

**Sustained Low Interest Rate Environment:  
Can It Continue?  
Why It Matters**

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## I. Executive Summary

Initially, this project's goals were to describe the impact on assets and liabilities if nominal interest rates remained low for an extended period of time. While this aspect of the research project was examined, it readily became obvious that several other questions were just as important and might provide insights to the reader.

**Is a long-term low interest rate scenario possible?** Almost all firms use a base scenario that is level, but many interpret this to mean a slowly increasing scenario. This can be accomplished by unwinding a positively shaped yield curve using its term structure and bootstrapping techniques, or using an economic scenario generator with an upward bias (most use long-term average interest rates for mean reversion that are higher than the current environment). Some consensus forecasts by economists also show interest rates slowly increasing. Few companies are testing deflationary scenarios, and some act as if negative rates are theoretically impossible. They are not. High unemployment rates and improved productivity have produced downward pressure on inflation in many countries. The United States last experienced deflation during the Great Depression era, a period when the price of housing also fell. While our memories are short, deflation has been part of the economic cycle throughout history. So yes, it is possible to have a long-term low interest rate scenario.

**What could cause a long-term low nominal interest rate scenario and should this be presented to management?** There are several drivers of low growth that could lead to long-term low nominal interest rates. In addition, the Federal Reserve Bank has the ability to drive down interest rates to encourage investment over an extended period. As these scenarios are discussed in this paper, readers should consider their own estimates. Is there a sufficient likelihood of its occurrence to present a scenario with extended low nominal interest rates, and even deflation, in discussions with senior management and board members? With these scenarios, is the management team likely to consider mitigation strategies that change product features or divestiture of a product line?

**What strategies should insurers and others providing oversight consider in response to an extended low interest rate scenario?** The most challenging part of managing a block of business for an insurer is that only one scenario will actually occur. Mitigating a potential rate spike at the same time as a perennial low interest rate scenario is cost prohibitive in the marketplace. Strategies can include mass mitigation strategies that increase price and preclude sales; making a market bet on interest rate direction, credit risk or equity risk and acting accordingly; or paralysis and inaction. Systemic risks, those that threaten the entire financial system, are created by interactions between actual scenarios and reactions to them by market participants. Regulators should consider focusing on industry practices in addition to the impact of a specific company's actions. Transparency of actions is the key for regulatory strategies. It should be noted that some, especially in the regulatory community, refer to macroprudential

(rather than systemic) risk when individual companies, acting prudently, cause instability in the system from their collective actions.

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.

### **A. Interest Rate Scenarios**

No one knows the *one* interest rate scenario that *will* play out. A few years ago, when 10-year Treasuries fell below 6 percent, if financial experts had been asked (including this researcher) how likely it was that in 2013 those interest rates would have *risen* back to 3 percent, after being below 1.5 percent, their probability estimate would have been very low. Yet, that is the historical scenario that has occurred. This result came with an assist from the Federal Reserve and the aftermath of a series of burst bubbles with names like the dot-com crash and the Great Recession. Bubbles were made worse with leverage and misaligned incentives. Spreads have also compressed, as low issuance has combined with high demand to create bidding wars for some existing assets.<sup>1</sup>

Only with the perspective of time can we begin to make sense of the financial circumstances we live in today. It is important to recognize the financial ramifications of both sustained low nominal interest rates and interest rate spikes, along with the proverbial Goldilocks scenario where interest rates rise slowly enough that they fail to trigger options granted to either assets or liabilities. This paper will focus on nominal interest rates, rather than real rates (real rate plus inflation equals nominal rate), as liability guarantees are supported by actual returns.

Along with inflationary expectations and relative currency strength, economic growth drives interest rates by impacting demand for debt. Low growth means less demand for loans and other forms of borrowing, with nominal interest rates following suit. For comparison, using the data available from FRED Economic Data at the Federal Reserve Bank of St. Louis, since 1946 GDP growth has geometrically averaged 6.56 percent, while since 1988 the growth rate has been only 4.63 percent.<sup>2</sup> Today's loose monetary policy, combined with a tightening and haphazard fiscal policy, is untested territory for the economy. Short-term implications may not align with long-term results.

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<sup>1</sup> Earley, Mike, and Lloyd Ayer. *Asset Allocation Strategies for a (Still) Low Interest-Rate World*. Deutsche Asset and Wealth Management. September 2013.

<sup>2</sup> Data Source: FRED, Federal Reserve Economic Data, Federal Reserve Bank of St. Louis: *Gross Domestic Product*; U.S. Department of Commerce: Bureau of Economic Analysis; <http://research.stlouisfed.org/fred2/series/GDP>; with quarterly data through January 2014; accessed May 29, 2014 utilizing quarterly data through Jan 2014.

## ***B. Drivers of Low Growth***

Several hypotheses have been put forward about why nominal growth is low or could slow in the future. The world economy is in many ways in a unique situation, so specific forecasts should be viewed with caution. Alternative outcomes should not be ignored. What is known is that financial markets cycle, so the status quo is unlikely. One can find historical experiences where interest rates were both lower and higher than they are today.

The velocity of money has reached historically low levels. This metric has been known to mean revert over time, and a return to average levels would provide an inflationary push to nominal gross domestic product (GDP). Because velocity is often driven by behavioral responses and trust in the “system,” it is very hard to predict. The current low level of velocity seems to help keep nominal interest rates down, but it is unclear what drives this metric or how it interacts with long-term Federal Reserve Bank stimulation.

