be a three standard deviation event that you can assume will happen regularly. Management and the board need to know whether the company's operations remain viable under these circumstances.

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Exploring C1 Risk

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Table 4

Class	Weights	Risk	Correlations Treasuries	Bonds	Mortgages	Stocks
Treasuries	10%	0%	1			
Bonds	55%	4.82	0	1		
Mortgages	25%	7.60	0	1	1	
Stock	10%	28.10	0	1	1	1
Portfolio	100%	7.36				

Portfolio Optimization

Expected excess returns

Excess return, for a period, is what remains after removing the risk-free component of an index total return. You do this after identifying the total return on a treasury instrument that has a duration equal to the index. In general, the excess return will be positive if the index's risk premium remains the same or falls. It may be negative if the premium rises. The average of the residuals from this process is the expected excess return. It makes sense because the company's liabilities are generally priced as a function of the risk-free rate. That is why investment year method models have been important to insurance companies. Endowments and foundations often use real returns and estimate other parameters from their real return series.

Sometimes this process yields an absurd result. One series' risk and return may be dominated by another's. In these cases, a Bayesian approach can be useful, the prior conviction of which is that the asset class' variance is more reliable then its excess return. You can then assign an expected excess return to the class that is consistent with its risk and the risk/return pairs of other classes.

This describes excess returns expected to prevail over longer periods of time. They are appropriate for relatively permanent allocations and may be called strategic excess returns. By contrast, most classes may be quoted at current levels. It is not clear what these quotes mean since the excess return premium and realized excess return can change during the holding period. They are commonly called current returns.

Constraints

Consider constraining the optimization in four ways to make the portfolio more robust. First, the portfolio needs a minimum level of liquidity. A reasonable approach is to assign degrees of liquidity by relative bid/ask spreads. A better approach is to measure relative asset class salability during periods of financial crisis. You need to keep your institution viable during the most stressful periods; markets often don't function well during these times. So treasury instruments would have a liquidity index of 100, venture capital 0 and everything else in between. The actual constraint depends on the certainty of the company's funding and how much transaction cost it is willing to incur to accommodate disintermediation.

Second, the portfolio should not encumber more than a certain amount of risk-based capital. Finance functions often complain about the portfolio using too much capital. A simple means of addressing the issue is to assign capital loads by asset class. Then constrain the optimization to a maximum capital encumberance. In this way, allocation decisions play within the rules of the NAIC and private rating agencies, but are made on the basis of sound economics.

Third, since some constituents care about the distinction between debt and equity, the allocation can be so constrained. Fourth, managers may have reasons—such as unrealized taxable gains they are unwilling to trigger—to slow the pace of reallocation.

Optimization of excess returns

A simple constrained non-linear optimization routine maximizes expected excess return at a target risk.

Be prepared to work with the allocation through trial and error. Two common problems arise. First is the robustness problem of a barbelled portfolio. The second problem arises because the partial derivatives in the maximization function can be almost equal. The routine may load up on one class even though there is only immaterial benefit to doing so.

Table 5 on the next page shows some optimization runs. Your position on portfolio parameters and constraints can dramatically affect what your optimal asset allocation is. Indeed, your allocations almost tip off what you consider to be important.

Table 5

Class	Return	Risk	Liquidity	RBC	Base	Allocation Percentages				
						1	2	3	4	5
Treasury	0.0%	0.0%	1.0	0.0%	10.0%	23.0%	19.0%	28.0%	9.0%	0.0%
Bonds	0.73	2.41	0.85	1.0	55.0	38.0	40.0	37.0	67.0	83.0
Mortgages	0.93	3.80	0.4	4.0	25.0	27.0	28.0	22.0	15.0	12.0
Stocks	6.30	14.05	0.9	30.0	10.0	12.0	13.0	13.0	9.0	5.0
Return					1.26%	1.29%	1.36%	1.28%	1.20%	1.03%
Risk					2.29%	2.29%	2.41%	2.29%	2.29%	2.29%
Liquidity					0.76	0.77	0.76	0.80	0.80	0.80
RBC					4.50%	5.00%	5.30%	5.10%	4.00%	2.80%

(1) Optimize at base risk with no constraints.

(2) Optimize at bond-quality portfolio with no constraints.

(3) Optimize at base risk with minimum liquidity of .8.

(4) Optimize at base risk with minimum liquidity of .8 and maximum RBC of 4%.

(5) Optimize at base risk with minimum liquidity of .8 and maximum RBC of 4% and maximum equity of 5%.

Strategic, actual and tactical allocations

A strategic allocation represents relatively permanent and maximized strategic excess returns. You can use it for many benchmarking and return attribution purposes.

The actual allocation will naturally wobble around the strategic allocation due to operational cash flows, uneven asset class maturities and market value changes. To a degree, these fluctuations are trivial and you shouldn't try to manage them. Beyond this degree, they represent a fundamentally different allocation and you might want to take steps to nudge the actual toward the strategic allocation. Fluctuations of riskier classes upset economically equivalent portfolios more than fluctuations of less risky classes. Bands placed around strategic allocations—such that all allocations within the bands are stipulated to have economically equivalent levels of strategic excess return and C1 risk—should reflect this uneven impact.

A tactical allocation is one in which you adjust a class weight above or below the strategic bands in the belief that it will perform better at the new weight than at the strategic weight. This performance ought to reveal itself within a short time, perhaps a year. You will want to measure how your tactical decisions perform along with how much the move affected the portfolio's C1 risk. Relative valuation models are reasonable bases for these moves.

Policy

Insurance regulation

The commissioner's office ought to be responsible for imposing a maximum level of C1 risk by company. It should depend on the reliability of the company's funding sources, its other risks and its capital. Maximum C1 risk ought to represent consistent potential for ruin from company to company. Given the clear concept of C1 and the understanding of the company's entire portfolio of risks, consistent statistical measurements of ruin likelihood should be feasible.

Beyond these steps, however, the company is responsible for establishing its C1 target within this limit.

Investment policy

The company's board of directors has a grave responsibility in establishing the investment policy. It needs a basic understanding of the company's funding sources and capital position. In discharging its responsibility, the board will establish a risk target. It may also establish liquidity limits and may go as far as placing upper limits on individual classes.

Beyond these steps, however, management is responsible for deploying its C1 risk budget.

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Exploring C1 Risk
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Risk interaction

C3 risk
It's useful to develop cohorts of risk and correlation estimates under rising and falling risk-free rates. To the extent that they are different, portfolio risk may be similarly different. It's good to know how sensitive the portfolio risk is.

It's probably not useful to estimate excess return cohorts or to optimize excess return under each rate environment. Doing so would assume that you know what environment will prevail over the investment horizon.

Exchange rate risk
In general, currency risk reflects the possibility that the market value of surplus would fall as a result of changes in foreign currency values relative to the U.S. dollar. It is complicated by at least two factors.

First, a company may have insurance operations—premium and reserves—denominated in a foreign currency. The operations may take place under a branch or subsidiary arrangement and may be wholly or partially owned. Although the financial reporting may differ under any of the arrangements, there is no significant exchange rate risk to foreign operations. This is because, whatever happens to the dollar-denominated value of the assets also happens in rough proportion to the dollar-denominated value of the liabilities; surplus is almost unaffected.

For foreign currency-denominated assets unmatched by reserves, there is a second complication. In contrast to the single-event nature of C3 risk, foreign currency risk is driven by how multiple specific currencies combine to affect surplus. So foreign currencies also have a portfolio effect. And to measure company exchange rate risk, you need to measure the variability of each currency, relative to the dollar, to which the company is exposed. You then need to measure how these currencies interact with one another.

It may often make sense to accept some exposure to foreign exchange risk. Think of securities in each currency being fairly priced for their level of credit risk. Now if you can offset some of the foreign exchange risk, then you have produced value.

It's more intriguing to reflect on decoupling foreign currency variability from the pure C1 risk in foreign stocks and bonds. Foreign exchange markets allow companies to hedge the currency risk in these markets without affecting the actual C1 exposures themselves.

Liquidity and crises
Sharply curtailed liquidity, although different in nature from C1 risk, often accompanies the same economic downturn that heightened asset price volatility does.

Insurance risks
Most life and property risks have nothing in common with financial markets. So insurance exposures don't reflect back to raise or lower C1 risk.

But they do influence the company's C1 risk target. Here's the argument: the company's overall financial risk limit ought to be expressed as a tolerable percentage of company surplus. Assume the same amount of surplus in both of the following cases. If relatively few insurance risks are present, then the company may be able to bear greater C1 risk. Additional units of C1 risk, however, will translate directly into proportionally greater overall financial risk and the company may have little room to adjust its C1 exposure. If relatively greater insurance risks are present, then the company may be able to bear less C1 risk. Additional units of C1 risk, however, may have little incremental influence on the company's overall portfolio of financial risk.

Financial reinsurance
Co- and Mod-co contracts remind us that not all C1 exposures are present on the company's balance sheet, and that not all balance sheet items bear C1 risk. Financial reinsurance contracts can leverage or deleverage the economic balance sheet. Proper C1 assessment reflects the reality of the contracts rather than the fantasy of published statements.

Institutional aspects of C1 risk

Allocating investment income
Imagine that C1 optimizations take place at two levels. The more important global process allocates all consolidated general account invested assets to specific classes as I've described. The subsequent process drives the global allocation down to specific lines of business. The output of the second optimization is the investment spread that attaches to each line of business. It is one of two important components of equitable investment income allocation. Here are some details.

Each line should receive the risk-free rate prevailing at the time reserves came into the company or were reinvested. This is a standard investment year method with two clarifications. First, in this component of investment income, I'm referring only to the risk-free rate, not the total return. Second, it should receive the rate that is consistent with the duration of the reserves. That is, if a line has a liability C3 variability (as measured by duration) of 4.5, then the risk-free rate should be that of whatever treasury has a duration of 4.5. As treasury rates migrate to different levels, the line will develop a weighted average risk-free rate. This rate will respond quickly to changing treasury rates in short duration lines and more slowly in long duration lines.

Each line should then receive a C1 spread on top of its risk-free rate. This is merely the weighted average spread of the asset classes allocated to it.

The product level C1 optimization begins with the company's actual asset allocation. It then swaps assets in each class for each product line in and out of surplus. You can assign unique risk targets and liquidity and RBC constraints

to each line. The objective function of the optimization is to maximize the aggregate product line spreads subject to their risk targets and boundary conditions. That is, the process will conclude when the partial derivatives of return per unit of risk are equal across product lines.

You can establish product line C1 parameters for risk, liquidity and RBC on the same basis as you establish them for the company as a whole. How long is it until the cash is needed? Are there important insurance contingencies? Are earnings strong? Is capital plentiful?

This process can yield some intriguing results. Consider the following in a Life/P&C group of companies. It's easy for me to imagine allocating some municipal bond excess returns to a life insurance line even though the life company wouldn't hold the actual bonds. But since the life reserves allowed the group to hold a greater dollar amount of municipal bonds (at a given allocation), it can share synthetically in the excess returns.

Product line managers may want to receive units of excess return based on RBC rather than true C1 risk. They may further want to receive current weighted average spreads rather than long term spreads. Both of these make sense to me, provided there is a consensus among managers.

Product segments and surplus investments

One approach is to isolate the two portfolios according to the source of funds—surplus and reserves—and then optimize them independently. A nice feature to this approach is your ability to specify objective functions and constraints in each. But there are theoretical and practical problems with the approach. Optimization theory tells us that the aggregate of two efficient portfolios may not be efficient. So it's better to have one portfolio with well-crafted parameters. Furthermore, from a practical perspective, the two portfolios bleed between one another. So when a product line has earnings, the same dollar moves from reserves to surplus. And, in times of stress, it moves back to reserve. The notion of separate portfolios have a long history in industry convention, but is not real.

I think it's best to have just one portfolio. Then carefully target the portfolio's C1 risk, reflecting the company's surplus level and other factors, and establish an efficient allocation. This will give you good economic characteristics. Subsequent to all of this, direct investment excess returns to various products and to surplus.

Multiple companies in a group

It is almost always more efficient to construct just one portfolio rather than aggregate several. I like to look through group entity structures in assessing and optimizing C1 risk. This supports the reality that management provides capital to subsidiaries under stress or sells them and bears the loss.

Two qualifications are useful here. First, it remains true that, subsequent to the group's overall allocation, real securities need to be placed in real insurance companies. Each entity demands a reasonable, albeit not efficient, allocation. Secondly, there may be contractually understood circumstances to pass specific returns to specific claimants, even outside of the variable product context. Examples include certain participating policies and CBO structures in which the company owns the entire equity portion and are consolidated under GAAP.

But in general it's best to think of the group having just one portfolio. Then make reasonable allocations.

Mutual and stock charters

We've known for a long time that, if a corporation—including a stock insurance company—doesn't see good opportunities for its capital, then its board should dividend the capital out for shareholders to deploy in another equity venture. By analogy, if a mutual insurance company doesn't see good opportunities for its capital, then it should increase its exposure to equities. That is, as a proxy for shareholder stock investment, the mutual can make the same investment itself, in theory for the benefit of policyholders. In practice, many stock company boards do not declare this type of signaling dividend, acting more like a mutual company. In any case—stock or mutual, dividend or not—greater amounts of free capital are appropriately allocated to equity investments.

More generally, greater levels of capitalization are associated with greater risk bearing capacity within the insurance company. So the target risk, around which to optimize the portfolio, can be greater. This is consistent with the dividend irrelevance theorem of Modigliani and Miller. And the type of legal charter doesn't change the economics.

Life and property companies

Investment professionals, who are lay asset-liability managers, are fond of telling company management that they have structured the portfolio to be "consistent with the nature of the liabilities." Almost without meaning in itself, investment managers use the assertion as a way to avoid the question of why they have mortgages and corporates in the life company and municipals and stocks in the property and casualty company.

But the question remains. And it becomes more poignant once you get past the C3 variability issue, which truly may be different for life versus property and casualty. On what basis do you structure the C1 exposure so differently?

I look to the drivers of C1 capacity: available capital, other insurance risks, reliability of funding sources and board temperament. These factors are not fundamentally different between life and property companies. Indeed, some groups contain both types of charters. With capital transferability, consolidated risks and common boards, I submit that the C1 risk targets ought not to be fundamentally different. Most differences in portfolio structure ought to relate to taxation or potential rating agency scrutiny.

Differences in the way life and property companies ought to consider, assess and target C1 risk are trivial.

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Exploring C1 Risk
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Income and capital appreciation
Income returns are deemed to have an endogeneity that capital gains do not have. So income returns are capitalized more heavily in company valuations. Visible capital gains give the impression of earnings volatility. And so gain streams are heavily discounted in company valuations. Management often believes that it is adding value to shareholders by substituting relatively modest income in place of relatively robust capital gains.

In truth, the distinction between capital gains and investment income is economically meaningless. Long-established financial reporting conventions distinguished between monies clearly owed the investor—declared dividends and timely coupons—and the balance of the investment corpus. The distinction begins to crack with high premiums and deep discount bonds because monies clearly owed are adjusted by amortization and accretion to derive interest income. And it crumbles when applied to interest-only securities in which there is no ultimate principal balance. Financial engineers exploit the convention by ascribing amortized cost and NAIC 1 treatment to a 30 year note that is roughly five parts S&P 500 and one part U.S. treasury zero coupon bond that will ultimately pay its par value on all six parts.

True C1 risk reflects the variability of the asset class' total return series, net of its C3 variability, without regard to the character of its return components. Management focused on producing investment income may be responding to shareholders' current desires, but it is probably not building economic value.

Investment performance measurement
Actual returns demand a context, so people compare to benchmarks. In the context of C1, it is clear to me that the first comparison is between actual total return and excess return. This will tell you whether and by how much your particular subset of an asset class outperformed the class as a whole.

