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# Transition to a High Interest Rate Environment

Preparing for  
Uncertainty



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SOCIETY OF ACTUARIES

# Transition to a High Interest Rate Environment

Preparing for Uncertainty

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## I. Executive Summary

*I'm not smart enough to know if it's going to be inflation or deflation. The smart money knows that it could be either one, so you need to prepare for both. So have your hard asset portfolios ... but also have some cash. That's your deflation hedge.<sup>2</sup>*

James K. Rickards

Interest rates cycle over long periods of time. The journey tends to be unpredictable, full of unexpected twists and turns. This project focuses on the impact of interest rate volatility on life insurance products. As usual, it brought up more questions than it answered. It points out the importance of stress testing for a specific block of business and the risk of relying on industry rules of thumb. Understanding the nuances of models could make the difference between safe navigation of a stressed environment and a default. Proactive and resilient practices should increase the odds of success.

Hyman Minsky had it right—stability leads to instability. We live in an era where monetary policies of central banks steer free markets in an effort to soften the business cycle. Rates have been low for over 20 years in Japan, reshaping the global economy.

The primary goal of this paper is to explore rising interest rates, but that is not possible without considering that some rates could stabilize at low levels or even decrease. Following this path, the paper will look at implications of interest rate changes for the life insurance industry, current stress testing practices, and how a risk manager can proactively prepare for an uncertain future. A paper published in 2014 focused on why rates could stay low,<sup>3</sup> and some aspects of this paper are similar (e.g., description of insurance products). This paper also uses a sample model office to help practitioners look at their own exposures. It includes typical interest-sensitive insurance products and how they might perform across various scenarios, as well as a survey to establish current practices for how insurers are testing interest rate risk currently.

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<sup>2</sup> Interview with Greg Hunter, Oct. 12, 2014, interpreting Warren Buffett's actions to hold excessive cash amounts (\$55 billion at the time) and hard assets like railroads and autos.

<https://www.youtube.com/watch?v=3vwxGxmDOZk&feature=youtu.be>

<sup>3</sup> Rudolph, Max J. 2014. Sustained Low Interest Rate Environment: Can It Continue? Why it Matters.

<https://www.soa.org/Research/Research-Projects/Risk-Management/research-2014-sustained-low-interest.aspx>

## 1. History Repeats

The 2009 book by Carmen Reinhart and Kenneth Rogoff, *This Time Is Different*,<sup>4</sup> and companion articles have put concerns about high debt levels and the ramifications to interest rates at center stage. The authors created a database that spans the globe and goes back eight centuries. They show that excessive debt accumulation, whether by banks, corporations, consumers or governments, leads to financial crisis and slower gross domestic product (GDP) growth. It is difficult to put an absolute boundary on what is a safe level of debt. Breaking points seem to be driven by trust in the home currency, and this is behaviorally driven. A crisis of confidence can't be represented by a formula, and people tend to forget past crises as time elapses. The party continues until it stops, and often ends badly for those who got caught up in a debt-fueled boom. Avoiding leverage, where possible, reduces downside risk and lessens the impact of a crisis happening around you.

Professors Reinhart and Rogoff define financial crises by events tied to sovereign defaults, banking crises (like 2008), and currency crashes/inflation crises. Extreme levels of capital mobility, mean-reverting results with overcorrections in both directions, and political desires to remain in power make these types of crises inevitable over long time horizons.

Over the last century, central banks (in the United States the Federal Reserve Bank was created in 1913) have attempted to reduce economic volatility through mandates tied to inflation and sometimes unemployment (the U.S. central bank has this dual mandate). Some argue the Fed has overmanaged the downside risk following the technology-driven stock bubble and the attacks of Sept. 11, 2001, allowing asset bubbles to form.<sup>5</sup> These critics argue that the systemic risk of financial crisis grows higher as the debt-to-GDP ratio increases, reducing flexibility and negating rules of thumb utilized in lower-debt environments. The risk of contagion increases during these periods as massive interactions between participants lead to unexpected consequences as a lack of transparency becomes clear.

In a follow-up paper, the Reinhart/Rogoff team reviewed 100 relatively recent systemic banking crises, focusing on the evolution of real per capita GDP (this eliminates the bias introduced by differences in population growth).<sup>6</sup> The authors found that the recent crisis was comparable to

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<sup>4</sup> Reinhart, Carmen M., and Kenneth S. Rogoff. 2009. *This Time Is Different: Eight Centuries of Financial Folly*. Princeton University Press.

<sup>5</sup> Bordo, Michael D., and John Landon-Lane. *Does Expansionary Monetary Policy Cause Asset Price Booms; Some Historical and Empirical Evidence*. NBER Working Paper 19585 prepared for Sixteenth Annual Conference of the Central Bank of Chile, "Macroeconomic and Financial Stability: Challenges for Monetary Policy" Santiago, Chile, Nov. 15-16, 2012. <http://m.nber.org/papers/w19585.ack> (subscription required).

<sup>6</sup> Reinhart, Carmen M., and Kenneth S. Rogoff. *Recovery from Financial Crises: Evidence from 100 Episodes*. Forthcoming in *American Economic Review Papers and Proceedings*. May 2014.



pre-World War II events but nowhere near the severity of the Great Depression of the 1930s for the United States. By tracking how long it took to recapture the previous peak of real per capita GDP they found that nearly half (43 percent in their sample) experienced double dips where real per capita GDP dropped after starting to recover. The median time to recovery was 6.5 years.

Many financial metrics make sense only in the context of where you stand at the time of measurement. If interest rates are at 20 percent, risks differ from when rates are at 2 percent. Over long periods, interest rates tend to cycle from low to high and back again in a mean-reverting process that interacts with other variables like a complex adaptive system. During boom periods the public and its leaders often become convinced that they have developed a new model for success, driven by innovation and productivity gains. This is epitomized by the famous saying “It’s different this time.” History tells us this is rarely true and generally ends badly for those using leverage (debt) to enhance returns.

While it is true that living standards have improved over time, unintended consequences of actions and misaligned incentives can lead to system fragility. When the system “breaks”, for example when an asset bubble bursts, this leads to lower growth. High debt levels eventually lead to procyclical results, with higher highs and lower lows (and greater likelihood of insolvency).

Considering current debt levels, and potential mean reversion of rates, an argument can be made that interest rates will rise from current levels. However, the many competing events and exposures force us to consider both high and low interest rate scenarios.

## ***2. Monetary Policy***

Since 1913, and especially starting with Paul Volcker’s tenure as chairman, the Federal Reserve Bank has set policy using various monetary policy tools. Each chairman has used a unique blend of instruments.

During the 1960s a period of U.S. government deficit spending was often described by economists using a guns and butter metaphor to illustrate the options available between defense spending and capital goods. The Vietnam War (guns) was conducted concurrently with fiscal social expansion (butter). Initially, low inflation rates held despite the deficit. The 1970s started with an end to fixed exchange rates, followed by oil price shocks, stagflation, and finally Volcker’s series of contractionary policies. As rates fell, the era of “great moderation” ensued. The late 1990s until the Great Recession saw higher money supply, low rates and economic growth. Both the 1960s and much of the most recently completed decade appear to have built up imbalances that needed to clear for the financial system to recover. Guns and butter led to a challenging decade where growth was slim and unemployment high, and the housing bubble triggered imbalances in 2008 that continue to be unwound today.

### ***3. Interest Rate Scenarios***

Deterministic scenarios allow a modeler to stress test specific conditions. Using mosaic analysis to combine results from the survey and model office, the risk manager should consider deterministic scenarios that have a range of environments and interactions. A proper balance is necessary, with neither too few nor too many. Statistical significance is not important. Each scenario should tell a story about the block of business and concerns being tested.

Fewer than 10 deterministic scenarios can describe the primary risks and implications if properly selected to include optionality that occurs from both liabilities and assets. Modelers should avoid adding on scenarios that are similar to others already run, such as one that increases 25 basis points (bp) annually when there is already a 50 bp annual increasing scenario. Modelers should include some scenarios that would likely result in a rating downgrade to the industry. To be avoided, or at least understood as best case scenarios, are slow up patterns from low rates and slow down patterns from high rates. From the survey completed as part of this research project it appears that these types of scenarios are being presented to management as the most likely due to mean reversion, with more stressful but just as likely scenarios not shared.

Stochastic scenarios cover many more situations, but they often repeat similar scenarios rather than testing plausibly stressful conditions occurring in the tail of a distribution. In low interest rate environments these model generators suffer from a methodology that does not allow negative rates and from a slow tug toward a historical mean result. Rates that stay low for long periods of time or spike quickly and severely do not occur frequently enough to impact metrics determining capital requirements. Especially when starting from an extreme scenario—for example, high price-to-earnings multiples in 1999 for equities—the expert's expectations may diverge from the model. These tail scenarios can reward the model expert with scenarios not tested otherwise, and those who take the time to look at the absolute worst and best results for drivers are more knowledgeable for their efforts. An expert may develop interactions between variables that do not perform as expected by a model assuming independence.

Currency interactions are described by the concept of purchasing power parity, but scenarios rarely contemplate policy changes. If a currency war ensues it becomes a game of leapfrog, with each country trying to debase its currency and improve exports before the others.

While the overall size of the pie is growing, monetary policy in one country (loose or tight) results in very similar consequences as if everyone else had the opposite policy. For example, when Japan enacts policies to weaken the yen this means that the dollar, euro and other currencies all strengthen. Since oil is priced in U.S. dollars, some say that a strong dollar leads to a reduced oil price, creating geopolitical havoc in countries where oil is the primary export like Russia and Venezuela.

Some scenarios might be driven by nonfinancial events like a war or climate change. The benefit is thinking through how potential events could be dealt with, either mitigating them or being the first to capitalize on an opportunity.

#### ***4. Drivers of Rising Interest Rates***

Guessing where interest rates are going next is a fool's game. A risk manager's time can more effectively be used to describe and test potential scenarios and their impact. In order for rates to rise, a couple of scenarios seem plausible given historical reference. The Federal Reserve believes it can manage this process to increase interest rates while keeping them from ballooning out of control.

Typical of many countries today, the United States has high debt and loose monetary policy. Both of these have historically led to inflation, an increased velocity of money, higher nominal GDP, and higher interest rates. This scenario could be very healthy for the economy with higher wages, lower unemployment, and a situation where the country can grow its way out of debt. Most would view this as a positive scenario.

A more stressful scenario starts with a liquidity-driven recession (e.g., 2008), an aging population (demographics), and countries exporting their deflation by printing exorbitant amounts of money. Once deflation occurs, the economy could be susceptible to a massive loss of trust and a rush to buy "things" as quickly as possible. This scenario occurred in Germany (hyperinflation) following World War I and currently is happening on a smaller scale in Russia and Belarus.

#### ***5. Impact on Insurance Liabilities***

Rising interest rates, from today's low levels, can be a positive or negative event depending on how quickly the change takes place. A slow up scenario is likely a best case, while interest rates that quickly increase 5 percent or more will trigger lapses and capital losses. Each insurer's block of business will react to these scenarios in a unique fashion, making it important to model the risk realistically. Some products are tied more directly to interest rate changes than others. Insurers should take the time to understand any bets on the direction of interest rates they have taken (e.g., assets shorter than liabilities) and become comfortable that they fit with their chosen risk appetite.

Recent experience in Japan with low interest rates for an extended period led to changes in that market in product mix (away from offering interest-guaranteed products), consolidation, cost cutting, and a willingness to consider alternative investment asset classes. The guaranteed interest rate has been lowered but not abolished. In other markets, it could lead to a surge in mergers as companies seek economies of scale.

If rates continue their cycle, bottoming out and starting to rise again, it is possible that the life insurance industry will evolve with a new set of product features. As rates have fallen this has led to lower guarantees and greater attempts to pass through risk to the policyholder. Potential stresses in a rising environment include participating life versus universal life (UL) and indexed products versus pure general account offerings. We may also see a wave of consolidation, as life insurers merge with casualty insurers and multinational purchases occur to reduce currency concentration risk. A less active insurance industry in the asset markets could have a big impact on the financial markets, as insurers have historically been a primary institutional investor in longer maturity assets.

Insurance policyholders have not historically exercised the options they hold in an efficient manner, but this should not be relied on in the future. As was seen previously with home mortgage refinancing, Canadian Term-to-100 policies and whole life insurance loans (when interest rates spiked in the late 1970s), it only takes a few people or newspaper articles to create a trend and increase consumer sophistication. Companies can somewhat mitigate this risk by assuming an increasingly sophisticated clientele that understands the options that were granted. At the very least, an insurer should look at its long-term business using a scenario of sophisticated policyholders efficiently utilizing options granted to them.

Given these challenges, insurers should develop stress tests that take into account differences between accounting regimes (especially statutory vs. GAAP), consider both deflationary and fast rising scenarios, and understand the cost of float in products sold. The impact of interest rate changes on the industry is highly correlated across insurers, creating potential systemic risk that regulators and management teams should contemplate.

## **Model Office**

Several typical insurance products were tested using a simple set of deterministic scenarios. Much more sophisticated tools are available, but this one leverages analysis previously completed for other purposes.

Blocks of single premium deferred annuity (SPDA), UL, and UL with secondary guarantee (ULSG) policies were separately tested valuing the block using a present value of distributable earnings (PVDE) metric over 30 years discounting at the 10-year Treasury rate. Chart ES1 compares the results across these product types. The scenario labeled Base shows the results from holding a level yield curve for the entire time horizon. For each of the other scenarios an immediate change occurs, which then is held level. The D300 scenario lowers the yield curve (Down) by 300 bp. The U1000 curve raises (Up) the yield curve by 1,000 bp.

The SPDA curve resembles a price behavior curve (PBC) for the product, showing the high level of optionality found without the computer intensive requirements for a PBC. Generally an SPDA block of business performs well when rates move slowly and performs poorly when rates change

materially in either direction or are volatile. This is due to policyholders ability to withdraw their funds at any time (with a penalty until the initial commission is amortized) while also receiving a guaranteed nominal credited rate.

The UL block is much more stable than the others as it depends less on interest spreads since it also has profit from mortality margins. The lower value when rates rise is due to higher discount rates and some disintermediation.

The ULSG block is very interest rate sensitive, and performs similarly to an interest rate derivative. Since rates have been dropping for the 10 years during which this block has been growing, it is not very profitable in most scenarios. It is clear that higher rates improve profitability.

It is unclear whether companies consider these different return profiles when they develop strategic plans. What some might call best practices incorporates this type of analysis when developing a risk appetite statement.

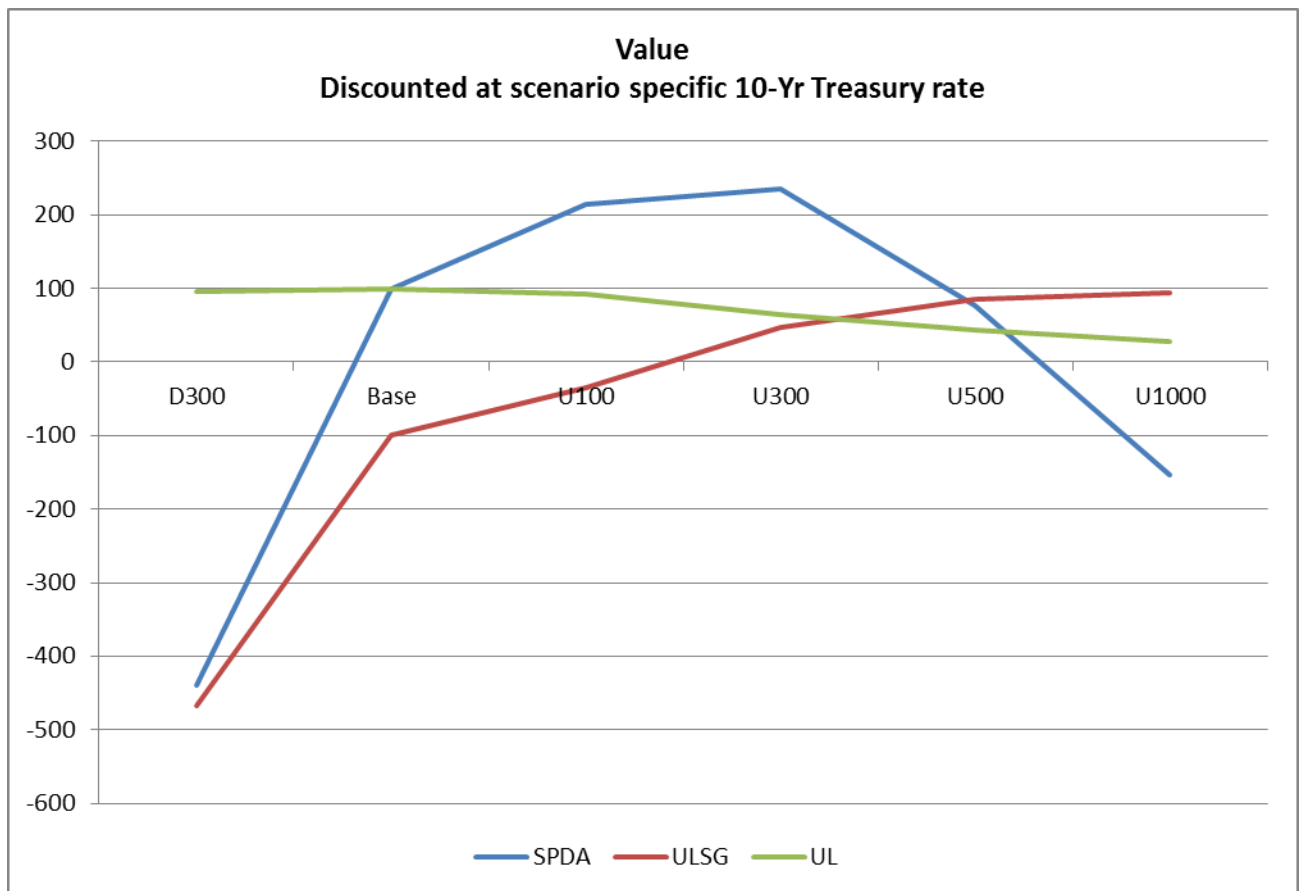


Chart ES1

In Chart ES2 the SPDA results are shown for each of the deterministic scenarios for both the Baseline assumptions and a sensitivity of lapsation parameters. This type of presentation quickly shows that the lapsation sensitivity, with the policyholder less constrained by surrender penalties, has little impact on the results using this metric. While the risk manager is not likely to share this information “up the ladder,” it can be a useful tool for understanding what matters and what doesn’t matter.

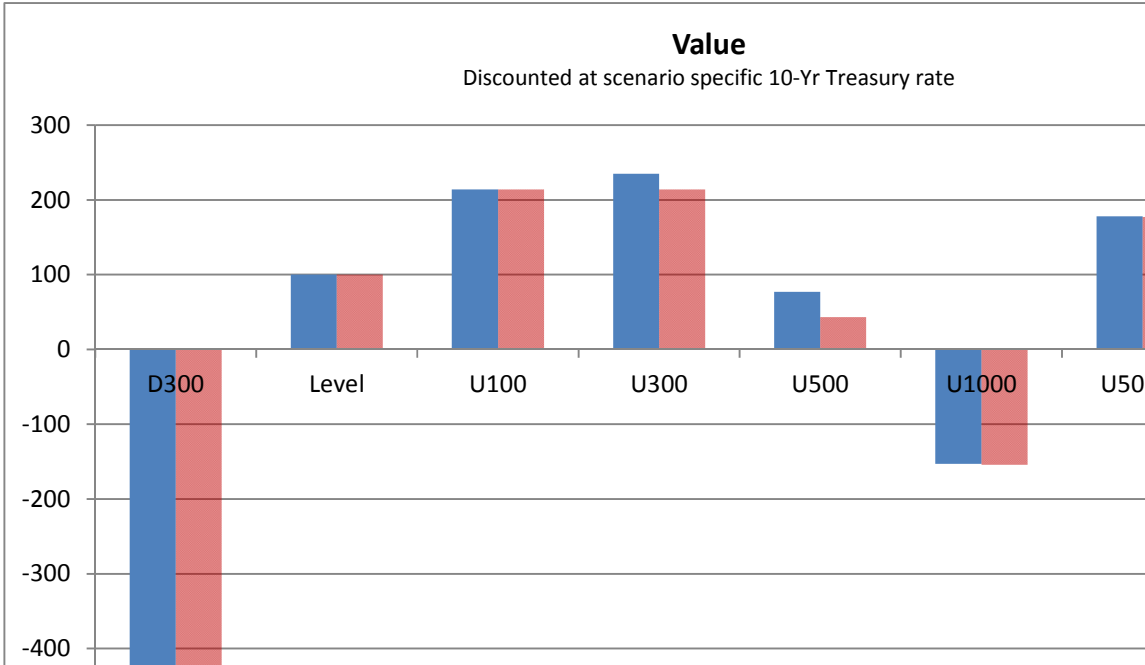


Chart ES2

**6. Impact on Assets**

Corporate borrowers in the bond and loan markets that receive options tied to interest rates would be expected to select against the buyer when it is in their best interests to do so. If interest rates rise, bonds and commercial loans with prepayment features can be assumed to be fixed, as sophisticated institutions rarely have reason to refinance to higher rates. Residential mortgages and their aggregators, on the other hand, will continue to have some prepayments as homeowners move due to new family circumstances such as changes in family size, marital status and employment. This turnover will increase as the economy gets better and employment options increase.

Alternative asset classes are especially susceptible to excessive optimism as early adopters have success in a small market and a demand surge follows, driving prices above economic values until demand moves on to new opportunities and prices drop.

A company's investment policy statement (IPS), in addition to considering asset and liability risks in isolation, considers interactions between combinations of assets and liabilities. This optionality of a combined portfolio of assets and liabilities allows the risk manager to consider basis risk, where a hedge might not be perfectly correlated, along with risks that are aggregated across the enterprise.

By managing risk holistically and considering a range of potential outcomes, financial institutions can manage their way through most future scenarios. This resiliency will allow greater flexibility and an improved risk culture.

## ***7. Company Practices***

In the summer of 2014 a seven page survey was distributed to life insurers varying by size and product mix, and 19 responded. The results showed, not surprisingly, that companies currently focus on interest rate scenarios that regulators ask them to complete. In addition, deterministic scenarios are often completed, but these tend to be historical remnants of discussions from a decade ago and need to be revisited in today's low interest rate environment. Very few test negative interest rates or rates higher than 9 percent. Some tests do not seem to provide additional information beyond the other scenarios tested (e.g., pop-ups of 100, 200, 300, 400, 500 bp). A story should accompany each scenario and describe reasons for running it.

Larger companies are more likely to test stochastically generated scenarios, and most use the VM20 generator developed by the American Academy of Actuaries. Some adjust the mean reversion parameters to better reflect company expectations.

About half of companies surveyed have adjusted their portfolio based on testing, and many have taken bets that rates will increase by shortening their asset duration below targets.

## ***8. Conclusion***

It is foolish to think that the complex adaptive system governing world financial markets can be modeled precisely or accurately. Instead, a preferred response would be to develop resilient methods and culture that allows insurers to survive and "fight another day." Whether events and trends such as demographics drive interest rates lower, or high levels of debt drive them higher, is secondary to setting up a process that considers unique exposures and circumstances.

The 2008 global recession showed that liquidity-driven risk should not be ignored. What risk(s) are building today that will surprise risk managers in the future? Ever changing, but well-meaning, regulations have distracted risk managers from considering long time horizons and emerging risks. Stress tests covering a broad range of future events, not stopping after 12 or 36 months, are necessary to incorporate risk management into the strategic planning process.

## **II. Background**

This research project was funded by the Committee on Life Insurance Research, the Financial Reporting Section, and the Society of Actuaries (SOA) Research Expanding Boundaries (REX) Funding Pool. The paper uses a survey, model office, literature review, and mosaic theory to develop its conclusions, using previously published material where available to make specific points.

The authors used the Federal Reserve Economic Data (FRED) database from the Federal Reserve Bank of St. Louis to assemble some of the data used herein; see the source notes for information on the specific series.

Research reports do not create themselves in isolation, and the researchers thank the Project Oversight Group (POG) members for their insights during the development of this paper: Zoe Bi, Matt Clark (chair), Donna Megregian, Bill Sayre and Jim Thompson. SOA research staff members Jan Schuh and Ronora Stryker provided excellent logistical support and final edits. Of course, all errors and omissions remain the responsibility of the researchers.



### III. Researchers

The researchers for this project are Max Rudolph, Randy Jorgensen and Karen Rudolph. Max is the primary researcher and lead author. Randy is the lead author for the section titled “A Plausible View of a Rising Interest Rate Scenario.” Karen is the lead author for the section titled “Model Office” and provided actuarial modeling support in the preparation of this report. The views and opinions expressed in this report by other contributors/authors do not necessarily reflect those of Milliman, Inc. or Creighton University.

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## IV. High Interest Rates and Their Implications

*In economics things take longer to happen than you think they will, and then they happen faster than you thought they could.*

Rudiger Dornbusch

This research project aims to capture several interrelated topics.

- What are the implications to the life insurance industry of rising rates?
- What are insurers doing today to stress test their existing blocks of business for changes in interest rates?
- What leading indicators could be monitored to anticipate interest rate scenarios and how should this be communicated to management?
- What strategies should insurers and others providing oversight consider in response to a rising interest rate scenario?

The Federal Reserve System was created in 1913. This followed a financial panic in 1907 where private banker JP Morgan was the primary calming influence. This means there are very few historical data points, and multiple economic theories about proper actions (e.g., Keynesians believe in active responses and the Austrian camp of Hayek and von Mises believes in non-intervention). Since that time, and especially since Paul Volcker became chairman in 1979, the United States has conducted monetary policy using tools that had not been used previously. Not everyone agrees that a strong central bank is the best policy, and politicians like Senator Rand Paul (R-Ky. and a current presidential candidate) continue to make it a campaign issue today, reflecting past leaders such as Andrew Jackson. Policies enacted during the financial crisis of the last decade materially increased government debt through fiscal policies and the Fed's balance sheet in efforts to stimulate the economy. Common theories about expansion of the monetary supply would expect these policies to be inflationary, but to date rates have remained low and deflation seems more of an immediate concern. Policies by the Fed to keep interest rates low are designed to stimulate the economy, but protagonists would say they are building asset bubbles through market manipulation. The lack of consumer price inflation has been explained by some claiming that asset prices have inflated<sup>7</sup>, increasing financial inequality as a byproduct.

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<sup>7</sup> Sumner, Scott. Asset Prices, Inflation, and Interest Rates. Nov.25, 2013. CATO Unbound. <http://www.cato-unbound.org/2013/11/25/scott-sumner/asset-prices-inflation-interest-rates>

This paper will share two scenarios that lead to rising interest rates, one driven directly by money supply and one where inflation follows deflation. Interactions between assets and liabilities in these scenarios are discussed along with current stress testing practices and the sensitivity of common lines of business across a variety of interest rate scenarios.

Global interest rates are likely to be volatile over the next decade, making it important for insurers to stress test both low/falling interest rate scenarios (including some deflationary ones) and rising interest rate scenarios. A slowly increasing or pop-up scenario that increases by 3 to 5 percent may be the best case scenario and should be communicated using terms other than baseline. Leading indicators are pulling interest rates in both directions. Commentators use the same information to make predictions that directly oppose each other. As is often the case, an insurer may be able to gain a competitive advantage by thinking independently.

Going forward, reporting requirements may be driven by systemically important financial institutions (SIFIs). These companies, formally designated in the United States by the Financial Stability Oversight Council (FSOC), have been identified as firms whose collapse would pose a serious risk to the economy. They will receive additional oversight and may be required to hold higher levels of capital than non-SIFI-designated firms. There is also a global SIFI designation, and a special category for reinsurers deemed “too big to fail.”

### ***A. Current Environment***

Interest rates are near the lowest levels most people can remember. Chart 1, taken from the Federal Reserve Bank of St. Louis' EDGAR database, shows the 10-year Treasury rate for over 50 years. Since the stagflation era of the late 1970s, when both inflation and unemployment were simultaneously high, interest rates over time have dropped. Volatility caused occasional blow-ups for those using margin, memorably in 1994, but buy-and-hold investors have generally maintained higher portfolio earned rates than new money rates would offer.



Chart 1<sup>8</sup>

At U.S.-based life and health insurers, falling interest rates have resulted in net yields falling over the last few years as shown in Chart 2 (statutory accounting net yield includes income from coupons as well as capital gains).<sup>9</sup> This is despite increased allocations to alternative asset classes (the annuity line upturn in 2013 is due to higher derivative income so likely reflects the impact of indexed life and annuity products). The insurance industry tends to be a buyer of illiquid assets due to a buy-and-hold strategy reflecting the ability to hold assets across long time horizons. These include lower-quality and higher-duration bonds, private placements, bank loans, international assets and real estate. Many life insurance and annuity products have interest rate guarantees with floors mandated by their domiciliary state according to National Association of Insurance Commissioners (NAIC) model regulations. These are based on the original issue date and remain constant over the life of the contract. The low interest rate environment has

<sup>8</sup> Data Source: FRED, Federal Reserve Economic Data, Federal Reserve Bank of St. Louis: *10-Year Treasury Constant Maturity Rate*; Board of Governors of the Federal Reserve System; <http://research.stlouisfed.org/fred2/series/DGS10>; accessed Apr. 27, 2015.

<sup>9</sup> Yu, Mark. Presentation at SOA Annual Meeting 2014, Session 56, October 2014.

moved the industry toward products indexed to equities and pure protection products that are repriced annually like term life, health, and casualty products. Products that combine asset and liability risks, like universal life and deferred annuities, eventually need the ability to subsidize interest margins from other profit sources when rates stay low for extended periods.

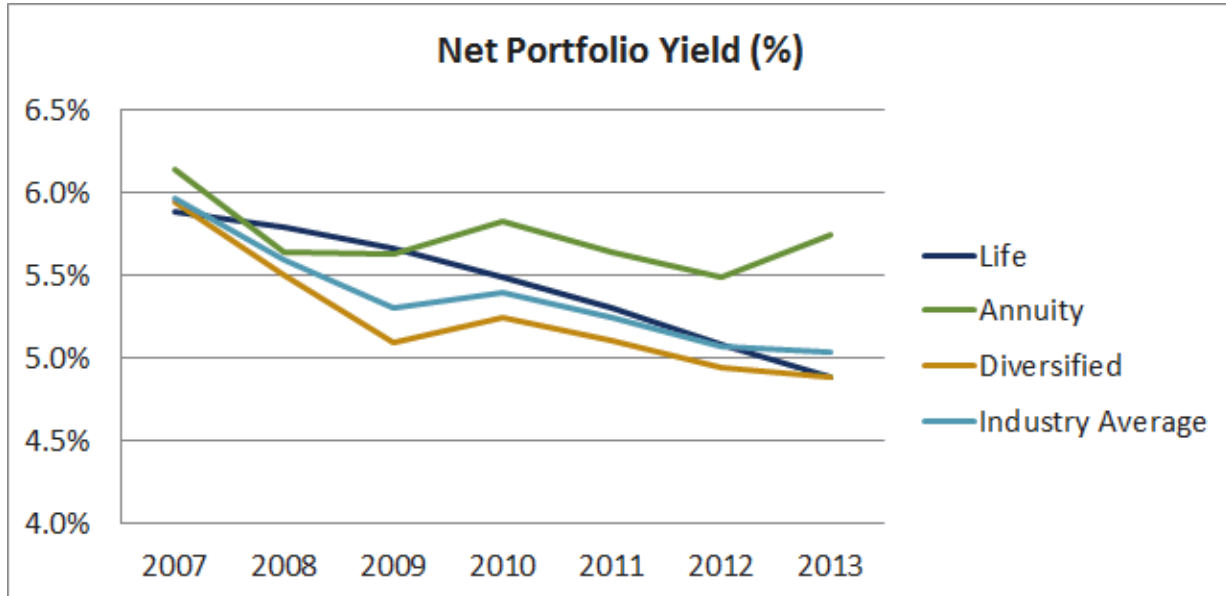


Chart 2

The Federal Reserve has kept short-term interest rates low for a long period of time, using quantitative easing (QE) tools to buy government securities with electronically created money to generate demand even with rates already close to zero. If another round of QE is started in the United States after 2014, purchases of equities may be considered much as the Japanese program of late 2014. Long-term rates have historically been harder to control. Economists, regulators, and the man on the street all seem to expect rates to slowly increase. This is a best case scenario for most products sold by insurers, as charges for optionality add to profits but the options (primarily withdrawals) do not get exercised.

The NAIC interest rate generator, originally developed by the American Academy of Actuaries and currently available at the Society of Actuaries website,<sup>10</sup> has a mean reversion factor that forces interest rates to trend toward historical averages.

Few stochastic interest rate generators support negative rates, and most work from historical data so mean revert. This leads to scenarios that rise from low levels and fall from historically high levels. The risk manager must use deterministic scenarios to truly test extreme yet plausible story lines.

<sup>10</sup> <https://www.soa.org/research/software-tools/research-scenario.aspx>.