Worldwide demographic trends show an aging population for many years into the future. Each geographic region has its own pattern, with Japan the first country to age and shrink in size. The United States is younger than many developed nations so may be able to learn the lessons of other countries through observation.

Various forms of family planning and changes to culture have reduced fertility rates to sub-replacement levels in some countries even as earlier generations continue to work their way through a demographic bubble. Other countries likely will follow suit, led initially by the developed nations that saw women enter the workforce leading up to and after World War II. Eventually this could include even those countries with currently high fertility rates, as economics and limited resources lead away from cultures where large populations are encouraged.

Another potential driver of slow growth rates is sustainability, where people create conditions with nature that can endure over a long period of time. This process balances ecological elements, manages climate change, and manages resource depletion. Some challenge that the causes of these activities should be a concern, but a risk manager’s role is to consider those (especially those) events that are considered tail events but seem more likely. Climate change moves very slowly, even when it is happening relatively quickly in a historical context. With so much noise in the data to confuse the signal, it is hard to understand the true trends but easy to manipulate the data to support nearly any conclusion. The downside to ignoring a climate change scenario is large. Among the experts in this field consensus is building that there is a problem.

The overuse of limited resources such as oil and fresh water has historically been without recorded costs from an economic perspective. In other words, current accounting measures consider economic “goods” but not economic “bads.” Pollution, resource depletion and climate change have not directly impacted financial balance sheets or income statements. If events reach

tipping points in the environment, and negative non-reversible situations occur, large costs will be incurred. Alternatively, some of these effects might be held stable or even reversed if population growth slows or reverses. This would have economic consequences, since population growth is a key component of economic growth.

If solutions to these environmental issues were successfully implemented, after a challenging period of adjustment this would position world economies for future growth. Proactively, economic growth could slow due to structural additions that anticipate environmental changes such as building levees, dikes and gates to hold back storm surges where ocean levels are rising. This would not be possible everywhere, and major cities like Miami and Mumbai could still be at risk. These activities are unlikely to occur without government intervention, which may lead to inefficiencies, excessive regulation and political favoritism for favored sectors.

Taking a view that economic expansion of the past three centuries was due to a unique series of events, and that multiple factors termed “headwinds” will slow future growth, Northwestern University’s Robert Gordon anticipates that future nominal GDP growth will return to the 0.2 percent rate he assumes was present prior to 1700. He views the three industrial revolutions since that time as non-repeatable, bolstering his argument by citing major inventions such as the steam engine, railroad and computer supplemented by follow-on inventions that improved standards of living and drove economic growth. While this seems like an extreme scenario, it provides boundaries that can be useful for risk managers to be aware of.

Gordon has identified six headwinds that will slow future growth. They include:

1. Lack of a demographic dividend, where females entering the workforce caused a one-time growth spike in the last century that cannot be recreated.
2. Plateau in educational attainment, as college graduation percentages fade from a peak about 20 years ago.
3. Rising inequality, as growth in real income bifurcates between “haves” and “have-nots.”
4. Interaction between outsourcing and technology, eliminating jobs from all but those who charge the least in a global marketplace. The manufacturing regions charging the least hold these jobs until the cycle repeats itself and jobs shift to a new low-cost region. Some of these jobs are returning to developed countries as machines are developed to do the work previously performed by humans (e.g., textiles).
5. Events related to energy and the environment (also described in Section IV B 2, “Sustainability and Population Growth”) leading to clean-up costs and proactive charges as new processes are devised to collect carbon emissions, keep out rising waters or maintain food production.

6. High consumer and government deficits leading to higher taxes, combined with lower benefits and services and possibly currency devaluations.

As was seen in headwind No. 5 on Gordon's list, there is overlap between these scenarios. Each of them could occur simultaneously, or there could be partial versions of these anti-growth drivers. Some could exacerbate the other scenarios, especially if overpopulation and climate change reach a tipping point that accelerates the impact. This could occur through a variety of events: disease spillover from the mammalian population to humans that results in massive fatalities; regional conflicts over fresh water, scarce minerals or energy; a warming climate that floods coastal areas and lowers monoculture crop yields; overharvesting that wipes out fish populations; or a failure of the existing "just-in-time" science to adapt quickly enough to overcome evolving mutations of insects and diseases around pesticides and antibiotics. A sudden climate cooling, especially if due to volcanic particles blocking the sun, would have severe impacts as well. The earth can successfully adapt if conditions change slowly, but any sudden changes will have surprising and unintended consequences. Maintaining an appropriate balance between developed and developing countries, with varying cultures and attitudes toward population growth, will require strong international leadership.

### ***C. Impact on Insurance Liabilities***

A low interest rate scenario that extends beyond insurers' tactical business plans, meaning longer than three to five years, will have a strong negative financial impact on those selling products with interest rate guarantees. Those products with the ability to reprice regularly, like casualty, term life, and health insurance products, should have minimal consequences. Direct writers of life insurance, annuities and health products like disability income and long-term care will have the greatest impact due to the long-term nature of their interest guarantees. Products tied to financial market results will be stressed if riders such as guaranteed living benefits are aggressive, backed by general account assets (rather than embedded in the variable product itself) and rely on liquid markets and derivatives to manage the benefit risk.