It's useful, though, to ask the next question. In an asset allocation context, the investor holds a particular asset class to play a certain role in the portfolio. At times, the manager of an asset class generates a positive excess return by investing in securities that are not members of the asset class. Doing so may reflect sound portfolio management, but only if the actual securities portfolio has statistical properties similar to the index. Otherwise, the efficiency of the portfolio has been compromised. Indeed, a good measure is the amount of excess return a portfolio has earned per unit of tracking error. The pension investment literature calls this an information ratio. So, think of the average excess return divided by the standard deviation of the excess return series. It is analogous to a Sharpe ratio, which indicates excess return per unit of risk. A high information ratio acknowledges that excess return is valuable. It also acknowledges that the asset class has a role to play in the overall portfolio and that a high excess return that compromises this role is less useful.

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1998-99 Redington Prize Awarded

To promote investment research, the Investment Section sponsors a biennial prize of $2000. The prize is named after F. M. Redington, the eminent British actuary who coined the term "immunization" in a 1952 paper in the Journal of the Institute of Actuaries. This is the sixth award since the prize was first established.

The Council would like to thank all those who took the time to send in nominations. The Prize Committee received a total of 11 nominations. Many worthy papers were submitted, and therefore, the Committee's decision was not an easy one. For the 1997–98 publication period, the Prize has been awarded to:

"Term Structure Models: A Perspective from the Long Rate" by Yong Yao (A.S.A.) in *NAAJ,* Vol. 3, No. 3, (July 1999).

The paper responds to an important need in the actuarial profession, which is the valuation of long term insurance or pension plan cash flows where the yield curve, as measured by prices of traded securities, does not exist.

The paper partially answers two questions: in frictionless markets having no arbitrage, what should the behavior be; and, in known term structure models, what can the behavior be. In frictionless markets having no arbitrage, yields of all maturities should be positive and uniformly bounded from above. The yield curve should level out as term to maturity increases. Slopes with large absolute values occur only in the early maturities. The paper goes on to show how the long rate behaves in well known term structure models. Practitioners using these models at these longer durations should be aware of their behavior.

On behalf of the Investment Section, the Council would like to congratulate and thank Mr. Yao for the exceptional work he has accomplished. The Council also expresses its gratitude to the members of the Prize Committee. These are Nino Boezio, Luke Girard, Jeremy Gold, David Li, John Manistre, Robert Reitano, Michael Sherris, Elias Shiu, Ken Seng Tan and Richard Wendt.

The next Redington Prize will be awarded in 2003 for papers published in 2000–01.

30-Year Treasury Rates and Defined Benefit Pension Plans

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bond, as published in their Web site. These rates are very close to each other. They follow annuity rates used for closeouts by life insurers, while attaining the goals of simplicity, stability, and transparency. This paper then examines the use of these index rates for other related calculations, and suggests some modifications. This paper assumes that the mortality basis will be updated to the RP2000 with projection for future improvement.

Background

The Society of Actuaries commissioned a study of indices that could replace the 30-year Treasury in the calculation of the Current Liability and other pension-related calculations. The objective was an index that would approximate the net interest rates used for group annuity closeout pricing by life insurers and that would be simple to use, transparent, stable, and expected to be around for a long time. While the Society of Actuaries commissioned this report, any conclusions or policy statements are those of the author and are not necessarily endorsed by the Society.

The impetus for the study was the belief that the decline in treasury issuance resulting from the budget surplus has caused volatile and widening spreads between the 30-year Treasury and corporate debt securities. This is having a negative impact on defined benefit pension plans in the U.S., by unnecessarily increasing funding costs.[3]

While credit spreads normally widen at the onset on a recession, the decline in issuance is also having an impact. The 10-year Treasury has replaced the 30-year as a benchmark for the bond market, which is consistent with global practices. Based upon CBO projections of budget surpluses, all redeemable Treasury debt held by the public will be paid off by 2006, and the U.S. Treasury will either have to buy back non-callable bonds or invest excess funds.[4] The Treasury market, as we know it, will disappear. Thus it will become necessary to find replacement indices where Treasuries are currently used.

"The impetus for the study was the belief that the decline in treasury issuance resulting from the budget surplus has caused volatile and widening spreads between 30-year Treasury and corporate debt securities."

Methodology

A survey of pricing practices of life insurers active in the group annuity closeout market was completed. Based upon composite answers, model office pricing was constructed. PBGC[5] Interest Rates were also used, since they are based upon a survey of annuity rates used by insurers. Available fixed income indices were considered in relation to insurer rates and other objectives. The effect of using the best indices on the Current Liability and other calculations was then measured, with possible modifications. In calculating duration and early retirement, RP2000 data was downloaded using the Society of Actuaries Table Manager. The effects of generational projection AA were derived from Table 8-1A of the RP2000 Mortality Tables.[6] While the results were reviewed for reasonableness, the data was assumed to be accurate.

Survey Results

Survey of Life Insurer's Pricing for Group Annuity Closeouts

Pricing actuaries at eleven life insurances companies[7] that are currently active in the group annuity closeout business were contacted. All but Travelers agreed to participate with the assurance that their responses would be confidential. The following is a summary of these responses.

Interest Assumptions—The most common response was that liability duration (or projected cash flow) was given to the investment area to obtain a gross rate. Capital (and profit) charges are deducted usually based upon Corporate ROE requirements using NAIC factors with an assumed asset mix (in one case the asset RBC was given with the gross rate).[8] Overhead expense was also deducted, as was an asset default charge in some cases. One rate was used for the entire case for most companies. One company had a yield curve from investments from which they picked a rate based upon liability duration. One company in the small case market used an assumed duration for all cases. This company used 10-year A-rated bond yields, unless they were funding a specific asset. One company appeared to use a percent of premium for the profit/capital charge.

Only two companies used anything resembling transfer pricing, with benchmark assets to obtain rates and capital charges. These were the only companies that used spot rates to discount liability cash flows. A few companies looked at cost of funds relative to LIBOR

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30-Year Treasury Rates and Defined Benefit Pension Plans

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[London Interbank Offered Rate]. While the investment areas of some of the companies might be using benchmark assets and cost of funds measures, it is more likely that they are funding specific assets. These liabilities are generally not subject to early withdrawal and thus ideal for private loans, commercial mortgages and other highly illiquid long-term investments of life insurers. There is significant liquidity premium that would not show up in bond indices with similar credit ratings.

Expense Assumptions—Overhead was usually deducted as part of the interest spread. Two companies deducted overhead as a percent of premium. Most companies had a set-up charge and a per life charge. The per life charge is based upon a present value of future benefit expenses, and was typically $200 to $300. One company converted these charges into an interest spread. A few companies projected future benefit expenses and discounted them with the benefit cash flow. Despite different computational methods, administrative expenses are remarkably similar for all companies.

Mortality Assumptions—There was a great deal of variance in the base tables used. However, all companies adjusted their mortality by projection to the current date (one company in the small case market used an age adjustment). Most companies projected future improvement (generational projection). The most common projection scale was AA.[9] One company used an interest spread to cover future mortality improvement. A few companies used different tables for hourly versus salaried employees, or made other adjustments to customize mortality assumptions to the group covered. All companies used sex distinct rates.

The following is a summary of the tables used[10]:

Mortality Table	Number of Companies
83 GAM	3 (1 basic)
94 GAR	5 (3 basic)
RP2000	2

Early Retirement Assumptions—Most companies used retirement scales with annual decrements. One company used a scale with three ages for early retirement decrements while one company used an assumed early retirement age for the group. The choice of early retirement scales was highly dependent on judgment. Historical data and company prospects could be taken into account. This particular assumption may account for much difference between insurers' quotes for a given case.

Statutory and Tax Reserve Strain—Most companies include statutory reserve strain as a capital cost, and have additional charges to cover shortfall between what surplus earns and ROE requirements. While tax strain is not currently an issue, most companies indicated that it would be reflected in pricing, if it became an issue in the future.[11]

Optional Forms of Annuity—For the most part, these are not subsidized. Occasionally plans may have subsidized joint and survivor factors or lump sum factors. However, since GATT[12] lowered the cost of offering lump sum settlements to all non-retired participants in lieu of annuity benefits at plan termination, these optional forms have become less of a factor in pricing. However, if included, they would be priced similar to early retirement assumptions, based upon conservative rates of election.

Select and Ultimate Rates—This refers to the practice of using a lower rate after 20 or 30 years, to reflect reinvestment risk. While a few insurers still do this, it is an anachronism from the 1980s, when interest rates were high, and most debt securities were callable or matured in 10 years or less. In the current, low interest rate environment, 30-year non-callable bonds are commonly issued, and there are 50- and 100-year bonds available. Derivative products also exist today to immunize long cash flows, although they have regulatory and accounting issues. Thus insurers are able to fully immunize terminal funding cash flows with high yielding corporate debt and so there is no need to make assumptions regarding reinvestment rates after 20 or 30 years.

There has been little change since the original paper on terminal funding pricing was published in 1986, other than to update interest and mortality assumptions.[13]

Model Office Pricing

Based upon the foregoing survey, we have constructed a model of insurer pricing. First a 30-year NAIC 1 bond, represented by 30-year A3 industrial bonds from Bloomberg, is chosen as the asset.[14] Then redundancies are applied to NAIC capital charges giving a total required surplus of 3%.[15] The target after tax return on this surplus is 12%[16], and we have assumed surplus earns 7% pretax, and the tax rate is 35%. The required spread rounds to 0.35%. We have added 0.20% for overhead and investment management expenses, 0.05% for asset defaults[17] and 0.10% for administrative expenses, giving a total spread of 0.70% off the A3 bond rate. We have ignored surplus and tax strain, which are not an issue at this time.

In practice, insurers frequently invest in less liquid assets and obtain higher rates with the same RBC (*e.g.,* private placements) or assets with higher RBC (*e.g.,* commercial mortgages) where the asset spread more than offsets the additional capital charge. While the Current Liability provides for early retirement costs, the insurer's pricing actuary will likely be more conservative than the plan actuary, since he cannot revise pricing assumptions in the future if experience

deteriorates. The insurer's administrative expenses will also vary by case size. We have assumed an average consideration of $25,000 per life and ignored any per case charge.

PBGC Rates

The PBGC collects sample annuity rates from participating insurers quarterly. Such rates were not available for this study. However, the PBGC uses an average of the June 30 and September 30 rates to produce its valuation rates. The interest rate is extracted from the average annuity rates from the survey by assuming 1983 GAM mortality. The interest rates are then updated to November assuming rates change in proportion to an average of Moody's AA and A rates. The rates are fitted to a select and ultimate rate where the rate decreases slightly after 20 or 25 years. This becomes the January initial rate for the following year, which is then updated monthly using changes in the Moody's yields.

While the methodology used by the PBGC is somewhat arbitrary, it gives an indication of the relative level insurers net purchase rates for closeouts. I could find no explanation for the anomaly of rates below treasuries prior to 1998 in the attached chart. The strengthening of insurer's mortality assumptions relative to the 1983 GAM would have had the opposite effect. It may be a result of the Safest Annuity Rule[18], which forced out smaller companies with higher expense loads, thereby changing the companies in the survey.

Survey of Other Organizations Considering Similar Issues

Attempts were made to contact individuals at the PBGC, DOL [Department of Labor], and Treasury to determine if anyone in government was working on replacement indices for pension related calculations. While there are high-level studies underway on the effect of reduced treasury issuance on the economy, no one is looking at specifically at the interest rates used for the Current Liability, or if they are, it is a secret.

Fixed Income Indices

The 10-Year Treasury

The 10-year treasury has replaced the 30-year as the benchmark security for the U.S. bond market. However, it is inappropriate for the Current Liability for two reasons. Its duration of seven is much shorter than typical pension plan, with duration of 10 to 20. Also it has limited shelf life, assuming budget surpluses materialize as expected.

Agencies

Three U.S. agencies have benchmark securities programs designed to replace U.S. treasuries as standards for the bond market. Two of these, Fannie Mae and Freddie Mac[19] have non-callable 30-year notes that could be used for the Current Liability. Both Agencies have scheduled auctions and buy back and reissue programs designed to provide liquidity similar to Treasuries. The programs are substantially identical, and the securities have the same yields, within a basis point. Fannie Mae's benchmark securities program has $3.5 billion in 30-year bonds outstanding while Freddie Mac's reference note program has $4 billion. (U.S. Treasury has $15.9 billion of 30-year bonds outstanding).[20]

Either of these agencies, or an average of both, could be used. We chose Fannie Mae because its Web site has benchmark yield curve and historical yield information for these securities that is easily downloadable. To get yields for Freddie Mac requires Bloomberg, a subscription service. The chart at the end of this paper shows monthly yields for the Fannie Mae 30-year bond compared to other rates for the past five years. The Fannie Mae yield closely follows the 30-year swap rate, which on average is about five basis points higher. The correlation between changes in swap rates and agencies is extremely high—0.985 during 1998–99 period which covers the extreme spread widening from the Russian debt and Long Term Capital Management crisis.[21]

The chart also shows that Fannie Mae bond has been close to PBGC rates in recent years. On average during the past five years, Fannie Mae yields have been 0.74% below that of A3 Industrials, which is in line with our model office pricing spreads. Agency issuance is projected to continue to grow, and exceed U.S. Treasury outstanding public debt in 2005.[22]

The Fannie Mae, FNMA 30-year benchmark bond has the characteristics of a good index for the Current Liability. It follows insurer pricing and is simple to use, transparent, with long expected shelf life.

Swap Rates

The use of fixed—floating interest rate swaps has grown exponentially in recent years, with daily trading volume of $22 billion in 1998.[23] Swap rates have already replaced treasuries as the risk-free discount rate for future cash flows in many private transactions. Swap rates are now published in the Federal Reserve Statistical Release H.15, and are accessible on their Web site. Under a fixed-floating swap, one party pays a fixed rate in exchange for a floating rate based upon LIBOR on a notional amount. LIBOR is a short-term rate paid on Eurodollar deposits. The rate is set daily in London based upon the average paid by AA banks for various terms up to one year. For example, if three month LIBOR is exchanged for a fixed rate, the LIBOR rate would be reset every three months based upon the rate then in effect for three month deposits.

Swaps have the advantage of not depending upon physical securities. They have a high level of liquidity. However, most activity is under 10 years and there is currently a 4-basis point bid ask spread on 30-year swaps,[24] although there is growing use of long dated swaps. When a bank is downgraded, it is dropped from LIBOR calculation, and so LIBOR is a constant AA rate. This would be lower than an AA bond at long durations, where the bond has downgrade risk. Thus, it is not surprising that swap rates are close to agencies. On average swap rates were five basis points higher than 30-year FNMA bonds over the past five years.

The use of a single rate, the 30-year swap, instead of pricing off the swap

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30-Year Treasury Rates and Defined Benefit Pension Plans

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curve (*e.g.,* pricing cash flow at year one using the one-year rate), is more than a simplification for ease of use. Only 20% of the insurers in our survey use spot rates. Most use a single, long-term rate. This reflects the nature of insurers' assets and liabilities. Most insurers have short liabilities, such as GICs and SPDAs that are managed with long-term liabilities. Any excess asset cash flow at the early durations can be used for these short-term liabilities.

Like the 30-year FNMA bonds, the chart show 30-year swap rates close to PBGC rates in recent years. On average, 30-year swap rates were 69 basis points below A3 Industrials during the past five years.[25] Thus it matches our model office pricing for closeout annuities. The 30-year swap rate has the characteristics of a good index for the Current Liability. It follows insurer pricing and is simple to use, transparent, with long expected shelf life.

Corporate Bond and Other Indices

There has been a proliferation of bond market indices in recent years, numbering in the hundreds, counting sub-indices. Most of these are total return indices and are designed for measuring performance of fixed income managers. Measures of yield, such as yield to maturity, yield to worst, and option adjusted yield can be extracted for these indexes. There are a number of indices that focus on yield.