While interest rates have (eventually) reverted to the mean in the past, from today's rate levels there are no guarantees that rates won't drop further or overshoot long-term averages. Think of the mean reversion point as the equilibrium position for a pendulum, with the bob starting out at a random point and then overshooting the hoped-for steady state result through seemingly random movements. Of course the pendulum example comes up short because the financial markets do not follow the laws of physics and could, for example, move further away from the neutral position.

## 1. Low Growth Drivers

In spring 2014 the lead researcher of this project completed a paper looking at what could cause interest rates to stay low.<sup>11</sup> There are several GDP growth drivers that could cause interest rates to remain low or go even lower. Recall that nominal GDP is represented by productivity multiplied by population, or velocity of money (VM) multiplied by money supply, so anything that impacts these variables will also impact GDP.

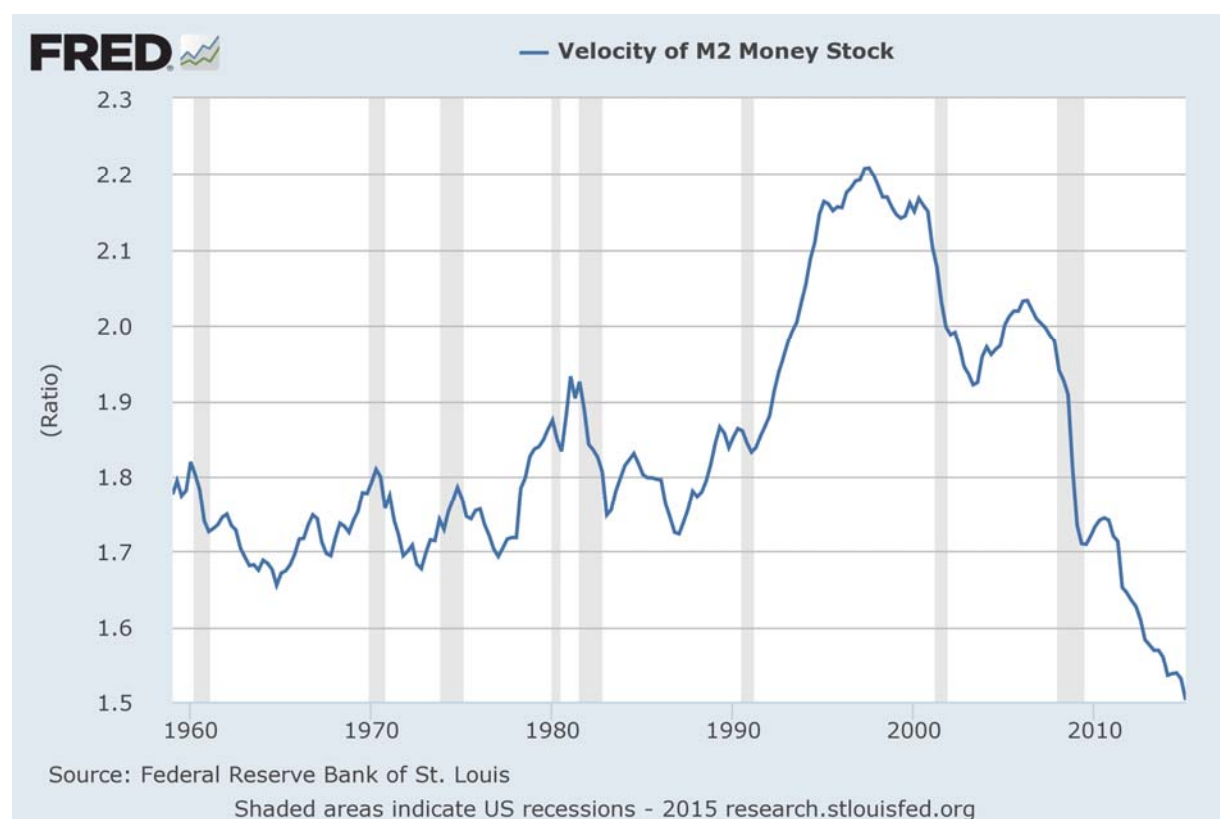


Chart 3<sup>12</sup>

<sup>11</sup> <https://www.soa.org/Research/Research-Projects/Risk-Management/research-2014-sustained-low-interest.aspx>.

<sup>12</sup> Federal Reserve Bank of St. Louis, *Velocity of M2 Money Stock* [M2V], retrieved from FRED, Federal Reserve Bank of St. Louis <https://research.stlouisfed.org/fred2/series/M2V/>, Apr. 29, 2015.

As seen in Chart 3, the velocity of money has reached historically low levels. If this metric reverted to its historical average it would provide an inflationary push to nominal GDP. The velocity of money was once thought to be a constant but seems to be driven by behavioral responses and trust in the “system.” While low today, it is unclear what specific indicators drive this metric or how it interacts with long-term Federal Reserve Bank stimulation.

Demographic trends, especially in developed countries, reveal aging populations. Japan was the first developed country to age and shrink in size, and this has led to multiple recessions over the past 25 years. GDP is broken down into productivity times population, so fewer people naturally leads to a smaller GDP. The United States may be able to leverage its status as the reserve currency with its laggard demographic position to initially observe others go through the aging process.

Sustainability, sometimes referred to as the study of climate change (but actually broader to include use of finite resources), seeks to create conditions that can endure over a long period of time. Historically, conditions on planet earth have changed very slowly but lately have been occurring at relative breakneck speed. It is hard to identify the true signal among the extraneous noise, and so it becomes easy to manipulate the data to support nearly any conclusion. The overuse of limited resources such as oil and fresh water has historically been without recorded costs from an accounting perspective. The true costs will eventually need to be paid to maintain a habitable planet, and this will slow growth. Proactively, structural investments that slow the impact of climate change (e.g., sea walls) will also incur a cost.

Northwestern University professor Robert Gordon<sup>13</sup> views the three industrial revolutions since 1700 as one-time events and expects economic growth to return to the slightly positive level present before that time. His “headwinds,” which are not independent, include:

1. No large productive group waiting to enter the workforce (e.g., women in 20<sup>th</sup> century).
2. Fewer college graduates.
3. Rising inequality.
4. Outsourcing and technology moving jobs to low-cost alternatives.
5. Sustainability.
6. Recent government interventions in many countries that will need to be unwound.

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<sup>13</sup> Gordon, Robert J. Is U.S. Economic Growth Over? Faltering Innovation Confronts the Six Headwinds. Centre for Economic Policy Research, Policy Insight No. 63. [http://www.cepr.org/sites/default/files/policy\\_insights/PolicyInsight63.pdf](http://www.cepr.org/sites/default/files/policy_insights/PolicyInsight63.pdf). The book he is working on has a working title of *Beyond the Rainbow: The American Standard of Living Since the Civil War*, Princeton University Press.

## 2. Energy Impact on Current Account Deficit, Inflation and Growth

The price of energy has been much more volatile over the past 50 years than other consumer items, leading many to use deflators that ignore this component (food is another component often left out). The presence of cartels, along with newly discovered resources, has led to this volatility. The presence of cartels means that price is not determined by supply/demand balances, and as new supply has come on-line from outside the cartel partners the marginal cost to supply the commodity is well below the oligopoly price. This puts downward pressure on the price, which is revealed when demand slows. In early 2015 the price dropped below \$50 per barrel of oil (West Texas Intermediate crude) after previously being in the \$100 range, which is said to be below the marginal cost to produce for some of the new suppliers using fracking techniques. Cartel members have chosen (so far) to continue to pump at their lower marginal cost, hoping to force out the new entrants (some also feel there is an effort to put pressure on countries like Russia and Iran for political reasons). In any case this process is likely to have far-reaching and unintended consequences.

When total imports exceed exports then home currency leaves the country, creating a long-term tendency for currency devaluation and inflation. Oil imports, for example, are paid for with dollars, which then return as investment or to buy exports. As the United States has developed its domestic energy fields through the fracking process, less energy is imported. This impacts the current account deficit, long-term inflation, and demand for the dollar internationally. Some experts have predicted that the United States could be a net exporter of natural gas by 2020.<sup>14</sup> In late 2014 this situation facilitated, along with loose Japanese monetary policy, a drop in the price of oil and a strengthening dollar. This will have ramifications in the emerging markets as foreign direct investors scramble to convert local currencies back to dollars.<sup>15</sup> A risk to the health of the U.S. economy relative to others is our dependence on fracking for recent economic growth and currency strength. Some localities ban the process due to environmental and health concerns. If fracking was more broadly restricted, a shock event reminiscent of the 1970s OPEC cartel could result. The dollar as reserve currency could be at risk, and it is unclear how this along with easy monetary policy and high government debt could be systematically unwound.

Energy is probably the hardest sector to time the market because the prices are often inconsistent with supply/demand balances. In most sectors the marginal cost to create the good is not far from where the cost ends up after a small profit is added. But even with improvements to the fracking

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<sup>14</sup> Information in this section used <http://www.aei.org/article/economics/benefits-of-hydraulic-fracking/> an American Enterprise Institute article by Kevin Hassett and Apama Mathur titled Benefits of Hydraulic Fracking and <http://environmentnewyork.org/reports/nye/costs-fracking> a white paper by the Environment New York Research & Policy Center titled *The Costs of Fracking: The Price Tag of Dirty Drilling's Environmental Damage*.

<sup>15</sup> Wray, Worth. Thoughts from the Frontline: Why the World Needs the US Economy to Struggle. Jan. 4, 2015. Mauldin Economics.



process the marginal cost is still below \$70 for the oil that balances the market (that meets demand). And we've seen it go past that price today and other times when the Saudis decide to speed up their pumps. Investors should proceed with great caution in this volatile environment.

### **3. Section Conclusion**

Nominal interest rates have not been as low as they are currently in more than a generation, and with active fiscal and monetary policy it is uncertain how they will trend going forward. Many current life insurance products were developed in a high or falling interest rate scenario, using equity and derivative exposures as well as traditional bonds and loans. Many have interest rate guarantees that are being tested by the current environment.

Demographics, sustainability, low nominal yields and volatile energy prices could lead to stalled economic growth. Loose monetary policy and large deficits could lead to high levels of inflation. This paper will look at how this may play out in the future, starting with a review of several recently published books.

## ***B. Learning from the Past: Literature Review***

### **1. Why “This Time Is Different” Never Is**

Until Carmen Reinhart and Kenneth Rogoff compiled data across eight centuries in their 2009 book *This Time Is Different*, there had been no systematic look at thresholds driven by inflation crises, currency crashes and currency debasement, events like banking crises, or external and domestic defaults. This comprehensive look at similarities between “crashes” led to several conclusions.<sup>16</sup> The common factor they found was not surprising; the commonality of it was. Excessive debt accumulation is built up during good times, often preceded by financial liberalization and increasing systemic risk. This overconfidence sets up vulnerabilities in the financial system, and becomes more likely as time since the last crisis passes. Everything looks fine until confidence—and trust—in the system is lost. Countries try to manage this risk, but tend to undercorrect during boom times and perhaps overcorrect during bust times. There does not appear to be a single level of debt that triggers this realization that the economy has overexpanded, but current levels of debt in many countries seem high.

Debt is defined broadly. It could arise from government, banks, corporations or consumers. Boom times seem like they will go on forever, with outsized profits and higher standards of living. Sovereign defaults occur when external or domestic debt obligations are not paid. External debt is a bigger deal, especially when compared to exports. Economically this is the same as a high inflation environment (historically debasement was an event in this category, where metal was shaved off coins). Some think this scenario can be managed to reduce debt-to-

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<sup>16</sup> Reinhart, Carmen, and Kenneth Rogoff. 2009. *This Time Is Different: Eight Centuries of Financial Folly*. Princeton University Press.

GDP ratios over time by growing the economy. It is hard to get this right, and failure to recognize its difficulty remains the primary error behind many calculations during debt crises.<sup>17</sup> Banking crises lead to amplified recessions, rather than being causal, and make it harder to outgrow financial crises. The United States has had 13 banking crises since 1800.<sup>18</sup> No major country has yet been able to graduate from banking crises.<sup>19</sup> The after-effects of these events often lead to high levels of government debt, with Reinhart/Rogoff stating that three years after a banking crisis government debt has typically increased by 86 percent.<sup>20</sup> The bank business model is to accept asset-liability management (ALM) risk, with short-duration deposits reinvested in long-horizon loans. This makes the industry vulnerable to bank runs, when depositors refuse to roll over debt.<sup>21</sup> Deposit insurance protects savers but likely creates moral hazard as banks accept higher levels of risk without the likelihood of a bank run. In the United States this played out with the Savings & Loan crisis, where depositors left their money to earn high rates even after it was clear that many S&Ls would not survive. A currency crisis can be especially painful for emerging market countries that experience procyclical capital outflows.

Those who lived through the 2008 crisis saw a differentiation between illiquidity and insolvency. Similarly, countries may differentiate between willingness and ability to pay. An entity may face a short-term funding problem or one where it is unwilling or unable to service debts. A country may choose not to repay.<sup>22</sup> Bonds issued by governments are not risk-free, despite this assumption in many theoretical models.<sup>23</sup> A firm may be forced to default due to exogenous circumstances they have no control over.

## Similarities

Financial crises tend to have these characteristics:

- Asset markets collapse (housing 35 percent over six years, equities 56 percent over 3.5 years).
- Declines in output and employment (unemployment rate rises 7 percent and lasts for four years, output falls 9 percent for about two years).

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<sup>17</sup> Ibid page 33.

<sup>18</sup> Ibid page 153.

<sup>19</sup> Ibid page 147.

<sup>20</sup> Ibid page xxxii.

<sup>21</sup> Ibid page 144.

<sup>22</sup> Ibid page 59.

<sup>23</sup> Ibid page 118.

- Government debt rises (main cause is not bailout/recapitalization of banking system but collapse in tax revenues) and interest rates may spike. Fiscal policy may contribute to the buildup of debt.<sup>24</sup>

Since World War II, creation of bodies such as the International Monetary Fund (IMF) has coincided with shorter but more frequent episodes of sovereign default.<sup>25</sup> This appears to have helped countries become more resilient, while at the same time creating concerns that this safety net has created conditions increasing moral hazard, where lenders and borrowers accept and take risks they might not have otherwise. According to Reinhart/Rogoff, during this period the pattern has been housing boom and bust.<sup>26</sup> This type of analysis may provide the analyst with leading indicators to anticipate a coming problem.

When a banking crisis impacts all—or most—countries, it makes it a more lengthy process to escape. Growth options often depend on exports, and a worldwide contraction will not find buyers. Currency trading is a closed system, so a country can only weaken its currency if another currency strengthens.

The Reinhart/Rogoff research shows that government debt above 90 percent of GDP reduces GDP growth by 1 percent. While higher debt does seem to be linked to default, the timing and trigger for these types of events are impossible to quantify. Each situation is different, but as seen in Chart 4 the United States has surpassed this threshold for the past several years.<sup>27</sup>

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<sup>24</sup> Ibid page 224.

<sup>25</sup> Ibid page 62.

<sup>26</sup> Ibid page 159.

<sup>27</sup> Data Source: FRED, Federal Reserve Economic Data, Federal Reserve Bank of St. Louis: *Federal Debt: Total Public Debt as Percent of Gross Domestic Product*; Board of Governors of the Federal Reserve System; <http://research.stlouisfed.org/fred2/graph/?id=GFDEGDQ188S>, accessed Apr. 27, 2015.

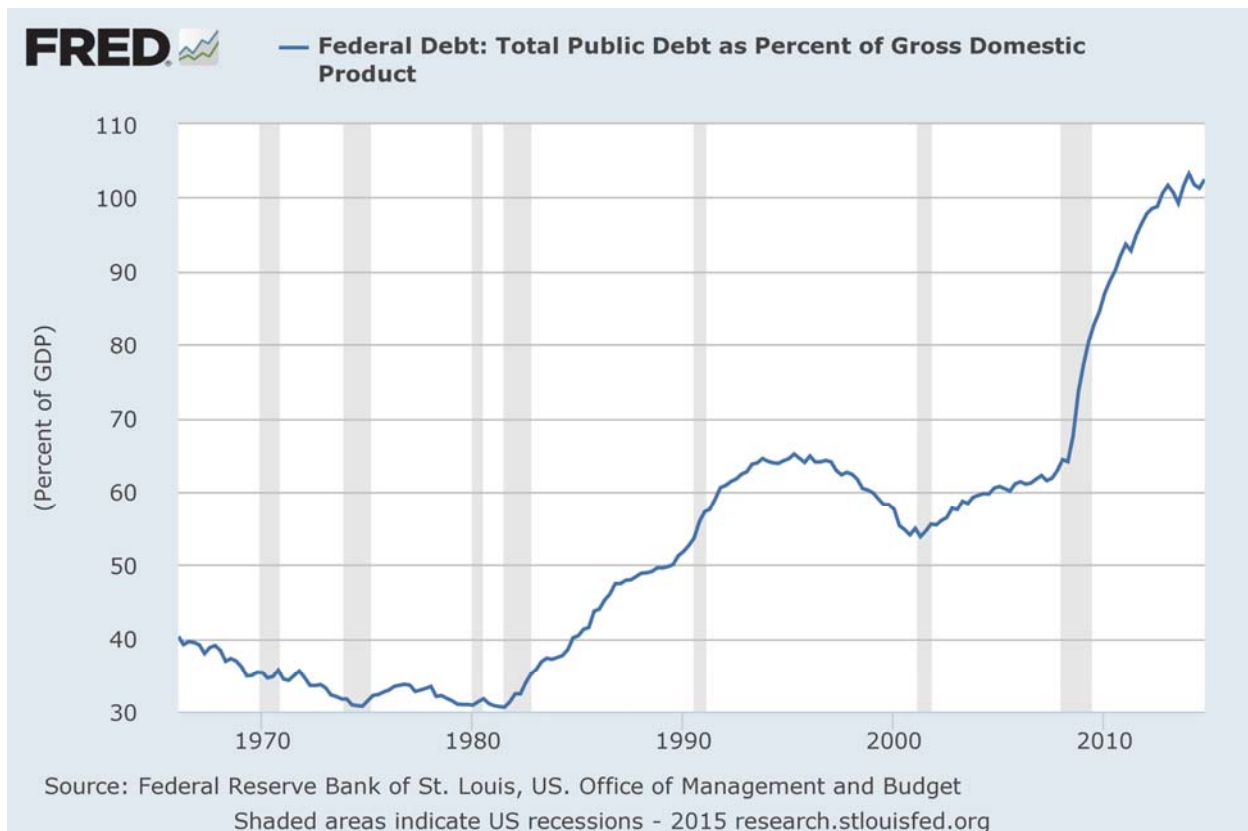


Chart 4

Some countries have been serial defaulters; Greece has spent more than half the years since 1800 in default. Others, including Mexico and Venezuela, have spent over 40 percent of this period in default.<sup>28</sup>

There are several current examples of countries that seem to fall into the risky category. Countries experiencing high inflation include Belarus, Argentina, Ukraine, Syria, Iran, Sudan and Venezuela. In late 2014 Russia experienced a currency crisis. Each of these countries has other risks that may have driven its economy to hard times. The world's economy is much more entangled than it has been in the past, and falls under the study of complex adaptive systems. Contagion (fast) and spillover (gradual) effects of correlation remain a primary risk to the rest of the world. The European Union continues to integrate previously distinct economies and, more importantly, cultures. Initially in late 2014 Japanese actions to stimulate its economy played out in the oil market as the dollar strengthened, and the world economy has entered what is being called a currency war. Future scenarios (some can only be assessed qualitatively) considered must be broad, taking into account everything from a return to the gold standard to a newly defined global currency.

<sup>28</sup> Ibid page 98.

Valuation methods during a boom period are frequently assumed to be new and improved, often due to a recently developed and superior financial system. Reinhart/Rogoff research shows that innovation does not change the prior rules of valuation.<sup>29</sup>

## **Comparison to Emerging Markets**

Banking crises in developed and emerging markets tend to be similar, but the United States following the 2008 crisis has been unique (so far) in some ways. Its exchange rate did not plummet, interest rates did not soar, and access to capital markets did not shrivel. As the international reserve currency, the dollar attracted investment from around the world.<sup>30</sup>

### **2. James G. Rickards—*The Death of Money and Currency Wars***

An argument presented by James G. Rickards in *Currency Wars*<sup>31</sup> and *The Death of Money*<sup>32</sup> is that, absent a gold standard, politicians have no self-control over long time horizons, and inflation is inevitable. Rickards has had an interesting career. He was the general counsel for Long-Term Capital Management (LTCM), and negotiated its demise in 1998. Since then he has worked as a portfolio manager and consultant on financial warfare. He presents the case that, going forward, cyber warfare will include attacks on the financial system. Everything from shutting ATMs down to changing orders on the NYSE is within reach.

The Stuxnet computer worm illustrates techniques that might be utilized. With Stuxnet someone searched out Iranian centrifuges suspected of enriching uranium and manipulated the speed their motors operate at to destroy them. Rickards claims that recent NYSE stoppages were ordered by Russian leader Vladimir Putin and that utilities, transportation and financial systems are all at risk.

### **3. *The Forgotten Depression***

In *The Forgotten Depression*,<sup>33</sup> James Grant (well known for his *Interest Rate Observer* newsletter) argues that a non-interventionist policy would have worked better than an active response to the Great Recession. Historically this was tested in the brief depression in the United States following the inflationary period created by World War I. After a short period of negative

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<sup>29</sup> Ibid page 210.

<sup>30</sup> Ibid page 222.

<sup>31</sup> Rickards, James G. 2012. *Currency Wars: The Making of the Next Global Crisis* (paperback, hardback published 2011). Portfolio/Penguin.

<sup>32</sup> Rickards, James G. 2014. *The Death of Money: The Coming Collapse of the International Monetary System*. Portfolio/Penguin.

<sup>33</sup> Grant, James. 2014. *The Forgotten Depression, 1921: The Crash That Cured Itself*. Simon & Schuster.

growth, the financial system cleared itself through deflation of both prices and wages. This led to the good times of the 1920s. He contrasts this to the desire to “do something” by the Federal Reserve and Hoover administration in the early period of the Great Depression. By artificially holding wages high and insisting that owners lower their profits, he argues that unemployment was much higher and longer than was necessary.

This laissez-faire policy in 1921 led to a self-fulfilling confidence that the bad times would not last long despite reports that this downturn was the strongest of 14 business-cycle contractions since 1812.<sup>34</sup> Following the war Russia had seen a workers’ revolt and the Communist Party was active elsewhere, including the United States. Previous wars had been followed by depressions, driving expectations.

Interestingly, the author does not address two questions that immediately come to mind. World War II was followed by an economic expansion, not a depression, and one could argue that the backstop of the Federal Reserve Bank generated trust in the system so did not result in a run on the bank. Second are the obvious differences between 1921 and today. Following World War I the United States had recently become an international creditor, and exports exceeded imports. Neither is true today. Other changes were also underway. Gold no longer needed to be physically moved, and the ramifications continue to play out today. The greater interconnectedness of the world economy today, with no gold standard and fiat currencies, makes it hard to state that any specific policy would have worked better in today’s environment, but Grant’s arguments deserve to be considered and discussed.

*There is nothing new except what is forgotten.*

Rose Bertin

#### **4. Code Red**

John Mauldin writes a weekly newsletter, *Outside the Box*,<sup>35</sup> and his thoughts over several years were summarized in a book co-authored with Jonathan Tepper titled *Code Red*, following up their 2011 book *Endgame* and covering the period following the 2008 recession.<sup>36</sup> *Code Red* describes loose monetary policies like quantitative easing and zero interest rate policies (ZIRP) that were implemented in 2008. The United States is now starting to unwind these policies and the fallout could be ugly; everything from stagflation (such as Russia is currently experiencing) to default or hyperinflation (economically equivalent events).

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<sup>34</sup> Ibid pages 5-6.

<sup>35</sup> <http://www.mauldineconomics.com> .

<sup>36</sup> Mauldin, John, and Jonathan Tepper. 2014. *Code Red: How to Protect Your Savings from the Coming Crisis*. Wiley.

A country that has both trade and fiscal deficits requires either private savings or monetary expansion by the central bank. Through the process of central bank manipulation of rates (keeping them low), the financial system subsidizes borrowers and exporters at the expense of savers and importers. As the theorists say, there are no free lunches, and eventually subsidies need to be unwound.

Currency adjustments do not happen in isolation. If one currency rises (or falls) then at least one other currency must also adjust in the opposite direction to balance the system. So, for example, when Japan adopts a loose monetary policy the yen falls but other currencies rise to counteract the policy change. The country with loose monetary policy has exported deflation to others. These other countries will respond to support their exports and at least somewhat negate the original loose policy, joining a currency war.

The Japanese situation may provide educational material for the rest of the developed world as they are the first country to get older with a decreasing population. Demographics matter, old people vote, and bonds have historically been bought in Japan by the retirement plans of the workers who are now liquidating those bonds to pay retirees. Growth is driven by productivity and population, and increasing public debt per person and debt/GDP ratios will make it harder. Interest is already a major component of the Japanese budget. Slack capacity will continue to increase, making it inevitable that prices will eventually fall. The authors hypothesize that the situation “could destabilize inflation expectations so dangerously that it pushes Japan from deflation to ultra-high inflation, without stopping for long at any point in between.”<sup>37</sup> If they are correct then players in this currency war following similar policies could follow suit.

When a central bank dominates the market for government bonds, this decouples the link between interest rates and risk for all asset classes priced relative to the risk-free rate. According to Peter Bernholz in *Monetary Regimes and Inflation*, and quoted in *Code Red*, “Hyperinflations are always caused by public budget deficits which are largely financed by money creation.” He continues, “Hyperinflations are not caused by aggressive central banks by themselves. They are caused by irresponsible and profligate legislatures that spend far beyond their means and accommodative central banks that lend a helping hand to governments.”<sup>38</sup> The author contends that deficits above 40 percent of expenditures cannot be maintained.

## 5. Section Conclusion

Several recently published books have argued that combining loose fiscal and monetary policies will likely lead to inflation at some point. Some countries have already reached this point, and Reinhart/Rogoff point to debt as a ratio of GDP as the driver historically. Many countries are

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<sup>37</sup> Ibid page 83.

<sup>38</sup> Ibid page 217.

consciously devaluing their currency to stimulate exports, hoping that this will lead to growth. Unfortunately this is a zero-sum game and there is little difference between one country devaluing and all the other countries strengthening their currency. Rickards and Mauldin argue that this leads to a currency war, including cyber warfare against the financial system, that spirals with little gains achieved.

Grant argues that allowing the financial system to clear naturally, as was done in 1921, rather than intervene would be the quicker and less painful method to deal with a depressed economy. In the next section we will look to the recent past for clues about the future.

### ***C. A Plausible View of a Rising Interest Rate Scenario***<sup>39</sup>

#### **1. Introduction**

The purpose of this section of the paper is to discuss some recent history of U.S. interest rates while also forming ideas as to where rates might go in the near future. Discussing the history of interest rates presents an interesting conundrum. From a historical perspective it seems government interest rates in developed markets have generally been characterized as being subject to central bank intervention. In more recent times it seems central banks don't intervene but rather guide the path of interest rates. While that is not absolutely true in all markets, the impact of monetary regimes certainly has a serious impact on the discussion of the recent history of interest rates. The phrase "this time is different" has been used with questionable veracity in discussions of financial markets, but it seems to apply to a discussion of the present interest rate environment. It's almost impossible to conceive of discussing the future path of interest rates without discussing monetary regimes in place, especially given the increasingly activist role of central banks.

Robert McNown and Knut Seip analyzed U.S. economic history from 1959 through 2007.<sup>40</sup> Their results present a useful manner in which to frame the discussion of historical interest rates because their analysis found that the periods identified match closely with changes in monetary policy.<sup>41</sup> They examine economic activity to determine periods of economic consistency and structural breaks in activity. Using principal component analysis, the authors identify six macroeconomic periods where economic activity could be viewed as different from other periods. They identified their periods without preconceived notions of how many periods would

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<sup>39</sup> This section was authored by Randy Jorgensen, Ph.D., CFA.

<sup>40</sup> McNown, Robert, and Knut L. Seip. 2011. Periods and Structural Breaks in U.S. Economic History 1959-2007. *Journal of Policy Modeling* 33: 169-182.

<sup>41</sup> Seip, Knut L., and Robert McNown. 2013. Monetary Policy and Stability During Six Periods in U.S. Economic History: 1959-2008: A Novel, Nonlinear Monetary Policy Rule. *Journal of Policy Modeling* 35: 307-325.



be identified and without pre-specifying what differences might look like. In their follow-up study, they link those periods to monetary regimes and, thus, to interest rates.

The periods identified break down as follows. 1959-1970 was marked by high money supply, medium industrial production and low inflation. This period ended with the oil price shocks of the early 1970s, combined with unstable money growth and the end of fixed exchange rates during the period 1970 to 1973. The next structural break occurs due to the stagflation that appeared in the mid-1970s. The period of 1975 to roughly 1978 defines this period. In 1979, the Fed changed the way it managed interest rates, driving the federal funds rate to historical highs. As a result, the period 1979 to roughly 1985 became one of restrictive monetary policies, economic slowdowns, and a driving down of inflation. The period from 1985 to 1997 is often referred to as the period of “great moderation” marked by moderate industrial production, money supply, and low inflation. McNown and Seip actually consider the period 1979 through 1997 to be essentially a single period in terms of their analysis but acknowledge the sub-periods to separate the impact of the changes in Fed policy from the period of economic activity that grew from the change. The period ends with the start of higher money supply, high industrial production, low/medium unemployment, and low interest rates that begin in 1998 and run through the end of their period in 2007. One could argue that we continue largely on this same path in terms of money supply and interest rates.

The McNown and Seip results are interesting because they provide evidence of the change from old monetary regimes to the more modern ones we know today. The change essentially occurs in the Volcker era beginning in roughly 1979. The periods after 1979 represent the period of greater central bank activity marked less by intervention and more by constant, active participation. Indeed, most studies that examine the history of interest rates with an eye toward a discussion of the future path of interest rates use roughly 1980 as a starting point.<sup>42</sup> We do the same in this analysis.

Before moving forward, it’s worthwhile to note that it is possible to find past periods where interest rates showed some parallels with the current market environment. However, while there might be historical similarities it’s hard to argue that they give any clear insights into what will transpire in the coming years. First, the U.S. central bank has rarely participated in markets to the extent it has recently. Second, financial markets have increasingly moved from a disconnected set of individual markets to a more integrated system of interest rate markets that feed back upon one another. Finally, central banks around the world have become increasingly more active in managing exchange rates and interest rates with a goal of impacting economic activity. Indeed, while it’s useful to have a discussion about the impact of the policies of the U.S. Fed on domestic

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<sup>42</sup> A good long-term history of interest rates can be found in Homer, S. and R. Sylla. 2005. *A History of Interest Rates*. Wiley. In this book they discuss interest rates from 3000 B.C. to modern times. Unfortunately, the analysis stops in 2005.

interest rates, the impact of changes in policy are subject to the impact of changes in China, Europe, Japan and, indeed, the rest of the developed world. This is what we mean when we say this time is different: The modern regimes make it unlikely that history, especially before roughly 1980, is a source that will provide useful insights about the future. To be complete, however, toward the end of this analysis we do provide evidence linking the current U.S. interest rate environment to a prior environment that shows remarkable similarities in terms of lead-up and structure.

## 2. Short-Term U.S. Interest Rates 1980 to Present and Federal Reserve Policy

Chart 5<sup>43</sup> shows short-term interest rates over the period January 1980 to August 2014. In the chart, the three-month commercial paper, effective federal funds, and three-month Treasury bill rates are almost indistinguishable from one another. As with the longer-term rates discussed later, rates have generally declined from their peaks in 1981. The current environment, with near-zero short-term rates since 2009, is unprecedented in the modern history of U.S. interest rates.