Unlike the banking industry meltdown of 2008, a continued low interest rate environment will have an impact on insurance companies independently as opposed to all at once as unique combinations of assets and liabilities are stressed at different rates. Depending on asset and product mix, each company's ability to withstand a continued low interest rate environment will be different. It is vital that the insurance industry take a proactive look at the possibility of a continued low interest rate environment and take action now in preparation for that possible scenario.

Insurance policyowners 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. The viatical market is one to watch in this regard. The profit on lapse-supported products falls when insureds with higher than priced for expected mortality sell their ownership in the policy to a viatical settlement company for an amount greater than the cash value instead of surrendering the policy. Viatical firms make this higher bid based on information acquired through updated underwriting. With current interest rates low, the incentives for buyers of these policies are also low, but this market is gaining experience as buyers focus on better understanding mortality risk. Companies can somewhat mitigate this risk by assuming an increasingly sophisticated clientele that understands the options that were granted.

The current low interest rates monetary policy by the Federal Reserve Bank stresses savers, from retirees to pension plans to lenders like insurance companies. Borrowers, including the government, are encouraged by the loose monetary policy to take risks they might not otherwise accept. As new investors enter the life insurance space with shorter decision-making time horizons and little historical experience of cycles and trends, this opens the possibility that poorly priced life insurance products will lead prudent insurers to lower standards in order to maintain market share, increasing systemic risk.

Life insurance company margins are stressed in low interest rate scenarios when the resulting nominal returns are insufficient to support guaranteed interest rate floors. Products like whole life, universal life with no lapse guarantees, and deferred annuities are the primary concern, and solutions are minimal if interest rates remain low for very long. The financial option instruments that are available are expensive and require rolling over every three to five years for the life of the insurance contract.

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), 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 acquisitions as companies seek economies of scale.

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

#### ***D. 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 drop and new loans are available, firms with an option to refinance corporate bonds and

commercial loans will tend to do so. An insurer should not assume that current market inefficiencies, especially those in the residential mortgage market, will continue into the future. 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.

Some think that the Federal Reserve, as it manages interest rates to drive demand, can inadvertently create (and has created) asset bubbles. Regardless of risk managers' views on this, they should develop scenarios to identify potential exposures using environmental scanning techniques. It is not the risk manager's job to predict a single scenario but rather to develop potential scenarios and determine which ones create risk exposures outside a firm's risk appetite that should be mitigated and which represent opportunities. 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.

As was seen in 2008 during the Great Recession, market liquidity should not be taken for granted. Insurers have the benefit of being a primary provider of liquidity during challenging economic times as cash inflows are less reliant on current financial markets. Although some past experiences, like what occurred with General American in 2000, provide contrary examples, there are very few insurance products that create the potential for a run on the bank. Insurers should consider additional testing for such products as fixed account deferred annuities that carry no built-in features to manage asset-liability management (ALM) risk. For example, market value adjustments align policyholder behavior with insurer interests (putable guaranteed investment contracts (GICs) and security lending programs are other programs that would benefit from robust testing).

Typically, insurers have responded to low interest rates by increasing credit risk, investing in longer-maturity assets and alternative asset classes such as real estate. Others have purchased derivatives or financial reinsurance. These solutions may be effective for short-term periods of low interest rates, but a long-lasting environment with low rates will require more fundamental changes to the industry driven by ALM, stress testing and regulatory changes. A company's investment policy statement (IPS) should express collaboration between assets and liabilities. Too many investment professionals treat liabilities as fixed, considering only duration and sometimes convexity metrics to define the liabilities, freeing up the investment manager to pull levers they have control over. While the term liability-driven investing is often used, it is inadequate and misleading. Both sides of the balance sheet should receive equal exposure, and the term *asset-liability management* is much more descriptive.

By managing risk holistically and considering a range of potential outcomes, financial institutions can manage their way through most future scenarios. Only time will tell if they have learned from past experience and improved their risk management practices going forward.

## **II. Background**

This research project was funded by the Joint Risk Management Section of the Casualty Actuarial Society, Canadian Institute of Actuaries and Society of Actuaries. The paper uses existing publications and mosaic theory to develop its conclusions, using previously published material where available to make specific points.

The author used the FRED (Federal Reserve Economic Data) 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 researcher thanks the Project Oversight Group (POG) members for their insights during the development of this paper: Bob Reitano, Dean Nelson, Dennis Radliff, Greg Slone, Howard Rosen, John Hubenschmidt, Rich Owens, Scott Orr, Tom Herget and Wei Hao. Society of Actuaries research staff members Barbara Scott and Steve Siegel provided their usual excellent logistical support and final edits. Of course, all errors and omissions remain the responsibility of the researcher.

## **III. Researcher**

The researcher for this project is Max J. Rudolph. Related articles and presentations on this and related topics can be found at his firm's website. His contact information is:

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## IV. Low Interest Rates and Their Implications

This research project aims to capture several interrelated topics.

- Is a long-term low interest rate scenario possible?
- What could cause a long-term low nominal interest rate scenario and should this be presented to management?
- What strategies should insurers and others providing oversight consider in response to an extended low interest rate scenario?

Despite current monetary policy efforts in the United States, there are several potential reasons that nominal interest rates could remain low. Insurers should continue to stress test low interest rate scenarios (perhaps even some deflationary ones), consider policy design features and regulatory changes to reduce systematic risk. This could be true in the long run even if interest rates increase in the short term due to current fiscal and monetary policy imbalances.

A brief detour is needed for clarification and definitions before moving forward.