While there are many indices, they can be divided into categories that are similar. The first category is the broker indices. Major, and some minor, bond brokers have total return indices. We would first eliminate all global and foreign bond indices as not applicable to U.S. pension liabilities. One problem with the domestic broker indices is that they are proprietary, and subject to change. The broker determines the pricing and analytics. Another is that the broad market indices have duration and convexity[26] characteristics that are ill fitted to pension liabilities. Examples include Lehman Aggregate, Merrill Lynch U.S. Domestic Master, and Solomon Smith Barney Broad Investment Grade (BIG).

The BIG index has duration of five and a yield to maturity on 7/31/01 of 5.7%. Solomon Smith Barney also has an index called Large Pension Fund Index that has duration of seven, which is still too short for pension closeout liability. There are, however, sub-indices that can approach pension liability duration. For example, Merrill Lynch U.S. Corporate A rated 15+ years index had duration of 11 and yield of 7.3% on 7/31/01.[27] While this may be an appropriate proxy for insurance company assets, the lack of transparency and the dependence on the broker makes these undesirable for the Current Liability.

Another category is publisher indices. These include some yield indices. Examples include Moody's, S&P, Bloomberg, and Barron's. They are available to subscribers and have similar transparency issues as the broker indices. The Moody's Corporate A Index, which is an unweighted average yield of 100 bonds, with average maturity of 30 years, would have a duration equivalent to the long bond, would be an appropriate proxy for insurers' closeout assets. The yield on 7/31/01 was 7.5%.[28] This has disadvantages as an index for the current liability similar to broker indices (*i.e.,* proprietary, and subject to change). We used Bloomberg fair market yield curve for 30-year A3 rated Industrial bonds in this paper because these are option adjusted (*i.e.,* bullet bond) yields.

Current Liability

The Current Liability of a pension plan is a measure of the cost of benefits accrued to date. It was introduced in OBRA 1987 and refined in RPA 1994.[29] It is designed to measure plan termination liability. It mandates mortality (1983 GAM for non disabled) and interest between 90% and 105% of weighted average of 30-year treasuries for the past four years, using a 4/3/2/1 weighting going back in time. Early retirement and turnover assumptions must be included if material. To determine if additional funding (and disclosure) is needed, the Current Liability is calculated at the 105% of smoothed treasury rate and compared to the actuarial value of the assets.

Looking at the past four years, swap rates have been about .8% higher than treasuries at 30 years. Assuming an average duration of pension liabilities of 15, similarly smoothed swap rates would reduce the Current Liability by 12%. However, if the RP2000 table were adopted at the same time, almost half of this decrease might be offset.[30] If the swap rate (or FNMA rate) were used flat (i.e., 100% instead of 105%) along with the mortality change, the reduction in Current Liability would be minimal for many plans.

A more radical change that would rationalize and simplify these calculations and make them more closely reflect the cost of purchasing an annuity would be to compare the market value of the assets and the Current Liability using the swap rate in effect on the same date. All calculations would be keyed off the ratio of these assets to liabilities. If the ratio exceeds 100% and duration of the assets and liabilities are reasonably close, no additional PBGC premiums or funding would be required. For non-immunized cases, some additional over-collateralization might be required.

Other Calculations

PBGC Premiums

PBGC variable premiums are 0.9% of the under-funding based on the current liability calculated using 85% of 30 year treasuries compared to market value of assets. Based upon 7/31/01 rates and duration of 15, a change to 85% of swap rates would reduce liabilities by about

11%, *cet. par.* However, if the mortality were changed to the RP2000, the decrease would be reduced to 6%, assuming 50% male/50% female.

Maximum Permissible Lump Sum Benefits From Qualified Plans

If this is changed from 30-year Treasuries to swap rates, the effect should be less than the previous examples, since those receiving maximum lump sums are likely to be older than the average plan participant. At age 65, the reduction from using swap rates would be about 5.5%. The increase from using RP2000 would be 2.5%, so the net change is a 3% reduction.[31]

Minimum Lump Sum Benefits Equivalent to Stated Income Benefits

The value of lump sum distributions should be close to the price of an annuity for the accrued benefit. If the value of the lump sum is too high (*i.e.,* if the interest rate is too low) and the plan provides for lump sum distributions, then the employers are being overcharged. There is also additional incentive for employees to choose a lump sum distribution, which could be squandered. This defeats the purpose of pension plans.

If the lump sum is too small compared to the value of the annuity then it would not be fair to employees and if they choose a lump sum they would not be able to replace the benefit. This may also encourage employers to amend plans to offer lump sums to obtain the lower cost, with the potential for the lump sums to be squandered.[32]

It may be appropriate to include early retirement subsidies and an estimate of insurer expense charges in order to better approximate annuity prices if realistic interest rates are used. However, this would require a change in the law and it would increase employer costs for ongoing plans that provide a lump sum option.

The chart below compares the effect of changes. We have illustrated the cost of early retirement for a plan with an early retirement benefit of 70% payable at age 55. We have illustrated expense of 5% ($250/$5,000), 50% male/50% female, using RP2000 Combined Healthy with an interest rate of 6.23%.[33]

Effect of adding the following changes to lump sum calculation

Age	*Swap Rate*	*RP2000 Projected*	*Early Retire at 55*	*Total including 5%*
30	-29%	+15%	+68%	+59%
50	-16%	+8%	+68%	+65%
70	-5%	+2%	0%	+2%

Annuity Rates for Converting Accumulated Mandatory Employee Contributions

Switching to swap rates from 30-year Treasuries would result in a higher accumulation depending on the number of years to normal retirement age. For example, for 10 years, the increase would be 7%, while it would be 24% at 30 years at current rates.

Other Related Calculations

Tax and statutory reserves of life insurers for annuities purchased by terminating pension plan can significantly affect pricing and availability of these annuities. Tax reserves have been based upon applicable federal rate since the Tax Act of 1987 (but not less than the statutory rate). This was originally done for revenue enhancement, but is not producing any at this point. To avoid problems in the future, tax reserves should be changed back to equal to statutory reserves. Statutory reserves for the current year are based upon a weighted average of Moody's corporate bond average for the period from July of the prior year through June of the current year and 3%.[34] The result is spurious reserve strain during periods of rising interest rates. Statutory reserves should equal the greater of reserves calculated using the 30-year swap rate for the month of purchase or GAAP reserves. This would involve changing laws in several states and Statutory Accounting Principals. Since new closeouts are an insignificant portion of reserves of very highly rated companies and since this change would apply prospectively, it should not be overly controversial.

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1) As described in 26USC412 and 29USC1082. Current Liability, which is part of the minimum funding rules, is discussed in detail later in this paper.

2) Federal National Mortgage Association, (Fannie Mae).

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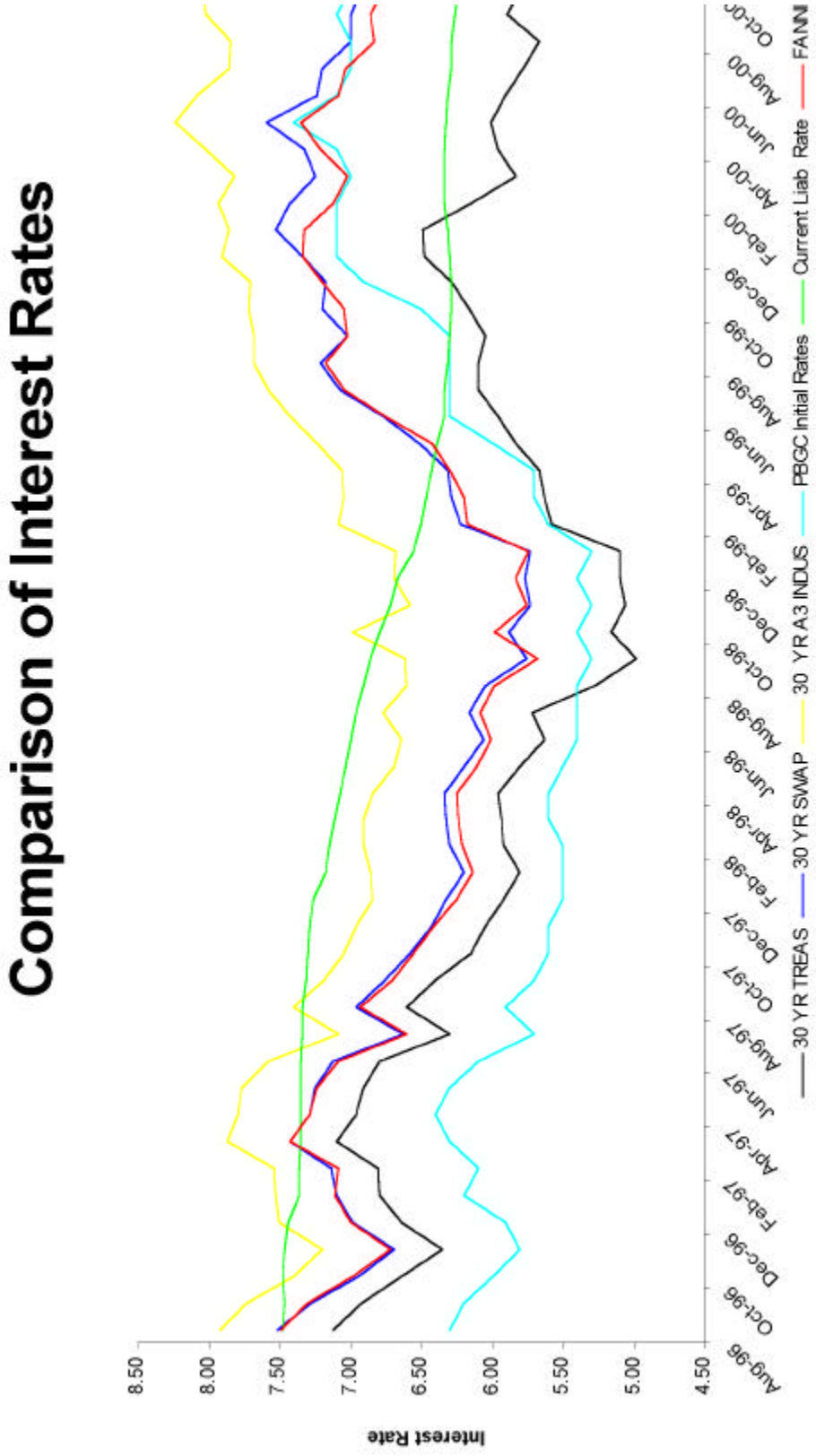

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8) ROE is Return on Equity; NAIC is National Association of Insurance Commissioners; RBC is Risk Based Capital, which is additional funds that insurers must hold to support liabilities

9) Retirement Plans Experience Committee, *Op.* Cit. p. 75

10) Basic indicates that margins for insurance company valuation of 7% to 10% have been stripped out.

11) Statutory strain occurs when statutory reserves are higher than gross premiums and the insurer must allocate surplus; tax strain occurs when tax reserves are lower than premiums, and the insurers must front income taxes.

12) General Agreement on Tariffs and Trade, Uruguay Round PL 103-465

13) Modugno, "Terminal Funding"

14) NAIC 1 is equivalent to A rating from S&P or Moodys; Bloomberg A3 industrial bonds is based upon bid prices for A3 bullet maturity bonds from industrial companies

15) National Association of Insurance Commissioners, "Risk Based Capital"; Assumes AA redundancy of 225%

16) This assumes 9 to 10% for cost of capital with the balance as shareholder value-added

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21) Flemming, "The Benchmark U.S. Treasury Market: Recent Performance and Possible Alternatives" p. 11

22) *Ibid.,* p.13

23) Flemming, *Op.* Cit., p.20

24) Bloomberg

25) Bloomberg

26) Convexity is the rate of change of duration with yield. Modified duration is the first derivative of price with respect to yield and convexity is the second derivative. More detailed information and sample calculations can be obtained on: *http://www.finpipe.com/duration.htm*

27) Bloomberg.

28) Ibid.

29) Omnibus Budget Reconciliation Act of 1987 and Retirement Protection Act of 1994 (GATT)

30) This assumes 50% male/50% female. RP2000 AA Generational Combined Healthy has lower mortality for males, but higher mortality for females at some ages compared to 1983GAM. Thus a group that was predominately female would see a greater reduction in current liability. Average age distribution assumed.

31) Assumes 50% male/50% female using RP2000 AA Generational Combined Healthy at 6%.

32) For a discussion of employee use and preference for lump sums see: Watson Wyatt, "Choosey Employees Choose Lump Sums!" and Working Group On Retirement Plan Leakage, "Are We Cashing Out Our Future?". For a information on the increase use of lump sums options see Committee on Retirement Systems Research of the Society of Actuaries, "Safest Annuity Rule" p. 47

33) The swap rate in effect on 7/31/01

34) See for example, California Insurance Code Section 10489.4.

What Do You Mean You Are An FRM From GARP?

by David N. Ingram

Editor's Note: In mid-January 2002, about two-thirds of the regional directors of GARP have moved to set up a rival organization PRMIA (Professional Risk Managers' International Association) in a disagreement over organizational structure and governance of GARP.

If you listened carefully, you heard references to GARP several times at last spring's SOA meeting in Toronto. If you looked carefully at the Power Week brochure, you saw two of the seminar speakers listing themselves as FRM in addition to FSA designations. GARP is the five-year old Global Association of Risk Professionals and FRM is their professional designation of a Financial Risk Manager.

GARP has over 20,000 members worldwide according to their Web site *www.garp.com* and about 1000 of those members have achieved the FRM designation. GARP hosts conferences on various risk management topics, publishes papers and administers the exams that qualify candidates for the FRM designation. Conferences in 2001 have included ALM, Energy Risk Management, Trading controls, VAR and Options Markets. GARP has chapters in North America, Europe, Asia, Middle East, and South America. A recent daily email bulletin had references to stories about happenings in Thailand, Philippines, Europe and the U.S.

The 2002 GARP annual meeting, February 11–14 in New York, has sessions like "Practical Approaches to Improved Market Risk Measurement and Management," "Market Risk Models and Reality," and "Derivative Accounting: Implications for Risk Measurement, Management and Hedge Assessment."

The organization is oriented to the highly technical risk managers in banking and other industries. Very little of their materials have addressed any Life or Casualty insurance concerns. However, several actuaries have found that affiliation with GARP is valuable.

John Gradwell, FCAS, is a member of the Philadelphia chapter steering committee. He sees GARP as an important bridge to the financial risk management area in banks and feels that with the coming convergence of banking and insurance that will be important to all actuaries. Ultimately he feels that actuaries can have a competitive advantage in the financial services arena due to our ability to model complex insurance liabilities.

The FRM exam is an all-day exam held annually in November. The exam focuses entirely on financial risk management as practiced in banks. Besides requiring a thorough understanding of the trading of bonds, stocks and derivatives on financial instruments, currencies and commodities, the course of study divides the main subject into Market Risk Management, Credit Risk Management and Operational Risk Management. The GARP materials proclaim that this is "a practitioner oriented exam [where] reading textbooks alone will not generally be sufficient to pass." GARP publishes a 1000-page study guide authored by Phillippe Jorion that includes a brief review of the materials and over a hundred sample questions with explanations of answers. From these samples it can be seen that some do actually depend on knowledge that is difficult to obtain outside of a trading desk. In addition, GARP has 8 texts of required reading and six optional texts as well as publications of the Basel Bank of International Settlements.

The student will be exposed to in-depth materials on capital market vehicles, decomposition of market risk factors, VAR methods, hedging linear and non-linear risks, portfolio based credit risk assessment and management, and RAROC techniques. Somewhat less useful to someone in the insurance industry are the materials on bank regulation and capital requirements.