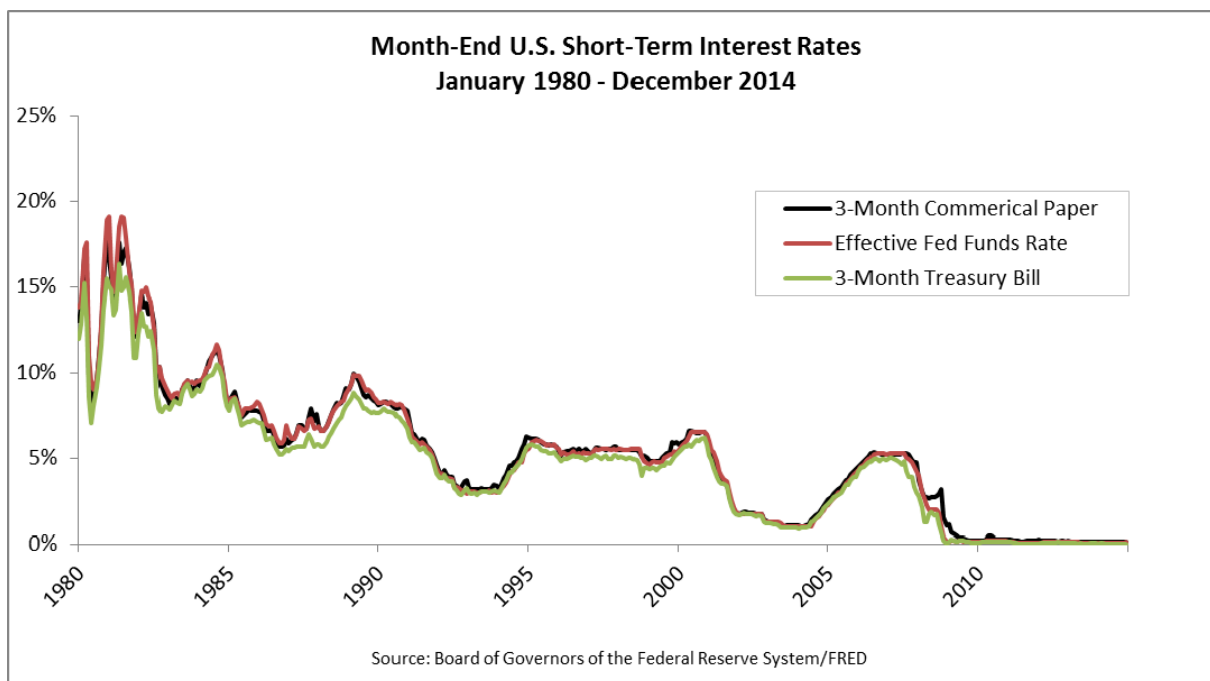


Chart 5

<sup>43</sup> Data Source: FRED, Federal Reserve Economic Data, Federal Reserve Bank of St. Louis: *3-Month Commercial Paper Rate (to December 1996); 3-Month AA Financial Commercial Paper Rate (January 1997 on); Effective Federal Funds Rate; 3-Month Treasury Bill: Secondary Market Rate*; Board of Governors of the Federal Reserve System; <http://research.stlouisfed.org/fred2/series/CP3M>; <http://research.stlouisfed.org/fred2/series/CPF3M>; <http://research.stlouisfed.org/fred2/series/FEDFUNDS>; <http://research.stlouisfed.org/fred2/series/TB3MS>; accessed Jan. 27, 2015.

The Federal Reserve engaged in some notable efforts to ward off anticipated inflation during the period covered in the chart. The Fed increased short-term interest rates during 1988 to 1989 in order to engineer a “soft landing” for the U.S. economy. World events acted to thwart the Fed’s efforts as the Soviet Union began to fall apart, Germany began to reunify, Japan’s economy began to deflate, the Latin American economies strengthened, and Iraq invaded Kuwait. One result of this confluence of world events was an increased level of uncertainty resulting in the U.S. recession of 1990 to 1991. The chart shows that bond yields marched almost steadily downward over the ensuing two to three years followed by another round of Fed tightening beginning in early 1994. This round of Fed tightening is notable because it created massive losses in the investment portfolio of Orange County in California, among others, ultimately leading the county to declare bankruptcy. The aggressive Fed policy in 1994 and 1995 tamed concerns about inflation and set the stage for a strong period of growth in the U.S. economy from 1996 to 2000 where growth of real GDP ranged from 3.7 to 4.5 percent annually. During that period the stock market surged toward the bubble peaks in early 2000. The Fed once again began moving its target federal funds rate in 1999 and early 2000, resulting in an increase in yields over the same period. The stock market bubble subsequently burst, and the Fed reversed its course and began a policy of easing in 2001 that lasted through 2004. The economy responded with relatively steady growth, prompting the Fed to once again engage in measured tightening that increased short-term rates from 1.0 percent in early 2004 to about 5.5 percent in mid-2007.

The events of the latter half of 2007 provided the genesis for where we stand today in terms of Fed policy. The Fed began to aggressively cut short-term interest rates and increase liquidity in an effort to ease the impact of diminished liquidity in the financial markets during late 2007. By December 2008 the federal funds rate had been driven to a level below 25 basis points (bp). During and after this period, the Fed launched its now-infamous Quantitative Easing (hereafter QE) 1 (November 2008), QE2 (November 2010) and QE3 (September 2012) programs. These efforts were met by similar activities by central banks in other developed economies around the world such as the U.K., Europe and Japan. Indeed, these efforts have not yet been reversed and have instead taken on new forms such as the Federal Reserve’s “Operation Twist.” It remains to be seen how these actions will ultimately impact interest rates, a topic we return to below.

### **3. Longer-Term U.S. Interest Rates 1980 to Present**

Chart 6<sup>44</sup> shows the path of longer-term U.S. interest rates from January 1980 through August 2014. The interest rates presented are the month-end yields on AAA-rated corporate bonds and 10-year constant-maturity U.S. Treasury (CMT) securities.

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<sup>44</sup> Data Source: FRED, Federal Reserve Economic Data, Federal Reserve Bank of St. Louis: *Moody's Seasoned AAA Corporate Bond Yield; 10-Year Treasury Constant Maturity Rate*; Board of Governors of the Federal Reserve System; <http://research.stlouisfed.org/fred2/series/AAA>; <http://research.stlouisfed.org/fred2/series/DGS10>; accessed Jan. 27, 2015.

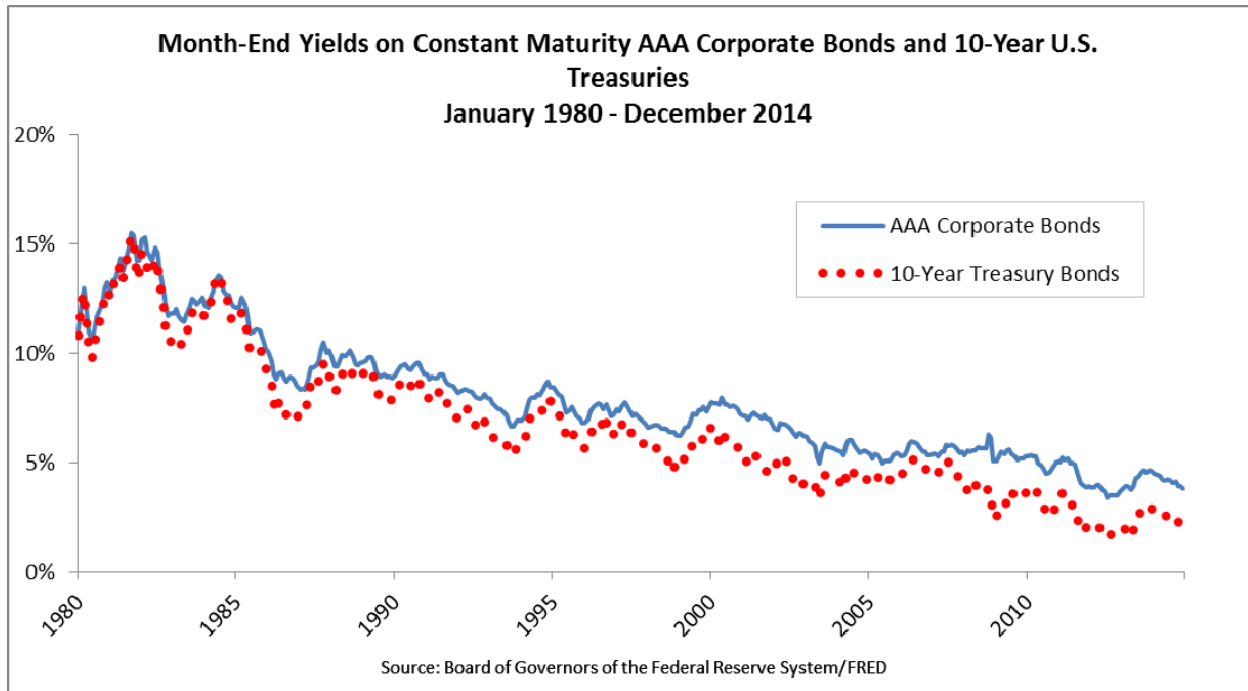


Chart 6

The chart shows that yields generally increased until September 1981 and have generally followed a downward path thereafter with the Treasuries reaching a low of 1.53 percent in July 2012. In spite of the long, downward trend there have been at least seven reversals in yield since 1981 that resulted in increases in yields of between 100 bp and 300 bp. Most of those reversals can be traced to monetary tightening on the part of the Federal Reserve. The recession of 1981-1982 was followed by a relatively rapid decrease in yields, whereas the recessions of 1990-1991 and 2001 were followed by a more generally slow decline in interest rates. The recession of 2008-2009 is also marked by a relatively sharp decline in yields.

The spread between the two interest rates averaged 1.20 percent, standing at 1.58 percent at the end of August 2014. Since 2000, the spread between the two rates has averaged 1.61 percent, reaching a low of 0.64 percent and a high of 2.68 percent. Notably, the interest rate spread narrowed during the early 2000s and prior to the market dislocations of 2008. The widening of the spread during the recession of 2008-2009 is greater than what is observed from the prior three recessions included in the chart due largely to the significant illiquidity events that marked this period. Since 2010, the interest rate spread has remained relatively constant. A general theme in the discussion of yield spreads is that if financial market volatility remains low for an extended period of time, interest rate spreads narrow. This pattern is clear in the years leading up to 2008, but it has not yet reappeared in the recent market environment, with spreads remaining fairly close to 1.80 percent since 2009.

#### 4. U.S. TIPS 2003 to Present

Chart 7<sup>45</sup> presents the yields on constant-maturity U.S. Treasury Inflation-Protected Securities (TIPS) with five- and 10-year maturities since 2003. Because the principal value of TIPS is adjusted for inflation, TIPS are generally viewed as representing the real rate of interest in the market. The pattern of yields is consistent with earlier charts, with yields spiking in the latter stages of 2008 and declining fairly significantly thereafter. During 2013, TIPS yields actually turned negative for both series of rates, with the yield on the 10-year rising back above 0 percent in late 2014. Investors don't actually incur a negative return, of course, since they earn the promised TIPS yield plus the rate of inflation.

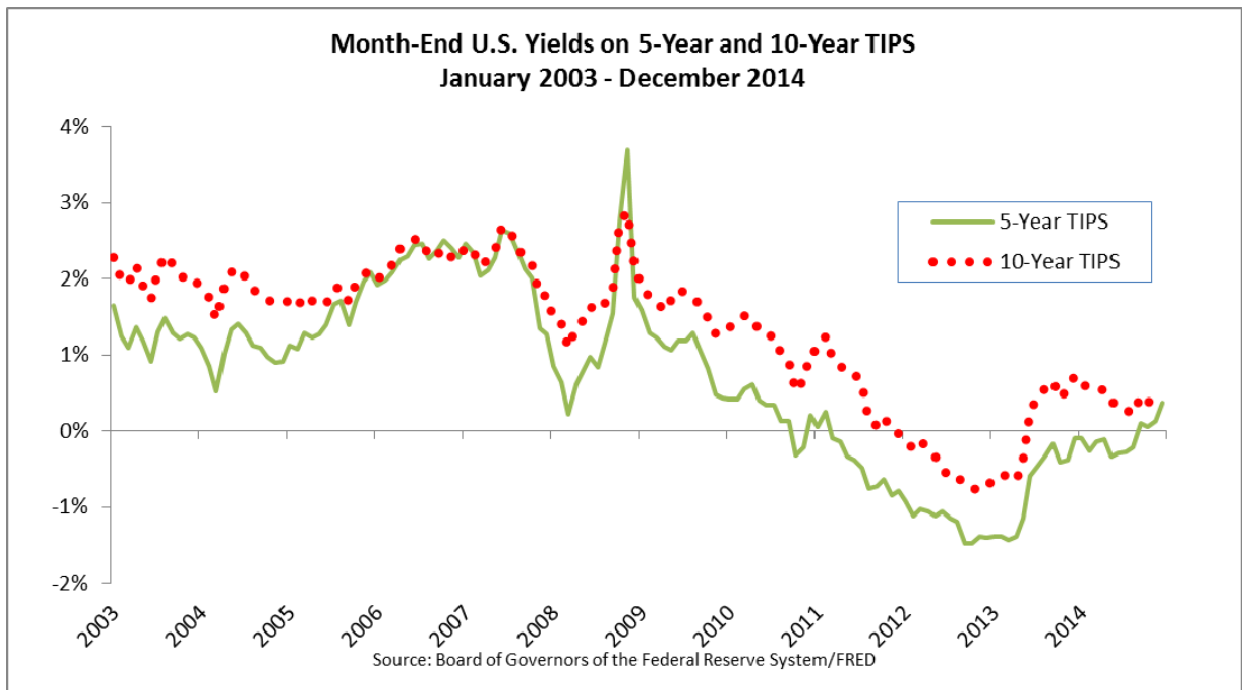


Chart 7

Interest rates on Treasury securities are viewed as containing a real rate of interest plus a premium for expected inflation plus a maturity premium. Comparing the yields between the constant-maturity 10-year Treasuries and TIPS from the prior two charts reveals investors' expectations for future inflation, at least as represented by the spread between these yields. Since the beginning of 2010, inflation expectations based on the yield differential between these two series have averaged 2.20 percent, with a low of 1.68 percent and a high of 2.60 percent. The final year presented in the chart shows TIPS yields increasing by over 100 bp. However, over

<sup>45</sup> Data Source: FRED, Federal Reserve Economic Data, Federal Reserve Bank of St. Louis: *5-Year Treasury Inflation-Indexed Security, Constant Maturity*; *10-Year Treasury Inflation-Indexed Security, Constant Maturity*; Board of Governors of the Federal Reserve System; <http://research.stlouisfed.org/fred2/series/DFII5>; <http://research.stlouisfed.org/fred2/series/DFII10>; accessed Jan. 27, 2015.

this same period expected inflation as measured by the differences in yields between the first two charts remained fairly constant at about 2.20 percent. This is well within the range of what the Federal Reserve considers to be inflation that is “tame” and unlikely to result in a response that leads to a tightening of policy. Extrapolating this to a prediction of future Fed policy, the market for TIPS does not seem to indicate any immediate tightening by the Federal Reserve.

## 5. Consumer Loan Interest Rates

Chart 8<sup>46</sup> shows interest rates on consumer loans as represented by 30-year mortgage rates and 24-month personal loan rates over the same periods as presented in earlier charts. These rates follow a similar pattern as the rates discussed previously, first rising into late 1981 and then declining on a fairly consistent basis to present levels. The spread between the two rates has remained fairly constant since about 2000, averaging 6.10 percent and ranging from a high of 7.28 percent to a low of 5.05 percent. This pattern is also consistent with the pattern of interest rate spreads indicated in prior charts. As of April 1, 2014, the spread was 5.34 percent. This chart shows that 30-year mortgage rates dipped below 5 percent while 24-month consumer rates dropped below 10 percent at the end of the series.

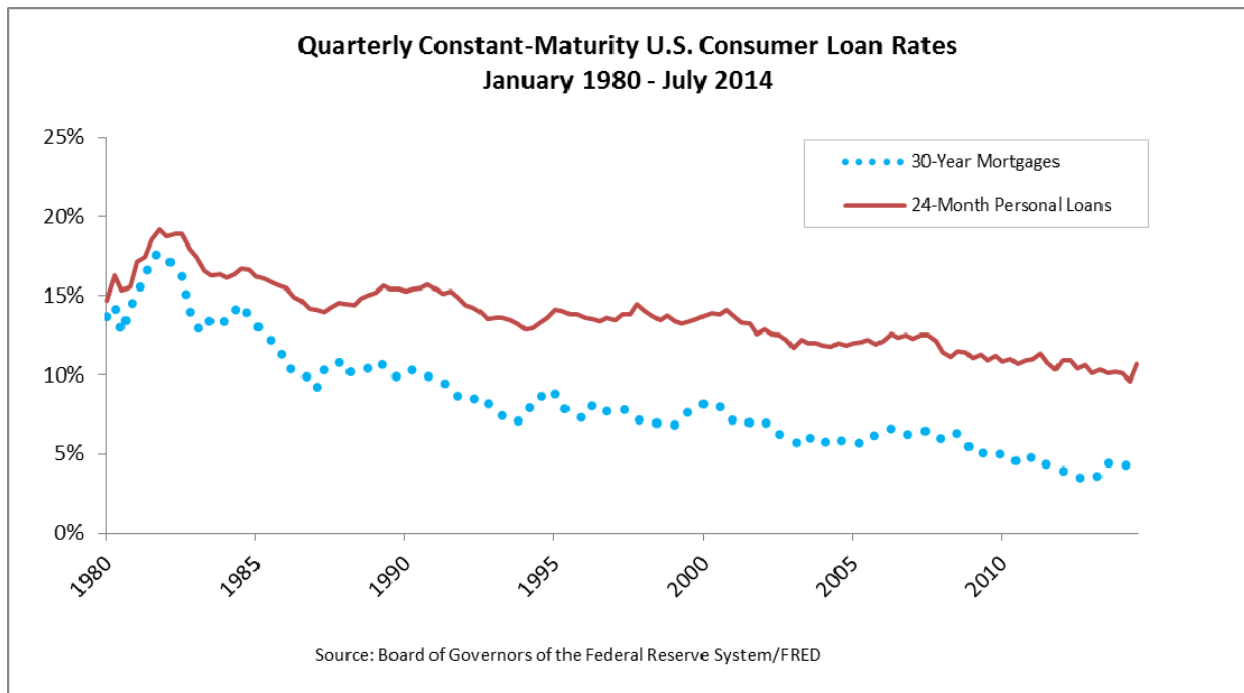


Chart 8

<sup>46</sup> Data Source: FRED, Federal Reserve Economic Data, Federal Reserve Bank of St. Louis: *30-Year Fixed Rate Mortgage Average in the United States; Finance Rate on Personal Loans at Commercial Banks, 24 Month Loan*; Board of Governors of the Federal Reserve System; <http://research.stlouisfed.org/fred2/series/MORTGAGE30US>; <http://research.stlouisfed.org/fred2/series/TERMCBPER24NS>; accessed Jan. 27, 2015.

## 6. U.S. Interest Rates, Inflation Rates and Exchange Rates Compared with Other Developed Economies

The discussion thus far shows a fairly consistent pattern of declining interest rates since 1982 with rates recently reaching, in many cases, minimums from this period. The decline in interest rates is not isolated to Treasury rates but extends to corporate rates as well as consumer rates. Yield spreads have remained fairly constant in the most recent periods even as interest rates have declined. As a result, investors have been able to earn higher yields by assuming credit and maturity risk, but the absolute level of nominal yield is relatively low by historical standards regardless of the fixed income security considered.

A logical question is how U.S. interest rates compare over time and recently with those of other developed economies. Chart 9<sup>47</sup> compares national risk-free rates from Germany, Japan, Canada, the U.K., and the United States. In each case, the chart shows the foreign interest rate minus the U.S. interest rate. The data dates from January 2003, the period at which at least two of the foreign series became available on FRED. According to the chart, prior to about 1990 spreads over U.S. rates ranged as widely as between -5 percent and +4 percent depending on the country rate examined. The chart also shows the spread between the various series has been narrowing in recent years. By the end of 2014 the spread between rates had narrowed substantially to about -2 percent to just over 0 percent. There has been much discussion in recent years about the prospect of currency wars as developed countries endeavor to keep their currencies competitive on a relative, global basis. The chart suggests that in terms of interest rates, there has already been a great deal of integration of financial markets around the globe. While this harmonization of rates does not preclude one central bank stepping out of line with the others, it does suggest that the odds of that happening appear much more unlikely now than at any other time in recent history.

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<sup>47</sup> Data Source: FRED, Federal Reserve Economic Data, Federal Reserve Bank of St. Louis: *Long-Term Government Bond Yields: 10-year: Main (Including Benchmark) for Germany*; *Long-Term Government Bond Yields: 10-year: Main (Including Benchmark) for the United States*; *Long-Term Government Bond Yields: 10-year: Main (Including Benchmark) for Japan*; *Long-Term Government Bond Yields: 10-year: Main (Including Benchmark) for Canada*; *Long-Term Government Bond Yields: 10-year: Main (Including Benchmark) for the United Kingdom*; Board of Governors of the Federal Reserve System; <http://research.stlouisfed.org/fred2/series/IRLTLT01DEM156N>; <http://research.stlouisfed.org/fred2/series/IRLTLT01USM156N>; <http://research.stlouisfed.org/fred2/series/IRLTLT01CAM156N>; <http://research.stlouisfed.org/fred2/series/IRLTLT01GBM156N>; accessed Jan. 27, 2015.

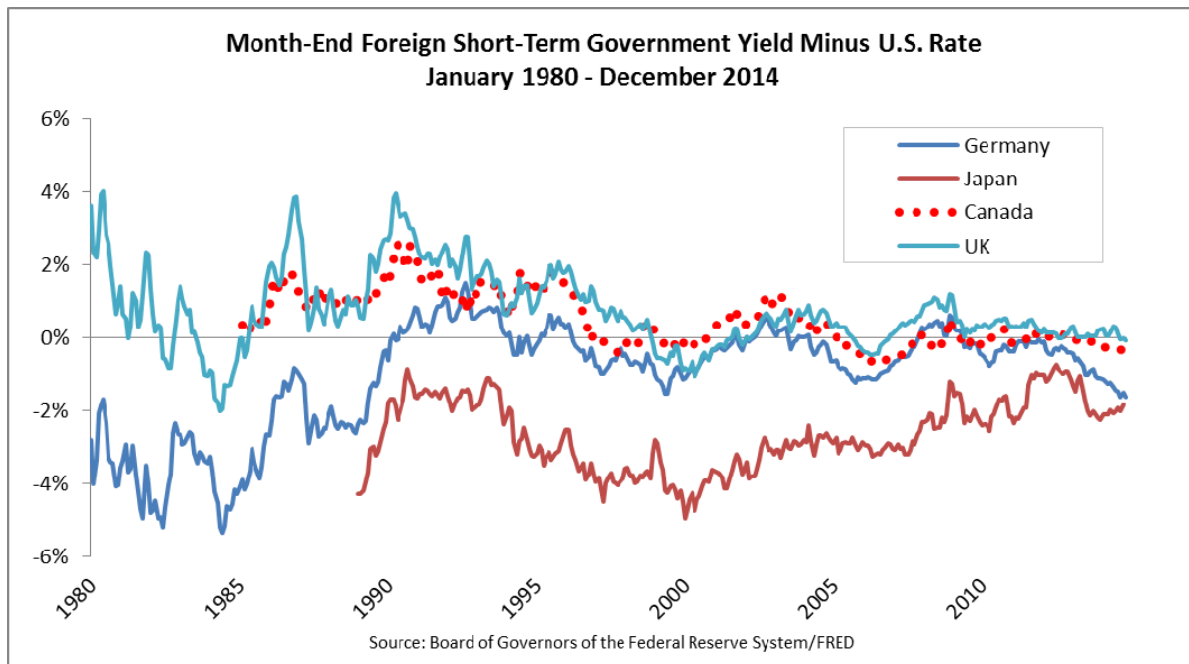


Chart 9

There is a great deal of evidence and theory linking international interest rates, rates of inflation, and exchange rates. For example, Interest Rate Parity describes a no-arbitrage condition that links the interest rates of two countries, and the International Fisher Effect links the expected change in the exchange rate between two countries to the differences between their respective rates of inflation. Chart 10<sup>48</sup> shows the relative exchange rates among the developed economies discussed in the last chart. Germany has been dropped from the analysis due to the introduction of the euro. As with the previous chart, this one shows that the variability of the exchange rates has declined over time, and especially since 2008. Since 2008, the exchange rates tend to move together with the exception of Japan. The U.S. dollar/Japanese yen exchange rate has declined noticeably since 2012, driven by Japan's efforts to stimulate its economy. The exchange rate between the United States and Canada has varied the least over the 34-year period. Since 2008 the U.S.-euro exchange rate and the U.S.-U.K. exchange rates have moved in similar patterns to one another.

<sup>48</sup> Data Source: FRED, Federal Reserve Economic Data, Federal Reserve Bank of St. Louis: *U.S. / Euro Foreign Exchange Rate*; *Japan / U.S. Foreign Exchange Rate*; *Canada / U.S. Foreign Exchange Rate*; *U.S. / U.K. Foreign Exchange Rate*; Board of Governors of the Federal Reserve System; <http://research.stlouisfed.org/fred2/series/EXUSEU>; <http://research.stlouisfed.org/fred2/series/EXJPUS>; <http://research.stlouisfed.org/fred2/series/EXCAUS>; <http://research.stlouisfed.org/fred2/series/EXUSUK>; accessed Jan. 27, 2015.



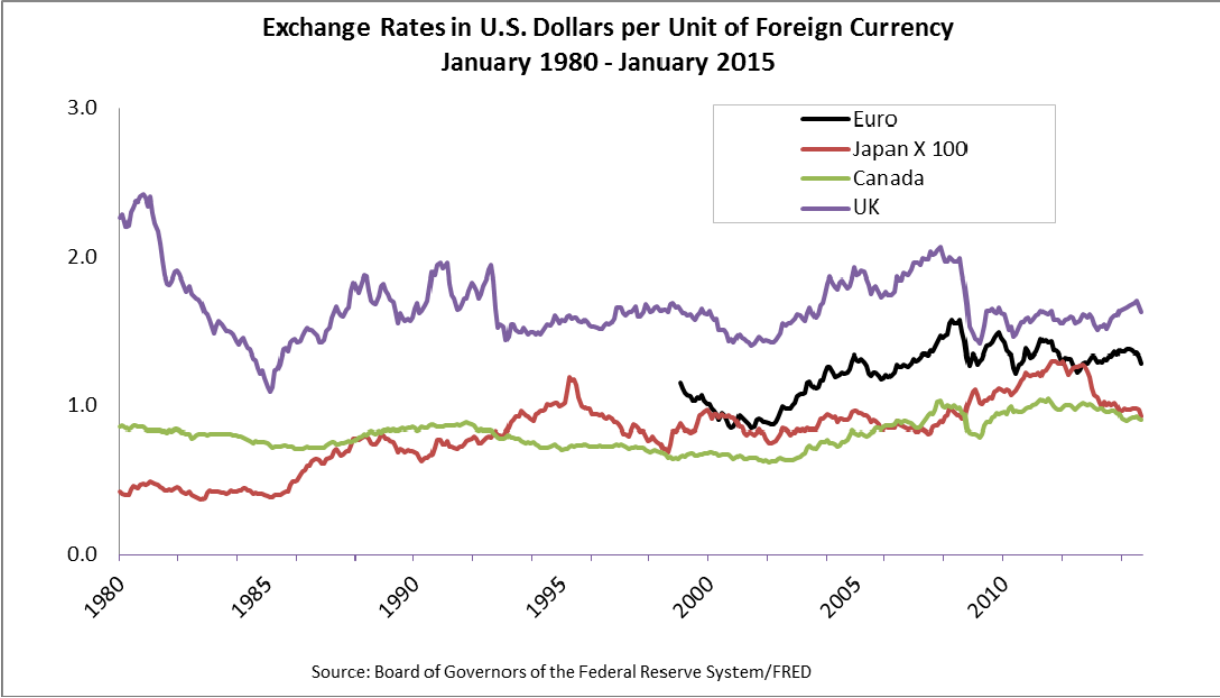


Chart 10

Chart 11<sup>49</sup> shows the relative rates of inflation for this set of developed economies. As expected and consistent with the prior two charts, the annualized rates of inflation differed materially prior to 1980. Since 1980, rates of inflation among the various economies have become more predictable, ranging from a low of about -1.5 percent to a high of roughly 4.5 percent. As with past charts, the rate of inflation for Japan represents a bit of an outlier, exhibiting mostly periods of deflation since the late 1990s. The annualized rates of inflation all collapsed after 2008 before rebounding slightly. Since 2008 the inflation rates among the United States, Germany, Canada and the U.K. appear to be highly correlated.

<sup>49</sup> Data Source: FRED, Federal Reserve Economic Data, Federal Reserve Bank of St. Louis: *Consumer Price Index: Total All Items for the United States*; *Consumer Price Index of All Items in Germany*; *Consumer Price Index of All Items in Japan*; *Consumer Price Index of All Items in Canada*; *Consumer Price Index of All Items in the United Kingdom*; Board of Governors of the Federal Reserve System; <http://research.stlouisfed.org/fred2/series/CPALTT01USM661S>; <http://research.stlouisfed.org/fred2/series/DEUCPIALLMINMEI>; <http://research.stlouisfed.org/fred2/series/JPCPIALLMINMEI>; <http://research.stlouisfed.org/fred2/series/CANCPPIALLMINMEI>; <http://research.stlouisfed.org/fred2/series/GBRCPIALLMINMEI>; accessed Jan. 27, 2015.

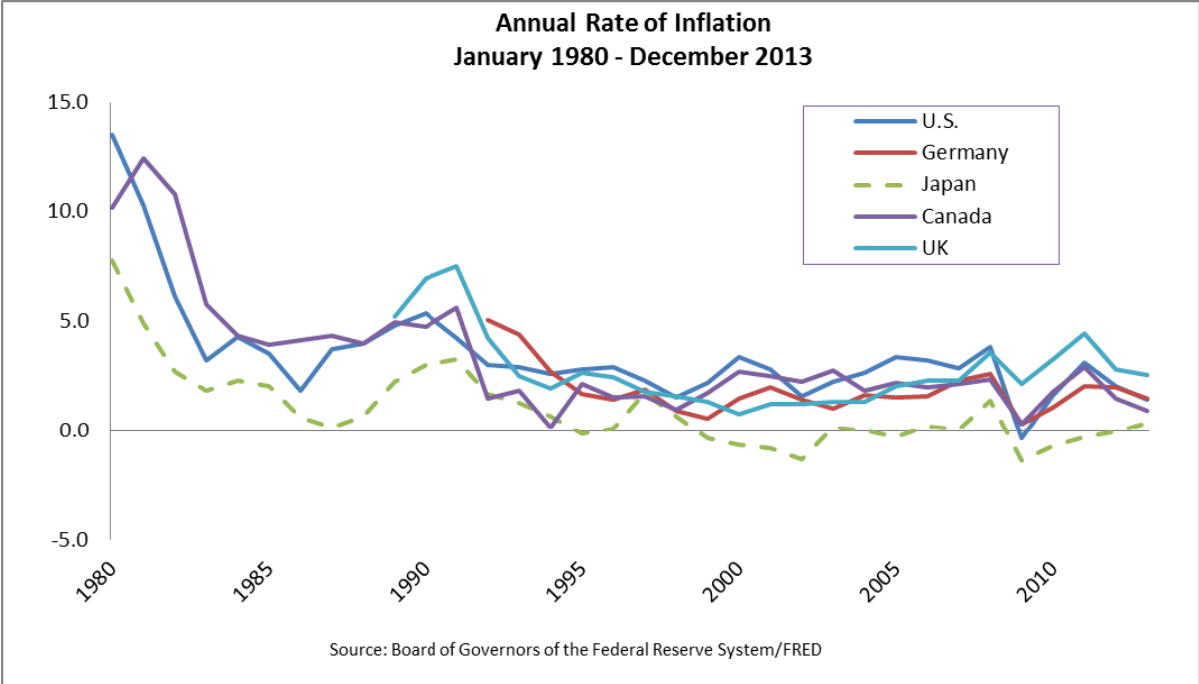


Chart 11

Taken together, these three charts demonstrate that historical differences in exchange, interest and inflation rates between the United States, Germany, Canada, the U.K. and the eurozone had largely disappeared by the beginning of the year 2000. Moreover, since 2008 these various series have become noticeably linked, moving almost in lockstep with one another. Japan remains an outlier with its extremely low interest rates and inflation. It remains to be seen whether Japan’s recent efforts to spur its economy on will bear fruit or not. Regardless, it’s only natural to conclude from this discussion that the remaining economies remain linked.

**7. China and Emerging Markets**

A discussion of world interest rates and rates of inflation would not be complete without a discussion of China and emerging markets. Both present difficulties for different reasons. Emerging markets require a definition of the market to be considered, and the data are often discussed in index or composite form rather than in the form of individual country statistics. China presents unique problems in that, as opposed to the other economies discussed, the Chinese economic system is not based on free markets, and the quality of the data reported can be a source of dispute. In light of these shortcomings the discussion in this section is brief and focused on very broad statistics.

Chart 12<sup>50</sup> shows the annual rates of inflation for China and, for comparison purposes, the United States. The chart shows a pattern that is similar to what is displayed in the prior chart. Prior to 1999 inflation in China ranged widely and was much higher than inflation in the United States. Since 1999, the rates have moved in similar ranges, moving almost in lockstep after 2008. In other words, inflation in China since 2008 appears to behave in a pattern that parallels that of inflation in the developed-market economies discussed in the prior chart.