- Systematic risk is unavoidable; when the market moves, everyone with that risk exposure moves with it. Alternative yet equivalent terms are market risk and non-diversifiable risk. The possibility of a long-term low interest rate scenario is a systematic risk.
- A systemic risk can collapse the entire financial system due to “instability, potentially catastrophic, caused or exacerbated by idiosyncratic events or conditions in financial intermediaries.”<sup>3</sup> Interdependencies lead to a cascading failure that brings down the entire market. In 2009, Federal Reserve Chairman Ben Bernanke said that systemic risk could include “unsafe amounts of leveraging by banks, gaps in regulatory oversight and the possibility that the failure of a large interconnected firm could lead to a breakdown in the wider financial system.”<sup>4</sup>
- The term macroprudential risk is similar, if not identical, to systemic risk and is preferred by the International Association of Insurance Supervisors (IAIS). Their goal is to enhance the resilience of the system without impairing efficient activities.<sup>5</sup>

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<sup>3</sup> Wikipedia. Systemic risk citing FRB source no longer active. The same definition is found elsewhere.

<sup>4</sup> Boles, Corey. Bernanke Offers Broad Definition of Systemic Risk. *Wall Street Journal*, Nov. 18, 2009. <http://blogs.wsj.com/economics/2009/11/18/bernanke-offers-broad-definition-of-systemic-risk/>.

<sup>5</sup> International Association of Insurance Supervisors. Macroprudential Policy and Surveillance in Insurance. July 18, 2013. [www.iaisweb.org/view/element\\_href.cfm?src=1/19149.pdf](http://www.iaisweb.org/view/element_href.cfm?src=1/19149.pdf).

- A systemically important financial institution (SIFI) is a financial institution, formally designated in the United States by the Financial Stability Oversight Council (FSOC), whose collapse would pose a serious risk to the economy. These companies will receive additional oversight and may be required to hold higher levels of capital than non-SIFI designated firms.

This paper focuses on actions that lead to systemic risk rather than identifying specific companies. While some events can surprise all financial institutions, others can proactively be mitigated through actions by regulators, industry and specific companies. Products such as seven-day puttable GICs and credit default swaps could have been written by many companies, but weren't. Other practices are endemic to the insurance industry and relate to pricing practices regarding longevity risk, pandemic risk, genetic modification risk and zoonotic disease risk. These are industry practices, so regulation and industry practices need to focus at that level rather than on specific companies (individual firms acting alone to account for a potential systemic risk will price themselves out of the market). Low interest rates reflect a possible systemic risk as it impacts the entire financial system, not an individual company.

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

### **1. Interest Rates and Other Economic Drivers**

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 some blow-ups for those using margin, but buy-and-hold investors have generally maintained a higher portfolio earned rate than new money rates would offer.



Chart 1<sup>6</sup>

Interest rates can stay low for a long time, as we have seen in Japan, where they have been below 1 percent for over 20 years. Many now refer to a long-term low interest rate scenario as a “Japan” scenario.

Japanese life insurers have mostly survived this stressed scenario, although a few mid-sized life insurers failed.<sup>7</sup> They have:

1. Adjusted their product mix away from accumulation products and toward less interest rate sensitive products like cancer coverage.
2. Had favorable mortality experience.

<sup>6</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 June 11, 2014.

<sup>7</sup> Shirakawa, H., and S. Ogasawara (Credit Suisse). What Has Happened under Japan’s Zero Interest Rate Regime? Part 2: How Has Japan’s Life Insurance Industry Adapted to the Low Rate Climate? *Japan Economic Adviser*. Sept. 29, 2011.

3. Cut operating expenses.
4. Adjusted their investment mix toward foreign securities, alternative investments and longer Japanese government bonds, and away from corporate bonds, municipal bonds and equities.

There are several interesting aspects to the Japanese insurance market that should be considered when making analogies with its U.S. counterpart. The largest life insurer in the world, Japan Post Insurance (JPI), is owned by the Japanese government. Its investment yield was 1.64 percent in 2011. After-tax profits were 77 billion yen on 100 trillion yen of assets and 7,342 billion yen in premium. Even without this behemoth, which writes 21 percent of life insurance premiums, the industry is concentrated with four companies controlling over 65 percent of the life market (47 companies total versus 875 in the United States and three groups controlling over 90 percent of the non-life market (52 companies total versus 3,441 in the United States). Failures of seven mid-sized companies led to mergers and acquisitions with multinational firms 15 years ago, and a wave of mega mergers followed in 2010. Regulations have been revised to valuation and solvency requirements that allow for longer-term recovery of deficits. Cash flow testing time horizons are not required to go out more than 10 years. Insolvent firms are allowed to adjust their interest rate guarantees, and the average duration mismatch is five years.

JPI earned enough from mortality and expense gains to offset negative interest spreads (nearly 3 percent annually). Typical life insurance products in Japan are traditional individual endowments, whole life and term. The aging population and low interest rates have rotated growth products from saving and mortality protection to health-related and living benefits like hospitalization, cancer and long-term care coverage.<sup>8</sup>

For U.S. companies, it would not be surprising to expand the Japanese strategies to include acquisition strategies built around creating economies of scale and investment expertise. Capital requirements will need to keep up with any new asset classes.