Andres Vilms, FSA, FRM, became interested in the FRM exam because he found the syllabus to be an interesting body of material. He feels that banking is "doing more sophisticated risk management in a more standardized framework with more timely and intensive analysis." Vilms expects that when the U.S. adopts Fair Value accounting, there will be rapid convergence of banking and insurance company risk management practices. He found that the learned quite a bit about VAR, Credit Risk Management and Operational Risk management from his FRM studies. One area of the exam that he felt was not as useful to actuaries was the detailed material on the bank regulatory capital requirements. The FRM exam allowed Vilms to find out how well the actuarial exams prepared him for the level of analytic and quantitative rigor required of other financial services professionals.

One reason that David Braun, CFA, FSA, FRM, took the exam was to gain more asset-side risk management knowledge. Two years after taking the FRM exam, he feels that the preparation he did for the exam was "incredibly worthwhile." He has found that material he had studied on capital at risk, RAROC, correlation effect on risk, natural hedges and true economic capital has been useful to him in his work as a consulting actuary. As a result of what he learned, Braun has been able to incorporate more recent developments in investment theory in his models. Ultimately, he feels that the real value will emerge as the insurance industry learns to use the risk management techniques to "not just protect yourself from risk, but to use these skills to identify and exploit profitable opportunities."

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Swap It! Variable M&E Revenue for Fixed M&E Revenue

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received by an insurer. Thus, market declines can have a dramatic and immediate negative impact on a company's current income statement because of reduced M&E fees earned during the period. Other companies with asset-based fee products, such as mutual fund distributors, are suffering from declining revenues for exactly the same reason.

Swap Review

A swap is a contract entered into by two counterparties in which each party agrees to exchange cash flows at pre-determined dates. For example, Party A agrees to pay Party B a fixed rate of interest on $1 million (the notional) every quarter (the reset frequency) for 10 years (the tenor) and Party B agrees to pay Party A a floating rate of interest each quarter for 10 years. Market makers typically base the floating rate on a debt instrument benchmark (the underlying) such as the London Interbank Offer Rate (LIBOR).

The financial industry commonly refers to this example as a *fixed-for-floating interest rate swap.* The counterparties usually net the two cash flows so that one payment occurs between the parties on the settlement dates. Swaps can also involve equity-based returns on either one or both sides of the swap. The most readily available equity swaps are based on an equity index such as the S&P 500 Index. Swaps are a very flexible, effective risk management tool as they are tailored to satisfy one or both parties hedge requirements.

The M&E Fee Total Return Swap

An insurer can use a total return swap to eliminate the market risk associated with M&E fees. Each of the swap attributes are flexible based on the individual insurer's needs. The key basic terms of an *M&E fee total return swap* are as follows:

- **Notional Principal:** Notional = M&E fee (%) * Remaining Units$_t$ * Initial Unit Value; A declining schedule consistent with remaining policies inforce at future settlement dates (time t).
- **Total Return Payment$_t$:** Notional * (1 + Cumulative Actual Total Subaccount Return$_t$)
- **Fixed Rate Payment$_t$:** Notional * (1 + Cumulative Fixed Rate Return$_t$)

Since the insurer receives M&E fees driven by the returns on the subaccounts underlying the contract, the insurer has the option to pass the returns along (or swap them) to a counterparty for current fixed rates of interest. The insurer needs to design the swap to achieve the desired hedge, from partial to full market risk protection.

The insurer is likely to establish a declining notional schedule for the swap structure based on expected persistency of the existing block of policyholders over time, as opposed to a level notional principal typical in swap arrangements. One challenge to establish the notional is to predict the remaining amount of business that will be inforce at certain times in the future. An insurer is likely to use past surrender experience and projected behavior in setting the swap notional. The insurer might put an additional swap arrangement in place for every sub-account due to differing anticipated persistency patterns within each subaccount. If the insurer is writing new variable business, it may enter into a number of swaps as new business is acquired to assure all fees are completely hedged.

Note that the payment formulas use *cumulative* total returns from the transaction commencement through the time of payment. If an insurer wishes to hedge its M&E fee received, say five years from today, it will collect X basis points times the actual account value in five years. The account value in five years equals the initial account balance plus all accrued cumulative returns for the five years, the desired hedgeable item. The cumulative fixed rate return can be expressed as a level annualized fixed rate. This rate is similar to a fixed rate quoted in a "plain vanilla swap" as it would not change for the life of the swap agreement. An alternative structure might swap the total return of the subaccounts for a *floating* interest rate. In this structure, the floating rate and the sub-account returns are unknown until the settlement dates.

To hedge M&E fees assessed against sub-accounts, the insurer needs to swap the return of its *actual* underlying sub-accounts to avoid retaining basis risk. Basis risk is the risk associated with any mismatch between the sub-account return and its benchmark indices. An insurer would retain this basis risk if it swapped index returns, as opposed to actual subaccount returns for fixed rates. Thus, using the actual sub-account is ideal for the insurer.

The market bases the fixed rate for swap transaction on a number of factors. These include the current rates on risk-free investments at the time of the transaction and any risk charges the fixed payor requires for retaining the unhedgeable basis risk. The fixed rate is typically set so that there is no initial payment from one party to another.

The following table illustrates the net payments received by the variable payor (the insurer) under a hypothetical scenario in which the assumed sub-account total returns are 1% per annum, used solely for illustration purposes. In practice, the payments are based on actual sub-account returns known only after the period has elapsed. For simplicity, the example assumes that the fixed rate price for the transaction is 5% and the M&E fees are collected annually at the end of each year. Other assumptions are as follows: 1) expected total withdrawals are 5% per annum, 2) the M&E fee is 1.0%, 3) the initial unit value is $1 and 4) the insurer is hedging total account balances of $1 million.

As stated previously the swap structure is flexible enough to achieve other objectives. For example, it can be set to eliminate any market risk associated with surrender charges assessed against the account value. Additionally, call options embedded into the structure can allow the insurer to participate in rising markets while providing a floor protection on the downside.

Assumes Sub-account gross returns are 1% per annum

Years	Expected Persistency	Units Remaining	Annual M&E Swapped	Swap Notional	Annualized Fixed Rate	Fixed Cumulative Total Growth	Annual Actual SA Gross Total Return(1)	Subaccount Cumulative Total Growth	Annual Fixed Payment	Annual Variable Payment(2)	Net Settlement to Variable Payor
0	100.0%	1,000,000									
1	95.0%	950,000	1.00%	$ 9,500	5.0%	105.0%	1.0%	101.0%	$ 9,975	$ 9,595	**$ 380**
2	90.3%	902,500	1.00%	9,025	5.0%	110.3%	1.0%	102.0%	9,950	9,206	**744**
3	85.7%	857,375	1.00%	8,574	5.0%	115.8%	1.0%	103.0%	9,925	8,834	**1,092**
4	81.5%	814,506	1.00%	8,145	5.0%	121.6%	1.0%	104.1%	9,900	8,476	**1,425**
5	77.4%	773,781	1.00%	7,738	5.0%	127.6%	1.0%	105.1%	9,876	8,133	**1,743**
6	73.5%	735,092	1.00%	7,351	5.0%	134.0%	1.0%	106.2%	9,851	7,803	**2,048**
7	69.8%	698,337	1.00%	6,983	5.0%	140.7%	1.0%	107.2%	9,826	7,487	**2,339**
8	66.3%	663,420	1.00%	6,634	5.0%	147.7%	1.0%	108.3%	9,802	7,184	**2,618**
9	63.0%	630,249	1.00%	6,302	5.0%	155.1%	1.0%	109.4%	9,777	6,893	**2,884**
10	59.9%	598,737	1.00%	5,987	5.0%	162.9%	1.0%	110.5%	9,753	6,614	**3,139**

(1) Total return of subaccount calculated before any management, performance or any other fees assessed
(2) Equals actual M&E fees received if actual persistency equals expected

Accounting Ramifications

Before implementing any risk management solution a complete analysis of its accounting ramifications is warranted. The hedge described above fits the definition of a derivative under the recent accounting statement FAS 133, *Accounting for Derivatives Instruments and Hedging Activities*. Under FAS 133, the AICPA considers a financial instrument to be a derivative if it 1) has cash flow that varies with one or more variables (the underlying), 2) requires no initial investment, and 3) is net settled. The *M&E fee total return swap* satisfies all of these criteria. Derivatives under FAS 133 are required to be marked-to-market with changes in market value flowing through the income statement. However, the contract described above is likely to qualify as a cash flow hedge under the statement as the hedged item, M&E revenue, affects reported income. Under hedge accounting treatment, net settlements flow through the income statement when they are actually made or received and changes in the mark-to-market value of the swap do *not* flow through current period income. These are desirable attributes from the insurer's perspective since future expected M&E revenue is not marked-to-market on its financial statements. According to FAS 133, "hedging ineffectiveness" of a cash flow hedge needs to flow through the income statement when it occurs. However, since the underlying of the swap is the actual subaccount, the swap will be highly, if not "perfectly effective."

The above structure would be perfectly effective only if actual persistency exactly equaled the expected persistency that determined the swap notional set at the swap's commencement. Thus, if an insurer tried to completely hedge all of its exposure and fewer policies persisted than anticipated, the insurer would have an overhedged position as the swap notional would exceed the amount actually needed. As a result, the insurers would have to recognize this hedging ineffectiveness in their GAAP income statement. However, even with hedging ineffectiveness flowing through the income statement, earnings volatility is likely to be substantially lower with the M&E fee swap than without the swap. One solution to avoid being overhedged is to hedge against only a portion of the business at the onset.

It is interesting to note that the above structure would provide for capital relief for all companies following Canadian reporting guidelines. Briefly, the new capital requirements issued by OSFI, the regulating body in Canada, require companies to perform Monte Carlo valuations of the present value of guarantee fee revenue less claims and hold capital to satisfy somewhere between the 95th–99th percentile of the projected scenario set. Clearly, a swap contract like the one described above would provide net payments to an insurer in these tail scenarios thus lowering capital requirements. This makes the use of the swap described above very desirable for companies that are required to hold capital under the new Canadian standards.

Conclusion

Currently, very few insurers hedge the market risk associated with their variable products. In light of recent events, insurers should conduct a prudent analysis of this risk and the potential earnings volatility it produces. A swap, while not the only solution to stabilize current volatile earnings, is one worth exploring for many variable product insurers.

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30-Year Treasury—Trick or Treat?

Editor's Note: The following article appeared in the November 2001 issue of the Ryan Labs, Inc. newsletter. It is reprinted with permission.

Note from the authors: As the leaders in liability index management, we pay close attention to matters that may affect the long-term prosperity of our country. In the closing stages of October, the Treasury Department announced the elimination of Thirty-Year Treasury Auction Issue. We believe this announcement will have major ramifications on liabilities throughout America.

On October 31, 2001, a day which will live in infamy, Undersecretary of the Treasury for Domestic Finance, Peter R. Fisher, announced the suspension of the 30-year Treasury bond auctions. The repercussions of this action will ripple through our financial economy. Here is a list of potential problems:

Pensions

Currently, pension contributions are governed by IRS 404(a). This rule is based upon discounting pension liabilities using a weighted average of the 30-year Treasury over the last four calendar years. GATT legislation for pension plan terminations is based upon the average 30-year Treasury rate a month before the end of the fiscal year. PBGC premiums for under-funded plans is based upon valuing the current liability calculation at 85% of the 30-year Treasury as a discount rate. It remains to be seen how all these bodies react so soon to their year-end calculation date. Currently, with the recent supply driven rally, contributions and pension liabilities will be going up. This could be costly especially when viewed that these funds are not recoverable if rates rise after the date of calculation.

State Lotteries

Most State Lotteries price their liabilities off the Treasury STRIP curve. Moreover, most defease their liabilities with Treasury STRIPS. Since the majority of STRIPS come from stripping the long bond, it remains to be seen how defeasement will work here in time. Given the immediate supply driven rally on long Treasuries, lotteries are hit with higher defeasement cost. If maturities of these games have to be shortened, then costs go up even more. For most states, the lottery is one of their largest revenue sources.

Agencies

By law, government agencies can only buy Treasury securities (non-marketable). Social Security has become the major buyer. The growth rate of such non-marketable purchases has accelerated to the point that it will soon be the largest segment of Treasury debt. Much of these purchases are long maturities either by formula or to match a liability schedule:

(Trillions)

Fiscal	Marketable	Non-Marketable
1996	3.418	1.802
1997	3.439	1.967
1998	3.331	2.187
1999	3.233	2.414
2000	2.992	2.629
1Q/2001	2.966	2.651

Bond Market

There is no question that the 30-year was a key issue for the bond market. It was usually the base rate for pricing other long bonds. In international markets it is the benchmark for long durations. The bond market works like a solar system where most bonds gravitate around one key issue in a yield-spread orbit. Spreads may change but wherever the key issue (sun) goes in interest rate direction, so goes the entire solar system. A lot of bonds will now trade in outer space looking for direction. America had one of the very few continuous long bond issuances. The world was weaned on this security. We certainly don't want to lose this level of market acceptance.

The volume of trades done with the 30-year Treasury is a testimony to its usefulness as it was one of the most widely traded securities in the world. Most traders used the 30-year Treasury futures to hedge their long position(s). This contract is now in jeopardy. Traders are now at more risk if they cannot effectively hedge.

As a result, less efficient pricing and trading now occurs in the long end. Confusion reigns here. Treasury brokers and dealers hit hard by the WTC crisis must now feel that financial terrorists have hit the bond market.

Swap Curve

The swap curve has become a tool for hedging positions given the loss of some of the key Treasury auction maturities. Investors find the swap curve more difficult and confusing as most of their risk/reward analysis is Treasury based. For an in-depth review of the Swap Curve, please call our sales people (212-635-2300 ext. 233 and 241) for our research article "The Swap Curve (Pros and Cons)".

Prudent Person Rule

Supposedly, the prudent investor should invest to match his/her investment horizon or needs. Treasury financing will continue long-term if not in perpetuity. The recent economic slowdown, 10-year tax cut and the Social Security problems of the future tend to insure this reality. In fact, the Social Security letter to all beneficiaries in September 2000 stated clearly that the system will go into a deficit mode beginning 2015 and will be 28% under-funded by 2037. If you have long-term financing needs, finance them with long-term bonds, especially when interest rates are historically low. The mismatching of assets versus liabilities has very visible scars in America (i.e. S&L crisis), but, apparently, a short memory.

Reinvestment Risk

Financing long-term needs through short maturities has high reinvestment risk. The rollover of the two-year auction 14x over the next 30 years is full of speculation. The yield curve was just inverse for most of the year 2000. How soon we forget. With the 30-year yield at the lowest yield level since June 1967, most borrowers would lock up such rates for as much time and volume as they could digest. Even individuals are going through major mortgage refinancings to lock up these attractive rates as long-term fixed mortgages. According to the Mortgage Bankers Association of America (MBAA) mortgage applications are at the highest level in history with refinancings accounting for 75% of these applications.

Liquidity

Liquidity is like the lubrication between gears, it makes the engine work smoother with less friction. The financial engine of America squeaks. Losing the one, three, four, seven and now 30-year Treasury auctions over a short time frame is causing friction. The Corporate bond market was in a pricing disarray in the late 1990s because of this lack of a base rate. Futures and options markets are surely hurt. The security markets thrive on volume and liquidity. It is the glue that keeps it together. Liquidity crises are not a pretty sight and should be avoided at all cost.

Intrinsic Value

The true economic or intrinsic value of any investment is versus the Treasury with the same maturity or duration. This is the best measurement of Alpha or the value added. Without a base yield curve of comparison (baseline portfolio), relative value becomes vague and leads to higher risk strategies. If you underperformed the Treasury yield curve, you knew you did not add any value. That calculation of relative value is now more suspect. You may have more risk than you know, since the risk-free asset is missing in action.

Solutions

America needs a well defined yield curve with maturities that extend far out into the future. The pricing of most fixed income securities is dependent upon it. The defeasement and pricing of liabilities is dependent upon it. The liquidity of the bond market is dependent upon it.