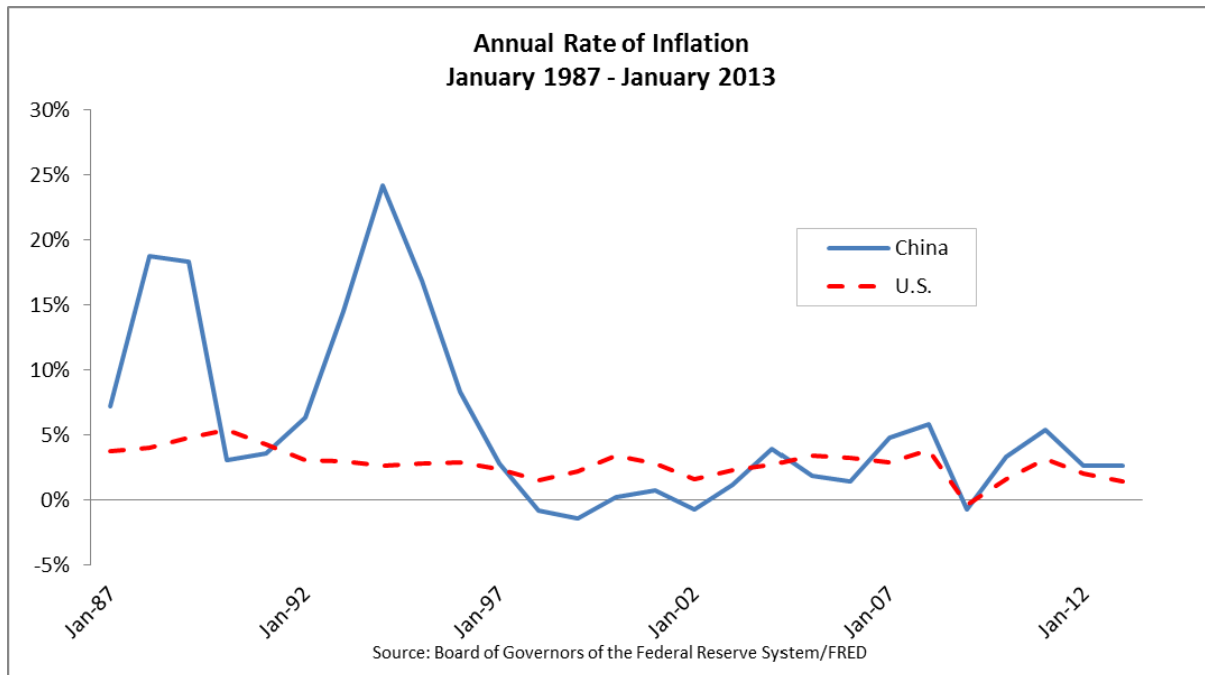


Chart 12

Chart 13<sup>51</sup> displays interest rates on three-month government securities for China and for the United States. As with the previous chart, the United States is added to provide a frame of reference. Prior to roughly the year 2000, short-term Chinese interest rates declined fairly consistently. From 2000 to 2008, rates fluctuated but in a range similar to that of the United States. Immediately after 2008, Chinese interest rates declined dramatically along with the rates of the United States and other developed economies. Since that time, Chinese interest rates have

<sup>50</sup> Data Source: FRED, Federal Reserve Economic Data, Federal Reserve Bank of St. Louis: *Inflation, consumer prices for China; Inflation, consumer prices for the United States*; Board of Governors of the Federal Reserve System; <http://research.stlouisfed.org/fred2/series/FPCPITOTLZGCHN>; <http://research.stlouisfed.org/fred2/series/FPCPITOTLZGUSA>; accessed Jan. 27, 2015.

<sup>51</sup> Data Source: FRED, Federal Reserve Economic Data, Federal Reserve Bank of St. Louis: *3-Month Treasury Bill: Secondary Market Rate; 3-Month or 90-day Rates and Yields: Treasury Securities for China*; Board of Governors of the Federal Reserve System; <http://research.stlouisfed.org/fred2/series/TB3MS>; <http://research.stlouisfed.org/fred2/series/IR3TTS01CNM156N>; accessed Jan. 27, 2015.

increased fairly significantly, at least on a relative basis. Historically, China followed a policy of pegging its currency to the U.S. dollar, revising the exchange rate only periodically, although in more recent years China changed to a managed float system, pegging its currency to a basket of major currencies. China has altered this approach at various times due to changes in economic activity, most notably in 2008 and 2010.

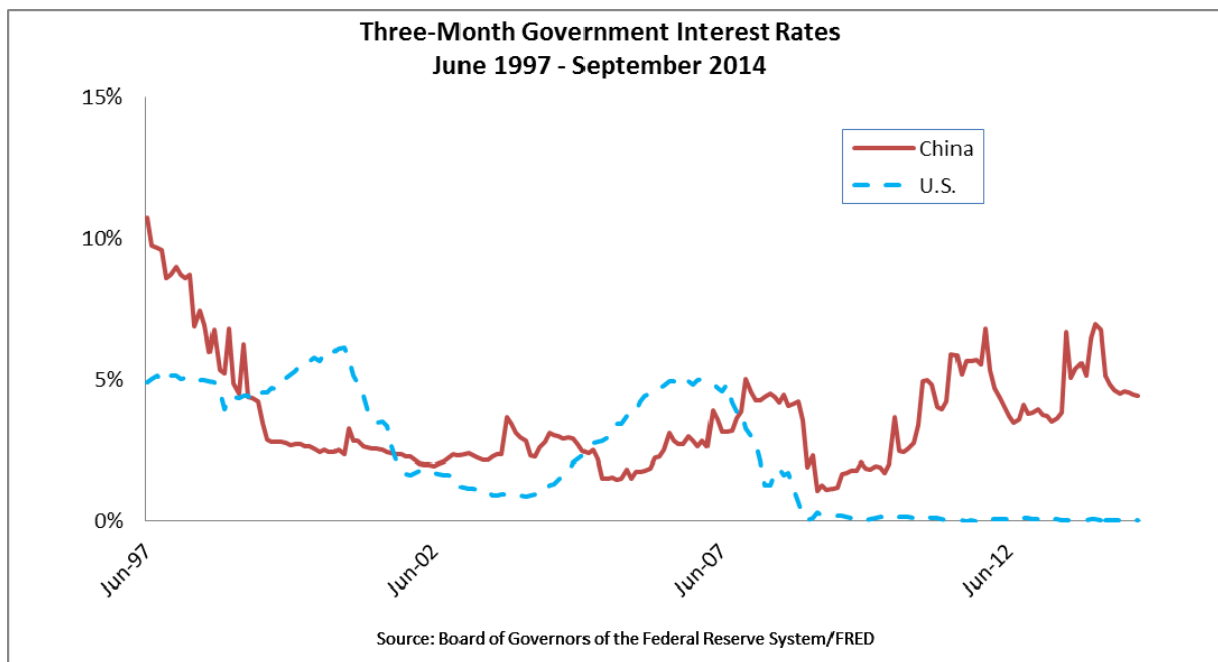


Chart 13

Chart 14<sup>52</sup> shows interest rates for several definitions of emerging markets. The rates used are those published as the BofA Merrill Lynch Latin America Emerging Markets Corporate Plus Sub-Index Effective Yield. The chart shows a pattern that has emerged fairly consistently throughout this analysis. Rates varied widely prior to about 1999 and then collapsed into strikingly similar patterns during the early 2000s before spiking in 2008. At the peak in 2008, Europe, Middle East and Africa (EMEA) were the highest, followed by the eurozone emerging market index, the index for Latin America, and finally the index for rates in Asia. Since 2008, all

<sup>52</sup> Data Source: FRED, Federal Reserve Economic Data, Federal Reserve Bank of St. Louis: *BofA Merrill Lynch Latin America Emerging Markets Corporate Plus Sub-Index Effective Yield*; *BofA Merrill Lynch Asia Emerging Markets Corporate Plus Sub-Index Effective Yield*; *BofA Merrill Lynch Euro Emerging Markets Corporate Plus Sub-Index Effective Yield*; *BofA Merrill Lynch Europe, the Middle East, and Africa (EMEA) Emerging Markets Corporate Plus Sub-Index Effective Yield*; Board of Governors of the Federal Reserve System; <http://research.stlouisfed.org/fred2/series/BAMLEMRLCRPIIAEY>; <http://research.stlouisfed.org/fred2/series/BAMLEMRAECPPIASIAEY>; <http://research.stlouisfed.org/fred2/series/BAMLEMEBCRPIIEEY>; <http://research.stlouisfed.org/fred2/series/BAMLEMRECRPIEMEAIEY>; accessed Jan. 27, 2015.

rates have declined substantially and once again appear almost harmonized post-2009. Toward the end of 2014, the rates ranged from 3.1 percent to 5.4 percent. Looking back at the second chart, rates for AAA-rated U.S. corporate bonds ended the same period at about 4.0 percent.

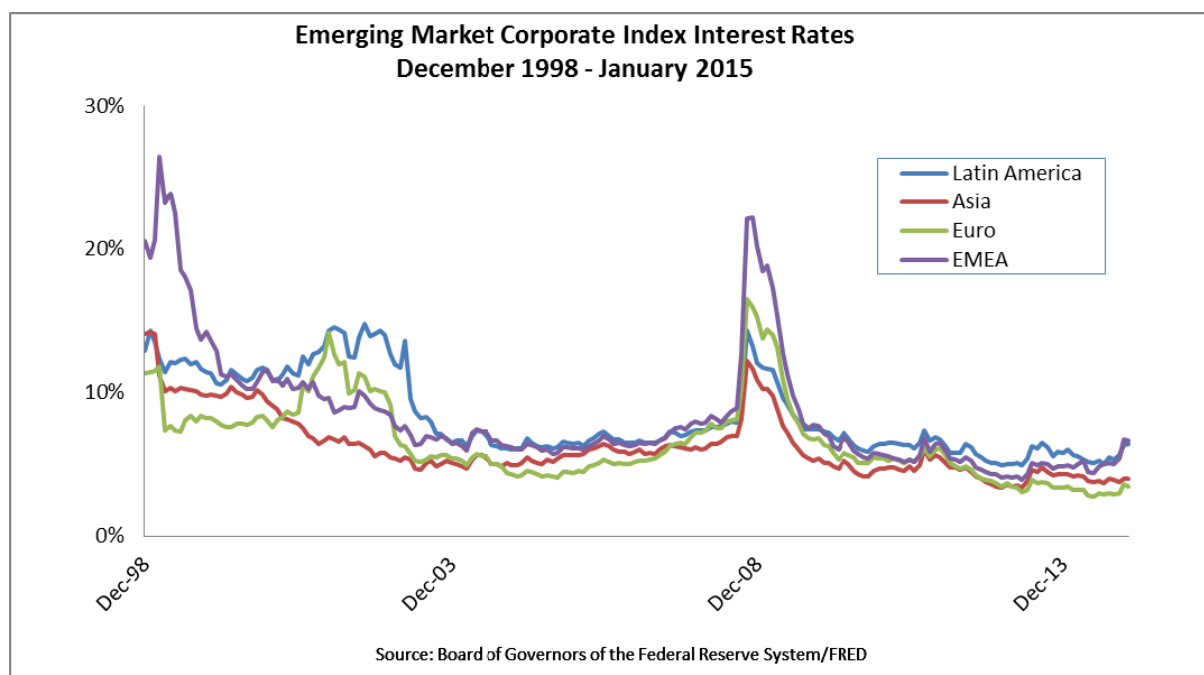


Chart 14

## 8. Yield Curves

A discussion of the history of interest rates would be incomplete, at least from a practitioner view, without a concurrent review of yield curves both past and present. One of the difficulties in reviewing yield curves is that they continuously are updated. The problem then becomes reducing the number discussed to a reasonable few. In the discussion that follows, selected yield curves are presented from distinct historical periods.

## 9. Yield Curves from the 1990s

Chart 15<sup>53</sup> shows yield curves from January 1994, January 1995, September 1998 and September 2001. In each case, the yields are plotted for constant-maturity Treasuries with maturities of one,

<sup>53</sup> Data Source: FRED, Federal Reserve Economic Data, Federal Reserve Bank of St. Louis: *1-Year Treasury Constant Maturity Rate; 2-Year Treasury Constant Maturity Rate;;3-Year Treasury Constant Maturity Rate; 5-Year Treasury Constant Maturity Rate; 7-Years Treasury Constant Maturity Rate; 10-Year Treasury Constant Maturity Rate; 20-Year Treasury Constant Maturity Rate; 30-Year Treasury Constant Maturity Rate*; Board of Governors of the Federal Reserve System; <http://research.stlouisfed.org/fred2/series/GS1>; <http://research.stlouisfed.org/fred2/series/GS2>; <http://research.stlouisfed.org/fred2/series/GS3>; <http://research.stlouisfed.org/fred2/series/GS5>; <http://research.stlouisfed.org/fred2/series/GS7>;

two, three, five, seven, 10, 20 and 30 years. The yield curve of January 1994 represents a fairly normal-looking, upward-sloping yield curve. One year later, all rates at all maturities had risen fairly dramatically and the yield curve had flattened substantially, largely due to the Fed's aggressive tightening that began in early 1994. By September 1998 yields had declined again, although the curve remained flat. By September 2001, the yield curve had become almost a mirror image of the earliest yield curve presented in the chart. We return to this result below.

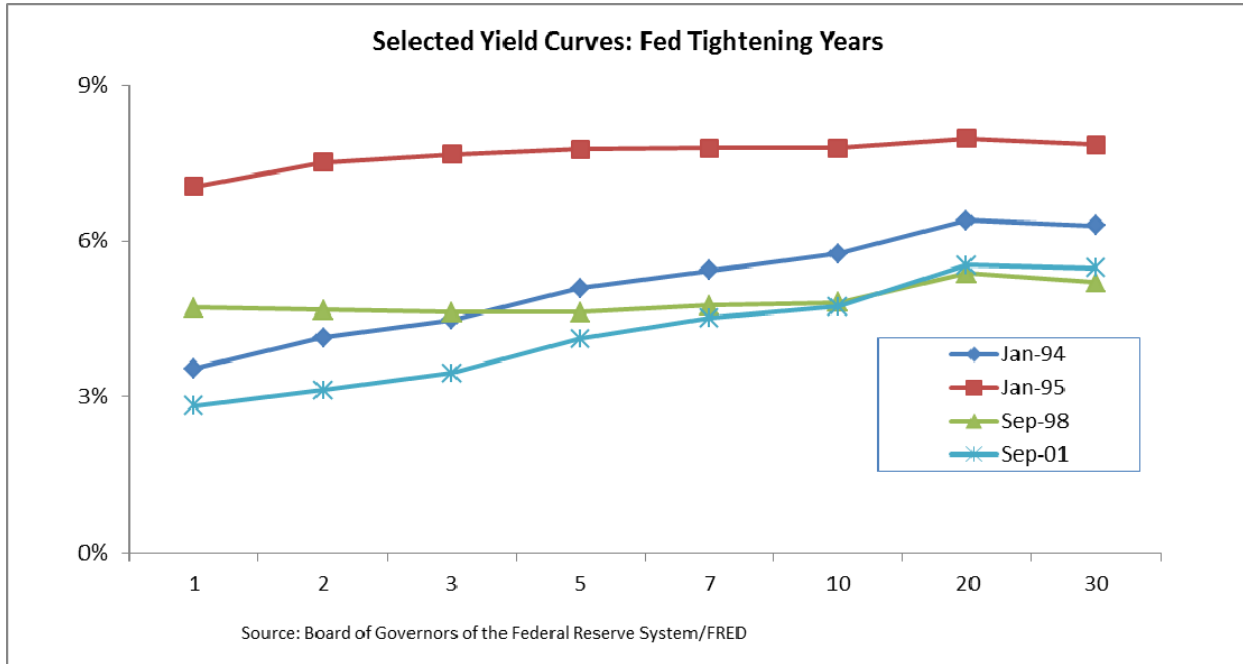


Chart 15

Chart 16<sup>54</sup> shows yield curves from the period leading up to the financial crisis in 2008. The yield curves range from September 2001 to September 2008. The yield curves of 2001, 2003 and 2008 are once again examples of what one comes to call a “normal” looking yield curve. From a starting point of 2001, yields declined over time to 2003 (note that the 30-year Treasury was not issued during 2003). By 2007, the yield curve had flattened with short-term rates rising fairly dramatically in response to the financial crisis. By one year later, in 2008, the yield curve had recovered a more normal aspect.

<http://research.stlouisfed.org/fred2/series/GS10>; <http://research.stlouisfed.org/fred2/series/GS20>; <http://research.stlouisfed.org/fred2/series/GS30>; accessed Jan. 27, 2015.

<sup>54</sup> Ibid.

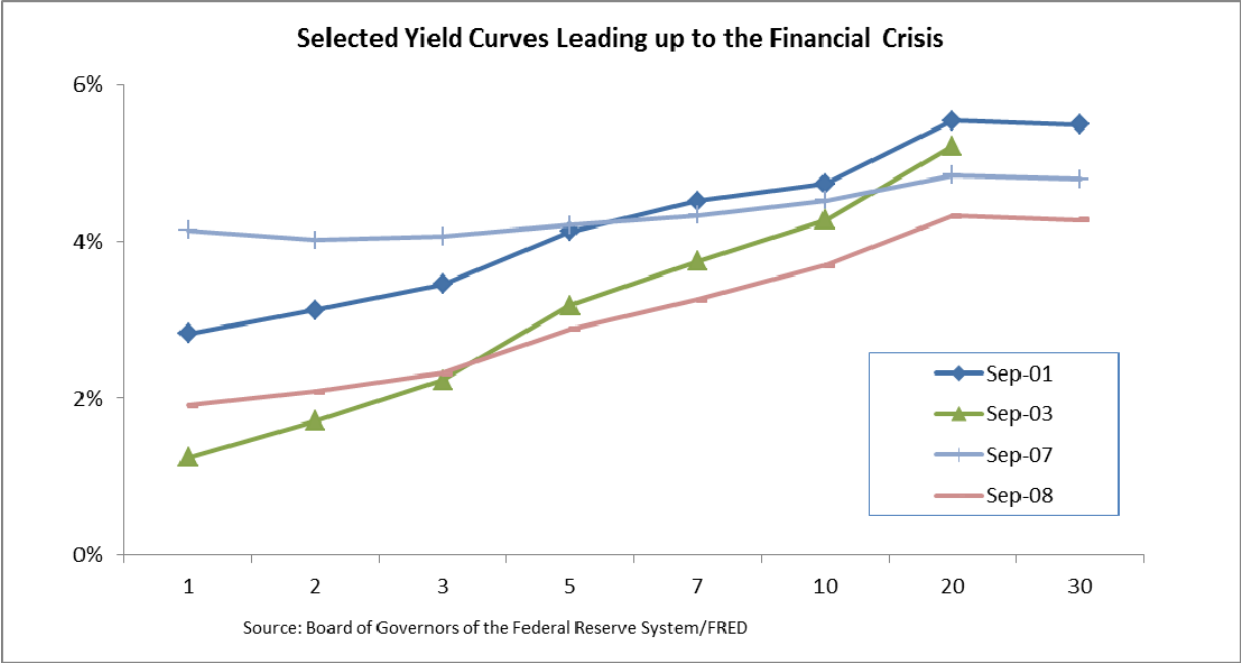


Chart 16

Chart 17<sup>55</sup> shows yield curves that have existed since the financial crisis of 2008. Over time from 2008 to 2014, interest rates have declined in general. From 2008 to 2012, rates declined at all levels resulting in an almost parallel shift of the yield curve downward. From 2012 to 2014, short-term rates remained fairly constant while intermediate and long-term rates increased somewhat.

<sup>55</sup> Ibid.

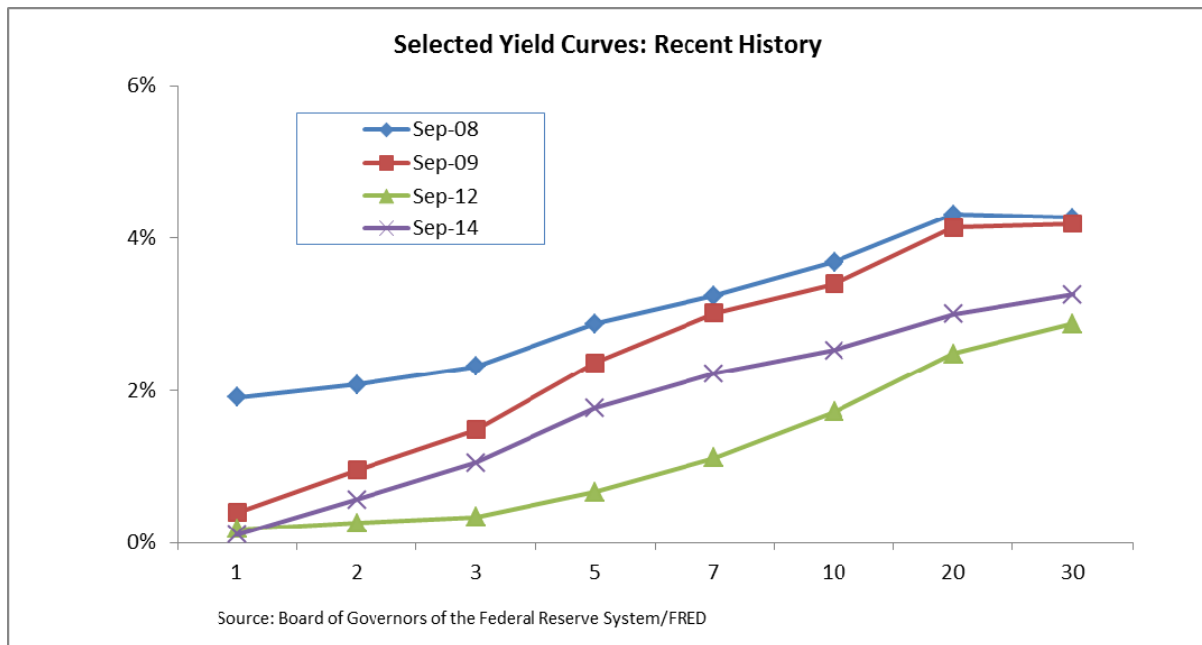


Chart 17

Chart 18<sup>56</sup> shows yield curves that existed in the month prior to the announcement by the Fed of its QE1, QE2 and QE3 programs. The yield curves prior to each are similar in that they are generally upward-sloping as one would expect. The quantitative easing of 2008 presaged a general decline in all interest rates as evidenced by the yield curves of 2011 and 2012 in the chart. The easing initiated in November 2010 resulted in a slight decline in yields with a maturity of longer than one year. The aftereffects of QE3 can be observed from the prior chart.

These charts show yield curves during various extreme points in economic history, including just prior to significant tightening by the Fed, just after such tightening, during a financial crisis, and in the years following a financial crisis. The most current yield curve represented, as of September 2014, presents no unusual aspects. The curve is upward-sloping as one might expect. Moreover, the curve does not appear to provide much, if any, indication about the future direction of interest rates.

<sup>56</sup> Ibid.



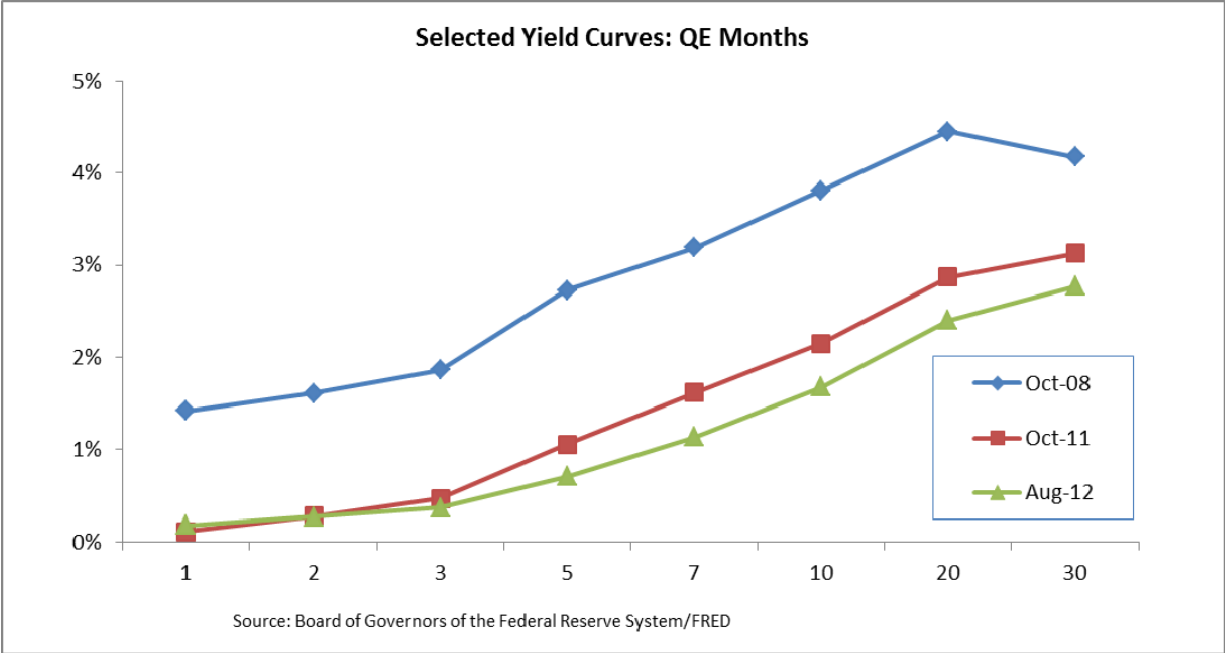


Chart 18

**10. Comparing the Yield Curves of 1994 and 2014**

The period leading up to January 1994 is similar in character to what has transpired recently in the U.S. economy. That period was marked by an economy that was growing, albeit at a measured rate, and by a financial period that could be described as relatively stable. This seems an apt description of the situation that exists at present in the U.S. economy. Chart 19<sup>57</sup> presents these two yield curves together for comparison purposes.

<sup>57</sup> Ibid.

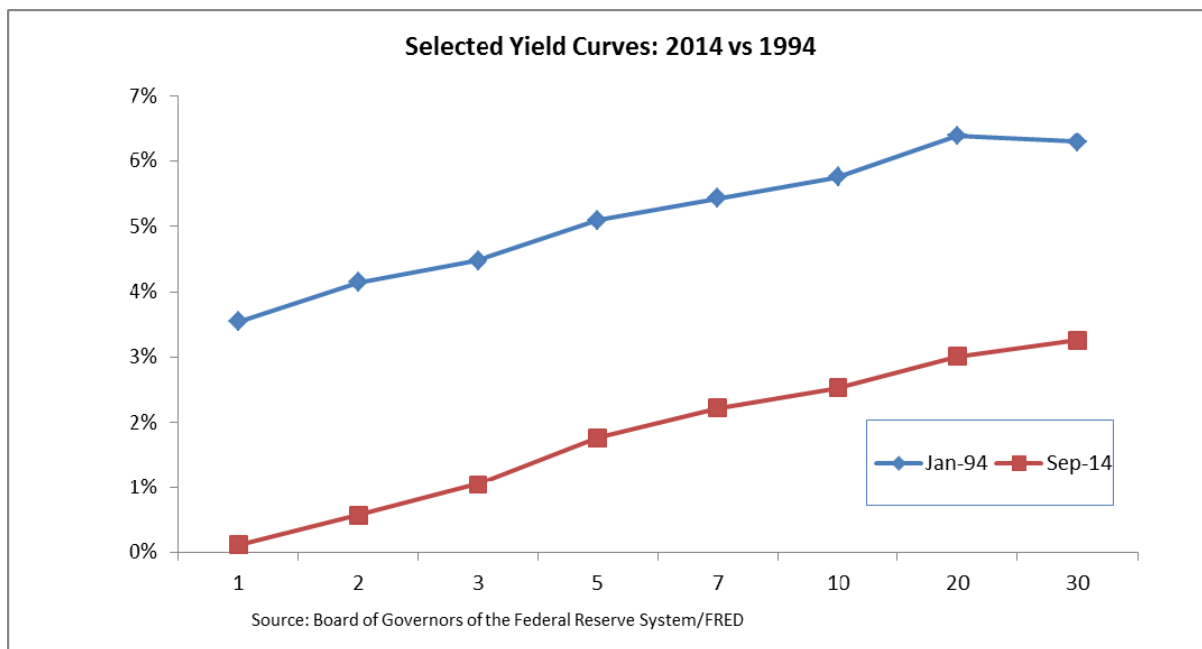


Chart 19

While the absolute yields are substantially different, the two yield curves in this chart are strikingly similar in shape. The spread between the shortest rate and the longest rate is in the neighborhood of 3 percent, and each shows a relatively constant increase in yield as maturity increases with the exception of the longest rate in 1994. As a result, from both an economic perspective and an interest rate perspective, we might consider what happened after January 1994 as a model for what could possibly happen to U.S. interest rates in the near future. Recall from chart 15 that the Fed engaged in fairly aggressive tightening of monetary policy beginning in early 1994. The result was a fairly sharp increase in interest rates across all maturities with a flattening of the yield curve, meaning short-term rates adjusted upward more than did long-term rates. Short-term rates rose by 351 bp while long-term rates rose by 156 bp. Translating those values to today's rates would result in a one-year yield of 3.62 percent and a 30-year yield of 4.82 percent. This would be a rather dramatic increase, but it's also important to note that the Fed tightening of 1994 was both unexpected and relatively dramatic by historical standards. Moreover, the tightening did not come as a result of any specific economic events other than a general strengthening of the economy.

## 11. Section Conclusion

The purpose of this section was to discuss the history of U.S. interest rates while also forming some ideas as to where rates might go in the near future. The evidence presented in this analysis of the history of U.S. interest rates provides little reason to expect either real yields (based on Chart 7) or risk premiums (based on Charts 6 and 8) will change dramatically in the years ahead.

The evidence shows that both have been relatively stable in recent years. Moreover, the shape of the yield curve doesn't show any evidence of unusual yield behavior.

The evidence presented in this study shows that U.S. economic policies do not exist in a vacuum and should not be viewed in isolation from competing markets. Much has been written about the co-movement of exchange rates, inflation and interest rates in the period from 2000 to about 2008, and the charts presented above bear that out. Interest rates and rates of inflation in the United States and other developed economies, emerging markets and China appear to have harmonized, moving closely with one another and within relatively narrow ranges of one another. All interest rates spiked in around 2008 followed by dramatic decreases. Rates of inflation also dropped dramatically over this same period. Since roughly 2009, rates of inflation and short-term interest rates have once again moved mostly in similar patterns across the various markets. It remains to be seen whether this pattern will persist, but there is no evidence to suggest it won't.

The wild card that remains for almost all economies is expected inflation, and it is probably the single largest unknown that could drive the U.S. Fed to engage in monetary tightening. Given the evidence in Chart 9 and in later charts, it seems unlikely the Fed could engage in tightening unilaterally or what the effect on domestic rates might be if central banks around the world respond to such action as would be expected. Using 1994 as an analogue, and assuming little to no impact from responses by other central banks, an unexpected tightening by the Fed would likely lead to a flattening of the yield curve with interest rates at the short end rising roughly twice as much as interest rates at the long end of the yield curve. The next section will look at the drivers of interest rates. It's the most technical part of the paper and, while short, may require a second reading for those new to the subject.

## ***D. Factors Affecting Interest Rates***

### **1. Stimulus—Fiscal/Monetary Policy and Incentives**

When asked at the 2013 Berkshire Hathaway Annual Meeting about government manipulation of interest rates to stimulate the economy, company vice chairman and noted value investor Charlie Munger stated “*They had to hurt somebody, and the savers were convenient.*”<sup>58</sup> Savers generally have a longer time horizon than other investors. They provide capital for loans and economic growth, both directly and indirectly, and are in the accumulation stage of wealth creation. While any entity (e.g., individual, business, trust) can be a net provider or user of capital, and sometimes it varies by stage of life cycle, in general savers are older households near retirement

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<sup>58</sup> The Telegraph and Ambrose Evans-Pritchard. “I feel sorry for savers suffering ‘brutal’ yields, says Warren Buffett.” *Bloomberg News*. May 6, 2013. <http://business.financialpost.com/2013/05/06/bonds-are-a-terrible-investment-right-now-warren-buffett/>.

and institutional investors such as pension plans and insurers. Users of capital tend to be non-financial companies, younger households and governments.

Monetary policy is designed to either stimulate or dampen the economy. When working in concert with fiscal policy, the economy is thought to be best managed by lowering interest rates during recessions to increase demand and raising them during booms to calm growth. Keynesian fiscal policy suggests that greater spending is expansionary and less spending is contractionary. These changes are relative, not absolute, so for example a temporary tax holiday becomes a tax increase when the holiday expires. In spring 2015 the United States is at an interesting data point, with the Federal Reserve having stopped expanding its quantitative easing program designed to lower interest rates while the elected branches of government allowed an austerity program of cuts to be implemented in 2014 (relative spending/revenue cuts, continuing revenue shortfalls) and permitted a government shutdown to occur in 2013. The European Central Bank has pledged to go all out to restore the economy in its region and may soon be put to the test. At the same time, Japan has entered into a program designed to end its deflationary environment, consciously devaluing its currency and potentially starting a currency war while simultaneously considering tax increases. When a country attempts to increase domestic inflation, other countries absorb the shock by strengthening their currencies and lowering their inflationary rates. With no major Organisation for Economic Co-operation and Development (OECD) member countries with strong balance sheets, it is unclear how this will play out. One option is for the world's safe harbor currency, the dollar, to increase in value. If other countries do not accept this result and devalue their currency, this could result in a race to the bottom where deflation is present everywhere, having been exported from Japan. This resembles the trade barriers in the 1930s that exacerbated a worldwide depression. Savers would experience great pain in such a scenario.