At U.S.-based life and health insurers, falling interest rates have resulted in net yields falling over the past five years from 5.57 percent in 2008 to 5.03 percent in 2012 as part of a longer trend of reducing rates.<sup>9</sup> This is despite increased allocations to alternative asset classes with higher credit, liquidity and currency risk. 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

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<sup>8</sup> International Monetary Fund. Financial Sector Assessment Program: Japan. *Insurance Core Principles: Detailed Assessment of Observance*. August 2012. [www.imf.org/external/pubs/ft/scr/2012/cr12228.pdf](http://www.imf.org/external/pubs/ft/scr/2012/cr12228.pdf)

<sup>9</sup> Lewis, Angelo John. *Slow Motion*. Best's Review September 2013.

according to National Association of Insurance Commissioners (NAIC) model regulations. These are based on the issue date of the contract and remain constant over its life. Continued low interest rates could transform the industry away from products with a pure investment focus that credit interest like deferred annuities and toward pure protection products that are repriced annually like term life, health, and casualty products. Products that combine asset and liability risks, like universal life, would need the ability to subsidize interest margins from other sources.

Accounting rules may enable management to manipulate short-term results, which could be done to influence incentive compensation. This is the case, for example, where the accounting regime fails to differentiate between interest earned and realized capital gains. At one time, realized capital gains were amortized under statutory financials, spreading the gain over the remaining life of the asset, but they are now reported immediately as income. Some may try to manipulate short-term results without adding long-term value by realizing capital gains in the current period, resulting in additional income today, with greater surplus invested at lower yields in the future.

The Federal Reserve can keep short-term interest rates low in a subsidized fashion for long periods of time, and has used creative methods such as quantitative easing (where securities are bought to create demand even when rates are already close to zero). Long-term rates are harder to control. Regulatory regimes seem to assume that interest rates will gradually increase. The NAIC interest rate generator, originally developed by the American Academy of Actuaries and currently housed by the Society of Actuaries, has a mean reversion factor that forces interest rates to trend back up from currently low rates to historical averages. For capital requirements the NAIC has never updated the C-3 Phase I generator's mean reversion rate, so updating it to the current environment will likely produce material capital increases for annuity writers (although this should have been anticipated by companies). An upward bias is typical of proprietary generators in this environment as well. Companies are not complaining, as slowly increasing scenarios are among those with the best results (lowest capital and reserve requirements, highest pricing returns). Many firms do not use scenario generators exclusively; rather they supplement the results with deterministic stress tests based on specific risk profiles to best understand evolving risk exposures.

## **2. What if Interest Rates Spike Instead?**

Interest rates have several potential future outcomes, and all should be considered. They could increase slowly, allowing portfolio yields to move above interest rate guarantees without increasing so quickly as to encourage excess policy lapses. If interest rates spike, some insurers may become insolvent due to policyholder disintermediation, asset losses and other ALM/liquidity issues. In the current regulatory environment, which requires both explicit and implicit nominal interest rate guarantees for many insurance liabilities, a long-term low rate scenario would seem to create a regulatory created systemic risk that would strongly affect many life insurers, potentially creating widespread challenges in meeting obligations.



### 3. Historical Perspective of Interest Rates

The 2009 book by Carmen Reinhart and Kenneth Rogoff, *This Time Is Different*,<sup>10</sup> and companion articles have put concerns about high debt levels at center stage. Their research attempts to create a database for researchers to use that spans the globe and goes back many centuries. They show that excessive debt accumulation, whether by banks, corporations, consumers or governments, leads to financial crisis and slower 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 the 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 over-corrections in both directions, and political desires to remain in power make these types of crises inevitable.

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. Some argue the Fed has over-managed the downside and allowed asset bubbles to form.<sup>11</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 also increases during these periods as massive interactions between participants lead to unexpected consequences.

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>12</sup> The authors found that the recent crisis was comparable to pre-WWII 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

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<sup>10</sup> Reinhart, Carmen M. and Rogoff, Kenneth S. *This Time Is Different: Eight Centuries of Financial Folly*. Princeton University Press 2009.

<sup>11</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>12</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.

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 and asset values differ from when rates are at 2 percent. Over long periods, interest rates tend to cycle. 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. While living standards have improved over time, unintended consequences and misaligned incentives can lead to system fragility and lower growth. Leverage tends to win if you give it enough time. *The business cycle has evidently not been tamed.*<sup>13</sup> 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.

#### **4. The Impact of Energy Supplies on the Current Account Deficit, Inflation and Growth**

Macroeconomic metrics are linked in a never-ending tug of war between supply and demand. Current account statistics compare imports and exports of goods, services and transfers between countries. From a home country perspective, buying more goods than are sold leads to home currency leaving the country. This creates a long-term tendency for inflation, although interdependencies with other variables sometimes override this in the short term. As of the end of December 2013, the current account deficit in the United States was \$81.1 billion.<sup>14</sup> This means that foreign investors continue to provide funding for the American economy. Much of this transfer has historically been due to importing oil and its byproducts. Changes in U.S. energy dependency will impact the current account deficit, long-term inflation, and demand for the dollar internationally.

The process of hydraulic fracturing, or fracking, allows extraction of oil and natural gas from deposits that were previously inaccessible. (Fracking has created an economic boom in areas such as North Dakota, where jobs created in the Bakken Shale Formation directly and indirectly

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<sup>13</sup> Reinhart, Carmen M., and Kenneth S. Rogoff. *This Time Is Different: Eight Centuries of Financial Folly*. Princeton University Press, 2009. Page 270.