Utopia is a zero-coupon yield curve where bonds can be effectively priced on a duration basis and liability-driven objectives can be efficiently matched.

The 30-year Treasury is critical here allowing for 60 distinct zero-coupon maturities. Unless the Treasury is willing to issue STRIPS as a shelf registration where buyers can get almost any maturity they need, the 30-year Treasury is the only vehicle available to create such a wide spectrum of maturities. This provides a very well defined yield curve that is easily priced and purchasable.

Without the 30-year auction, in time, the maturity spectrum of STRIPS is cut by 66% assuming the 10-year auction is the longest available Treasury to be stripped. We currently have $171 billion in STRIPS. For a program started in March 1985, this has enjoyed great demand.

The Treasury yield curve is sacred ground. Most financial models have some basis built on this ground. To remove Treasury auctions creates very unstable footings for financial practitioners. We need our financial institutions supported at all costs. The economic viability of America may be dependent upon it.

God Bless the Treasury Yield Curve !

Designation Correction

Dave Gilliland's credentials were listed incorrectly from the last issue. In the July 2001 issue of *R&R* it said on page 34 that David Gilliland was a consulting actuary and FSA MAA when he is actually a software developer and a FSA FCIA CFA. We apologize for the misprint.

Gambling, or a Competitive Advantage?

The Investment Actuary Symposium Looks At Stochastic Modeling

by Max J. Rudolph

Financial risk management changed on September 11, 2001. Everyone knows that. But the techniques that we use to deal with this new environment are not that much different than the tools developed to deal with the old world. Actuaries are familiar with these tools. How can we become more involved as leaders in the new environment? It was within this framework that the Investment Actuary Symposium was held on November 8–9, 2001 in Las Vegas, Nevada. A total of 12 distinct topics were covered. Originally 21 sessions were scheduled across three tracks, but a slowing economy and travel concerns resulted in lower attendance than had been originally expected. Even so, the excellent networking opportunities and quality speakers made the seminar worthwhile for everyone who attended.

Adam Berger and Jay Glacy got things started with a portfolio optimization discussion that focused on efficient frontier concepts, adding constraints to extend the models to solve non-convex problems. Michelle Smith showed how, when determining changes in embedded value across years, to use a bridge run and waterfall charts to aid results analysis.

Kurt Karl shared Swiss Re's economic forecasts for international growth, while focusing on the U.S. outlook and his favorite leading indicators. His list of risks for the next year included both downside and upside possibilities. This tied in well with the general conference theme of using stochastic distributions of results to make decisions.

By showing how stochastic generators vary between pricing and risk management projects, Eric Thorlacius and Stephen Britt demonstrated the risks of using pricing based scenarios for risk management projects.

The lunch speaker, Michael Shackleford provided a nice break as he showed why he is the "Wizard of Odds," having parlayed his ASA into a job consulting for gaming concerns. His Ten Commandments of Gambling range from "Expect to Lose" to "Have Fun," but he also has run millions of scenarios to calculate odds of various games to the near basis point. Best advice: go off the main "tourist" strip to get better odds. Mike shared some results from his work and generated some great questions. Thanks Mike!

Samir Nangea then shared his thoughts on modeling credit risk using default models, correlation approaches and portfolio analysis. The current work being done on C-3 for equity risk was described by Stephen Britt and Mark Tenney. Complex products require stochastic RBC calculations to drive reasonable capital requirements, and the scenario generators must be up to the challenge.

Optimizing enterprise value is certainly high on everyone's list of things to accomplish, much like Mom and apple pie. Frank Sabatini not only talked about it, he shared an example of how you can use stochastic analysis to create shareholder value and give your company a competitive advantage.

Since the seminar was shortened from its original length this year, topics such as international issues, fair value and comparing CFA material against the SOA syllabus will have to wait until next year. It was interesting to take an informal poll of current CFA charter holders and those taking exams to see that half of the room had multiple designations.

On the second day of the symposium, Marc Altschull, David Weinsier and Jay Glacy discussed various graphical tools that you can use to leverage existing models as you generate efficient frontiers, perform risk-return analysis, and match duration and convexity across alternative strategies. Jay also shared some of the work being done at the Santa Fe Institute on Complex Adaptive Systems and how it could be applied to insurers. Be sure to ask him about the "Whack a Mole" analogy!

Alton Cogert shared an institutional money manager's perspective on current events and shared a sample checklist of questions to ask your manager. It just might improve the results if the manager sees that you are asking the right questions. He also discussed some risks to be aware of, both from new asset types and old.

Portfolio managers are always looking for alternative investment strategies to move them toward the efficient frontier. Jeff Jakubiak and David Hopewell shared some research showing returns and risk across a range of asset types. They shared the potential benefits of adding hedge funds to an institutional investor's portfolio, along with some new risks associated with the product.

David Braun described various risk management tools that can be used with variable annuity products. He showed how a combination of reinsurance, derivative-based hedging and natural hedges could mitigate the risks inherent in these products.

For those of you who did not make it to the symposium but would like more information, the SOA has made available (for a fee) the binder containing all of the handouts. You can order it from *www.soa.org.*

Planning will start soon for next fall's Investment Actuary Symposium. If you are interested in helping or have suggested topics, please contact either Max Rudolph or Frank Sabatini at the contact info listed in the online directory. We expect to provide a multi-track seminar in 2002 and are working with the CIA to merge with their seminar in 2003.

Max J. Rudolph, FSA, MAAA, is Vice President & Actuary at Mutual of Omaha in Omaha, NE. He can be reached at max.rudolph@mutual of omaha.com.

Topics and speakers at the Investment Actuary Symposium, November 8 -9, 2001

Portfolio Optimization
Anson J. (Jay) Glacy, ASA CFA — Genl Re-New England Asset Management
Adam J. Berger, Ph.D. — Lattice Financial LLC

Embedded Value
Michelle D. Smith, FSA FIAA MAAA — Tillinghast-Towers Perrin

Economic Outlook
Kurt Karl — Swiss Re Economic Research

Financial Models for Pricing/ Risk Management
A. Eric Thorlacius, FSA CFA FCIA — Swiss Re Investors
Stephen Britt, CFA FIAA — Tillinghast-Towers Perrin

The Wizard of Odds
Michael W. Shackleford, ASA — The Wizard of Odds Consulting

Credit Risk Management
Samir A. Nangea — Ernst & Young LLP

Stochastic Generators for RBC
Mark Tenney — Mathematical Finance Company
Stephen Britt, CFA FIAA — Tillinghast-Towers Perrin

Earnings at Risk
Frank Sabatini, FSA MAAA — Ernst & Young LLP

Enterprise Optimization
Mark N. Altschull, FSA MAAA — Tillinghast-Towers Perrin
David Weinsier, FSA MAAA — Tillinghast-Towers Perrin
Anson J. (Jay) Glacy, ASA CFA — Genl Re-New England Asset Management

Current Issues Faced by Investment Managers
Alton Cogert, CFA CPA — Strategic Asset Alliance

Alternative Investment Strategies
Jeff Jakubiak, ASA — HSBC Bank USA
David Hopewell, FSA MAAA — AEGON USA Investment Management

Variable Products Risk Management
David Braun, FSA CFA FRM MAAA — Ernst & Young LLP

So Long to 30-year Treasuries:
How Suspension Of The Long Bond Could Impact Markets

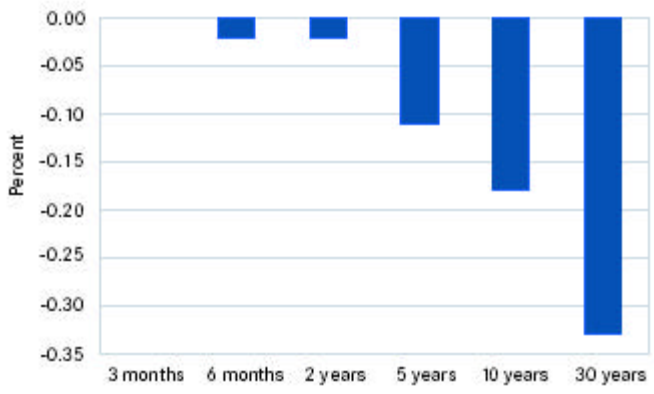
Editor's Note: The following article appeared in the October 2001 issue of the Barclays Global Investors newsletter. It is reprinted with permission

Just as the Federal Reserve has been aggressively cutting short-term rates, the U.S. Treasury has found a very effective way to cut long-term rates. Suspension of 30-year Treasury auctions will have minimal impact on bond market structure in the near term, but over the mid- to long-term, consequences could be profound. One thing is certain: markets will adapt, proving once again that necessity is the mother of invention. And of course this action may not be permanent. The Treasury could start issuing 30-year bonds again if economic or market conditions merit another shift.

The Announcement and Its Motivation

The U.S. Treasury surprised the bond market on October 31 by announcing it would suspend issuance of 30-year bonds. Investors rushed to buy the soon-to-be-scarce long bond, causing it to rally sharply. As the rally gained momentum, it snowballed into a classic "short squeeze." Investors who were short the long bond—they expected the yield curve to continue steepening in reaction to further Fed easing—forced to cover their short positions, driving prices yet higher. By day's end, the 30-year benchmark had rallied over 5.25 points, its best one-day performance since the stock market crash of 1987. The surge in the bond's price reduced its yield by over 30 basis points (Chart 1).

CHART 1
Change in Yields of Benchmark Treasury Securities, from 10/30/01 to 10/31/01



Source: Bloomberg, as of 10/31/01

This announcement was all the more surprising because the U.S. federal government will probably need to issue more Treasury securities over the next couple of years to finance a fiscal stimulus package designed to help revive the economy from September 11's terrorist attacks.While the Treasury acknowledges a deterioration in this year's budget outlook, it will concentrate increased borrowing needs on shorter-term instruments.

In addition to the long bond, the Treasury also announced plans to suspend auctions of 30-year inflation-adjusted bonds, causing these securities to rally strongly as well. As for the bond buyback program, which was initiated in March 2000, the Treasury left itself maximum flexibility for future purchases. Starting next February, the decision to conduct a buyback will depend on projections of the federal government's fiscal balance, quarterly cash needs, and analysis of how best to minimize borrowing costs.

In effect, the Treasury succeeded in doing to long-term rates what the Federal Reserve has been doing to short-term rates since the beginning of the year—that is, reducing them. While the Fed has cut short-term rates by about 4% this year, yields of 30-year Treasuries had not declined materially prior to October, drifting from 5.46% to 5.42% as of third quarter. The Treasury undoubtedly anticipated that its announcement would reduce long-term rates, and that this would likely have the desirable effect of stimulating the economy by enabling corporations to borrow more cheaply (increasing investment), and individuals to refinance home mortgages (increasing consumption).

Impact On The Treasury Sector

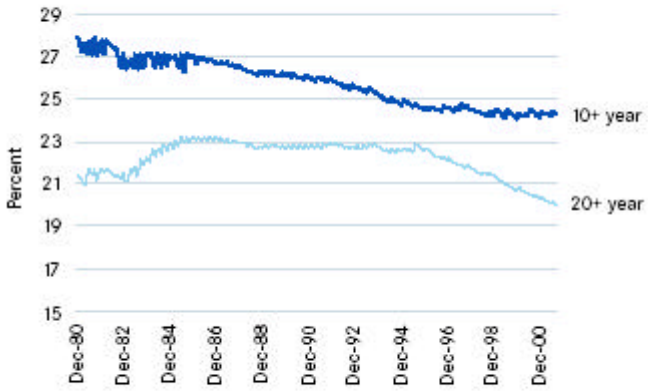
In the near-term, the Treasury's decision will not have a significant impact on the availability of long-term bonds because the size and frequency of 30-year auctions has been decreasing for several years (Chart 2). For example, in 1991 there were four auctions of 30-year bonds; more than $53 billion of those bonds remain outstanding today (adjusted for buybacks), though they are now 20-year bonds. In contrast, there have been only two auctions of 30-year bonds this year, with a total par amount of $15 billion. Clearly, this latest decision is the ultimate step in a trend toward smaller issues of 30-year bonds.

CHART 2
Par amount outstanding (in billions) of 30-year bonds by year of maturity

2021	$ 53.16
2022	$ 15.40
2023	$ 34.62
2024	$ 8.09
2025	$ 18.15
2026	$ 28.51
2027	$ 35.11
2028	$ 19.70
2029	$ 19.85
2030	$ 15.15
2031	$ 15.00
Total	$ 262.72

Source: Lehman Brothers, as of 10/31/01.

CHART 3
Average Maturity of Treasury 10+ and 20+ Year Indices



Source: Lehman Brothers, as of 10/31/01.

In addition, though the Treasury issued $15 billion worth of 30-year bonds during each of the past two years, they also repurchased about $30 billion in long-term bonds (maturing in earlier years) each year. In effect, net supply of long-term Treasuries shrank $15 billion per year during the past two years. Given the budget outlook in the near future, the Treasury may decide to buy back fewer long-term bonds. But if the Treasury bought back $15 billion of long bonds in 2002 with no additional issuance, the net effect would be a reduction in supply of $15 billion of long-term Treasuries. Alternatively, if it eliminates buybacks altogether, there will no impact on net supply: zero issuance and zero buybacks.

If the suspension of 30-year bond issuance persists over the long term, however, it will fundamentally transform not only the U.S. Treasury market, but also the entire U.S. economy and, indeed, the global bond market. At the risk of stating the obvious, if no new 30-year bonds are issued, then in 10 years there will be no Treasury bonds with maturities longer than 20 years; and in 20 years, there won't be any Treasuries with maturities longer than 10 years.

What about the average maturity of Treasury bond indices, which many investors utilize as part of their investment program? Looking at the past, we can make some projections about the future. Chart 3 shows that the average maturity of long Treasury indices has been declining over the past 20 years. For example, the average maturity of the 20+year Treasury index has declined from about 27 years in 1985 to about 24 years in 2001. During the same period, the average maturity of the 10+ year index has declined from 23 to 20 years.

Looking ahead 5 and 10 years, we can see the trend toward lower average maturity will continue.

CHART 4
Average maturity of index

Index	Today	In 5 years	In 10 years
10+ Treasury	20.0	16.5	14.3
10+ Treasurys	24.3	22.0	— *

** In 10 years, there will be no bonds left in the 20+ Year Treasury Index.*

Note: Projections assume the relative weights of bonds remain the same as today. In 10 years, there will be no bonds left in the 20+ year Treasury index.

Source: Lehman Brothers and BGI, as of 10/31/01.

Not issuing new 30-year bonds will also have a profound impact on Treasury bond futures.To be deliverable into the bond futures contract, a Treasury bond must have a minimum maturity of 15 years. As fewer bonds become eligible for delivery, the attributes that make futures a liquid hedging and trading vehicle will diminish. Eventually the contract, as it is currently structured, could become extinct.

Impact On Other Bond Sectors

How will investors gain exposure to long-duration instruments if there are no Treasury bonds and no Treasury bond futures? Chart 5 shows the market value of the Treasury, Agency and credit sectors divided into maturity ranges. Across the entire

(continued on page 30)

So Long to 30-Year Treasuries

continued from page 29

maturity range, the credit market is now larger than the Treasury market, and the Agency market is roughly half the size of the Treasury market. However, at the very long end (20+ year maturity), there are not enough Agency or highly rated corporate bonds (AA or better) for either to be a viable alternative to Treasuries. Both those markets are roughly one-fifth the size of the 20+ Treasury sector, and neither approaches the liquidity of long-term Treasuries. It is likely the long end of the Agency and corporate markets will see increased issuance in an attempt to take advantage of lower borrowing costs.