Historically, political incentives have led to loose fiscal policies prior to elections. Sometimes tighter economic policies have been implemented early in the terms of elected national leaders. It is said that voters vote based on their pocketbooks, so a politician with hopes of re-election will tend to err on the side of spending.

## **2. Quantity Theory of Money**

The study of economics is more art than science, and is constantly evolving as new information is gathered and processed in new ways. Although many formulas exist, few tend to be absolute, and they must be reviewed periodically to see if they continue to hold. In the quantity theory of money, changes to the money supply drive price-level changes.

In the formula  $GDP = PY = MV$ ,

GDP is the gross domestic product.

P is the price level.

Y is the output level.

M is the money supply.

V is the velocity of money.

Over short periods of time, output and velocity are assumed to be constant (at least by monetarists). Given the price level P, the velocity of money V can be solved for.<sup>59</sup>

An alternative discussion of inflationary drivers would be to view the quantity theory of money in terms of growth rates.

Rate of inflation + Growth rate of real output =

Growth rate of the money supply + Growth rate of velocity

If one assumes that these variables can all change, and the goal is expansionary monetary policy, then a smaller increase in velocity must be overcome by larger increases in the money supply. This is what the current Federal Reserve intends, but the underlying historical interactions and expectations between these variables may have changed.

Some analysts have focused on the level of public and private debt, and argued that current values are high enough that the velocity of money (VM) may have fallen from historical levels due to higher levels of conservatism.

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<sup>59</sup> Gwartney, James D., and Richard L. Stroup. 1995. *Economics 7<sup>th</sup> Edition*. Pages 347-348.

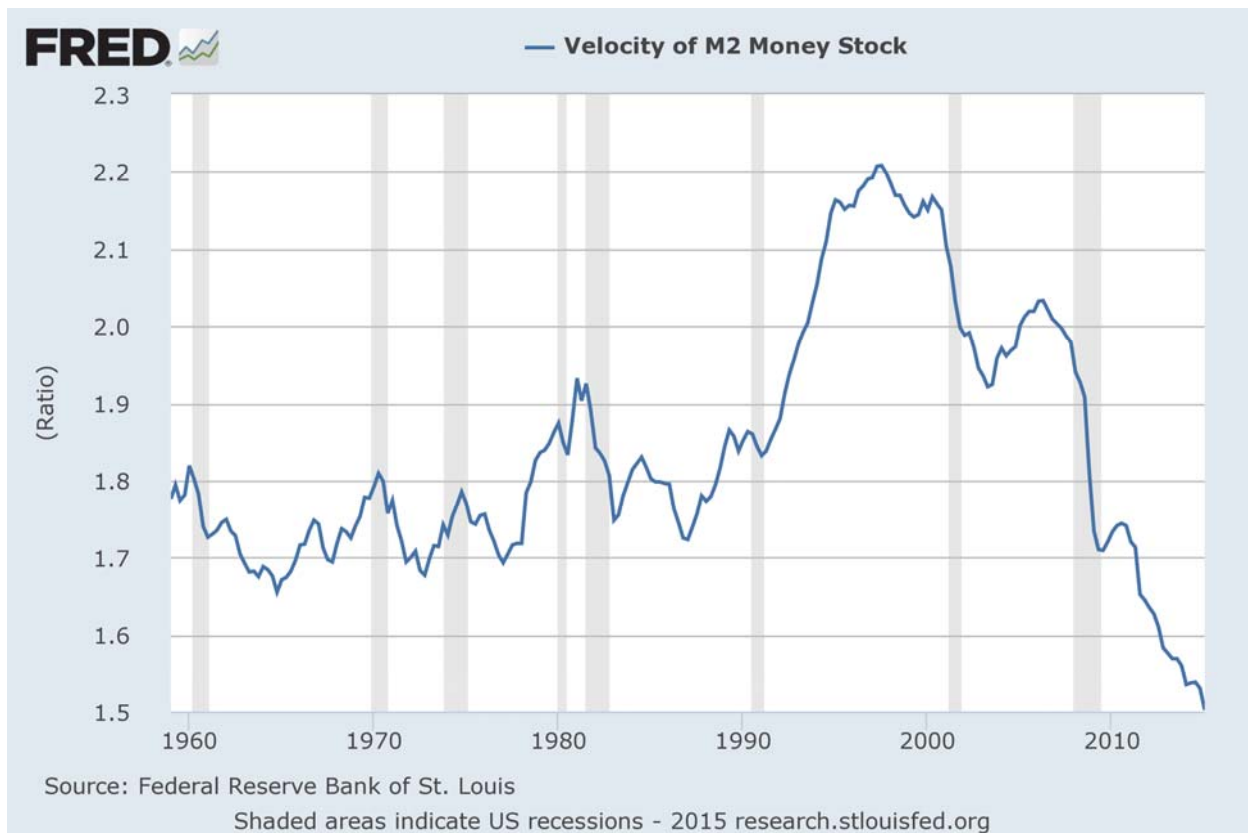


Chart 20<sup>60</sup>

As seen in Chart 20 (and a version shown in Chart 21 that combines earlier estimates), the current reported level of M2 (a fairly broad measure of money supply including cash and most amounts on deposit) velocity is lower than it has been since before 1960. In analysis compiled by Hoisington Investment Management,<sup>61</sup> when debt passes into a “nonproductive zone” above 260 percent of GDP, it becomes less likely that principal will be repaid. Practices become more conservative, both by consumers and lenders. Much is still not understood about the velocity of money, and the current environment will likely lead to new data points and better perspectives for the future.

<sup>60</sup> Data Source: FRED, Federal Reserve Economic Data, Federal Reserve Bank of St. Louis: *Velocity of M2 Money Stock*; <http://research.stlouisfed.org/fred2/series/M2V/>; accessed Apr. 29, 2015.

<sup>61</sup> *Hoisington Investment Management Quarterly Review and Outlook*. Mauldin Economics Outside the Box. Oct. 30, 2013. <http://www.mauldineconomics.com/outsidethebox>

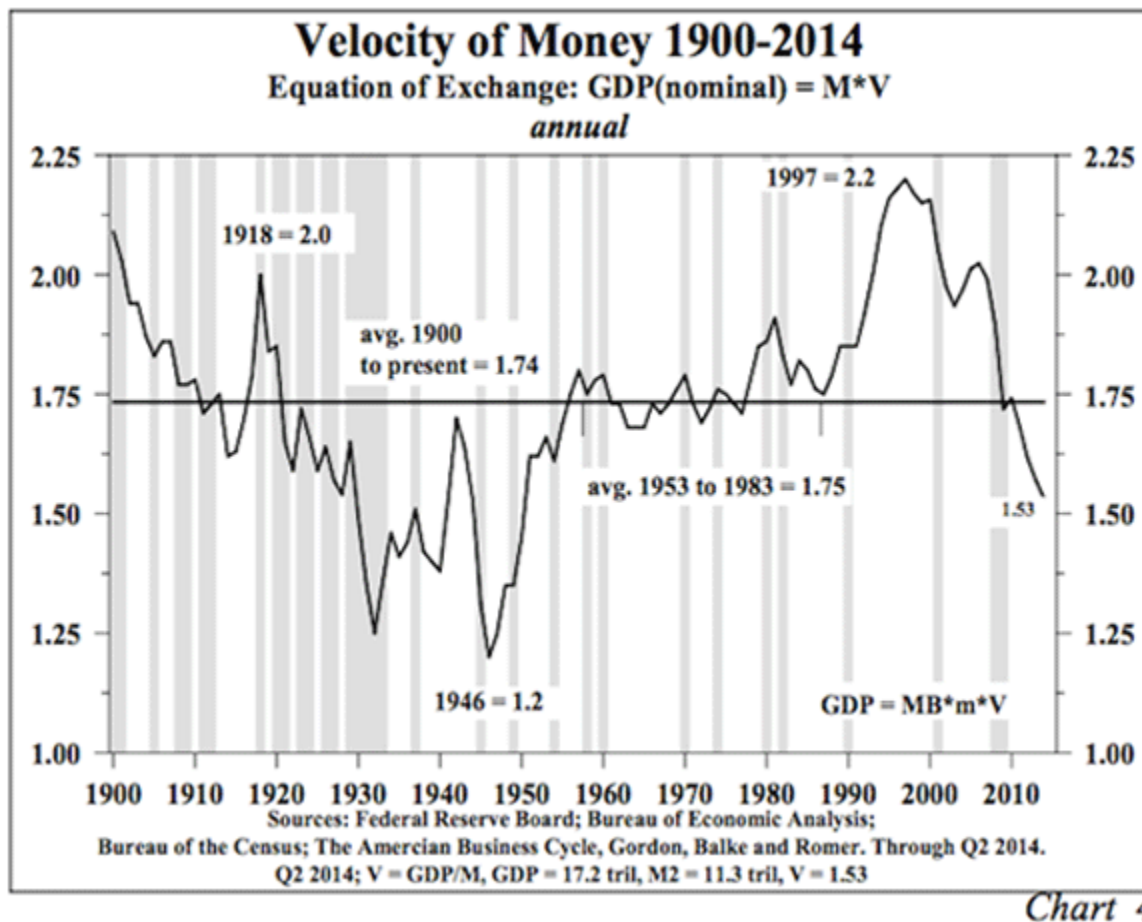


Chart 21<sup>62</sup>

In the period around World War II data was similar to today, with large deficits and a doubling of the monetary base. As a result the consumer price index increased by 90 percent between 1940 and 1951. This period of deleveraging, followed by money growth, led to higher velocity of money and high inflation.<sup>63</sup> From 2008 to now the Fed has transformed from a “small, clean, low-duration balance sheet on the asset side” to become large (and now includes mortgage-backed securities) and highly levered, duration has doubled, and quality has worsened.<sup>64</sup>

It appears that trust has a lot of ties to the velocity of money. But here trust has two definitions. When trust in a person’s ability to maintain a lifestyle is low, either because their job is at risk or they are afraid of potential future scenarios, the velocity of money reduces as people and businesses tend to hoard cash. When trust in the system itself is lost, everyone spends quickly

<sup>62</sup> Mauldin, John. Outside the Box blog. Oct. 22, 2014.

<sup>63</sup> Mauldin, J., and J. Tepper. 2014. *Code Red*. Wiley. Pages 206-207.

<sup>64</sup> Ibid pages 213-214.

while currency has value due to a desire to convert currency into goods. This leads to hyperinflation and a high velocity of money. Cash becomes a hot potato, with each person more eager than the last to trade it for something tangible.

### **3. Section Conclusion**

This section provided a refresher of some technical macroeconomics topics. Although central banks have used extraordinary means to keep rates low, the world economy has proven difficult to stimulate following the 2008 financial crisis. Once thought to be a constant, the velocity of money may hold the key. The low current rate of VM seems to reflect a commitment of individuals and businesses to reduce personal risk, and it is unclear how to maintain control of inflation trends when VM rises. In the next section, some methods to address interest rate risk are introduced that will set the tone for the rest of the paper.

### ***E. Considerations to Deal with Adverse Interest Rate Scenarios***

#### **1. New Paradigm—General Pricing Considerations**

Interest rate generators are typically not designed to produce negative interest rates. Odd things start happening in models when rates get close to zero, but this reflects back on the model and not the possibility that rates could go below zero. Perhaps not in our lifetimes, at least in the United States, but historically there have been periods of negative nominal interest rates. Recent experience often drives our perspective, and our surprise when something else happens. For example, during the financial crisis home prices fell, which had not happened in most investors' lifetimes and so was assumed to have zero likelihood. Just because it hasn't been seen recently doesn't mean it can't happen.

This does not mean that good scenario generators have not been produced, just that those commonly in use are not good choices for this particular type of scenario. Stakeholders will have to build the scenarios a different way, either by hand or through a new tool. They won't fit the statistical, multiplicative, theoretical-physics-driven approach used in many generators. It may be more appropriate to use a deterministic scenario that tells a story. For example, the pricing team might describe what would happen if nominal interest rates are negative. Management and the board of the company would be told to expect asset devaluations and problems with products having an interest rate guarantee. Qualitative discussions would result, including interactions between assets and liabilities, impact on firm value, potential governmental reactions, and potential reactions of competitors. This is not an exact science, but when the management team understands the firm's risk profile and risk appetite, it leads to better strategic and tactical decisions.



## 2. ALM Considerations

When managing assets and liabilities together, insurers have several tools available to them. At the purest level they focus on cash flows. Quite simply, in the long run inflows from premiums, reinsurance claims, investment income and asset maturities need to be greater than outflows from claims, expenses and commissions. For many liabilities it is impossible to find assets that pay out far enough into the future to match claims, so insurers incur reinvestment risk. This is part of a balancing act, maintaining enough reserves to support the liabilities without impacting profitability and marketability. For example, cash holdings improve liquidity but hurt returns. Holding high-risk assets may increase short-term profitability but increases longer-term liquidity and solvency risks.

Asset values and interest rates move in opposite directions. The price of a bond is the present value of its future coupon and principal payments. A higher discount rate will lower its value. If a bond has cash flows that match a liability, then the combined portfolio of assets and liabilities is immunized and the holder is indifferent to changes in interest rates. It is useful to know how sensitive an asset's cash flows are to interest rates. Duration is a metric used to measure interest rate risk, but it comes in many forms. Macaulay duration assumes future cash flows are fixed, and the result reflects the equivalent time a single payment would be made. This is often expressed graphically by a teeter-totter, with the fulcrum placed at the point in time that rolls together all the future cash flows into one proxy cash flow. Modified duration continues to assume no changes to cash flows, and the result reflects the percentage change in value due to a one percent change in rates (parallel shift of the curve). Both Macaulay and modified durations are relatively straightforward to calculate, but the user must be sure the cash flows are truly fixed so as not to introduce model risk. This is not true of effective duration, as it also incorporates changes in cash flows due to interest rates. Home mortgages that are allowed to prepay provide a helpful example. If interest rates fall homeowners are more likely to prepay, while if interest rates rise normal prepayments will reduce. Calculation of effective duration typically requires stochastic analysis across many scenarios to capture the variability of results. Effective duration requires three times as much work as calculating the base value. In typical calculations, one parallel up scenario (or set of stochastic scenarios) and one parallel down scenario are averaged against a scenario with no changes to measure the sensitivity. The measure is theoretically defined as an instantaneous change but is usually approximated by averaging results from 1 bp (0.01 percent) parallel changes to the yield curve in each direction.

Key rate durations (KRDs), or the similarly defined partial durations, segment each of these duration calculations by assuming non-parallel shifts of the yield curve and looking at interest rate sensitivities at specific points of the curve. These types of calculations provide ways to better understand an insurer's risk profile and provide modelers with great sources of asset-liability management (ALM) knowledge.

As with any tool, practitioners should become familiar with duration and how it performs at various times during the interest rate cycle. Especially with effective duration, model risk must be taken into account. Even for specific stress scenarios there are questions, such as when a 3 percent parallel shift down occurs and some points on the yield curve are already less than 3 percent. What makes sense in that situation? Reasonable people will differ in their response. Alternatives could include setting a floor at half the initial rate for each point on the curve, which changes the curve's shape, or to set the same floor for all points on the curve. Other model risk issues include proxies for investment returns and credited rates, where choosing a single point on the yield curve (e.g., spread over the 5-year Treasury) to drive these metrics leads to concentrated KRD results.

### **3. Ties to ORSA**

Starting in 2015, some states will require insurers to comply with the Own Risk and Solvency Assessment (ORSA) regulation. Insurers will be asked to describe their risk management practices and how they are applied when making decisions. With no right or wrong answers, the hope is that best practices will evolve to promote effective risk management and better-understood risk profiles and risk appetites. Insurers should trend their key metrics, including historical and projected data, graphing it where possible. It is expected that insurers will provide reverse stress test scenarios, and both low and high (especially spiking scenarios) interest rates should be strongly considered by many in the industry for this purpose. This will allow the insurer to see how these particular scenarios impact its specific and evolving risk profile.

A useful byproduct of the ORSA regulation may be that each state implements it in slightly different ways. By sharing best company and regulatory practices, the industry's ERM profile may improve.

### **4. Section Conclusion**

This section discussed interest rate risk and the tools used to test it by life insurers. Scenario planning and stochastic testing both have a role to play as companies manage risk and regulators seek out tools and best practices. It will become clear later in the paper that duration by itself is necessary but not sufficient when managing risk. In the next section current practices for managing interest rates collected via an industry survey will be discussed.

#### ***F. Current Practices for Managing Interest Rates—Survey***

In an effort to learn more about general practices surrounding modeling of interest rates across the life insurance industry, a short survey was distributed in July 2014 to chief actuaries. Combined with several specific company requests, the research team received 19 responses. Thanks go out to those who participated. As this is not a statistically significant sample, and not everyone answered every question, companies will remain anonymous and no appendix listing all responses and comments will be provided. Several model vendors were also contacted for

their knowledge of general practices due to the small size of the survey. These discussions occurred outside the survey, are reflected in observations only, and do not influence the compiled responses.

Eleven companies anticipated an ORSA filing requirement, with two expecting to be exempt and two unsure of their status. The ORSA exemption is based on premiums collected (below \$500 million) and does not consider assets under management (AUM). The survey asked about general account asset size, and a broad range was received as shown in Chart 22. Many thanks to the council members of the Society of Actuaries' Smaller Insurance Company Section, as their interest in the project led to several completed surveys from smaller insurers exempt from the ORSA requirement. This helped to avoid the general reality of surveys that reflect only the resources of larger firms.

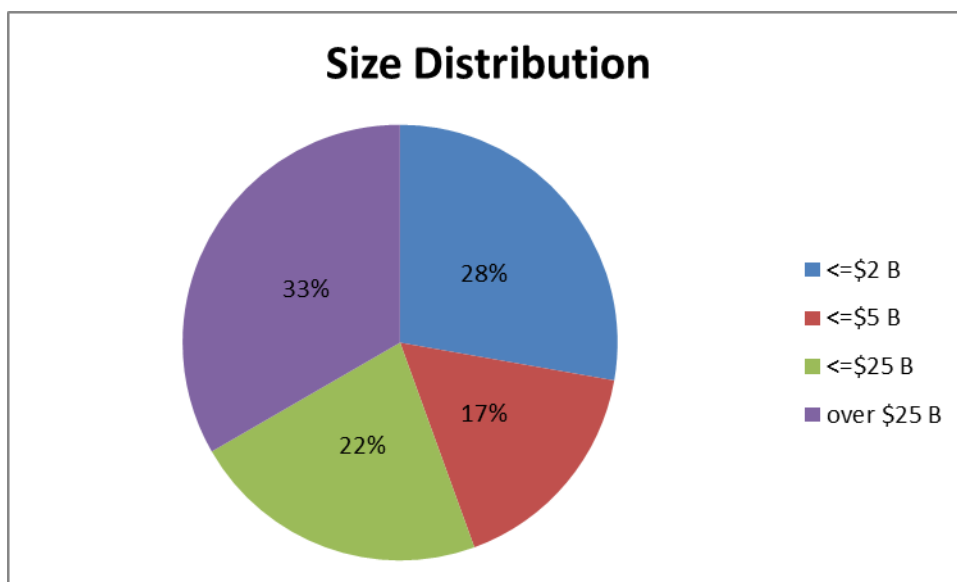


Chart 22

Product lines included a variety of group and individual annuities, whole life (participating and non-par), term life, universal life and indexed products. This mix of company size and product mix provides a good representation of typical and best asset-liability management (ALM) practices by company size. The survey was split into several sections.

### 1. Background Questions

The initial survey questions asked about testing done for regulatory purposes, covering primarily the actuarial opinion and memorandum and risk-based capital (RBC) testing for C-3 Phase 1. It was also an opportunity to see if companies had become familiar with the C-3 Phase 3 (also referred to as VM20) scenario generator developed for the National of Association of Insurance Commissioners (NAIC) by the American Academy of Actuaries (and currently found at <https://www.soa.org/research/software-tools/research-scenario.aspx>). While all the companies

performed at least the New York 7 deterministic scenarios, over half (11 of the 19) added to the seven regulatory scenarios. From follow-up discussions it was learned that some of these scenarios are held constant from year to year. This means some scenarios that make more sense in higher-rate environments—for example a level scenario with an inverted yield curve—might be performed for consistency across years. Others complete a lot of additional scenarios but seem to test the same risk over and over. For example, it may not be valuable to test pop-up scenarios at each of 1 percent, 2 percent, 3 percent, 4 percent, 5 percent, 6 percent, 7 percent, 8 percent, 9 percent and 10 percent increments (there may be other reasons to complete all of these scenarios, such as trending). Others run a number of complex scenarios, with rates increasing and decreasing for several years and then repeating. The modeler should describe the goal of testing each specific scenario. Complex scenarios can be hard to explain to senior management verbally, and may be better handled through stochastic scenario sets.

Many of the companies reported using one or more versions of the Academy generator as part of their regulatory reporting process. Some, especially at the larger firms, run both the C-3 Phase 1 and C-3 Phase 3 generators. The Phase 1 generator maintains its original parameters and mean reverts to a 6.55 percent, 20-year nominal risk-free rate, although the starting yield curve is updated each time the testing is performed. The current mean reversion parameter (MRP) for use with RBC C-3 Phase 3 testing during 2014 is 4.25 percent. The modeling portion of this research provided somewhat surprising results, and it will be interesting to see the results as companies perform their own analysis with actual blocks of business. Some larger companies have been asked to perform this sensitivity test as part of their 2014 reporting cycle (using the VM20 generator or a proprietary generator with pre-defined calibration completed). A few companies reported using vendor software or a generator developed in-house, but it appears from talking to vendors that this may actually be more common (especially for larger firms). For those running stochastic scenarios it was typical to run either 50 to 499 (37 percent—could have multiple responses) or 500 to 9,999 (47 percent). Some brief discussions indicate that many are running the 1,000 scenario subset of the 10,000 scenarios generated by the NAIC generator. Some of the biggest companies run a variety of scenario sets for different purposes. None reported using for regulatory purposes a scenario set of 10,000 or more, although one reported stratifying a large scenario set for general account models. Run-time issues can make it difficult to run large models without using proxies from methods like replication.

Almost half of the companies adjust the default parameters in the NAIC generator to better represent their own preferences, mostly by adjusting the MRP. This makes the results less comparable between companies but perhaps enables better buy-in for internal management purposes. After all, the AOM is an opinion and the person signing must be satisfied that the inputs are reasonable. None of the firms adjusted their parameters by product, and only three reported interest rate caps despite the question stating that the default parameters included a soft cap. A floor was reported by 32 percent of the respondents, between 0 and 0.25 percent, and typical generators impose a floor at or near zero. Only one company reported unwinding the

yield curve, for Canadian testing, and 63 percent of the respondents held the curve's shape stable. One company grades the shape of the yield curve to a historical average.

## 2. Current Practices

Almost all insurers had analyzed the impact of changes in rates (see Chart 23), 95 percent for increasing rates and 84 percent for decreasing rates. Many had taken steps to change their current investment profile, with over half (53 percent) acting due to increasing rates and 37 percent based on decreasing rates. Some had considered or implemented a shorter investment profile, while others had considered alternative investments or adding credit risk. One had extended duration to relieve spread compression. Downside risk was sought using interest rate derivatives by one company, with another installing a hedging program to protect against an interest rate spike. One company expressed concern that implementing a hedge program might make economic sense but reflect poorly in regulatory-driven scenarios.

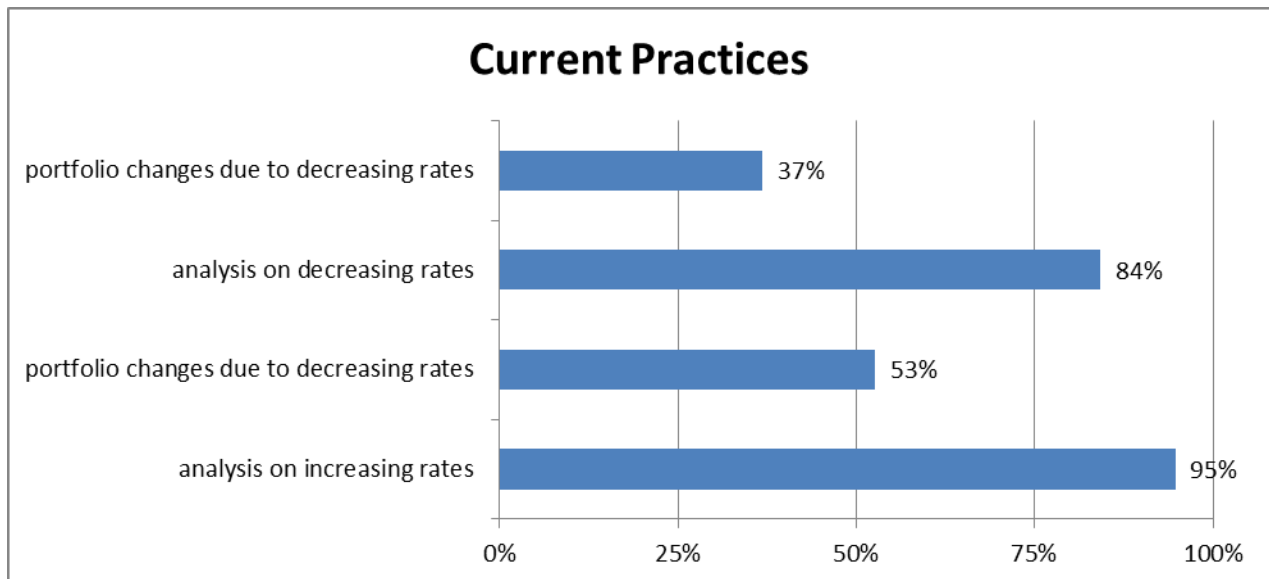


Chart 23

Most (63 percent), and all of the companies with over \$5 billion of general account assets, performed additional deterministic stress tests based on low and rising interest rate scenarios. For the low scenarios this included additional pop-down tests, Japan-like paths, reproduction of past recessions, and a level 1 bp scenario, as well as backing into how low rates could go before earnings and dividends were threatened (reverse stress test). One company described how they choose poorly performing scenarios from their stochastic analysis to perform additional analysis. Of those reporting the lowest 10-year Treasury rate tested, 27 percent shared a number below 30 bp, with the rest at 1.99 percent or lower. None reported testing negative scenarios, although subsequent discussions with other modelers found that some testing has been done.

For higher interest rates, scenarios tested include a broad array of simple pop-up and varying scenarios. Some are quite complex. Some are attempting to capture a scenario that remains low for several years and then pops up, recognizing that this environment can be very dangerous to life insurers holding liabilities with interest rate guarantees.

A reasonable question for the practitioner to ask is, “Why am I generating this scenario? What do I hope to learn that I don’t already know?” Applying a marginal approach—looking at additional knowledge gained relative to additional effort—can be effective. Running more than 10 scenarios and presenting them all to management or the board may be counterproductive as it could confuse rather than enlighten.

While some use expert judgment, many respondents stated that the highest rate in their rising rate scenarios was a fixed 5 to 10 percent above the current Treasury rate. Only 30 percent of those reporting shared a nominal interest rate above 10 percent in their testing. Some perform the Dodd-Frank Act Stress Tests (DFAST), developed by the Federal Reserve to stress test financial institutions (designed primarily for banks). Interestingly, 37 percent do not run additional rising scenarios. For companies with general account assets below \$5 billion this is especially true, with 83 percent reporting no additional scenarios.

All companies who responded to the survey except one model dynamic lapses (their block of business is minimally interest rate sensitive), using formulas seen since the 1980s in cash flow testing projects. This includes the additional lapse formula used in the Model Office section of this paper.

$A \times (MR - CR)^B - C \times SC\%$ , where

A, B and C are company specific factors.

MR is the current market rate policyholders could receive if they shopped their policy (some use a rolling average).

CR is the current credited rate.

SC% is the current surrender charge percentage in the policy.

Several respondents reported that the formula for excess life lapses is less sensitive than for deferred annuity business. This is likely due to re-underwriting and lower account balances. Other formulas use the arctan function, exponential function or another cumulative distribution function to estimate the impact of rate differentials between new money and credited rates. Some companies use seasoning, reflecting the number of years the policy has been in force, to reflect customer loyalty. Companies vary on whether they allow negative dynamic rates, and some reported a cap on either the extra lapses or total lapses, with some including stickiness in the initial excess lapses (no additional lapses until the market rate is greater than the credited rate by

a predetermined amount). With no historical studies available across an interest rate cycle, modelers are relegated to best guesses with no consistent approach for regulators to compare assumptions.

Fewer companies reported modeling dynamic premiums, with some focus on universal life secondary guarantee (ULSG) behavior and additional deferred annuity deposits when there are interest rate guarantees.

In addition to lapses and premium, a few (26 percent) reported dynamic modeling of assumptions such as policy loans, inflation, partial withdrawals, variable guarantees based on in-the-moneyness, and transfers between separate accounts.

### 3. Risks—Industry Practices

As seen in Chart 24, the industry products considered most at risk in an increasing interest rate environment were fixed deferred annuity, universal life, variable annuity and whole life. Small support was given to other products based on company-specific circumstances. Reasons given for prioritization included disintermediation, products where the sales focus is on interest rates, and products with asset mismatches.

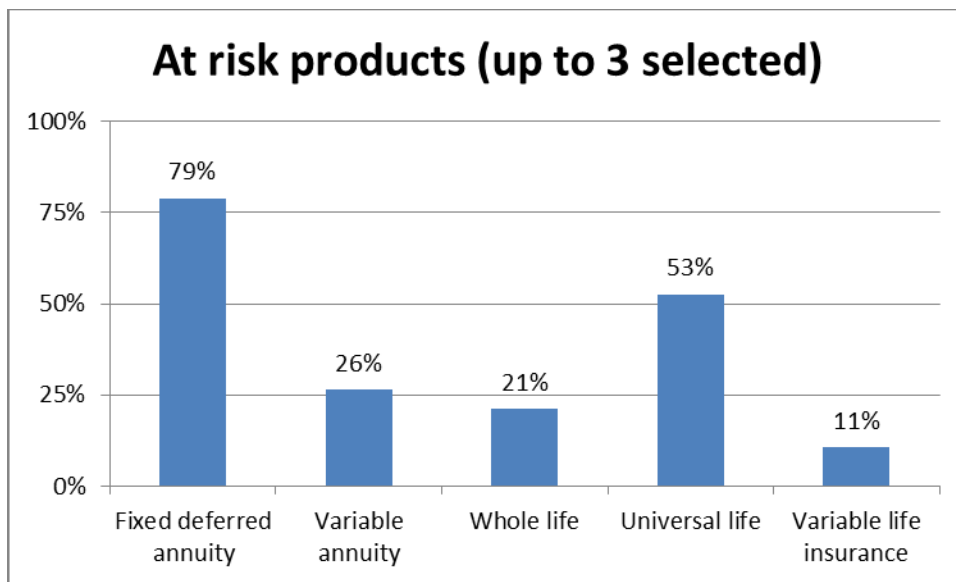


Chart 24

One respondent expressed concern about the viability of the variable annuity product if fixed products were earning high rates. Another noted that the underwriting aspect of life insurance made that product less susceptible to a run on the bank than for other products where interest is credited. Incentives encourage distributors to roll over insurance products since front-end compensation designs dominate.

While this survey was sent to life insurers, some respondents also write various types of property/casualty products. One of these companies commented on inflation, and the ties between rising interest rates, rising claim amounts, and the regulatory process to approve rate increases. It was pointed out that the timing of these updates is not perfect, and if rate increases are not stable (meaning the percentage increase isn't anticipated correctly), especially in a high, even hyperinflationary environment, that an insurer's profits could evaporate or even turn into losses. Reserve setting would be more difficult and concentration risk would increase for consumers as specific insurers ceased operations.

Survey respondents were asked to rank the risks at their company from 1 to 5 as defined for risk-based capital (RBC) purposes: credit, equity, insurance, interest rate and operational risks. As this survey asked about interest rate risk, it is not surprising that this risk was rated highest most frequently, followed by credit and insurance risk. Chart 25 details the results. Although not included in the chart, and somewhat surprising since the risks chosen were RBC standard broad risk categories, the following additional risks were suggested as being important: regulatory, taxation, strategic, unclaimed funds, capitalization, distribution, liquidity, policyholder behavior and reputational risk.