<sup>14</sup> U.S. Department of Commerce, Bureau of Economic Analysis News Release. U.S. International Transactions. March 19, 2014. <http://www.bea.gov/newsreleases/international/transactions/transnewsrelease.htm>.

have led to the lowest unemployment rate in the United States at 2.6 percent.<sup>15)</sup> Some experts have predicted that the United States could be a net exporter of natural gas by 2020.<sup>16)</sup>

On the other hand, some countries, as well as individual states in the United States, have a moratorium or have banned fracking due to concerns about environmental and health issues. If fracking was perceived by a broader group to be dangerous, and imports were required to replace them, this could result in a shock event reminiscent of the 1970s. During that period an oil price shock led to a 14.8 percent inflation rate in early 1980 before the Paul Volcker-led Federal Reserve Board initiated contractionary monetary policies.

The level of oil imports also impacts GDP growth. Higher domestic output keeps prices lower and drives up GDP, while higher imports do the opposite.

## 5. Factors Affecting Interest Rates

### a. Stimulus—Fiscal/Monetary Policy and Incentives (e.g., housing)

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>17)</sup> Those considered to be 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 not yet retired 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 slow down 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 dampen growth. Keynesian fiscal policy requires greater spending for an expansionary policy and less spending for contractionary purposes. These changes are relative, not absolute, so for example a temporary tax holiday becomes a tax increase when the holiday ends. In early 2014 the United States is at

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<sup>15)</sup> Bureau of Labor Statistics. April 2014. <http://www.bls.gov/web/laus/laumstrk.htm>.

<sup>16)</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>17)</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/>.

an interesting data point, with the Federal Reserve continuing its Quantitative Easing program designed to lower interest rates (although now tapering) while the elected branches of government allowed an austerity program of cuts to be implemented (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. 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. When a country attempts to increase domestic inflation, another country must be strong enough economically to absorb the shock by strengthening its currency. There are no major OECD member countries with strong balance sheets, so 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 much greater pain in such a scenario, with no returns to live off of.

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 easing.

## **b. 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>18</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 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 may have fallen from historical levels due to higher levels of conservatism.

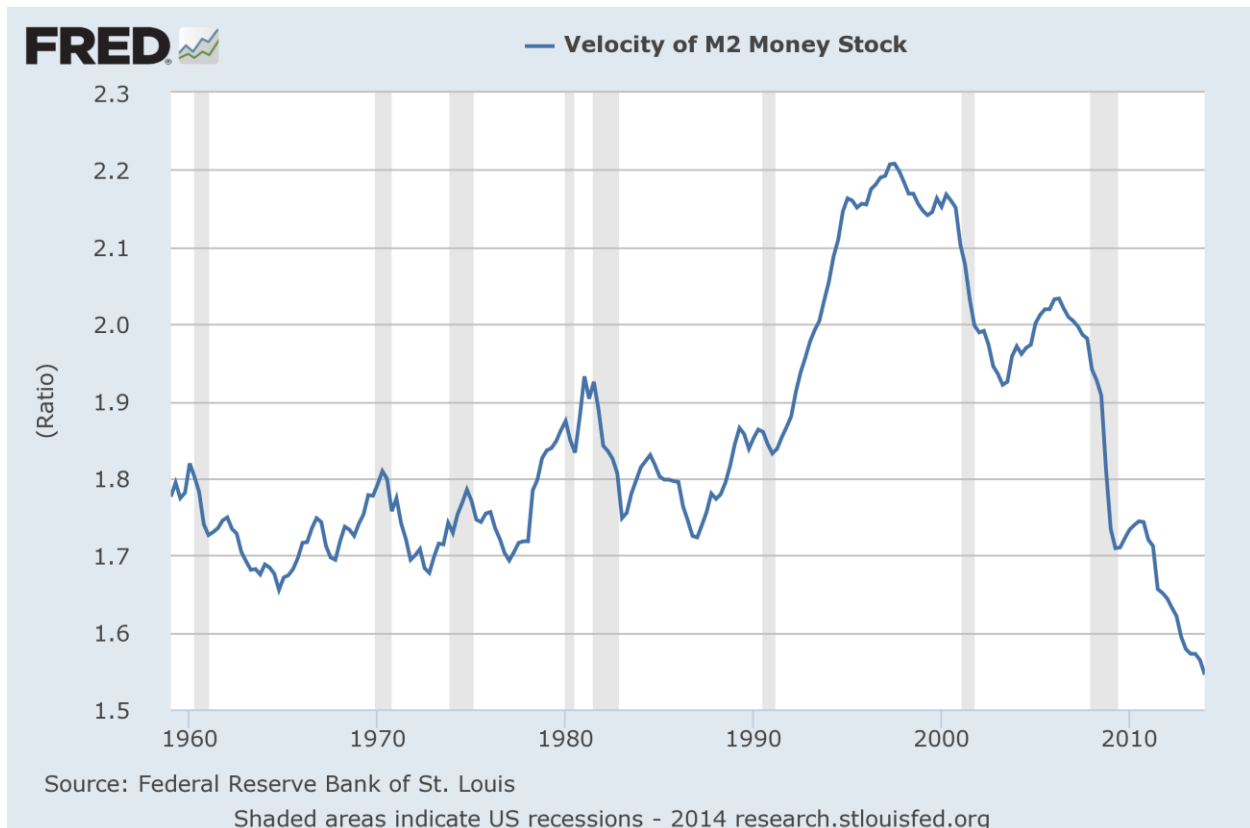


Chart 2<sup>19</sup>

<sup>18</sup> Gwartney, James D., and Richard L. Stroup. *Economics 7<sup>th</sup> Edition*. 1995. Pages 347-348.