CHART 5
Market value in billions

Maturity range	Treasury $	Agency $	Credit $	Credit AA+ $
1+ years	1,585	808	1,867	480
1ñ 10 year	997	701	1,409	398
10+ years	588	108	458	82
20+ years	289	56	328	55

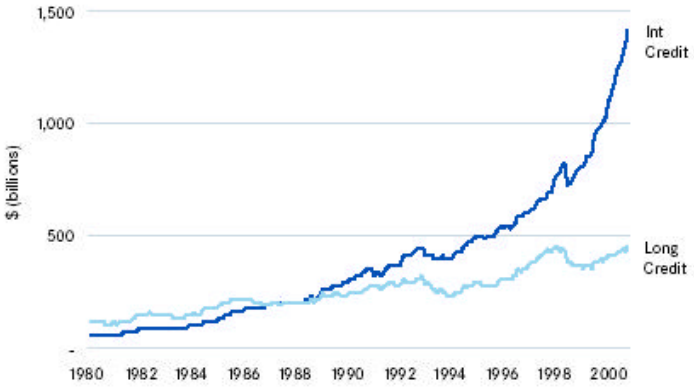
Source: Lehman Brothers and BGI, as of 10/31/01.

Yield Curve and Yield Spreads

As announced, the Treasury will concentrate their borrowing needs on shorter maturity instruments. All else being equal, the increase in supply of two-, five- and 10-year notes, coupled with the elimination of supply at the long end, will cause the Treasury yield curve to flatten. Furthermore, if demand for long duration instruments exceeds supply by a sufficient amount, the long end of the Treasury curve will become inverted. As has been the case in the U.K. for the past four years, the yield spread between 10- and 30-year bonds will become negative.

Because the flattening of the Treasury yield curve would be caused by demand and supply considerations, rather than fundamentals such as inflation expectations, we would not expect yield curves in other sectors to be affected commensurately. Therefore, we can expect the flattening of the Treasury yield curve to lead to wider sector spreads at the long end and narrower spreads in short-to-intermediate maturities. However, to the extent that Treasuries do not satisfy the demand for long-duration instruments, investors may turn to Agency and high-grade corporate bonds as the closest substitutes. This would mitigate the spread widening of long-term, highly rated bonds. Therefore,the spread between the highest-rated corporate bonds (rated AAA and AA)and lower-rated bonds (BBB) should widen. Furthermore, as corporations begin to issue more long-term bonds to meet this demand, the issuance pattern of the past 20 years will most likely reverse (Chart 6). And as lower Treasury yields drive prepayments higher from their already elevated levels, it is likely that mortgage-backed securities spreads will widen.

CHART 6
Market Value of Intermediate and Long-Term Credit Indices



Source: Lehman Brothers, as of 10/31/01.

A Final Thought

It's important to bear in mind that markets are comprised of people, and people adapt. Many of the structural changes discussed above will not occur for five, 10 or 15 years, and only then if current conditions remain. But the history of financial markets is one of innovation and of self-interest leading to a common good, so we can be sure that conditions will change. If there is an unmet need for long-duration instruments, these securities likely will be created. For example, if the current bond futures contract no longer remains useful for investors, it will either be modified or an entirely new instrument will be developed.

Finally, structural changes may not come to pass because the Treasury left open the possibility that the 30-year bond could be reintroduced. It's no coincidence that they used the word "suspend" to describe their decision, as the word connotes a temporary situation.

The views expressed in this article are those of Barclays Global Investors, N.A. as of the date above and are subject to change, and are provided for informational purposes only. None of the information constitutes a recommendation by BGI or a solicitation of any offer to buy or sell any securities, nor is the information intended to provide investment advice.

Reader Poll

How Many Scenarios?

Just how many simulations are required to produce an estimate with a given level of accuracy? We can invoke the Central Limit Theorem. It argues that the sample estimator will tend to asymptomatically converge to a normal distribution as the sample size n (the number of runs) increases. For example, to have a 95% confidence that our estimate x (sample mean) lies within 1% of the true mean u requires:

.95 = Probability(0.99υ<=x<=1.01υ)

If the sample mean is normally distributed with mean u and standard deviation s sqrt(n), this produces a sufficiently accurate simulation when:

$$\frac{.01\upsilon}{\sigma \sqrt{n}} \leq 1.96 \quad \text{which can be solved for } n \geq \frac{(1.96\,\sigma)^2}{(.01\,\upsilon)^2}$$

not knowing υ or sigma we must estimate them with the sample mean x and the sample standard deviation σ. This leads to:

$n \geq 38{,}416\ \sigma^2/x^2$

For example, if you are modeling bond prices, the standard deviation of bond prices was just under 8% of the price in 1999. Substituting into the formula above, we get n>= 246.

In 1999, stock prices had a standard deviation about 16% of the price. That would lead to n>= 983.

That is in a theoretical universe. Now to the real world. Please send me your answers to the following questions:

1. How many scenarios do you run?
2. How did you determine the number?
3. What confidence interval does your result have?

I will compile the answers and report back in the next issue of *Risk and Rewards*.

Send your answers to *david.ingram@milliman.com*

Source: *Measuring and Managing Operational Risks in Financial Institutions,* Christopher Marshall, Wiley, 2001.

Photos from the Annual Meeting in New Orleans

(Above left) *— Section council members at the Annual Meeting in New Orleans taking a break from the planning of Investment Section activities -*

(Above right) *— Max Rudolph, incoming chairperson, presents a "bull and bear" gift of appreciation to retiring chairperson, Peter Tilley, at the Investment Section Breakfast in New Orleans*

Front Row — L to R — *Max Rudolph (2001-2002 section chairperson), Peter Tilley (2000-2001 section chairperson), Mark Bursinger, Vic Modugno*

Back Row — L to R — *Larry Rubin, Craig Fowler, David Ingram, Doug George*

(Bottom right) *— Sharing a light moment, members of the Investment Section Council meeting in New Orleans...*

L to R — *Vic Modugno, Peter Tilley, Max Rudolph, Larry Rubin*

RISKS and REWARDS

The Newsletter of the Investment Section of the Society of Actuaries

SPECIAL INSERTION

NUMBER 38 FEBRUARY 2002

Understanding Equity Risk Premium

by Richard Q. Wendt

Several recent books and articles have addressed the issue of expected equity returns, with a range of opinions—from dourly pessimistic to irrationally optimistic. This article attempts to answer the following questions:

- What is equity risk premium?
- How should equity risk premium be measured?
- Does a constant risk premium provide the best model?
- What are reasonable expectations for the future?

What is Equity Risk Premium?

Equity Risk Premium (ERP) measures the excess equity return[1] over a specified time horizon with respect to a benchmark. The benchmark could be inflation, a rate of return, or a bond yield. ERP is thought to be the extra return demanded by investors for taking on a risky investment. ERP is usually stated for relatively long time horizons—either for a specific period, usually ten years or more, or for an indefinitely long horizon. For post-1960s U.S. history, ERP has been one of the most stable statistics in the equity market.

One of the advantages of using ERP is that the benchmark can dynamically reflect current market conditions, implicitly subsuming investor risk tolerance, economic growth expectations and uncertainty. For example, higher long bond yields generally indicate increased expectations for future returns, both in stock and bond markets. Some practitioners believe that price-to-earnings ratio or dividend yield statistics are superior to ERP for estimating future returns, but ERP has the advantage of automatically self-correcting for changes in market valuation.

Measuring ERP

Practitioners have used several methodologies to measure ERP, with two approaches becoming the most popular. These methods measure equity returns with respect to either:

- Long T-Bond returns over the measurement period, or
- Long T-Bond yields at the beginning of the measurement period[2]

Figure 1 shows the historical 15-year compound returns for the S&P 500 Index and Long T-Bonds, as well as the long T-Bond yields at the beginning of each 15-year measurement period. Figure 1 starts with the 1926–1940 measurement period and ends with the 1986–2000 measurement period. As in the recent article on the TimeTrack methodology [Risk & Rewards, July 2001], monthly data is shown in overlapping 15-year periods, starting each month from January 1926 through January 1986. Fifteen-year measurement periods were chosen so as to provide a moderately long time horizon, with a sufficient number of data points.

1 In this article, equity returns are represented by the S&P 500 Index total return.

2 For example, Ibbotson Associates' Yearbook measures ERP as average equity return over government bond income, ignoring principal changes. For forecasting returns, the Yearbook adds the historical average ERP to risk-free returns, as indicated by zero coupon bond yields for the appropriate maturity.

3 Long T-Bond returns and yields are for 20-year or 30-year maturity Treasury bonds, whichever was the longest maturity available at each date.

(continued on page 2)

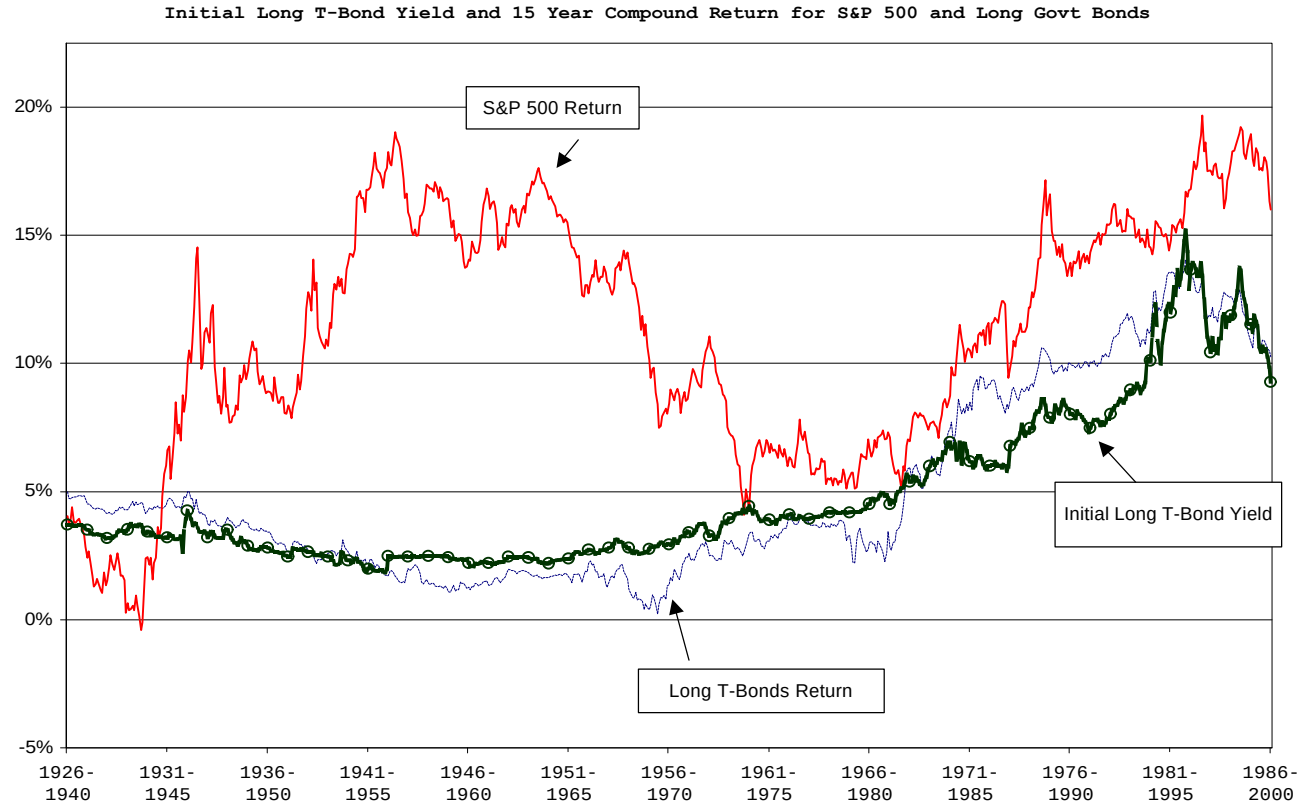


Figure 1

Figure 1 suggests some comments. The predominant impression is that the equity experience prior to 1960 looks quite different than the experience after 1960. It may be an optical illusion, at least to my eyes, that makes the early equity returns look higher than the later equity returns. Actually, the average equity return for each period is very similar; it's the bond yield and return that is significantly higher for the periods starting in 1960 and later. In addition, there appears to be very little relationship between equity returns and either bond returns or yields prior to 1960; after 1960, there appears to be a fairly strong relationship.

Some practitioners, myself included, believe that the extraordinarily large ERPs in those early years provide a distorted view of likely future relationships. Ibbotson, for example, uses all the historical data from 1926 onwards to calculate the average ERP over bond yields, arriving at an ERP of about 8%. That high average is principally due to the inclusion of the extraordinarily high historical ERPs in the 1935–1965 time frame.

Note also that the T-Bond 15-year return tracks the initial yields reasonably closely, sometimes higher, sometimes lower. The T-Bond 15-year return is a function of yield changes during the 15 years, as well as the initial yields. Over 15-year periods, the initial yield is a very powerful indicator of future bond returns.

(continued on page 3)

In order to use timely and relevant historical data, the analysis will include only the 15-year periods starting in 1960 and later. Through December 2000, that is a total of 313 overlapping periods.

15-year Periods Starting:	Observations	Average Compound Equity Return	Average Compound Bond Return	Average ERP Over Bond Returns	Average Initial Yield	Average ERP Over Initial Yield
1926-1959	408	11.0%	2.6%	8.4%	2.9%	8.1%
1960 & later	313	11.6%	8.1%	3.5%	7.4%	4.1%
All Periods	721	11.2%	5.0%	6.2%	4.8%	6.4%

Figure 2 isolates the results for periods starting 1960 and later.

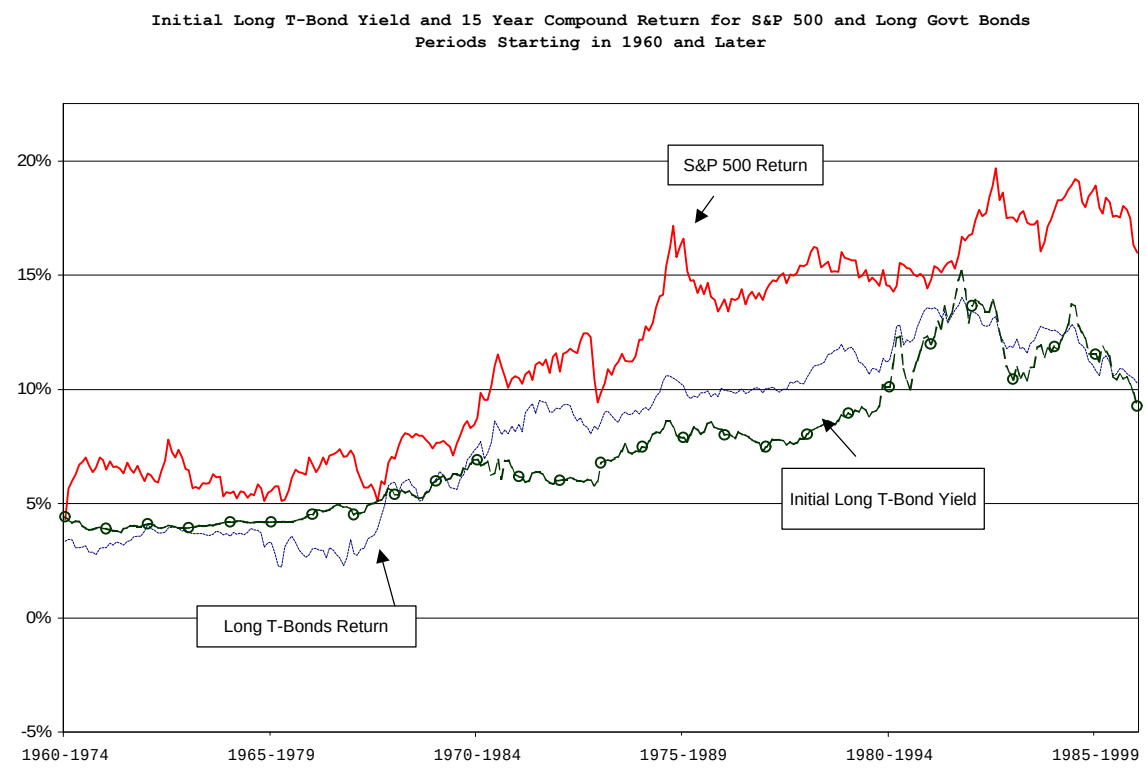


Figure 2

ERP Relative to Bond Returns or Yields?