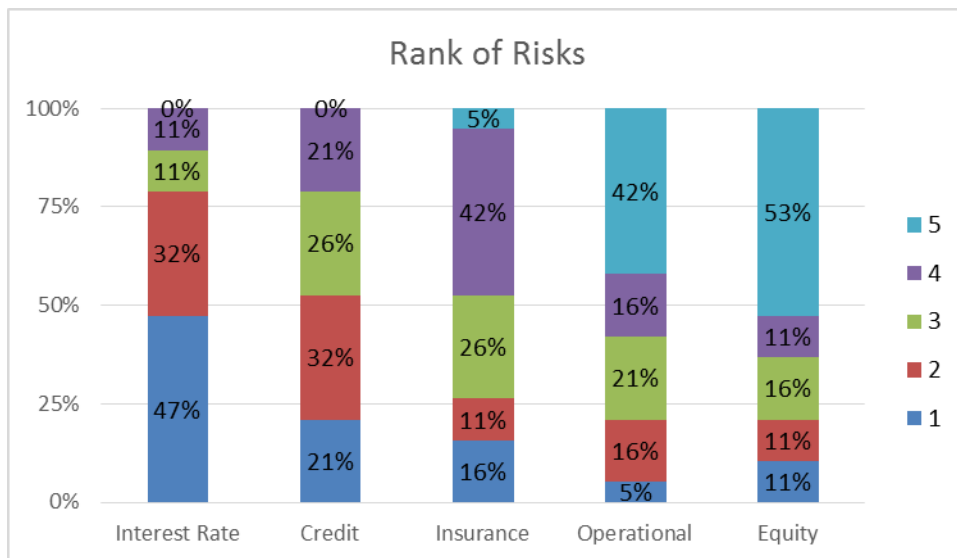


Chart 25

With a small sample size it is hard to draw firm conclusions, but it is interesting that operational and equity risk account for 95 percent of the lowest risk choices. The rank of insurance risk as middle-of-the-pack is also interesting, and the possible product mix cyclical turning point for the industry is discussed elsewhere in this paper.

In a question hoping to discern a range of results for predicted future interest rates, the responses were not consistent but interesting nevertheless. When asked the highest rates expected, respondents gave a range of 2 to 6.5 percent over the next three years and 2 to 15 percent over



the next 10 years. For the lowest rates, the three-year range was 1 to 3.5 percent, and the 10-year range was 0.5 to 4.5 percent.

Respondents suggested that other issues could have been discussed during the survey. These included the impact on sales, variable annuity (VA) hedging risk, time horizon used, credit spreads, inflation and regulatory risk.

#### **4. Section Conclusion**

This nonscientific survey shows that interest rate risk is consistently stressed by companies using scenarios defined by regulatory bodies, and in addition many companies internally stress their block of business based on where they have concerns. Larger companies, not surprisingly, with more resources, are able to do more testing. Some scenario stress tests being used could be considered overly complex and burdensome, while others are testing alternative generators to learn more about the nuances of their block. The current interest rate environment is unique, especially due to central bank monetary policies, and it will be a challenge for modelers in the insurance industry to stay ahead of this risk. In the next section this paper will look at some tools to help them.

### ***G. Model Office***<sup>65</sup>

#### **1. Overview**

As part of an investigation into the effect of interest rates on a life insurance company, in this section three products typically sold by life insurers have been modeled to determine their sensitivity to interest rates. The three products are fixed deferred annuity, universal life (UL) and universal life with secondary guarantees (ULSG).

The model designs are not intended to represent any particular product, but represent products that could be expected to appear in today's market. By including 10 issue years for UL and ULSG, and five issue years for fixed deferred annuity, the models can reflect asset and liability risks across various interest rate scenarios. In practice, a company may have multiple product generations within a five- or 10-year issue block.

While detailed parameters were generated for each product, only high-level assumptions are shared here as the focus is on relative performance across interest rate scenarios. Overall results are reasonable and consistent with expectations.

#### **2. General Model Settings**

The reporting metric for value used in this analysis is the present value of distributable earnings over a 30-year projection horizon (PVDE), discounted at the 10-year Treasury rates applicable

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<sup>65</sup> This section was authored by Karen Rudolph, FSA, MAAA.

for the scenario. The focus of the analysis is on relative results. Each scenario outcome is normalized against the baseline deterministic scenario outcome (set at 100). The valuation date is year-end 2013.

While general product specifications were consistent within a product, each single year issue block used investment and crediting assumptions appropriate for the conditions at time of issue (driven by the yield curve at that time).

The investment strategy for each product is assumed to maintain a specified asset mix over the course of the projection, rebalancing as needed within a tolerance. At the valuation date a simple weighted average number of years remaining to maturity was 11.5 years for the asset portfolio supporting the life insurance block and 6.4 years for the asset portfolio supporting the annuity block.

Cash accumulation values grow at the net portfolio earnings rate less a pricing spread, subject to a guaranteed floor rate. The portfolio earnings rate lags the rate for new asset purchases while existing assets roll over. Policyholders may exercise their option to surrender when rates rise as clients consider alternative products. These lapses are in addition to a base lapse rate that varies by duration since issue.

### **3. Interest Rate Scenarios**

Scenarios, both deterministic and stochastic, were run for each block of business separately. Interest rate shocks are effective in the first projection month. Rates for deterministic scenarios are not floored or capped, maintain the shape of the yield curve at inception, and are allowed to be negative. A level scenario, where the Dec. 31, 2013 Treasury yield curve is held constant for all years, provides a standard against which to compare the results of the other seven scenarios. The eight deterministic scenarios are described below (all points on the yield curve are adjusted by the same amount):

- D300                      Interest rates drop 300 bp in the first projection month
- Level                      Interest rates are held constant at the initial rates
- U100                      Interest rates increase 100 bp in the first projection month
- U300                      Interest rates increase 300 bp in the first projection month
- U500                      Interest rates increase 500 bp in the first projection month
- U1000                      Interest rates increase 1,000 bp in the first projection month
- U50\_10Yr                      Interest rates increase 50 bp annually for 10 years, then remain level
- Historical                      Applies changes to the initial rates similar to 10-year U.S. Treasury rates from 1976 to 2006, then remains level

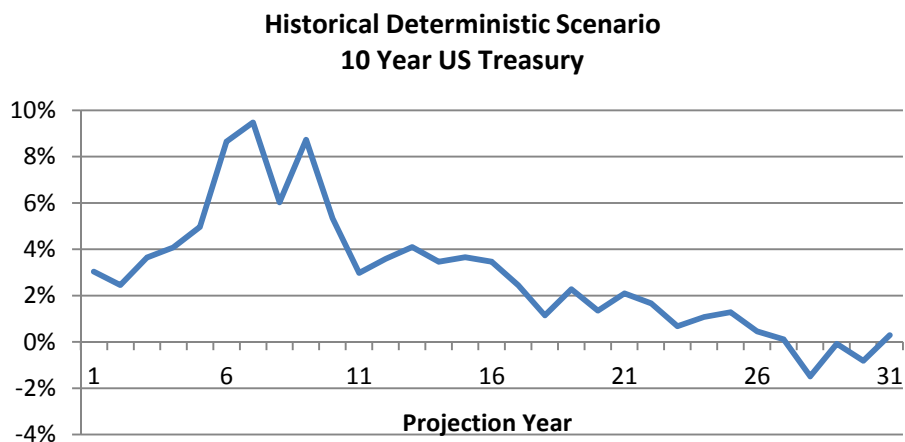


Chart 26

Repeating historical interest rate patterns is a common analytical framework. Chart 26 shows the pattern of 10-year Treasury rates starting in 1976 and over the next 30 years, as used in this analysis for the deterministic scenario labeled Historical.

The stochastic scenarios use the National Association of Insurance Commissioners (NAIC) parameterized Economic Scenario Generator Version 7.1 (ESG v7.1) and the embedded scenario picking tool, choosing 1,000 scenarios based on the default parameters and Dec. 31, 2013 starting yield curve. The mean reversion parameter (MRP) is 4.25 percent and always applies to the 20-year Treasury rate.

## 4. Liability Models

### Fixed Deferred Annuity

The fixed deferred annuity product is a typical single premium, one-year guaranteed annuity product with a 1 percent underlying guarantee. Policies are issued 2009 through 2013 and aged to year-end 2013. The credited rate is reset on each policy anniversary based on a 200 bp spread, with a bonus introductory rate paid in the first year. Free partial withdrawals up to 10 percent are available after the first policy year, and the surrender charge scale grades off over seven years.

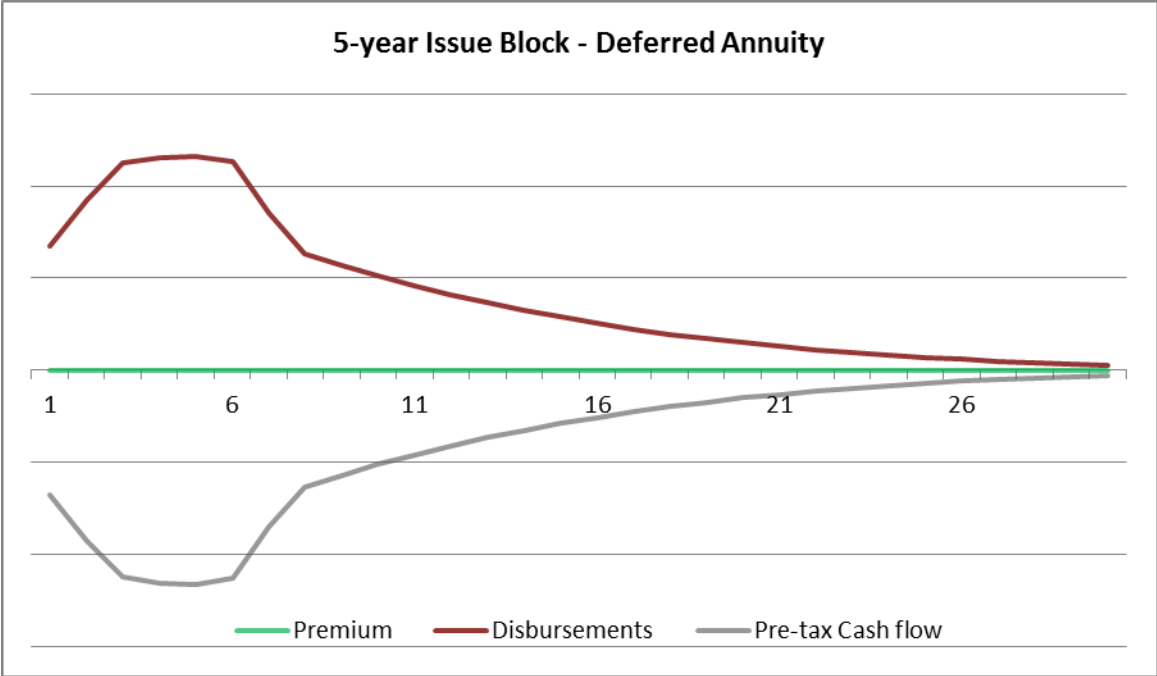


Chart 27

Chart 27 shows the pre-tax cash flow pattern for the block of fixed deferred annuities under the baseline scenario. With no premium revenue after issue the cash flows consist of benefit payments and expenses. The emphasis on asset principal and coupon payments to meet disbursement needs makes asset-liability management an important component of product management for deferred annuities.

**Deterministic Results**

	Value							Historical
	D300	Level	U100	U300	U500	U1000	U50_10yr	
1) Baseline Assumptions	-440	100	214	235	77	-153	178	60
Line 1 / Account Value in Force	-8.0%	2.4%	4.9%	5.6%	2.0%	-3.0%	4.4%	1.6%
2) Sensitivity Assumptions	-440	100	214	214	43	-154	177	60

Table 1

In Table 1, two sets of results are shown across the eight deterministic scenarios. Results in Table 1 are normalized to the Level scenario. Row 1 defines value as PVDE for baseline assumptions relative to the level scenario, defined as 100. Row 2 shows PVDE for a sensitivity of dynamic policyholder behavior. The ratio of PVDE for the baseline assumption to the initial

account value in force estimates the current value of the block based on discounted future spreads for each scenario going forward.

Policyholder behavior formula:

$$\text{Additional annual lapse rate} = \text{Min} \{ \text{Max} [ 0, .01 \cdot 4(\text{max}(0, \text{MR} - \text{CR}))^2 - \text{SCFac} \cdot (\text{SC}\%) ], .60 \}$$

Where

MR = Market Rate, or competitor rate of interest x 100 (e.g., 3 for .03 or 3%)

CR = Credited Rate of interest x 100

SCFac = Surrender Charge Factor = 4

SC% = Surrender Charge Percent = 1 - (CSV(t)/AV(t))

Sensitivity: SCFac = 1

Spread compression occurs when the net portfolio rate less the pricing spread is less than the guaranteed rate. Deferred annuities have issue expenses, including commissions, so over the life of the policy the pricing spread must cover all expenses and benefits, along with a profit margin. Since an in-force block is beyond the issue date, spread compression does not necessarily mean the PVDE metric is negative. Both the Level and D300 scenarios show spread compression and, not surprisingly, the D300 scenario has a negative value. Scenarios that alleviate spread compression improve results. Of the scenarios tested, the U300 scenario does best, in spite of a limited amount of additional (also called excess) lapsation. Scenarios with greater rate increases, U500 and U1000, experience more extreme additional lapsation as well as liquidity-driven capital losses on asset sales. The surrender charge provisions in the annuity contract do little to mitigate the adverse policyholder behavior.

Projection Year	Percentage of Account Value Remaining							
	D300	Level	U100	U300	U500	U1000	U50_10yr	Historical
Year 0	100%	100%	100%	100%	100%	100%	100%	100%
Year 5	60%	60%	60%	59%	16%	5%	59%	34%
Year 10	30%	30%	30%	32%	9%	2%	26%	9%
Year 20	7%	7%	7%	9%	3%	1%	8%	2%
Year 30	1%	1%	1%	2%	1%	0%	2%	0%

Table 2

Table 2 compares the projected account values remaining by scenario and by projection period. This provides a sense for the impact of dynamic policyholder behavior and higher credited rates for increasing scenarios. Since all scenarios have the same initial account value, this provides a comparison between as well as within scenarios.

In the U50\_10Yr scenario, where interest rates increase 50 bp per year for 10 years, additional lapse activity is less severe than when the increase occurs all at once as in U500. Lapses are

mitigated since the asset portfolio has a better chance of keeping in step with competitor rates. As a result, the projected account values of U50\_10Yr are about the same as the Level scenario after five years. In the Historical scenario, where rates spike after about five years and then slowly reduce, for a product line that quickly turns over it acts much as a U500 scenario since most of the business has lapsed before the steady decline begins. For the more extreme U1000 scenario, only 5 percent of policies remain after five years.

**Sensitivity Results**

An additional set of scenarios looked at the policyholder behavior formula as a sensitivity, adjusting the Surrender Charge Factor from 4 in the baseline set of assumptions to 1 in the sensitivity. This change reduces the protective value of the surrender charge on additional lapse activity. These results are shown in Row 2 of Table 1. The PVDE outcomes for U300 and U500 are increasingly worse under the sensitivity, but show no material change for U1000. This is because the additional lapse rate has breached the 60 percent cap under the baseline assumption and therefore the sensitivity of reducing the protective value of the surrender charge shows little to no change.

**Stochastic Results**

The first of two stochastic analyses includes the 1,000-scenario subset from the NAIC ESG v7.1 with a 2013 derived MRP of 4.25 percent, as well as a 200-scenario subset. Both of these subsets are derived from the larger population of 10,000 scenarios. The PVDE results for the two NAIC subsets are shown below. As expected, the 200-scenario subset provides a reasonable fit to the subset of 1,000 based on the statistics shown in Table 3.

		Value	
		ESG v7.1	
		1,000	200
Percentile	10 <sup>th</sup>	187	187
	25 <sup>th</sup>	210	210
	50 <sup>th</sup>	233	232
	75 <sup>th</sup>	246	245
	90 <sup>th</sup>	256	254
	Minimum	86	106
	Maximum	275	268
	Mean	226	226
	CTE90	166	168

Table 3

What is interesting to review is where the eight deterministic scenarios are on the distribution of the set of 1,000 scenarios. The slow upward bias of the ESG v7.1 is evident in that PVDE from the U50\_10yr, U100 and U300 represents data points within the distribution. As discussed above, these are increasing scenarios without material additional lapses.

Results from the Level, U500 and Historical scenarios are in or below the lower tail of the distribution. U1000 is not in the range of the distribution at all. Neither is D300, which is not shown on Chart 28 as it lies well below the lower axis limit. Those who are assuming stochastic scenarios provide materially adverse tail scenarios should test their own block of business against deterministic scenarios like these to confirm. For this block of single premium deferred annuities the stochastic scenarios produce a somewhat rosy picture, likely due to the current MRP (higher than current rate) and the low current interest rate environment, with a generator that floors rates just above zero.

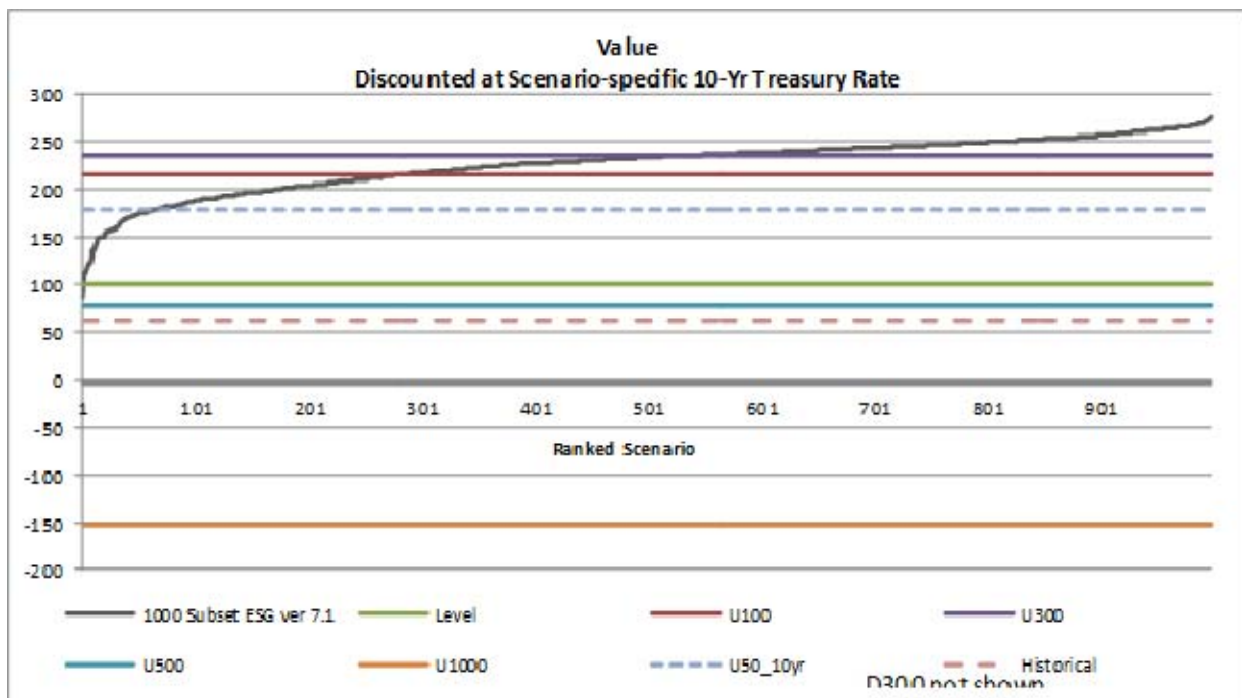


Chart 28

The second stochastic analysis focused on comparing the PVDE outcomes for 50 scenarios generated using the American Academy of Actuaries' C-3 Phase 1 generator. This generator is parameterized with an MRP of 6.55 percent. These 50 scenarios were originally derived as tail scenarios and were selected from a broader distribution. The approach to the C-3 component of NAIC risk-based capital (RBC) for fixed deferred annuities may transition from a weighted average of the 50-scenario subset to a CTE90 metric based on the ESG v7.1 subset of 200. This possibility is the reason for the second stochastic analysis described here.

Chart 29 compares the ESG set of 200-scenario PVDE results against the C-3 Phase 1 subset of 50-scenario PVDE results. Because the C-3 Phase 1 scenarios are tail scenarios from a larger distribution, they are compared against the worst performing from the ESG v7.1 subset of 200 scenarios.

While not directly comparable to the RBC statutory surplus metric, which is discounted at 105 percent of the after-tax one-year Treasury rates, the weighted average PVDE result across the C-3 Phase 1 subset is 164. The CTE90 result from the ESG v7.1 subset is 168. A company should test its own block, but the result from this set of policies may indicate little change with the transition to CTE90. Different product structures have the potential to react differently to these two tests as compared to the case study.

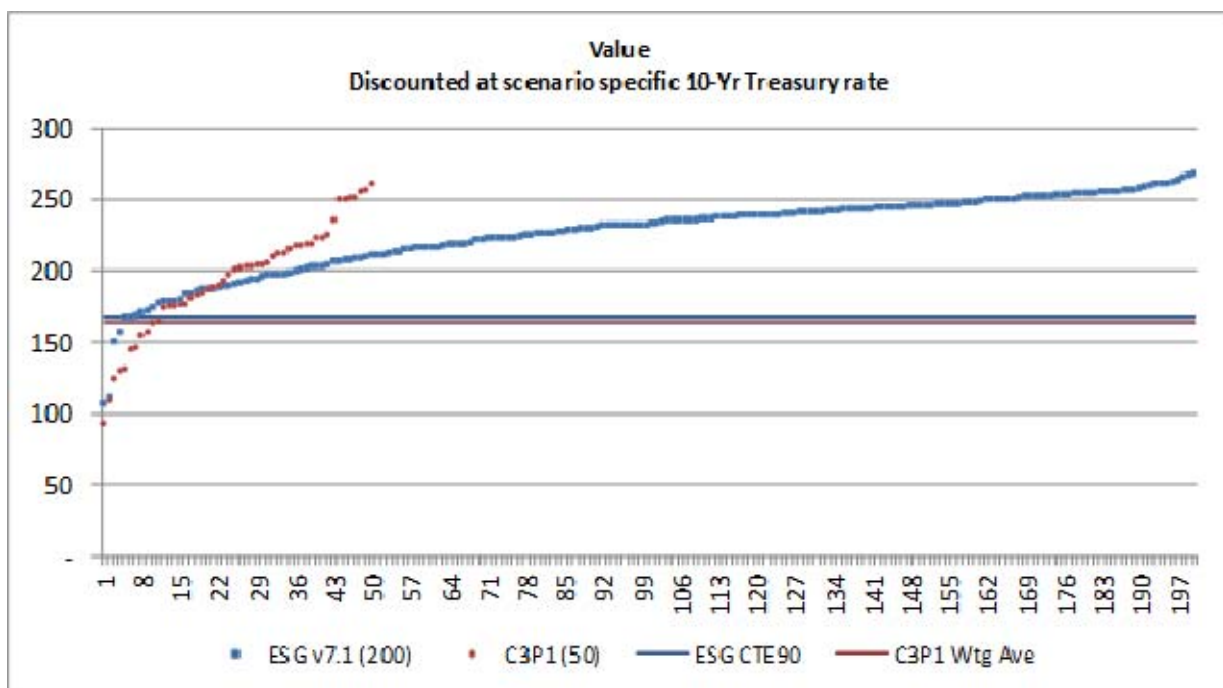


Chart 29

### Universal Life

The universal life product is a simplified issue, level death benefit, flexible premium UL product assuming a typical mix of gender, smoking, age and size combinations. Policies are issued 2004 through 2013 and aged to year-end 2013. The cash accumulation value grows at the net portfolio earnings rate less 150 bp pricing spread with a 3 percent guaranteed floor. The model assumes that the policyholder pays a target premium designed to keep the policy in force for many years under current assumptions while providing a reasonable profit margin to the company. Surrender charges grade off over a 15-year period.



Chart 30 shows cash flow patterns for the in-force block of UL. The pre-tax cash flow consists of premium revenue less benefit payments, commissions and expenses. Asset-liability management (ALM) risk is very complicated for UL products; initially issue expenses are greater than premiums collected, then premiums are greater than disbursements, which leads to reinvestment risk.

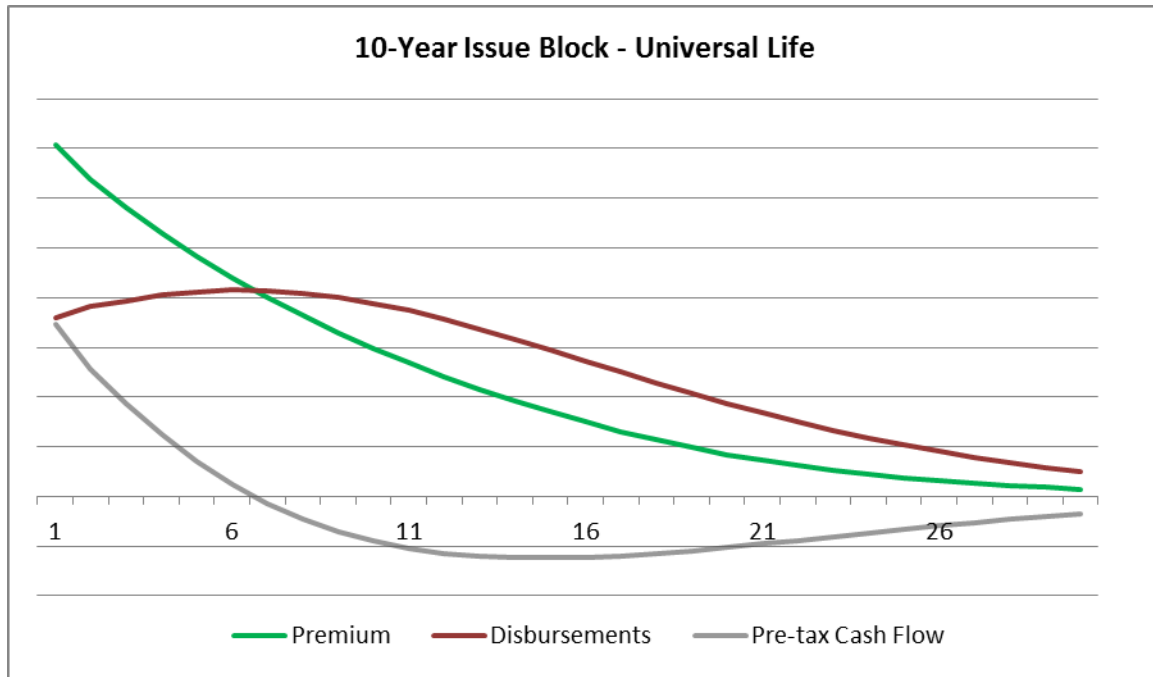


Chart 30

**Results**

Table 4 shows the PVDE metric for the UL product. Baseline assumption results are shown in Row 1, normalized to the Level scenario. Results for the sensitivity to the dynamic policyholder behavior formula are shown in Row 2. The sensitivity test results show limited impact to changing the surrender charge factor in the additional lapse formula. This formula is described later in this section.

	Value							Historical
	D300	Level	U100	U300	U500	U1000	U50_10yr	
1) Baseline Assumptions	96	100	93	64	43	29	55	57
2) Sensitivity Assumptions	96	100	93	56	41	29	54	56

Table 4

The Level scenario experiences mild spread compression (net earnings rate less 150 bp pricing spread is less than the guaranteed rate). The credited rate throughout this scenario and D300 is the guaranteed floor. Mortality charges are a source of profit as long as the account value in force stays positive, partially offsetting the source of earnings shortfall from interest rates. This UL block, which is past the period of high issue expenses, has a positive embedded value in a level interest environment. The D300 scenario has a slightly lower PVDE, with lower profits discounted at lower rates. The U100 scenario is very similar to Level, with improved investment income offset by a higher discount rate.

The U300, U500 and U1000 scenarios present increasingly stressful outcomes. Though the potential exists for greater earnings from the reinvestment strategy, the ability of the company to capture this potential is constrained by the significant number of policyholders surrendering their contracts before the company can take advantage of the increased interest environment. The dynamic lapse formula used in the model produces policyholder behavior that increases the rate of lapse with each advancing scenario, until reaching the formula’s cap on additional lapsation. Cash demands like this force the company to sell assets at a time when capital losses are unavoidable. The U50\_10Yr scenario allows time for portfolio rates to react to the increasing rates and limits additional lapse activity. For U50\_10Yr, the population after five years is nearly the same as in the Level scenario and after 10 years is 15 percent of the initial amount, while only 7 percent of the initial amount remains in the U500 scenario after 10 years. The gradual rise of U50\_10Yr results in less extreme cash demands from this scenario than others that rise by similar amounts but over a shorter time period.

The Historical scenario could be described as a delayed pop-up scenario. The PVDE results for Historical are not much different from the U50\_10Yr scenario.

Projection Year	Percentage of Insurance Amount Remaining							
	D300	Level	U100	U300	U500	U1000	U50_10yr	Historical
Year 0	100%	100%	100%	100%	100%	100%	100%	100%
Year 5	62%	62%	62%	54%	30%	23%	59%	51%
Year 10	39%	39%	39%	26%	7%	5%	15%	16%
Year 20	13%	13%	13%	6%	0%	0%	1%	5%
Year 30	3%	3%	3%	2%	0%	0%	0%	1%

Table 5

Table 5 compares the projected insurance amounts as a percentage of the initial amount, over each scenario, showing the impact of additional lapses from the policyholder behavior formula, shown below. Note that the formula, typical among those used by modelers, has different assumptions from the one used for the deferred annuity product. Since deferred annuities are sold as an investment product, and life policies would likely need to go through underwriting again, additional lapses for life products are less sensitive to interest rates than are deferred annuities.

Policyholder behavior formula:

$$\text{Additional annual lapse rate} = \text{Min} \{ \text{Max}[0, .01 \cdot 4(\text{max}(0, \text{MR} - \text{CR}))^2 - \text{SCFac} \cdot (\text{SC}\%)], .20 \}$$

Where

MR = Market Rate, or competitor rate of interest x 100 (e.g., 3 for .03 or 3%)

CR = Credited Rate of interest x 100

SCFac = Surrender Charge Factor = 1

SC% = Surrender Charge Percent = 1 - (CSV(t)/AV(t))

Sensitivity: SCFac = 0.5

### **Sensitivity Results**

Sensitivity test results are shown in Row 2 of Table 5, showing results when the surrender charge factor in the policyholder behavior formula was reduced by half. This sensitivity works to increase additional lapses by reducing the protective value of the surrender charge. This does not impact the U1000 scenario because additional lapse results of baseline assumptions have already breached the 20 percent cap.

### **Stochastic Results**

The stochastic analysis used the subset of 1,000 scenarios generated from the NAIC ESG v7.1 with a Dec. 31, 2013 valuation date. Table 6 provides the PVDE metric for the distribution of the stochastic results, and Chart 31 shows the relationship between stochastic and deterministic results. The distribution of stochastic results is very narrow, particularly in the upper half of the distribution. Results in Table 6 are normalized to the Level scenario under baseline assumptions.

		Value
		ESG v7.1 (1,000)
Percentile	10 <sup>th</sup>	76
	25 <sup>th</sup>	87
	50 <sup>th</sup>	93
	75 <sup>th</sup>	97
	90 <sup>th</sup>	99
	Minimum	49
	Maximum	102
	Mean	90
	Median	93
	CTE90	68

Table 6

What is interesting to review is where the eight deterministic scenarios are on the distribution of the set of 1,000 scenarios. There is little additional up-side in the stochastic scenarios beyond the Level scenario. The best results tend to come from those that are stable or increase only mildly. Interest scenarios that increase materially will experience additional lapsation and a resulting reduction in the account values, which is a source for profit. This UL block is profitable in all scenarios tested: more profitable under stable interest scenarios, less so under scenarios with increasing tendencies. The stochastic scenarios do not “spike” as quickly as some of the deterministic scenarios so results are not as drastic.