As seen in Chart 2, 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 at least 1960. In analysis compiled by Hoisington Investment Management,<sup>20</sup> the argument is made that when debt passes into a “nonproductive zone” above 260 percent of GDP it becomes less likely that principal will be repaid so 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.

### **c. U.S. GAAP Accounting**

With many assets marked to market, while liabilities are not, lower interest rates could simultaneously show increasing U.S. GAAP surplus and reducing or stable economic surplus. Of course this is a temporary condition that recoverability testing (loss recognition) would recognize, at least in part. Statutory surplus could also be managed by taking capital gains in a down interest rate scenario. This is sometimes done to meet current-year targets, manipulating incentive compensation schemes. The lower-yielding portfolio is then used as the expected going forward. Transparency requires longer time horizons in projection models and incentive compensation schemes to offset these anomalies.

### **d. Corporations**

Whether worried about regulatory and tax changes, continuing financial uncertainties or regional instability, corporations have accumulated a cash stockpile driven by budget cuts, delayed spending and lower cost of debt. According to the Federal Reserve, at the end of December 2013 liquid assets at non-financial corporations had grown to \$1.984 trillion.<sup>21</sup> Whether the cause is higher profit margins or offshore tax issues, it leads to lower investment demand through higher saving, helping to keep interest rates low. Activist shareholders have encouraged a return of this cash hoard through dividends and share buybacks.

## ***B. Drivers of a Low Interest Rate Scenario***

This paper identifies four routes to sustained low interest rates, which will be described separately. It is worth noting that there are similarities between these scenarios, and they will interact, so the end result could be a combination of some or all of them. Each draws from the

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<sup>19</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 May 29, 2014.

<sup>20</sup> *Hoisington Investment Management Quarterly Review and Outlook*. Mauldin Economics Outside the Box. Oct. 30, 2013. <http://www.mauldineconomics.com/outsidethebox>.

<sup>21</sup> Federal Reserve Statistical Release, March 6, 2014. Line 42.  
<http://www.federalreserve.gov/releases/z1/current/accessible/1102.htm>

reasoning that low GDP growth will lead to a low interest rate environment as supply/demand will balance over the long term at a low level of rates.

While the impact on assets and liabilities is important, if there are no plausible scenarios that keep interest rates low then the discussion is immaterial. Many base scenarios use level future rates, or unwind the yield curve in some way to show a slowly increasing rate pattern. Due to high levels of government debt, there are concerns that the economy may enter an environment where rates spike or at least increase faster than the yield curve would predict.

As noted by credentialed actuary Daniel Cassidy in a blog sponsored by the Society of Actuaries, a “resumption of the European crisis, significant trouble in emerging markets such as China or Brazil or disappointing U.S. economic news could all send rates lower.”<sup>22</sup>

## **Growth as a Driver of Interest Rates**

Most of the following arguments for drivers of interest rates discuss GDP growth and scenarios where it is low or negative. GDP growth is the product of productivity growth and population growth, so the relationship with interest rates is indirect. Productivity growth is the primary driver of GDP growth, especially if you assume population is stable over short periods of time. Changes in mortality rates will also impact population and thus productivity. Low productivity growth drives low relative demand and low interest rates.

### **1. The Gordon Conundrum**

Robert Gordon, a professor at Northwestern University, wrote a paper in September 2012 that summarized a book he is developing.<sup>23</sup> He argues that a number of historical, one-time, events have driven GDP growth over the past 250 years and that going forward we will revert to a very low-growth scenario that was the norm prior to that. He assumes growth before 1700 was about 0.2 percent annually. He focuses on the situation in the United States, but his arguments apply throughout the developed world. He identifies three distinct industrial revolutions, with primary inventions during each followed by incremental improvements. For example, control over interior temperatures via air conditioners and a transformed population, where 75 percent rural

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<sup>22</sup> Cassidy, Daniel. The Federal Reserve Bank’s Desire to Keep Interest Rates Low Has Made Saving for Retirement Very Expensive. Society of Actuaries blog Riskpertise. June 26, 2013. [http://riskpertise.soa.org/riskpertise/the-federal-reserve-banks-desire-to-keep-interest-rates-low-has-made-saving-for-retirement-very-expensive-2/?utm\\_source=feedburner&utm\\_medium=feed&utm\\_campaign=Feed%3A+Riskpertise+%28Riskpertise%29&utm\\_content=My+Yahoo](http://riskpertise.soa.org/riskpertise/the-federal-reserve-banks-desire-to-keep-interest-rates-low-has-made-saving-for-retirement-very-expensive-2/?utm_source=feedburner&utm_medium=feed&utm_campaign=Feed%3A+Riskpertise+%28Riskpertise%29&utm_content=My+Yahoo).

<sup>23</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.

became 80 percent urban, were one-time changes that contributed to growth and cannot be repeated.