Which relationship is the most appropriate—equity returns over bond returns or equity returns over initial bond yields? Since bond returns track initial bond yields reasonably well, either returns or yields can be used to measure ERP. However, there are some important differences. For one thing, the average ERP with respect to yields is about 60 basis points more than the average ERP with respect to returns.

(continued on page 4)

When practitioners set assumptions for determining asset allocation policy for a pension plan, insurance company or other institutional investor, the relationship between the asset class returns is usually more important than the absolute level of expected returns. For instance, in an ALM analysis for a pension plan, the key determinant is the relationship of portfolio return to pension liabilities. Since liabilities typically mimic bond returns, ERP for ALM purposes should normally be based on bond returns; that approach leads to estimates of relative equity return.

On the other hand, realized equity and bond returns can only be known after the time period is completed, while bond yields are known at the start of the period. Therefore, if one wants to predict the level of equity returns for the next 15 years, the model should reference the ERP to initial yield. Otherwise, one must first predict 15-year bond returns and then add the estimated ERP with respect to bond returns. Using bond returns as the basis of predicting equity returns creates two sources of error—bond return and ERP. Using yields has only one source of error—estimated ERP. The additional source of error makes it inefficient to use estimated bond returns to predict the absolute level of equity returns.

For the purpose of this article, I will focus on a predictive model of ERP relative to initial bond yields, using return data for 15-year periods starting from 1960 to 1986. The ERP statistics relative to bond return are fairly similar to the statistics relative to yield. But a predictive expectation is probably more interesting to our readers, most of whom would rather not wait fifteen years to determine bond returns. Figure 3 shows the historical ERP with respect to bond yield for those periods.

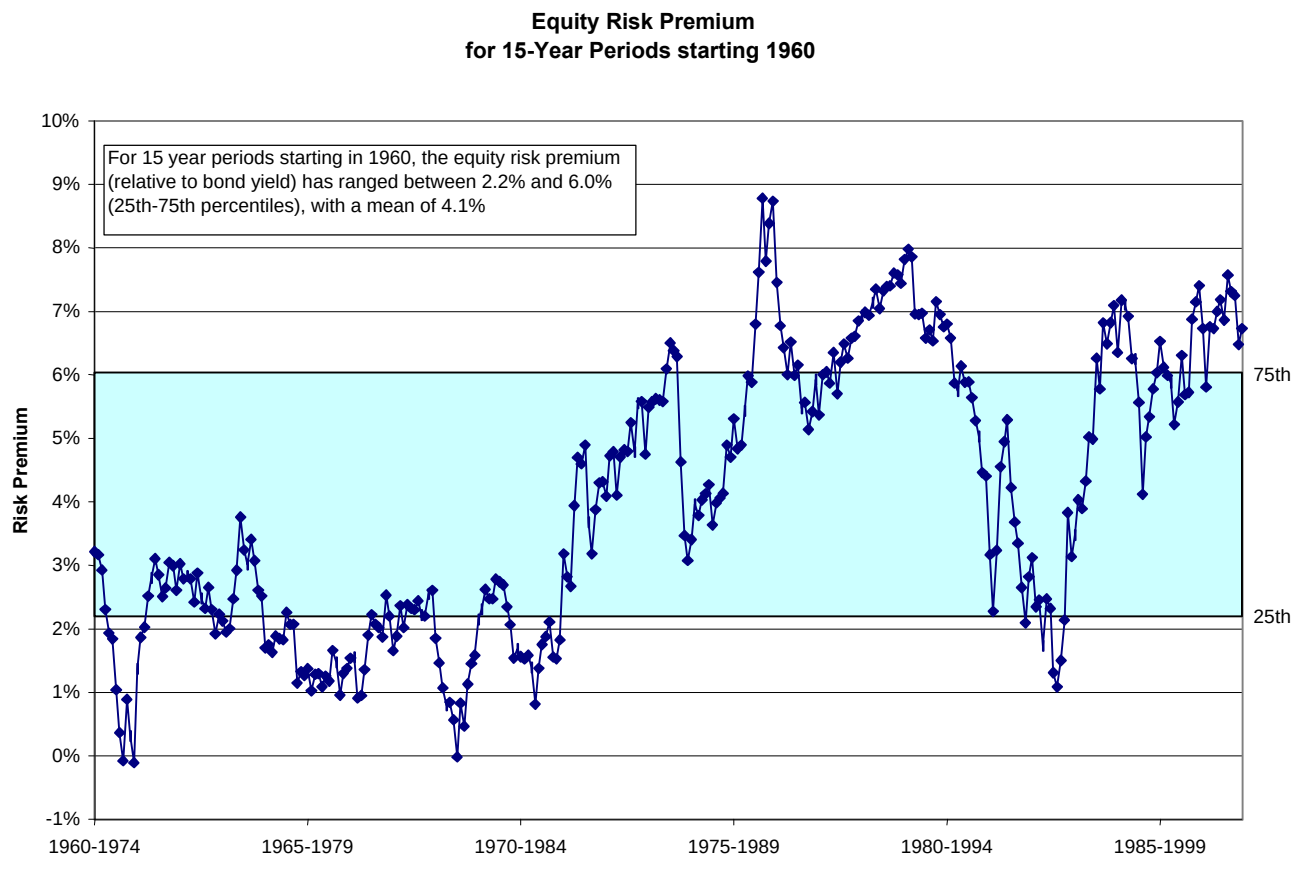


Figure 3

(continued on page 5)

Is Constant ERP a Reasonable Model?

A common practice is to determine an historical average ERP and use that value as an estimate of future ERP— regardless of current economic conditions. Using a constant value as a "model" of an economic variable is obviously a very simplistic model. That type of model would be appropriate when there is either no, an unknown, or an overly complex relationship between two variables. Perhaps the strong need for simplicity could justify such a—well, simple—model.

To explore this data, Figure 4 shows a scatter plot of 15-year equity returns versus initial long T-Bond yields.

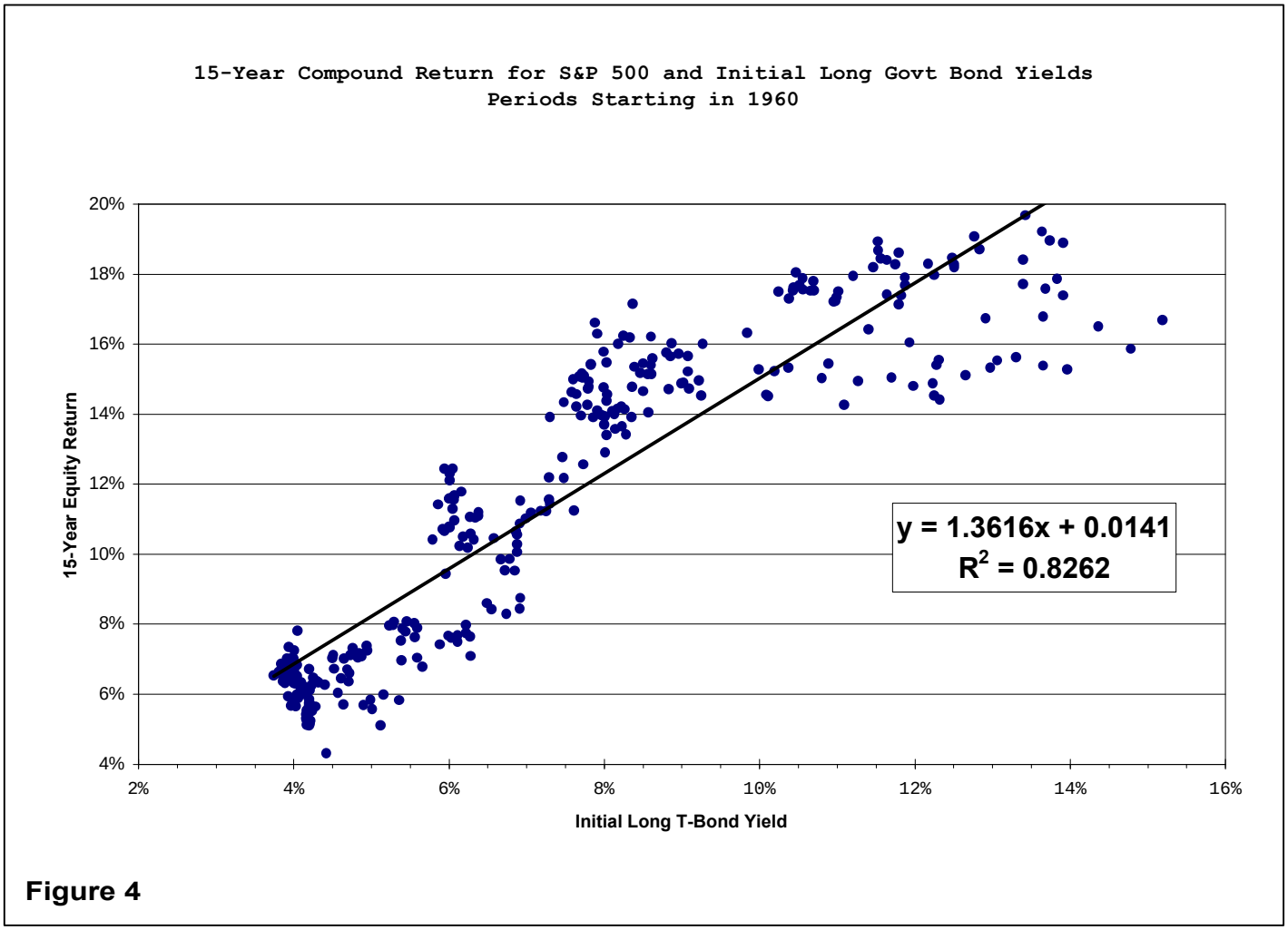


Figure 4

Figure 4 shows that, indeed, there is a strong relationship between 15-year equity returns and initial bond yields. The graph also includes a linear regression trend line, which shows an R^2 of 0.83. That level is not as significant as one might otherwise think, since the data has a very high amount of serial correlation.

Looking at Figure 4, it appears that the points at the upper right part of the chart are much more erratic than the remainder of the points. Given today's yield environment of 5%, it does not seem likely that yields will exceed 10% in the near future; therefore, it is not currently critical to model expected returns at those yield levels.

(continued on page 6)

To test the relationship without the outlying high yields, Figure 5 shows the linear regression, including only returns with initial yields less than 10%. This includes 252 data points. For that subset of the data, the average ERP is 3.75%. To compare the linear model trend line to the constant ERP, the graph also shows the estimated returns for a 3.75% constant ERP. With this version of the model, the R^2 of the trend line increases to 0.88.

The estimated returns from each model are quite different. Both models give consistent estimates of 9.75% equity return for initial yields of 6%. For initial yields below 6%, the constant ERP model is higher than the linear model, while the opposite is true for initial yields above 6%.

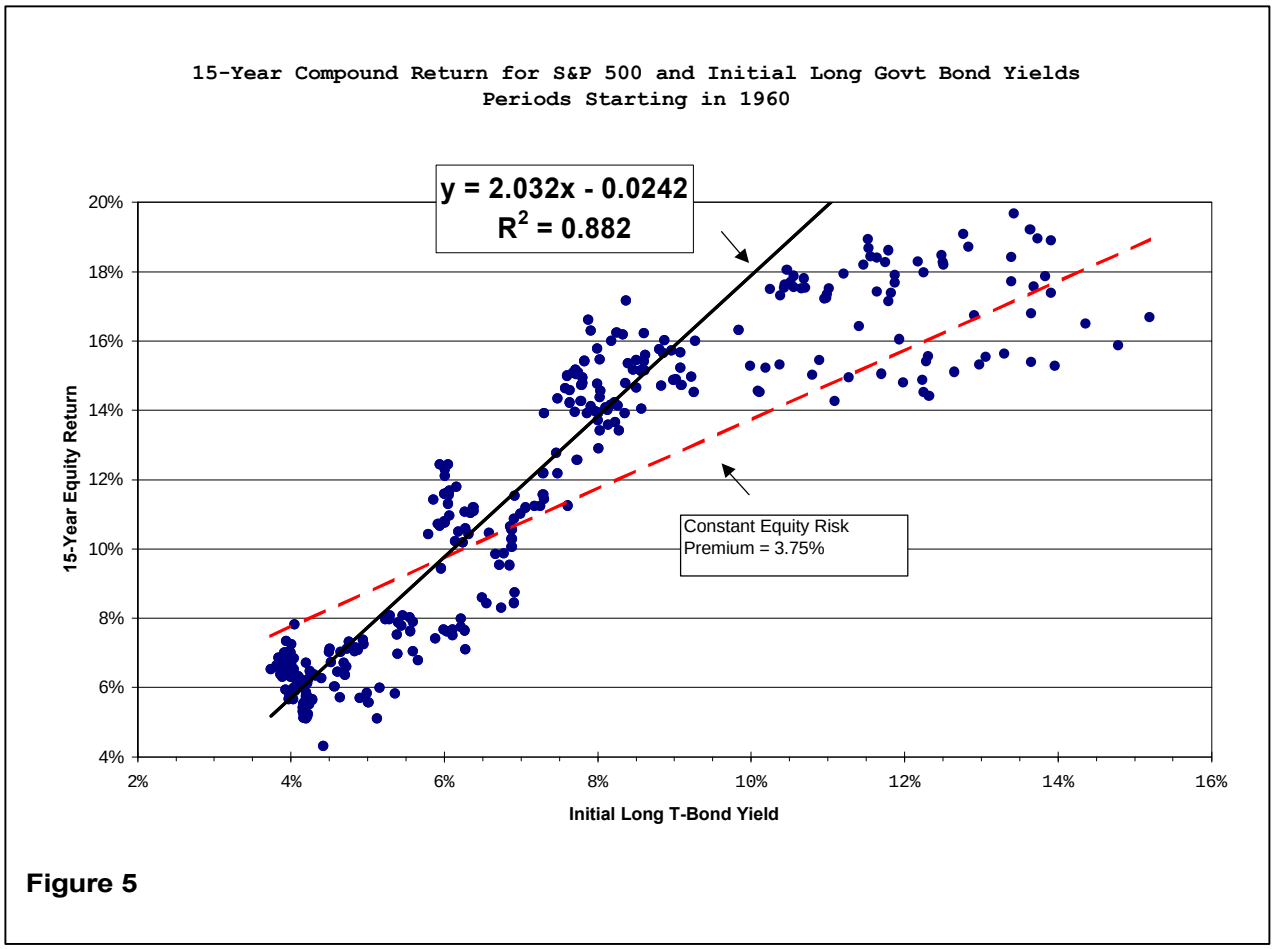


Figure 5

To complete the model for all yield levels, Figure 6 extends the model with an additional trend line that only applies to yields over 10%. That line is very flat, with a low R^2.