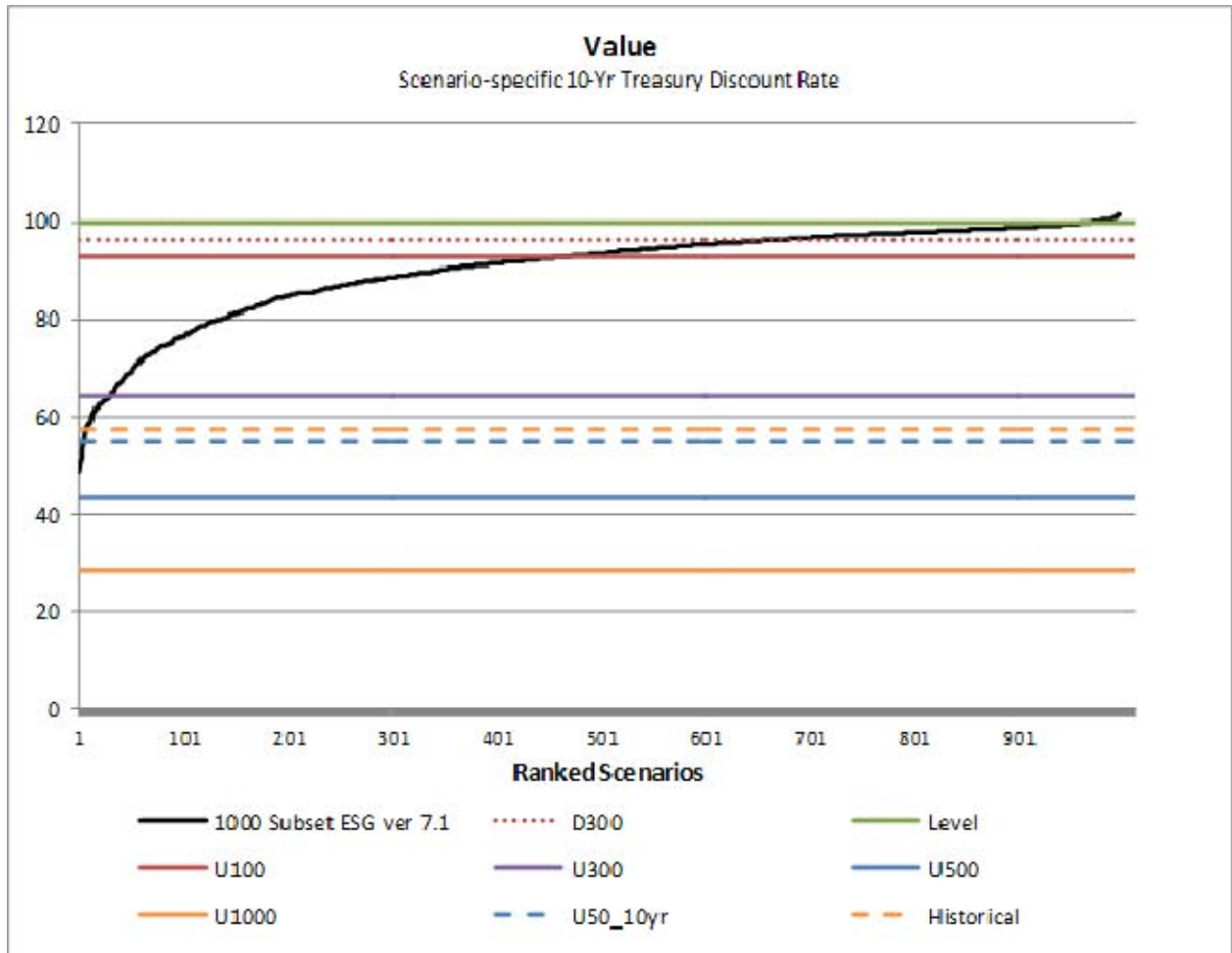


Chart 31

### Universal Life with Secondary Guarantee (ULSG)

The ULSG product is a shadow account product, guaranteeing continuing insurance coverage when paying a premium that supports the shadow account value. The secondary guarantee provision is structured as a single shadow account. Statutory reserves are defined by Model 830 and Actuarial Guideline XXXVIII. Baseline assumptions for this product do not include dynamic

policyholder behavior. Therefore there are no additional lapses beyond the baseline assumption. As a result, the number of policies in force is consistent between scenarios. Despite being a life insurance product having an account value with interest credits, there is no optionality in these ULSG liability cash flows. The liability cash flows do not depend on investment results. In theory, the asset portfolio could be managed separately from liabilities, a fairly unusual condition for long duration life insurance.

The cash flow pattern for the ULSG block is shown in Chart 32. It shows the importance of managing interest rate risk for this product since premiums must be invested to pay for future death benefits, expenses and commissions. The matching of premiums and disbursements was much better in the UL product, so getting it wrong for ULSG has greater ramifications. The product has material cash flows in later periods, even beyond the 30-year period used in the PVDE metric.

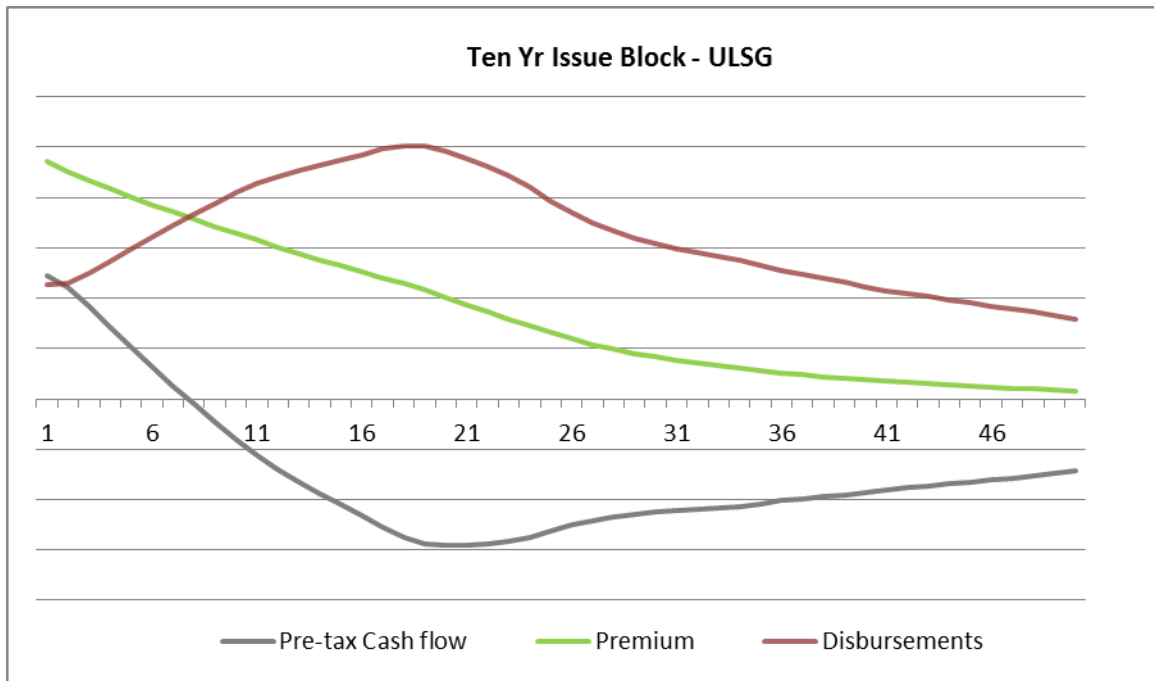


Chart 32

## Results

Note: Results presented are normalized to the Level scenario. In this case the result is -100 as the PVDE for the Level scenario is negative.

	Value							
	D300	Level	U100	U300	U500	U1000	U50_10yr	Historical
1) Baseline Assumptions	-468	-100	-35	46	86	94	43	-10

Table 7

Premium payment behavior does not change by scenario. The policyholder benefit requirements for the ULSG policies are constant across scenarios. What changes between scenarios is the proportion of policies “in-the-money,” where account value is \$0 while the secondary guarantee provision keeps the policy in force. Somewhere between U100 and U300, the portfolio is able to support the cash demands of the insurance block as well as provide a high enough credited rate to minimize the number of contracts that go in-the-money on the secondary guarantee. Table 8 provides the account value growth across the scenarios. Secondary guarantee account values remain the same across all scenarios because charges, loads and credited interest remain unchanged across interest environments. Growth in the account value does vary by scenario, and higher profitability follows in increasing scenarios. Higher assets under management (AUM) lead to higher profit from mortality (no mortality charge is collected when the policy is in-the-money) and interest spread. When account values grow large enough, tax defined corridors kick in to raise face amounts.

Projection Year	Projected Account Value as Percent of Initial							
	D300	Level	U100	U300	U500	U1000	U50_10yr	Historical
Year 0	100%	100%	100%	100%	100%	100%	100%	100%
Year 5	130%	136%	138%	142%	146%	157%	138%	137%
Year 10	102%	116%	123%	137%	152%	200%	128%	131%
Year 20	49%	69%	82%	116%	164%	393%	118%	99%
Year 30	23%	42%	62%	127%	242%	1060%	163%	66%

Table 8

## Stochastic Results

The stochastic analysis used the subset of 1,000 scenarios generated from the NAIC ESG v7.1 with a Dec. 31, 2013 valuation date. Table 9 and Chart 33 depict the PVDE results from the eight deterministic scenarios in relation to the distribution of 1,000 PVDE outcomes.

What is interesting to review is where the eight deterministic scenarios are on the distribution of the set of 1,000 scenarios. The slow upward bias of the ESG v7.1 is evident in that the U100, U300 and U50\_10Yr represent data points in the upper portion of the distribution. The D300 deterministic scenario is the only one that falls below the lower tail of the distribution and is not included on the graph.

U500 and U1000 lie above the upper tail of the distribution. If this product design is indicative of ULSG policies sold in recent years, it is clear the product should be redesigned for current and expected future interest environments. Companies that sell this product should analyze and understand the range of results possible.

		Value
		ESG v7.1 (1,000)
Percentile	10 <sup>th</sup>	-150
	25 <sup>th</sup>	-124
	50 <sup>th</sup>	-96
	75 <sup>th</sup>	-67
	90 <sup>th</sup>	-40
	Minimum	-238
	Maximum	51
	Mean	-96
	CTE90	-172

Table 9

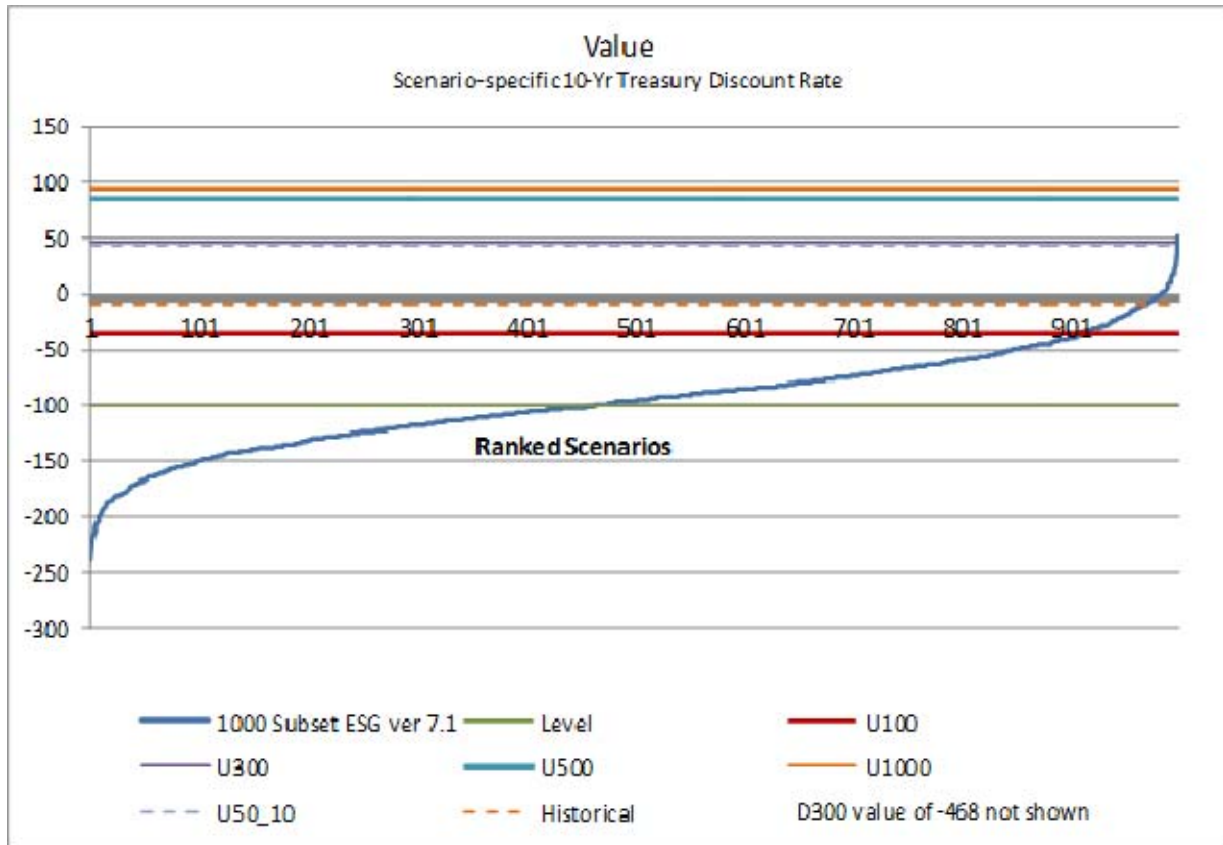


Chart 33

Chart 33 makes clear a nuanced result for ULSG. Most of the deterministic scenarios move once and then are level. The other two, U50\_10Yr and Historical, reflect higher rates than the initial yield curve. On the other hand, the stochastic scenarios reflect some of the volatility found in the real world. In other words, there are roughly as many scenarios that move lower than the initial starting point as move higher than the initial starting point. The ULSG product has low account values early on and is susceptible to going in-the-money for those stochastic scenarios that move lower than the initial starting point. Any rate reductions in the early projection periods erase existing account value. Even if rates rise, the account value may not grow materially due to increasing cost of insurance rates.

Relative to other insurance products, the ULSG product has unique characteristics that make its return profile more like a derivative instrument that pays off only when interest rates rise. The stochastic scenario results for ULSG are influenced by the volatility of interest rates. These characteristics may be the result of competitive pressures, or simply because companies are consciously betting on higher interest rates.



## **5. Section Conclusion**

In this section the paper considered practices a life insurer might use to test typical products in a model office. Using a PVDE metric over 30 years, eight deterministic and 1,000 stochastic scenarios were compiled for sample in-force blocks of deferred annuities, UL and ULSG products. The deterministic scenarios show graphically how much information about interest rate exposure can be discovered with minimal effort, and how the modeler can leverage regulatory work already being done.

Deferred annuities exhibit optionality when rates move in either direction. UL shows relatively stable profit across the interest rate scenarios tested. Future profitability of ULSG is very sensitive to interest rate movements. Each product has unique cash flow characteristics, so understanding the impacts of aggregation using actual block sizes should help the management team match expectations against a stated risk appetite. In the next section the paper will discuss the impact on financial institutions, with an emphasis on life insurers in the United States.

## ***H. Impact on Financial Institutions***

### **1. General Considerations in a Rising Rate Environment**

When interest rates are rising, the impact on insurance products depends on how fast the changes occur and how the insurer and policyholder react. While decreasing rates from current levels are consistently bad for any insurance product with an interest rate guarantee, options are more diverse for increasing rates. From the relatively low interest rate environment of 2015, rising rates are generally a positive event for insurers and their clients until new money rates are high enough to allow policyholders to get a higher rate elsewhere by surrendering the policy or for capital losses to impact an insurer's financial results. The slow up scenario tends to be the best case, with spikes in rates a potential solvency event that develops very quickly. Resiliency is the key to survival, and having a game plan in advance will help.

### **2. Notional Segmentation**

Insurance companies typically segment their general account based on characteristics such as investment strategy or product design. This is done on a notional basis, allowing all GA assets to legally support all product lines, rather than be segmented into separate accounts where the assets are contractually limited to support just those liabilities. Companies have options for creating these segments: based on duration, splitting them into asset portfolios that are short, medium and long; based on product designs requiring varying levels of liquidity; or choosing to accept additional credit or other risk to enhance returns. Large blocks of liabilities often have their own notional segment. Segments can't be shared across legal entities, which can create an issue for single state subsidiaries lacking economies of scale.

This structure allows policies to use the portfolio method of earned interest, where all investment earnings are shared, or the investment year method (IYM) where buckets are created based on when the cash flow was received and directly tied to assets purchased with those cash flows. Buckets can be created monthly or annually, depending on size and desired complexity. Given enough time all the assets in a portfolio will roll over and be reinvested, so often (but not always) the IYM buckets will aggregate over time into a portfolio rate. Sometimes this occurs as quickly as one year, but more typical is five to 10 years, reflecting principal and interest received from the original asset purchases.

Insurers who use a portfolio rate to price their products have had an advantage over an IYM new money process while rates were falling since new money earned rates have been lower than earned by assets purchased earlier. This advantage is cyclical, so flips when rates rise and new money products take market share from portfolio-driven offerings. This cycle can last many years and tilts the competitive landscape in unintended ways. When rates are low and expected to increase, consumers may view participating products more favorably, especially those that create new segments, since they expect to share in the higher returns. This is similar to a universal life (UL) product strategy, with the winning product more likely driven by marketing considerations.

### **3. Reinsurance**

Many insurance products are reinsured, and there are many variations to the simplified concepts described here. Yearly renewable term (YRT) contracts mitigate the excess claim risk (e.g., mortality, morbidity, casualty risk), while coinsurance shares the entire risk with the reinsurer as a proportion of the total risk. This includes investment and ALM risk. The assets may be held by the direct writing company or the reinsurer. The current reinsurance market is heavily weighted toward YRT products, but there is a lot of legacy coinsurance still on the books. While a run-on-the-bank scenario would primarily impact coinsurance treaties, all treaties would be impacted somewhat by higher lapsation as profitability targets would not be met.

Sharing a risk does not absolve the direct writer of the obligation to the policyholder due to counterparty risk. If the reinsurer is unable to pay, the direct writer remains responsible for any claims to the insureds. Financial reinsurance can provide temporary relief, while captives and offshore reinsurance often provide risk efficiencies. Many of the risks associated with rising interest rate scenarios apply to reinsurers as well, since it is a systematic risk not reduced by the law of large numbers. The primary risk in a rising interest rate environment is a run-on-the-bank-type scenario on coinsured policies where rates spike and/or trust is lost in the insurance industry. The impact on asset values may be greater than the economic risk since bids for assets that must be sold to meet liability needs will often have a haircut. The sharks will circle, looking for undervalued assets that *must* be sold. It becomes a liquidity problem for the seller. This can be offset by contractual provisions and other delaying tactics, available to all insurers, providing time to sell assets in a more orderly manner. Direct writers should seek more transparency from their reinsurers and monitor the global systemically important financial institution discussions.

Reinsurers with modified coinsurance treaties (funds withheld) may be at risk from the direct writer's investment results since assets are held by the contract originator with no input from the reinsurer. There is also risk to reinsurers from the interactions between them due to retrocessions and entangled ownership. If one reinsurer has a problem there is contagion risk, both among reinsurers and direct writers. A solvency issue at a direct writer might impact other contracts between the same parties but would likely have less impact on the insurance community.

#### **4. Insurance Products**

Rising interest rates generate disintermediation risk for insurers, particularly for products with policyholder liquidity options. Insurers have various tools to discourage lapses, but most products gradually become as accessible as a checking account. General account insurance products renewing annually face a risk during inflationary periods that they can't achieve regulatory approval of rate hikes in a timely manner. Rising interest rates are generally favorable for insurance products with long-tailed liabilities such as accumulation life and annuity products, payout annuities and long-term care (LTC). But when rates move quickly up, incentives shift and policyholders have good reasons to look at their options. They are essentially free agents, and can sell their funds to the highest bidder. This is less true when underwriting enters the process, as mortality and morbidity expectations of the policyholder may have worsened since the original issue date of the policy. This makes the original policy less likely to lapse.

Insurance in the United States is regulated primarily by the states using statutory accounting practices. These focus on solvency and tend to be more conservative than U.S. GAAP accounting, which focuses on the ongoing nature of a business and the income statement. For example, statutory accounting generally requires immediate expensing of acquisition costs, while U.S. GAAP requires deferral and amortization based on exposure or profitability. Analysis of insurance products sold in a low rate environment should review the underlying cash flows and understand the intended and actual accounting treatment. Many of the tools used to manage interest rate risk, such as duration, ignore the accounting treatment and look only at the true cash flows. Product management is complicated when assets are sold before maturity. At that point they incur a capital gain or loss, which is immediately reflected in income statements (both GAAP and statutory). This is inconsistent with a buy-and-hold strategy that is assumed for most crediting strategies, so some smoothing of the capital gains may be necessary.

Nominal interest rate guarantees are dependent on macroeconomic factors outside the control of insurers. An insurer's earned rate combines the risk-free rate, inflation, and a spread for risks such as credit and liquidity. If Treasury rates dip below zero, insurers should look at the components of these yields to develop products that make sense. Currently guaranteed rates consider only nominal yields. Insurers should be proactive with the National Association of Insurance Commissioners (NAIC) and other stakeholders, perhaps using real rather than nominal rates or allowing guarantees to reflect actual investment earnings. If interest rates rise this is less of an issue if cash flows from the assets and liabilities are closely matched.

## **a. Life Insurance**

Life insurance products can be divided between those that primarily provide mortality protection and those that also have a savings component. As regulated in the United States, life insurance contracts have interest rate floors for determining appropriate reserve levels and accumulating cash values for accumulation products. For statutory accounting purposes, these floors are set by year of issue and apply for the lifetime of the policy. Aggregate reserves are tested for adequacy each year through cash flow testing regulations, and capital requirements vary with the underlying risk exposures. Many life and especially annuity direct writers have posted additional reserves due to the current low interest rate environment.

Assets that typically back general account life insurance products include fixed income asset classes like investment grade bonds, commercial mortgages and securitized assets. The cash flows behind these assets are compared to the expected liability cash flows. Accounting practices often focus on book value or purchase price rather than metrics incorporating market value consistently for both assets and liabilities (in some cases the assets adjust to market value while the liabilities don't change). If the cash flows are perfectly matched, then a market value analysis will show no volatility since both assets and liabilities adjust in the same amount and direction as interest rates change. When assets are "shorter" than liabilities, either by choice or because available assets have shorter cash flow streams than liabilities, they need to be reinvested in the future. This introduces a risk often not considered at issue, and can result in shortfalls if rates fall or excess cash inflows if rates rise above what was expected at issue.

A firm may focus on being duration matched, but effective duration is a first-order measure and ignores all but small instantaneous changes. For assets and liabilities typically found on an insurance balance sheet, this is insufficient due to the optionality reflected by convexity and other higher-order metrics. Any variance from a perfect match reflects basis risk, resulting in an imperfect hedge. This may be a conscious bet or, more likely, an unintended consequence. In normal times small variances tend to offset, but periods of stress lead to contagion and unintended results tend to compound. The recent period of low interest rates, driven in part by government policy, is likely to result in surprises as the process is unwound. Of greater risk for life insurance products are spikes in interest rates or continued very low rates below those needed to support the minimal investment needs of the product.

### ***Protection Products (e.g., Term Life and ULSG)***

At one time, individual term life was primarily annually renewable term (ART). Some used the product to "buy term and invest the difference." Term life is sold in both the individual and group markets. Originally, the ART product was not very interest-sensitive and could be invested with a short-duration target. However, today's term life includes policies designed to be in force with level premiums for five, 10, or 20 years, even to age 65. These products act much more like whole life products to the policyholder as the maturity period extends and the assets are often

commingled. These products are generally referred to as level term. If they include a return of premium (ROP) feature they may include cash values. These ROP features have risks of a run on the bank similar to other cash value products. Companies with financing situations for their term products (letters of credit, captives, parental guarantees) may find that costs for the financing increase as volatility and interest rates rise.

UL products may include a no-lapse guarantee if a specified premium is paid, or a shadow account remains positive, and are then referred to as secondary guarantee universal life (SGUL, or ULSG). They are very sensitive to changes in interest rates since there is no repricing after issue, with reserves and shadow account interest rates making the guarantee more expensive. Decreases in rates from expectations directly lower profits, and increases in rates directly add to profits. This product is discussed further in the Model Office section of this paper. Future iterations of these products developed in a volatile interest rate environment might have shorter guarantee periods or a guarantee that rolls over and resets every few years based on the investment strategy. Companies with policies using this product design need tight controls on pricing and product management. Frequent repricing is necessary in a volatile interest rate environment due to profitability and competitive reasons. ULSG profitability is very dependent on interest rates and has a risk/return profile similar to a derivative in certain environments.

Protection products are not likely to experience dramatic increases in lapses due to a spike in interest rates. Policyholders will avoid another round of underwriting if their health has deteriorated, making it hard for them to chase the gain from interest rates. Insurers using portfolio yields will not be able to price new products to improve competitiveness until the portfolio earned rate catches up to the new money rate.

### ***Whole Life Insurance***

Included in this subset of life products are fixed premium contracts that pre-fund and build up a cash surrender value. Some collect premiums until death while others have limited payment periods for a specific number of years or to a certain age. Premiums and cash value buildup are defined at issue. Participating policies collect higher premiums and return redundancies as dividends, with interest, or provide additional insurance benefits. As experience is often better than conservative expectations for both mortality and interest, the additional value built up over time as cash (paid out, reduced premiums or held on deposit) or additional paid-up insurance can be a significant benefit to the policyholder. Blocks of whole life policies are invested with long-duration targets, so a spike in rates will take time for the portfolio earned rate to catch up to new money rates.

A policyholder has the option to surrender the policy and get the higher new money rates immediately, but is unlikely to do so for a couple of reasons. They must undergo fresh underwriting, and may not be in the same mortality rating class as when the original policy was issued. A UL policy using a new money crediting methodology would have a competitive

advantage in a rising interest rate scenario, for the same reasons portfolio yield products have had an advantage while yields were falling.

Regulators should proactively decide how they will deal with this situation now. Portfolio yield companies have told them for years that this strategy was not subsidization of new policyholders by existing clients because they would use the portfolio strategy throughout the entire interest rate cycle.

### ***Universal Life Insurance***

Universal life insurance comes in a variety of forms, some backed by the general account of an insurer and some by separate accounts. In a general account product the insurer takes the risk that investment earnings will be less than the amount guaranteed to the policyholder, while a basic variable universal life (VUL) “passes through” most of that risk to the policyholder in a separate account product. Most companies with general account UL policies utilize notional segmentation and buckets, where specific assets “back” specific liabilities to better match characteristics of each. This often reflects target durations of intermediate length portfolios. As product reserves increase, specific portfolios are sometimes created for a specific product line.

UL insurance was an industry response to those who planned to “buy term and invest the difference” when interest rates spiked in the late 1970s, triggering the last generation of product mix changes toward investment performance. It provides underlying interest rate guarantees but also promises to pass along any higher investment earnings (leading to volatile effective duration results when cost of insurance factors are applied to a lower net amount at risk). Guaranteed credited interest rates are defined by the year of policy issue. Margins are managed for interest, mortality and expense, but since expense charges are generally low, profit and expense margins (along with cost of capital charges driven by risk) come primarily from the interest and mortality components. The mortality charge is based on current age and is applied against the net amount at risk (the face amount net of the tax-deferred buildup of account value). Premiums received after issue and asset rollovers may earn investment income based on a new money rate, and companies use various strategies to grade to a portfolio credited rate. This is a case where very complex methods may be theoretically correct, but small bucket sizes can lead to assets assigned that are not representative of all assets purchased during that period (based on the earned rate, risk and liquidity).

Managers of a UL block should consider potential discontinuities between investment strategy and margin development. In order to minimize the impact of initial cash investments by an insurer, the statutory reserve is lower than the amount collected when a policy is issued. The new policyholder gets a report where the amount collected appears to be held in a personal account. This is often called the cash accumulation value. If policyholders were to surrender the policy they would receive the cash surrender value, netting out a surrender charge in the early years (generally grading off over 15-20 years) of the contract. Expenses related to issue and selling

commissions generally combine at a level higher than the premium collected. In addition, capital must be set aside to support the policy (this is true for all insurance policies). This means that phantom interest is being credited on policies from money that has not actually been invested, muddying the view most have of the UL product being a spread business. A pure spread business would have an identical level of assets and liabilities, with the spread being the difference between the rate earned and the rate credited. In this case the earned rate is higher than the credited rate but applies to a smaller base of assets. Discontinuities appear when companies credit the actual investment earnings on the smaller reserves, making it harder to align incentives with product managers using spread metrics for compensation. This makes an ALM strategy much harder to analyze. Additional time should be spent on this type of product, looking at various accounting (statutory and GAAP) and cash flow measures.

When interest rates rise quickly, some companies increase the credited rate more quickly than the portfolio rate (decreasing the spread) to conserve the policyholder. However, when rates rise slowly, companies will tend to increase the credited rate more slowly than the portfolio rate to increase the spread with the expectation of minimal excess lapses.

### ***Variable Life Insurance***

When assets are legally segmented from the general account in what is called a separate account, they back only those policies. The company borrows money (generally from its own surplus) to pay excess initial expenses, avoiding the basis risk that would come with not being invested in equities during a market that is advancing. Some of these products offer high fixed rate bucket guarantees and could be selected against, especially as insureds get older and seek lower volatility or see their fund balances shrink as equities drop.

### **b. Annuities**

The annuity market consists of policies designed to accumulate savings and/or distribute savings and protect against longevity risk. A majority of these policies are issued based on retirement planning by individuals, but there is also a group market and other needs served by annuities. In addition to interest rate risk, insurers accept credit risk, longevity risk, persistency risk and ALM risk with these products. Deferred annuities have components for accumulation and are required to distribute balances at older ages. Payout annuities simply pay out a periodic amount that is contractually stipulated at time of issue, although it can vary based on an index such as the consumer price index (CPI) that measures inflation or grows at a fixed rate.

### ***Individual Deferred Annuities***

Deferred annuities compete with products like certificates of deposit sold by banks. Credited rates generally vary with underlying assets, especially for single premium deposits sold in a competitive marketplace. Some reset based on current interest rates every three to five years, with surrender charges resetting at that time after a short window with free surrender, allowing

them to be shopped, while others adjust credited rates each year. Surrenders react to the current level of interest rates. If rates available in the market are higher than is being credited, surrenders will exceed an underlying base rate driven by years since issue and surrender charge or market value adjustment. This dynamic lapse effect is similar to the sensitivity borrowers apply to home mortgages (as rates drop) and is dampened by surrender charges. Contractually the products are required to have a payout phase, but generally if the policyholder wants a payout annuity the product is shopped for the best rate at that time. Taxes are deferred through inside buildup features and paid when the contract is surrendered or annuitized. Policies have interest rate floor guarantees. Currently this rate floats down to 1 percent based on issue date, but mature policies continue at higher credited rates and guarantees based on the original issue year and policy design. Astute policyholders will maintain these higher-yielding policies as long as possible and long-term lapse rates will be lower than expected when priced.

Investing for a deferred annuity can be tricky since its characteristics change over time. At issue the policyholder has five to 10 years of surrender charges and is unlikely to surrender during that time, but after that there is little difference in liquidity between a deferred annuity and a checking account except the annuity credits more interest (especially with guarantees). This creates a problem for the insurer who did not price for this difference. When interest rates stay low for a prolonged period it becomes harder to meet required spreads, and the portfolio rate becomes too low to support the guarantees. Some countries have allowed companies to proactively lower guaranteed rates due to the low current environment.

For increasing interest rates the risk is disintermediation, where policyholders accept a better deal elsewhere and surrender their policy. These excess lapses require assets to be sold to meet cash flow needs. Since rates have risen in this scenario, capital losses are usually realized. This has statutory implications, but for GAAP income the capital loss and deferred acquisition costs expected to be released over the profit lifetime must all be released immediately at surrender. It can be very stressful for an insurance company, but if it survives the initial test of solvency the company can effectively start over in a higher interest rate environment. The industry might see new entrants as interest rates rise and existing insurers are crippled and unable to accept new business. If an insurer has been declared a SIFI there will be additional implications and regulatory requirements.

### ***Immediate (Payout) Annuities***

Payout annuities have both interest rate risk through asset reinvestments and longevity mortality risk. Durations of these liabilities are longer than available assets. If interest rates drop after issue, then future rollovers must be invested at lower rates than were priced for. For payout annuities these inflows are tied entirely to reinvestments of investment income and capital since there are no future premiums. Payout annuities are long-duration products designed to prosper under periods of level, rising or cyclical interest rates, so a long period of low interest rates impacts results negatively. Reduced mortality is another risk, as payouts are generally life-



contingent (statutory reserves for defined-benefit retirement plans recently updated the required mortality table to one with extended lifetimes). Another risk for some products in this line is inflation risk, as some have a cost-of-living allowance (COLA) that is fixed or driven by the CPI. A fixed 3 percent growth rate guarantee in a low interest rate environment and reduced mortality could be disastrous if this is a core product with large exposure for the company. Although generally increasing interest rates are a positive event for payout annuities, if the product includes a COLA with no ceiling there could be shortfalls in cash flows and income. Structured settlement products that satisfy court judgments often have extremely long durations, paying out over many decades. Conservative assumptions should be used. An alternative product design could include a participating feature.

### ***Group Annuities***

Group annuities come in several forms. Some are payout annuities sold to employers to settle their post-retirement obligation. These liabilities create a challenge for asset managers as the duration is longer than is generally available in standard asset classes. They can be guaranteed investment contracts (GICs), paying to an institutional investor (e.g., 401(k) short account) either simple or compound interest, fixed rate or floating, over a stated period such as one, three or five years. Liabilities are often sold after the assets are purchased. GICs, or funding agreements, are often nearly perfectly matched if there are no prepayment features such as the ones that were problematic for General American in 2000. The General American product had a seven-day put option that was widely exercised after it experienced a reduction in its rating. If a floating rate funding agreement were put (returned) back to the insurer they would be forced to either sell the asset or create a new liability to meet the immediate liquidity need. Inflows can provide cash for outflows, especially in a crunch. This would also be an option if a company experienced a run on the bank, selling new business to provide cash for surrendering policies rather than auctioning assets at fire sale prices. This provides flexibility for liquidity but could have longer-term negative repercussions on income.

### ***Variable Annuities***

As with all insurance products, descriptions in this section are very high-level and designed to provide a general understanding of the risks in the product but not to understand the risk in-depth. Variable annuities in particular can be very complex. They serve as a kind of insurance wrapper around mutual funds, with the insurer often offering riders guaranteeing certain returns upon death or withdrawal. These guarantees are worth more when interest rates are low and equity volatility is high. In a simple example, consider a variable annuity holding general account reserves for a death benefit that is in the money (worth more dead than alive to the policyholder's heirs). A simple form of term insurance is used to value the option. This reserve can be very volatile as it reflects the equity markets as well as a discount rate. Newer forms of this product pass through the risk to the policyholder using mutual funds that hold the options rather than applying a wrapper. So-called living benefits guarantee returns as long as

withdrawals are taken over a lifetime or at least over several years (e.g., seven). Insurers have adopted product feature changes that limit choices for policyholders. For example, some force in-the-money contracts into specific asset mixes (e.g., into bonds and out of equities) or limit additional deposits. These constraints reduce current option costs but may not minimize costs in the long run as it becomes harder to return to out-of-the-money status.

### **c. Indexed Products**

Both life and annuity products are offered providing returns tied to an index (usually equity or bond) rather than a general account portfolio. In an indexed product the policyholder is charged a fee to be credited interest based on the index, with losses limited and gains capped. It is an attempt to provide an equity-like return to someone with a low risk tolerance. The product does not require Securities and Exchange Commission (SEC) licensing and so is an opportunity for an insurance agent to sell an equity-like product. This product works well in a liquid market with falling interest rates and low volatility. Basis risk must be managed closely so accepted risks are known and profits are not volatile. The participation rate of the derivative and determining the returns to the policy both depend on volatility. A concern is that the recent period of low volatility has allowed for arguably higher illustrated future returns. Rising rates and volatility could cause companies and consumers to look at this product in a new light, and insurers should look at the potential risks across various long- and short-term scenarios.

### **d. Property/Casualty Insurance**

Property risks (e.g., home and auto) usually cover a single year's exposure (longer-term run-outs for casualty exposures use ALM strategies), and are repriced annually using the expected combined ratio (loss ratio plus expense ratio). Interest rates interact with the combined ratio in the pricing process to earn a specific total return. If interest rates are high then the combined ratio allowing the same overall returns can be higher. On the other hand, if rates are low and there is little contribution to profit from investments, then premiums will have to be higher (to lower the combined ratio) to earn a similar return. This increases premiums to clients, but with no long-term guarantees embedded in the pricing rates solvency is not threatened.

Property insurers are more likely to invest independently from their short-duration liabilities. Premiums provide much of the cash flow needed to pay out claims and expenses. Since the policy lapses if premiums are not paid, this provides a very strong match to liability cash flow needs. The insurer can flexibly invest any reserves and capital (float) to include (for example) selectively adding volatility (stocks), interest rate risk (going out on the yield curve) or liquidity risk (investing in non-liquid alternative asset classes).

In a low interest rate environment, casualty insurers must rely on underwriting results to drive profits. Technology, such as the use of telematics (i.e., wireless computing used to monitor

actual driving practices), can be used to create a better match of risk and premium that helps offset lower investment income.

Property/casualty risk can provide diversification benefits to external investors, making cat bonds popular. This provides insurers with a reinsurance alternative to lay off risk and free up capital. As modeling software is consolidated across life and casualty practices, best practice casualty insurers can consider ALM strategies to better match assets and liabilities while also reaching for yield.<sup>66</sup>

#### **e. Health Insurance**

Health insurance is much like casualty insurance as it relates to interest rates for most of the products sold. Only pre-funded policies like LTC and disability income (DI) have material interest rate risk components. Others are driven by age, type of illness, and disease or injury onset.

##### ***Major Medical Insurance***

Social insurance is generally run by the government as a pay-as-you-go health system. In the United States this would include Medicare and Medicaid. In a private health care system, a major medical policy collects premiums to pay current year claims. It is annually renewable, and must cover expenses and commissions as well. Reserves are set up for short-term timing differences between premium collection and claim payout, and for major illnesses that may pay out over multiple years without additional premiums collected. Policies are generally issued to working-age members of the population, with spouses and children also generally covered. Individual policies are evolving as the Affordable Care Act is implemented, but the general characteristics are similar to the group product. Many health insurers outsource their investment function and have a short-duration, high-credit-quality, strategy.

##### ***Medicare Supplement Insurance***

In the United States, Medicare Supplement (Medigap) lines of business are similar to major medical for purposes of setting an investment policy. They are add-on policies covering deductibles and coinsurance payments for Medicare policies covering individuals aged 65 and over. Low interest rates have little impact. The investment strategy is slightly shorter than major medical due to the older age of the policyholders. At an insurer with both major medical and Medicare Supplement product lines, assets will generally be combined into a short- or intermediate-duration portfolio. The future premiums can be treated as an asset when setting investment strategies.

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<sup>66</sup> Kandell, Jonathan. Insurers Retool Their Businesses to Adjust to Low Interest Rates. *Institutional Investor*. Oct. 21, 2013.

### ***Disability Income Insurance***

Group and individual DI insurance policies pay insureds a percentage of salary when they are unable to work due to accident or illness. An active life reserve is set up to anticipate future claims and a disabled life reserve is held for those currently on claim. Group policies are issued to most employees, so they tend to have a younger average age than individual policies. From an ALM standpoint, this line of business tends to have intermediate cash flow needs. Historically there has been concern about high claims during an economic downturn, and certain professions have proven to be difficult to underwrite. From an interest rate perspective, the policy has more value to the consumer when interest rates are low.

### ***Long-Term Care Insurance***

LTC insurance was designed to provide protection from lengthy medical care needs of the elderly in their retirement years. This product was designed to be funded by level premiums, similar to a whole life product, with significant contribution to the net cash flows from investment returns. Increases in longevity, combined with increases in medical care costs and a decrease in portfolio yields, have all put downward pressure on the product's profitability. Rate increases are an option for management to offset some of the downward pressures to income as premiums are not fixed at issue.

Since premiums are often collected for 10 to 20 years from issue before claims typically occur, the ability to predict and immunize against the risks facing the insurer is limited. Specifically, the claims experience and portfolio returns are risks that have proven difficult to predict and actively manage on an in-force block of business.

Interestingly, for someone buying this product today, when interest rates are low, a spike in interest rates would increase consumer cost but possibly not increase the claim benefit for a basic policy with no inflation protection. LTC is pre-funded, so it makes sense to segregate the premium asset from the liability cash flows for all duration metrics.

## **f. Pensions**

Many insurers have offered defined-benefit (DB) benefits to employees at some point, and may also sell DB management to clients, either for individuals at retirement or for firms wishing to reduce or eliminate their exposure to the risks of a retirement plan.

DB pensions have historically been held by employers as off-balance-sheet liabilities. Unfortunately, this has made them less transparent and more easily manipulated by creative financiers. Valuation formulas have not been designed to match up with the economic present value of the liabilities. Historically, most of the assets held were equities, which do not match up well with liability cash flows due to high volatility. After the tech crash and the Great Recession, pension managers have moved toward liability-driven investing. This is a new name for ALM with a focus on matching bonds to liabilities using duration and convexity metrics. Even with

this goal it is common for assets to be shorter than liabilities. When interest rates are low, and stay low, this leads to increased pension valuations and higher contribution rates. Some pension managers have utilized alternative asset classes, increasing volatility while buying everything from real estate investment trusts (REITs) to timber and hedge funds, to increase returns.

It is very hard to invest asset portfolios long enough to match pension DB liabilities using duration-type metrics, and updated mortality tables reflect higher longevity and correspond with even longer durations for the liabilities. Many companies, including some insurers (e.g., CNA, Mutual of Omaha) have offered to buy out former employees' DB plans with a lump sum, reflecting these concerns. Another tool is to match cash flows for 15 to 20 years and manage the remaining assets to maximize total return.

## 5. Asset Class Review

According to a May 2013 ING Investment Management (ING IM) survey, asset managers in the U.K. were expecting to diversify into a number of alternative investment classes, including infrastructure, equities, emerging market securities and commercial loans, with reductions in sovereign and corporate debt. According to Jelle van der Giessen, deputy chief investment officer at ING IM, "With low interest rates the income is not sufficient to make the returns insurers are looking for."<sup>67</sup>

Asset bubbles occur, by definition, when their market value decouples from intrinsic value, measured using first-principle fundamentals. Sometimes a single asset rides a wave of popularity, sometimes it is an entire asset class (e.g., technology stocks in the late 1990s), and sometimes it extends to the entire market as we saw leading up to 2008. Much like the analogy to a balloon, rare is the situation where a bubble deflates slowly. Generally it pops and quickly deflates, often reversing direction past where its intrinsic value lies. Situations like that end up as behavioral finance case studies of crowd behavior and herd mentality.

What follows is an overview of various asset classes and is not meant to cover all aspects of each offering.

### a. Bonds

A bond is a promise to pay back principal combined with a schedule of coupon payments. As with any series of cash flows, a higher discount rate results in lower asset values. Since the inflationary spike in 1980 above 13 percent, the drop, while not continuous, has been steady. Recent risk-free interest rates in the United States have been below 2 percent and some rates in other nations have moved into negative territory. Rising rates lead to a drop in intrinsic value, and likely the market value would also fall. A bond issued by a sovereign government like the

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<sup>67</sup> Irrera, Anna. Chart of the Day: Insurers eye infra. *Financial News*. May 30, 2013. <http://www.efinancialnews.com/story/2013-05-29/insurers-to-increase-investment-in-infrastructure>

United States has historically been considered free of default risk (less so recently as high sovereign debt levels have driven ratings downgrades) and would trade at the risk-free rate for the appropriate maturity. Bonds issued by corporations also carry default and liquidity risk and so pay a higher coupon. Some bonds grant options to the borrower and/or lender, with higher/lower yields. Longer maturity bonds are more sensitive to interest rates as noted by their higher duration metric, due to the time value of money and preferences for shorter repayment schedules.

### ***Call Features***

A basic bond is non-callable. When it adds a call feature, the seller pays a higher coupon rate to offset the issuer's ability to buy the debt back at some point in the future. This mainly occurs when interest rates have fallen and the debt can be reissued at lower rates. When rates rise, the callable feature rarely comes into play, extending the duration and lowering market values.

### ***Below-Investment-Grade (Junk) Bonds***

Companies with higher credit risk are rated below investment grade by the rating agencies and pay a higher coupon rate than higher-rated investment grade bonds to reflect the additional risk. National Association of Insurance Commissioners (NAIC) risk-based capital (RBC) requirements are higher for lower-rated bonds. This is an asset class that tends to overshoot its intrinsic value in both directions as it gains favor or becomes unpopular with investors. These bonds are less susceptible to changes in interest rates because the nominal yield is often much higher than other bonds. They also tend to have shorter maturities than investment grade bonds due to the credit risk, lowering the interest rate risk.

### ***Municipal Bonds***

These bonds, exempt from federal taxes for some buyers, are generally issued by states and local governments. They rely on benefits provided by the tax code, and pay lower coupons due to this tax-favored status. They are less sensitive to changes in interest rates. Recent difficulties in locales such as Harrisburg, Detroit and the state of Illinois have reminded investors that these bonds carry credit risk and are not a homogeneous asset class.

### ***TIPS***

Treasury Inflation-Protected Securities (TIPS) are considered a hedge against future inflation concerns, but they also provide the market's current implied expectations about inflation. By netting the rates in Chart 34 (10-year TIPS) and Chart 1 (10-year Treasury), an estimate for inflation expectations can be calculated. For example, at the end of December 2014 the 10-year CMT was 2.17 percent and the 10-year TIPS was 0.49 percent, so expectations were for inflation of 1.68 percent.



Chart 34<sup>68</sup>

### ***Asset-Backed Securities (ABS)***

When underlying collateral is pooled (combined) into an asset it is referred to as an asset-backed security. This is a broad category that includes residential mortgage-backed securities (RMBS), collateralized debt, loans, credit cards and car loans. Securitized assets may be sold to investors as a proportion of the total block or tranced based on prioritized principal repayments varying with the creditworthiness of the asset. Securitized assets are sometimes combined with other assets of the same type, thinking that diversification and the law of large numbers would apply. As was seen in the recent past, this market can move in unison at times, creating systematic risk. In normal times, defaults and interest rate optionality tend to be the primary drivers of volatility. Capital requirements for insurers are driven by rating.

<sup>68</sup> Data Source: FRED, Federal Reserve Economic Data, Federal Reserve Bank of St. Louis: *10-Year Treasury Inflation-Indexed Security, Constant Maturity*; Board of Governors of the Federal Reserve System; <http://research.stlouisfed.org/fred2/series/DFII10/>; accessed May 4, 2015.

## ***Mortgages/RMBS***

Residential mortgages and complex securitization packages using them were one of the initial drivers of the financial difficulties in 2008. This left many originators of mortgages either out of business or with much tighter underwriting standards. Today's market requires higher credit scores and lower loan-to-value metrics in order to take out a mortgage. Banks must hold higher levels of capital under new regulations. Home values have risen off their lows, but the job market remains tight and many homes remain underwater (worth less than is owed), making long-distance moves due to job changes less likely. The market has returned to one of regional differentiation. Low interest rates have historically been a boon to the home-buying market, and recent increases above what may have been a generational low for home mortgage rates have stirred some buyers to complete their purchases and refinancings.

Refinancings occur when rates fall, and some homeowners whose mortgages are no longer underwater may be candidates now even if they weren't when rates were lower. Home mortgages are generally small enough that institutional investors prefer to invest in securitized assets due to the high cost of servicing the contracts. Scale is definitely important in this market. Even insurers lack economies of scale, and most prefer to buy securitized collections of home mortgages.

When contracts are aggregated they become a mortgage-backed security, and when they are then segmented and principal payments prioritized they become collateralized mortgage obligations (CMOs). This allows investors to buy short-term or long-term mortgage cash flows as desired. They are tranching (prioritized), and principal payments go first to the shortest tranche. Interest rates drive prepayments, but at stable or increasing rates the CMOs tend to lengthen.

## ***Commercial Mortgage-Backed Securities***

Commercial mortgages can be aggregated much like residential mortgages, although they are often large enough for institutional investors to hold individually. Because they reflect borrowing by sophisticated corporations they are thought to be more efficient when exercising any options granted.

### **b. Equities/Preferred Stock**

Stock values are impacted by interest rates through the discounting process and through the impact of rates on debt and profitability of the underlying business. This impacts future earnings. For example, the ability of firms to pass through price increases is important when rates rise. Capital requirements are very high for this asset class. Although relative capital requirements for equities (especially those at companies with high credit ratings backing their bonds) may be too high, it is difficult to develop a methodology that all investors can agree will improve it. Some investors believe markets are efficient, making consistent capital requirements obvious, while others believe that they can identify low-risk (value) stocks or differentiate in other ways.



Research has shown there are some inefficiencies in the market but only the best investors can take advantage of them due to frictional costs (e.g., trading fees).

Preferred stocks provide an alternative to bonds and equities. They are subordinate to bonds and senior to common stocks in the hierarchy of creditors, generally earning a fixed rate. For ALM purposes they act more like a bond but with slightly higher credit risk.

### **c. Derivatives**

As the term implies, these assets are derived from other assets and often have no underlying value. For example, one party might pay another each time an interest rate is above 3 percent or a stock index is above or below a predetermined level. If the instrument is based on interest rates, as many are with swaps (fixed for floating), caps (pay above a fixed rate), floors (pay below a fixed rate) and collars (pay when outside a range), the instrument's value will vary directly with rates when the contract is in the money. Investors often buy derivatives as a hedge, or form of insurance, against a specific risk they wish to cushion. This generally reduces the original risk but increases the counterparty risk. A risk can't be completely transferred, but it can be reduced by working within an exchange or other firms with high ratings. Insurers can pay to mitigate their interest rate risk but, in addition to the cost, the options generally need to be rolled over. This adds a reinvestment risk that the hedge is not available in the future when it is needed due to either specific product or broad market illiquidity (e.g., hyperinflation could lead to no interest rate hedges being available) as well as counterparty risk. Basis risk is created when the hedge is not a perfect match for the liability it is supporting.

### **d. Alternative Asset Classes**

Other asset classes are less dependent on interest rates, with some considered to have rate independence. These include commodities, foreign assets and currency. Each requires expertise not typically found with institutional investors, so it is common to outsource using external investment managers. Fees can be high, sometimes greater than 2 percent of invested assets each year, and investment mandates generally ignore liability characteristics. This makes these assets a better fit for surplus portfolios due to fewer constraints.

## 6. Interactions between Asset Classes

*Most people easily grasp the immediate impact of developments, but few understand the “second-order” consequences ... as well as the third and fourth.*

Howard Marks<sup>69</sup>

Some companies in the past focused on duration matching by engaging in barbell investment strategies—for example, combining a short block of GICs with a long block of payout annuities and backing them with an asset portfolio matching the duration of the overall liabilities. This assumed interest rate risk was linear, ignoring convexity and other higher-order effects.

Generally, as interest rates move away from the initial rates in either direction, the value of the assets net of liabilities (surplus) reduces due to optionality. The best case is often a level scenario (or slowly increasing if rates start off low). Insurers might think they have internally hedged their interest rate risk, matching duration, while in reality they have increased the risk of non-parallel interest rate movements. Regulators should be careful to avoid this oversimplification, including potential cash flows and higher-order metrics. Using multiple tools, such as graphing cash flows in addition to duration metrics, can help the risk manager focus on the actual risks and avoid distractions.

Volatility of results can often be reduced through diversification, accepting exposures from assets and liabilities that act differently at least some of the time as conditions change. A perfect hedge would exactly offset cash flows with no basis risk, but those are rare and would likely eliminate a large percentage of profits. Practical hedges generally look to reduce specific exposures to tail events, while diversification is usually accomplished by spreading out exposures that are not fully correlated with each other and may be independent.

When economic times are stressful it is said that all correlations go to one, but in reality it can be even worse than that. When assets all move in the same direction there are limited options to avoid a crisis so it becomes even worse. Liquidity risk creates results that are worse than would have been predicted in advance as all parties are trying to sell at the same time. Leverage (i.e., borrowing, buying on margin) can make a challenging situation much worse.

## 7. Strategies to Improve Yield

There are a number of strategies commonly used to improve yield, but it is important to recognize that each option brings increased risk of some kind. These may involve taking a bet on where the market is going, ignoring the liability characteristics. The insurer should be careful to include cash flow analysis in the decision-making process. Keep in mind that some risk managers say that cash flows are real and accounting-based income statements are opinion. A

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<sup>69</sup> Marks, Howard. The Lessons of Oil. December 2014.

<http://www.oaktreecapital.com/MemoTree/The%20Lessons%20of%20Oil.pdf>

number of finance-driven tools, including financial reinsurance, are available to temporarily improve balance sheets, but the insurer should analyze them over longer time horizons and include costs for their true impact.

High-yield bonds offer higher coupons than investment grade bonds, lower concentration by adding securities not already in the portfolio, and generally lower duration metrics. This makes them less sensitive to interest rate movements, especially since there are usually no call provisions. Credit spreads tend to cycle, so investors need to consider how the current environment is reflected in investor opinions about future defaults and recovery rates.

Bank loans offer floating rates, making them insensitive to interest rates (except when they become high enough to threaten solvency), with lower default rates and higher recovery rates (but less liquidity) than high-yield bonds.<sup>70</sup>

Insurers have lower liability based liquidity risk than most others who compete for institutional assets and so have an advantage in asset classes like private equity, where investors are paid higher returns in return for accepting higher asset liquidity risk.<sup>71</sup>

Equities must hold higher required capital than many other asset classes, making stocks less sought after by insurers. If a firm has excess capital, this asset class may be a good place to look for return that is unavailable elsewhere. Insurers should also be aware of arbitrage opportunities for accounting practices and capital requirements between life and property/casualty companies (and other financial institutions), perhaps placing surplus in a subsidiary with lower capital requirements for high-yielding yet risky satellite asset classes.

Other popular methods to improve yields include alternative asset classes like timber and hedge funds, along with going out the yield curve to buy longer-duration bonds (in an interest rate environment expected to go down over time capital gains can be extracted). Anything that pays the investor more to provide an option to the seller will increase yields, but will work against the investor if conditions change and the option is exercised. Investors can also utilize dividend-paying stocks, but RBC and rating agency capital requirements are high for equities and do not differentiate between them. Preferred stocks provide an alternative, generally yielding more than bonds issued by the same company. Some preferred issues are negotiated with a buyer(s) in ways similar to a private placement.

With interest rates near historic lows, additional research may be needed to determine if the traditional capital requirements where bonds hold materially less capital than equities is always

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<sup>70</sup> Siegel, Michael H., and Farzana Morbi. *Navigating Low Yields: Opportunistic Credit for Insurers*. GSAM Insurance Asset Management. December 2012.

<sup>71</sup> Earley, Mike, and Lloyd Ayer. *Asset Allocation Strategies for a (Still) Low Interest-Rate World*. Deutsche Asset and Wealth Management. September 2013.

reasonable. For example, portfolios hold the same capital for equity of a dividend-paying company with an AA bond credit rating as for an IPO with no current revenue and C bond rating. This may be another opportunity for those with excess capital to run their surplus account as a profit center.

Historically, asset classes identified as having extra yield have not initially recognized the additional risk. For example, RMBS were assumed to be independent credit events yet developed into a bubble that eventually burst. Catastrophe bonds are a relatively new asset class that provides both opportunity and risk. These bonds pay a steady return unless claims (or their proxies—for example, a Richter scale metric might represent claims in an earthquake-prone region) exceed a trigger. They provide diversification for a life insurance company but show the importance of risk budgeting as a property/casualty insurer could hold this same risk in their liabilities.

Many alternative asset classes are initially very small opportunities that earn good returns (think of a start-up hedge fund for comparison purposes). As high returns draw more money in, marginal asset investments become less likely to create strong returns. Eventually the “smart money” abandons the asset class.

Low interest rates lead to lower borrowing costs for companies, and when these are government subsidized they become fodder for asset bubbles. Unwinding these subsidies can be very painful for both leveraged firms and individuals. This is an unrecognized risk by most insurers when they run increasing interest rate scenarios.

## **8. Strategies to Manage Risk**

There are many things an insurer can try when managing through interest rate scenarios, but each adds new risks. It’s not easy. There are no silver bullets. Formal documents describing investment policy and risk appetite provide a road map to management as they work to build a specific set of risk exposures, identifying scenarios to be mitigated as part of an ALM strategy. Development and implementation of these goals and objectives are best accomplished through a team, pulling expertise from investment, product and corporate areas. This strategic planning team looks at risk and return holistically, with professionals having expertise in actuarial science, investments and sales all working together to improve an insurer’s risk profile.

### ***Derivatives***

Insurers can buy floors, futures and calls to hedge their liability risks, but these can be costly and have short time horizons, leading to reinvestment risk and often a false sense of security. As the AIG Financial Products Division reminded investors with its credit default swap product, buyers of derivatives accept credit risk from their counterparty. Since insurers grant options on both asset purchases (e.g., calls), and liability sales (e.g., surrenders), they should conduct thorough

testing across a broad range of interest rate, liquidity and credit scenarios, picking out a few to share with the board that shed light on the risk profile through reverse stress testing.

### ***Asset Provisions***

An insurer can buy assets with call restrictions or make-whole provisions, but must give up yield.

### ***Liability Provisions***

Conservation efforts can roll over existing, costly policies to newly priced products with less favorable features to the policyholder. Guarantees might be reduced, and surrender charges reinstated, but the insurer must be careful to add commensurate value in the transaction to entice conversion and reduce the risk of future lawsuits.

### ***Policy Features***

Insurers must be able to limit future premiums that must be accepted and ensure that loan provisions are fair to both sides under all scenarios. In the past, fixed rate loan provisions written when interest rates were low led to self-selection by policyholders when rates rose. Similarly, initial designs of variable annuities and equity-indexed annuity features were not completely thought through. These policyholders are simply doing what is best for them. Insurers should consider how increasingly sophisticated consumers might utilize contract features. Pricing actuaries might consider enlisting skeptics to think of ways to take advantage of policy features as efficient and sophisticated policyholders would.

### ***Regulatory Changes***

When worried about low interest rates the regulatory focus is on interest rate guarantees and whether they should be allowed to reset to lower levels. The regulatory regime is likely to encourage a product mix away from investment products where the insurer guarantees investment results and back to a liability-driven industry.

For annuities, the Standard Nonforfeiture Law allows a reset of rates periodically. Life products would be less risky with a similar provision. Both life and annuity products should consider a guaranteed rate that is driven by the current nominal rate rather than a fixed rate. Some European yield curves have been negative out to the 10-year rate, so practitioners are right to worry. Products could be priced using guaranteed rates driven by nominal rates experienced during the policy's lifetime or the expected remaining duration of a policy. For example, a single premium deferred annuity sold with six years of surrender charges would theoretically have a higher credited rate at issue than after the surrender charges had ceased. For life policies, regulators could allow guarantees that reset every 10 years, for example. With disclosure and transparency the marketplace would determine the competitive landscape without increasing solvency concerns.

The Federal Insurance Office produced a report in December 2013 that recommended modernization of insurance regulation in the United States. Federal, state and international regulators should work together to combine best practice quantitative and qualitative methods, considering the pros and cons of consistency and regulatory concentration risk versus multiple regulators and potential regulatory arbitrage. Regulators should proactively consider alternatives that would or should be available to ensure orderly resolution in an industry-wide tail scenario. They should consider developing robust tools to identify practices in the insurance industry that could lead to systemic risk.

The Federal Reserve plays a dual role, as a regulator as well as the driver of monetary policy. It should consider the impact of its actions on other savers in the economy, whether it is retirees, pension plans or corporations with surplus funds. An economy can't function properly in the long run without incenting savings. Skeptical analysis across a variety of scenarios can minimize unintended consequences as risks interact.

Finally, much was learned in the financial crisis that has not yet been incorporated in the capital charges for insurers in the United States. While regulatory arbitrage opportunities have been reduced, there is still much room for discussion to ensure consistency and transparency going forward. Implementation of Own Risk and Solvency Assessment (ORSA) following these suggestions would be helpful to industry health. This should include holistic analysis and principle-based methods that consider the initial environment and the entire financial entity.

## **9. Section Conclusion**

This section of the paper considered various classes of assets and liabilities and how they interact with interest rates. For many products a rising interest rate scenario tends to be good news, but the focus in this paper is on how a policyholder or borrower can select against the life insurer. Higher-order interactions should be considered (e.g., convexity), and strategies to improve yield discussed. There are no easy solutions, and companies need to be proactive regarding product design and in discussions with regulators as ORSA is implemented. Especially for skills that are outsourced, an insurer needs to be sure they understand the risks well enough to be able to tell good from bad scenarios. The speed of a solvency-threatening scenario is likely to be very fast, so companies should build resilience today.

## **V. Conclusions: Increasing Interest Rate Scenarios**

*Will slow growth lead to Japan-style deflation? Or will high-volume money printing to make it easier to repay the debt bring on chronic inflation? (The mere fact that intelligent people*

*worry simultaneously about both these polar opposites is in itself an indicator of the high level of uncertainty that is present.)*<sup>72</sup>

Howard Marks

### ***A. Is a High Interest Rate Scenario Possible?***

Volatility seems to be the most likely of scenarios going forward, with the current practice considering a slow, upward-trending interest rate scenario as the base seemingly least likely and often best case. Scenarios should include interest rate spikes, liquidity crises, and counterparty risk for derivatives in addition to standard New York 7 type scenarios.

### ***B. Potential Causes of Increasing Interest Rate Scenarios***

While no one will predict the actual path of interest rates, including the timing of rate changes, three scenarios are presented here. The first assumes that interest rates follow either a random walk or are cyclical, so eventually will rise. In the second, high levels of government debt and loose monetary policy eventually play out much as the “guns and butter” scenario did in the 1970s. In the third, the great recession continues to play out with a liquidity trap and currency war exporting deflation around the world until the velocity of money finally reflects that the government has lost the confidence and trust of the people in the financial system. This event potentially triggers a hyperinflation in many countries.

At some point the financial system must be allowed to clear. This means an unwinding of all manipulations applied to it by Treasury and the Federal Reserve. There is a very serious game being played, developing policy in times with no historical precedence. It is hard, and a soft landing may be asking too much.

### ***C. Impact on Insurers***

Insurers should test their specific risk exposures and strategies against broad scenarios to determine potential problems. For those products without disintermediation risk the ramifications seem minimal, but for an insurer with material surrenders, a spike in interest rates could threaten solvency. Some insurers may become insolvent due to policyholder disintermediation, asset losses and ALM/liquidity issues, and it could happen very quickly and unexpectedly. As the Federal Reserve considers systemic risks applicable to insurers, the implication of a low interest rate “Japan” scenario should be considered along with liquidity, claim and disintermediation risks. Transparency will be important in this discussion as conflicts abound, with the Federal Reserve considered a driver of some extreme scenarios.

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<sup>72</sup> Marks, Howard. Oaktree client memo, The Role of Confidence. Aug. 5, 2013. Page 3.  
[http://www.oaktreecapital.com/MemoTree/The%20Role%20of%20Confidence\\_08\\_05\\_13.pdf](http://www.oaktreecapital.com/MemoTree/The%20Role%20of%20Confidence_08_05_13.pdf)

As portfolio yields have fallen, insurers have invested in alternative asset classes that offer higher returns in exchange for increased risk. Each company should have a well-thought-out answer to the question, “Why did I not invest as strongly (or at all) in this asset class previously?” How would this asset class react if interest rates increased by 10 percent? Many insurers are taking a bet that the returns will offset the risks, ignoring the characteristics of the liabilities. In the long run this is likely to be a poor bet. What is different in today’s environment? Regulators should ask these types of questions as they review insurers’ ORSA reports.

Federal regulators have been looking at metrics promising to identify specific companies at risk. They call this systemic risk, and define it as a risk that could severely impair the financial system. Instead of focusing on individual companies on their first pass, regulators could use their tools to search for industry practices (rather than companies) that threaten the financial system. An excessive focus on metrics and group-think may distract from thinking about emerging risks, especially those without historical data sets. This makes it more important for risk managers to identify and communicate the risk to their management team. Regulators may not be able to change existing contracts, but as the lender of last resort for the insurer guarantee funds, the states should become engaged on the issue.

A new era is at hand, where investment professionals work with actuaries and strategic planners to understand ALM issues driven by risk exposures in different environments. This collaboration will move insurers closer to meeting their goals and objectives.

#### ***D. Final Thoughts***

This paper has looked at the causes and effects of rising interest rates and interest rate volatility. The life insurance industry’s best case scenario seems to be one that slowly grades up, quickly enough to maintain interest margins but not so fast as to trigger excess lapses. Continued low rates continually add to risk driven by interest rate guarantees. Companies should consider the types of products they can profitably sell in such an environment and engage their regulators in this discussion. In addition, companies should enlist contrarian thinkers to consider the ramifications of a spike in interest rates so mitigation strategies can be proactively put in place.

What follows are specific learnings from this research.

1. Rising interest rates could come about from a variety of circumstances.
  - a. Interest rates tend to cycle, and over long periods of time appear to follow a random walk. Rates eventually rise in such a scenario.
  - b. High government debt and loose Federal Reserve monetary policy leads to too much money chasing too few goods, resulting in inflation.
  - c. The liquidity-driven recession of 2008, in concert with demographic trends and a currency war (both currently deflationary in the United States), initially lowers the velocity of money metric as personal confidence decreases.



2. The velocity of money has been historically low and should be monitored. It currently reflects a lack of personal confidence by consumers, leading them to prefer cash and other safe, liquid investments typical when investors prefer less risky assets during a flight to quality. This has helped to keep rates low. Hyperinflations become more likely when central banks buy up public debt, increasing the velocity of money. When confidence and trust are lost in the financial system, there is a rush for hard assets as consumers try to reduce their levels of currency as low as possible because they fear the currency will soon be devalued.
3. Product cycle—the last insurance product cycle introduced universal life and variable products. As rates dropped we saw a move to indexed products. What else might we see if rates remain low, or if they rise? Other countries have seen a shift in product mix toward supplemental health products as rates dropped. Participating and other types of account value driven products may make sense for consumers if rates were to rise. Considering these product changes before rates move may provide insurers a first mover competitive advantage since it takes time to develop a product and receive regulatory approval. Which products will create unexpected basis risk as higher-order interactions surprise us?
4. Volatility—there are so many financial happenings today that have never been combined before. Their interactions are unknown and there will be unintended consequences. Companies should build resilience today if they hope to both survive and thrive. This means transparency and a strong risk culture where innovative thinkers are welcome.
5. Stress testing—insurers are not stress testing interest rates far enough in the tail at either end. They should not rely on the VM20 generator to accomplish this. Negative rates and double-digit rates should be considered.
6. Regulatory overload—new regulations are distracting and overwhelming ALM/risk teams from better understanding their own blocks of business and considering potential scenarios.
7. Real rates—risk managers should take the time to focus on real rates as well as nominal interest rates. Rules of thumb will be tested and broken if risk-free rates are negative.
8. Product risk/return profiles—each product has a unique risk/return profile and should be tested in isolation, in aggregate, and as a marginal addition to existing blocks of business.

Hopefully this research will help readers make conscious decisions about potential strategies and approaches based on an entity's unique risk profile, culture, and appetite for risk.