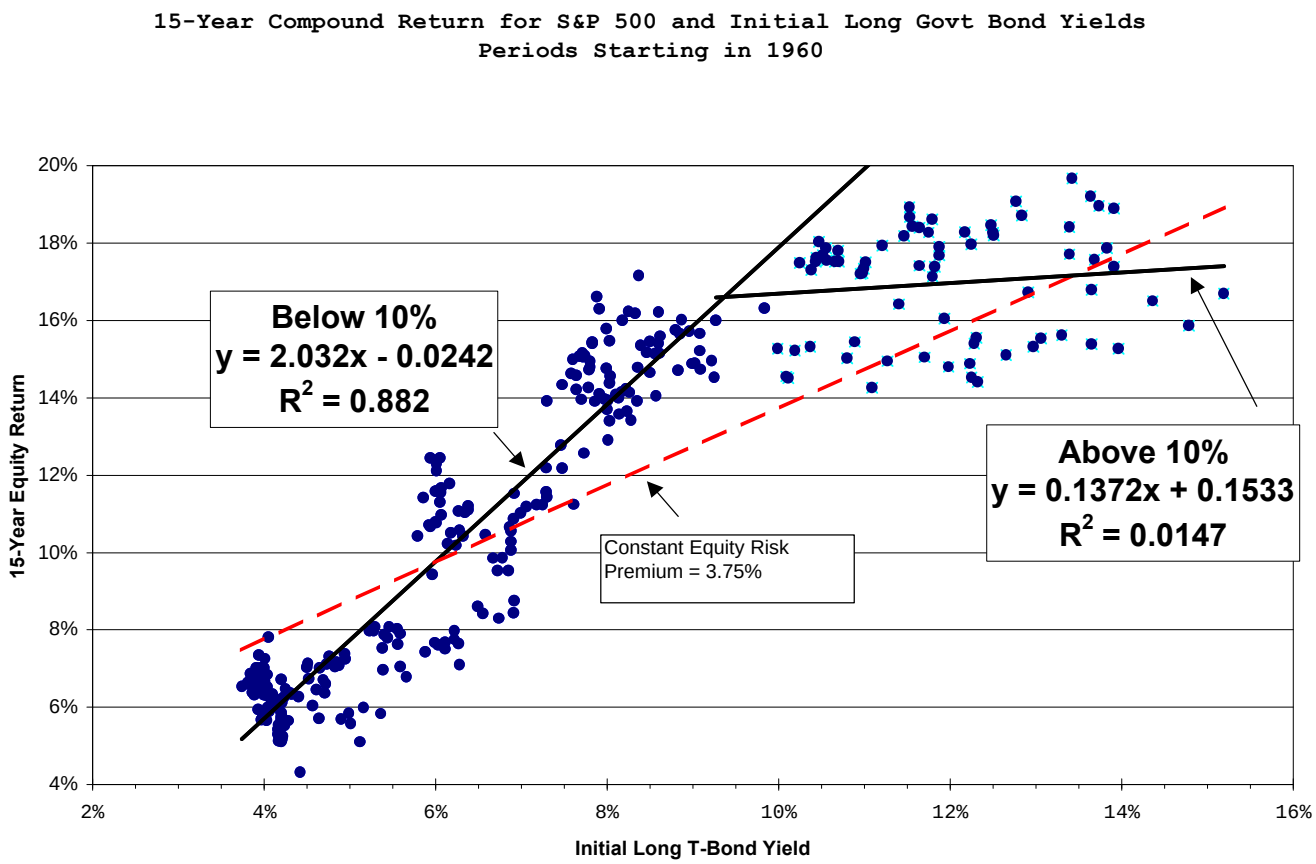


Figure 6

Figure 7a compares the constant ERP model to history from 1960 and Figure 7b compares the linear ERP model to history. Both graphs indicate the region where initial yields were above 10%; at those points, the secondary regression is used.

(continued on page 8)

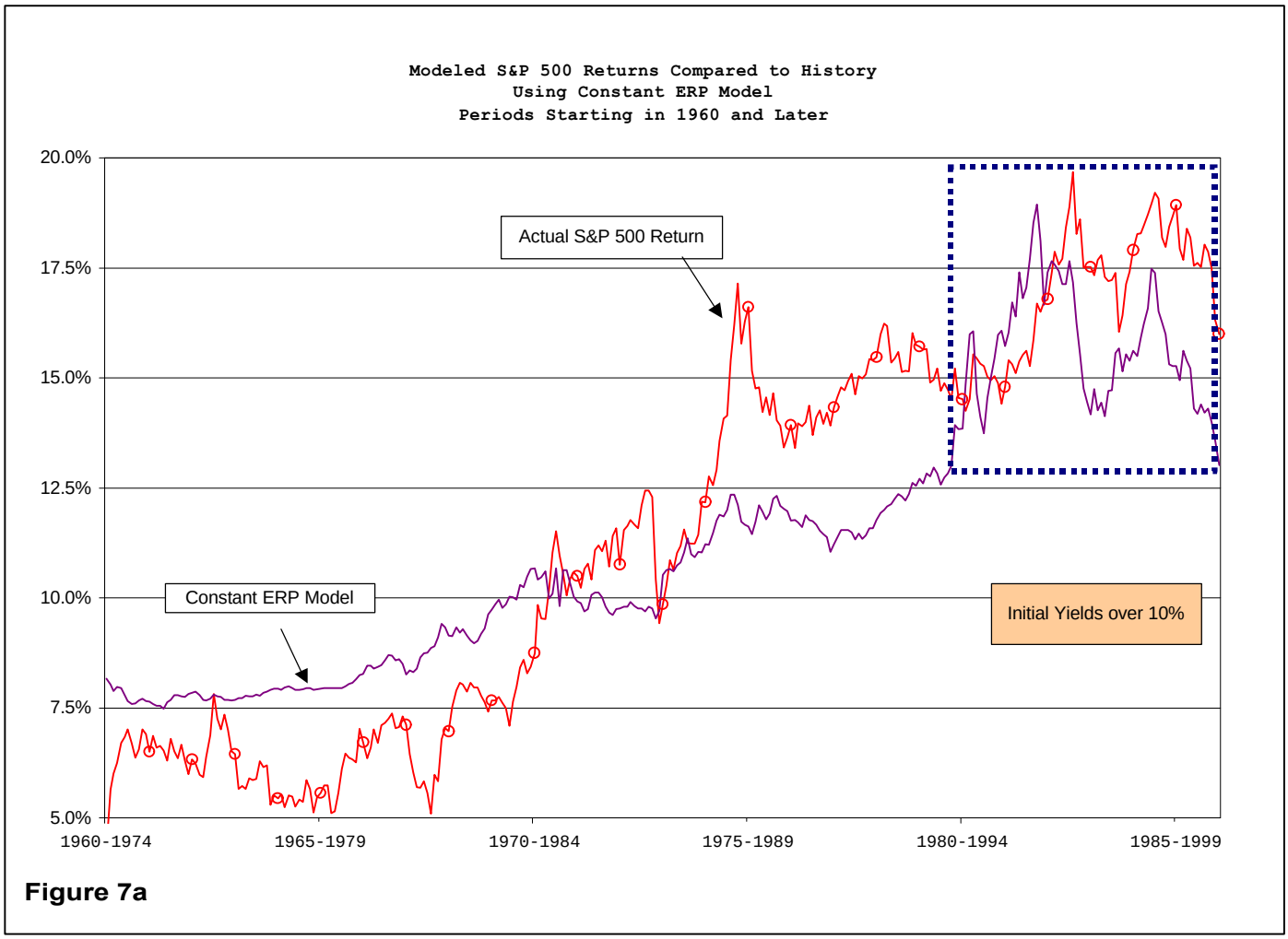


Figure 7a

Like a broken clock that is correct twice a day, the constant ERP model occasionally has estimates close to the actual S&P 500 history. Overall, the linear ERP model is superior to the constant ERP model.

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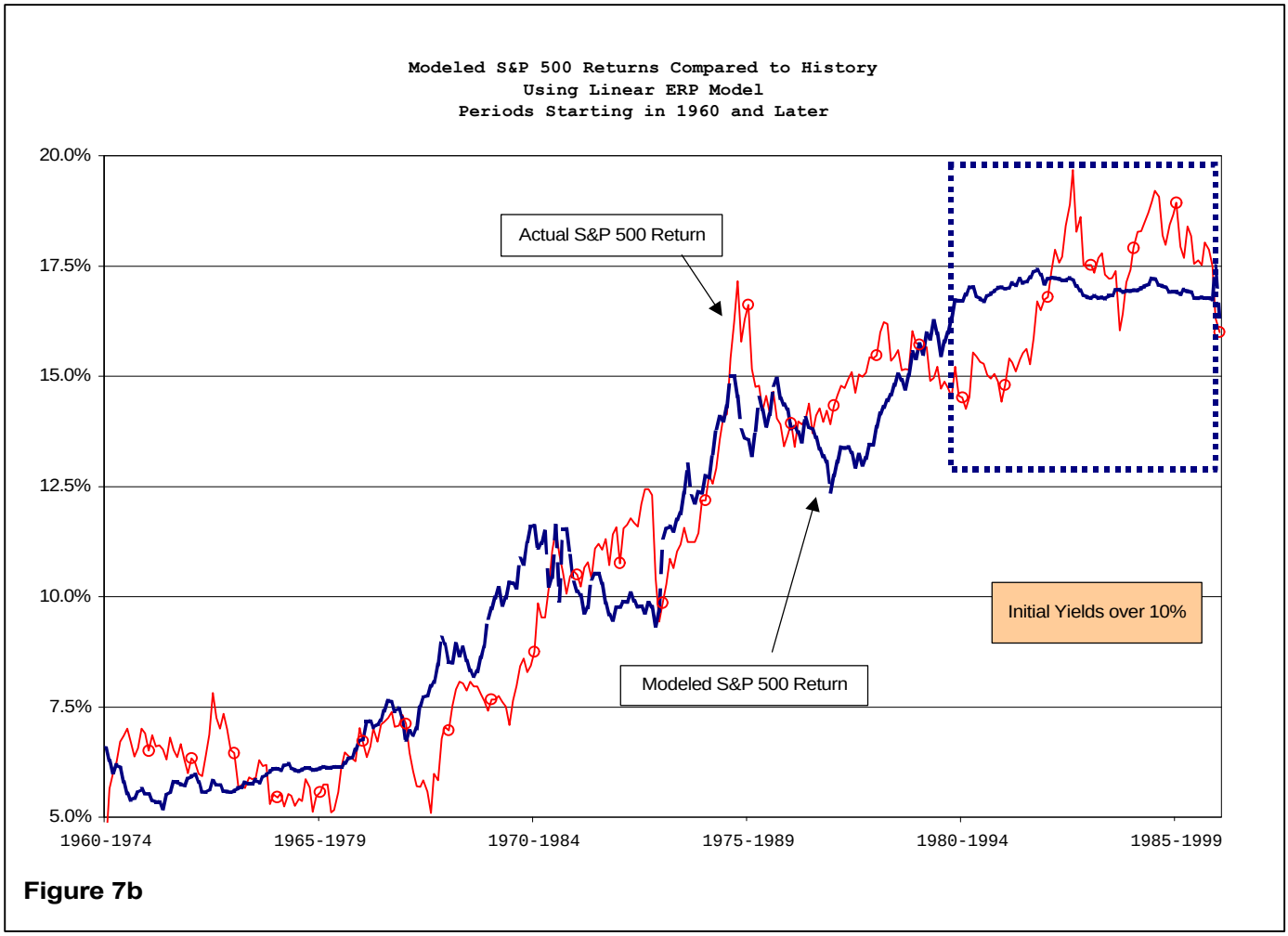

Figure 7b

Expectations for the Future

Our linear regression model for initial yields below 10% has the following equation:

S&P 500 Return = 2.032 * T-Bond Yield – .0242 ($R^2 = 0.88$)

This equation can be algebraically transformed to a more useful form by referencing the average ERP. The restated equation is then:

S&P 500 Return = T-Bond Yield + [1.032 * (T-Bond Yield – .06) + .0375]

and

ERP = 1.032 * (T-Bond Yield – .06) + .0375

In other words, the ERP is 3.75% at an initial yield of 6%, increasing about 103 basis points for every 100 basis point increase in yield. The estimated equity return increases 203 basis points for every 100 basis point increase in yield.

Similarly, the transformed equation for yields above 10% is:

(continued on page 10)

S&P 500 Return = 0.1372 * (T-Bond Yield – .122) + .17

This equation does not directly reflect the ERP, as estimated equity returns are very close to 17% for all yields over 10%.

Figure 8 shows the historical equity returns and forecast equity returns from the linear ERP model for the 15-year periods ending from 1/31/1974 to 12/31/2015. With the 1/1/2001 yield at 5.5%, the estimated 15-year ERP for 2001-2015 is 3.3%, giving an estimated compound equity return of 8.8% for the 2001-2015 period.

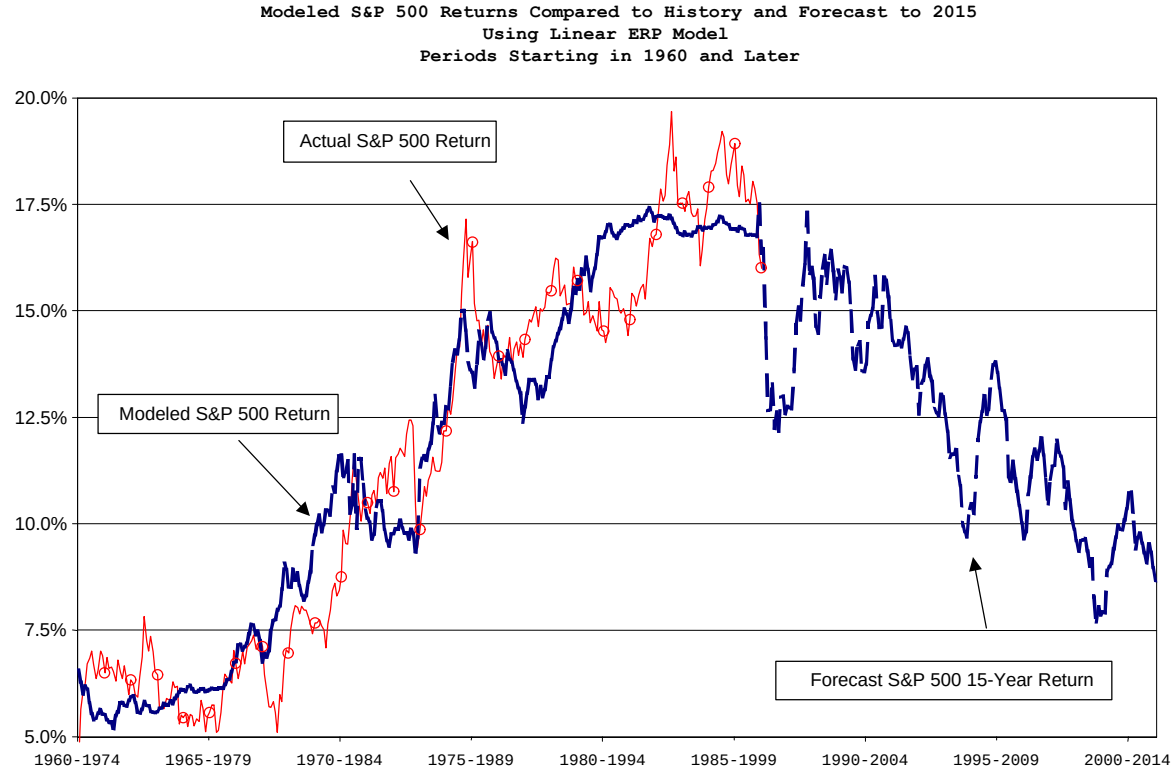

Figure 8

As of early December, long T-Bond yields were close to 5.3%; for that yield level, the linear model estimates a 15-year ERP of 3.1%. That would give an estimated 15-year equity return of 8.4%.

Summary:

Long-run equity returns and ERP are closely tied to long T-Bond yields, particularly for starting yields below 10%. The analysis shows that a simple linear regression model is a more effective predictor of 15-year equity returns than simply assuming a constant ERP. While the average ERP at a 6% initial yield is 3.75%, estimated 15-year equity returns increase 203 basis points for every 100 basis point increase in initial yield over 6%.