Professor Gordon argues that the pace of growth will continue to slow, due to six “headwinds,” back to historical long-term averages. These are:

1. Lack of a demographic dividend, where females entering the workforce caused a one-time growth spike in the last century that cannot be recreated. An aging population will result in a higher dependency ratio.
2. Plateau in educational attainment, as college graduation percentages fade from a peak about 20 years ago.
3. Rising inequality as growth in real income bifurcates between “haves” and “have-nots.”
4. Interaction between outsourcing and technology, eliminating jobs from all but those who charge the least in a global marketplace. These regions of choice revert to the lowest wages and flee as countries build a middle class. Some of these jobs are returning to developed countries as machines are developed to do the work previously performed by humans (e.g., textiles).
5. Events related to energy and the environment (also described in Section IV B 2 “Sustainability and Population Growth”) leading to clean-up costs and proactive charges as new processes are devised to collect carbon emissions, keep out rising waters or maintain food production.
6. High consumer and government deficits leading to higher taxes, combined with lower benefits and services and possible currency devaluations.

Professor Gordon assumes there will be no isolated growth gains or industrial revolutions to speed up growth, but does not predict that innovation will end. Innovation may be diverted to tasks such as cleaning air and water or more efficient desalination of sea water in the future, each a worthy task but unlikely to drive overall economic growth.

Each of these headwinds will drive unintended consequences as they interact with other events. For example, the sixth headwind in the above list has some fascinating potential implications. Governments could default on their debt, or follow a policy of inflation and currency devaluations to effectively do the same thing. This would not be an absolute benefit, as entitlements have various levels of indexing and some government bonds float with inflation levels.

The first revolution described by Gordon covers the period from 1750 to 1830, and includes the invention of the steam engine and early railroads. With follow-on inventions working off the original enhancements, by 1900 GDP growth had increased to about 1 percent per year. The



second period he identifies covers 1870 to 1900 and was a magical time that vastly improved standards of living for everyone, rich and poor alike. Inventions such as the electric light and internal combustion engine, along with fresh running water and the telephone, set up some of the one-time events Gordon describes by freeing up time and increasing the labor force. Following these initial inventions were automobiles, consumer appliances, supermarkets and sewers, which did much to improve the quality of life as well as life expectancy. Extending this era to 1970 incorporates television, air conditioning and interstate highways. The GDP growth rate spiked at about 2.5 percent annually and began to drop back down after that. The third phase of the industrial revolution was driven by computers, starting in about 1960 and continuing to play out today with secondary inventions.

His sixth headwind, driven by high leverage for both governments and consumers, could lead to stagflation or a financial breakdown in one or more countries. In late 2013, an unusual environment existed in the United States where fiscal policy was tightening and monetary policy was loose. This is one way to reduce government leverage, as currency devaluation encourages inflation while many of the government's debts are fixed rate. The Treasury Inflation-Protected Securities (TIPS) market, along with Social Security and Medicare entitlement programs, is inflation adjusted. A devaluation of the currency does not reduce debt as effectively as it would have in previous generations. Another risk some are worried about is a currency war where countries seek to devalue and no one steps up to be the "strong" currency that strengthens, since this will hurt domestic exporters. Japan's efforts, driven by Prime Minister Abe, to devalue its currency and build inflation domestically have potentially started this skirmish.

Gordon assumes there are no future one-time events to drive economic growth. Although this scenario should be considered, and contains some very interesting points about future growth rates and what their drivers might be, ingenuity should not be ruled out. In fact, based on Gordon's analysis of follow-on inventions the world should expect continued productivity growth based on the computer age into at least the near future. It is hard to argue that connectivity and other extensions of computer power have reached their limits.

## **2. Sustainability and Population Growth**

During the industrial age some say that economies have used resources without being charged, subsidizing economic growth. The accounting system accounts for "goods," but is asymmetric and ignores "bads" like pollution and soil degradation. One could anticipate a period in the near future where we repay these sunk costs to balance the slate for future generations. Economic growth would have to slow in this scenario, perhaps to a negative level, in order to pay to repair prior damage and proactively prepare for the costs of overshooting an ecological footprint and maintaining quality of life. This could lead to low economic growth and a low interest rate scenario far into the future.

Current value-based accounting practices incorporate the cost of capital, charging users an opportunity cost. Regulatory accounting practices should include a charge for subsidies received. Some are blatant, like the below-market-rate hurricane insurance offered by the state of Florida, but most are hidden costs like the damage done by a polluting factory to the atmosphere or water supply.

To repair past damage, and pay for future deterioration proactively, it is thought that 1 to 3 percent of GDP would be needed to stem the tide of climate change. This would impact economic growth and put downward pressure on interest rates. Some of these costs will increase before the benefits are seen, so decision-makers need to enact a longer time horizon than ever before.<sup>24</sup>

Politicians have adopted the “just-in-time” methodology that was so popular with manufacturers in the last generation but which was found to not be resilient. Everything from budget deals to immigration policy is taken to the brink of disaster before negotiations are even considered. Even greater risks are taken when applying this style to science. At some point human ingenuity will fail, with self-reinforcing feedbacks leading to a negative spiral. An increasingly warm atmosphere, with oceans saturated by carbon dioxide, could cause severe weather patterns to accelerate as the earth passes its sustainable tipping point. Monoculture crops may fail or regional freshwater shortages lead to conflict. This type of extreme scenario could cause governments to subsidize low interest rates as long as possible. It is unlikely they could do so forever without losing control of their currency.

Population constraints should also be considered. The earth held fewer than 2 billion people as recently as 1900, and now is at 7 billion and rising. Some cultures have utilized various forms of family planning to reverse this trend. These include culture changes that encourage smaller families, various family planning tools, and factors such as economic stagnation that cause couples to delay starting a family. Short term this leads to issues related to aging populations (e.g., Japan), with fewer workers for each retiree. In his book *Countdown: Our Last, Best Hope for a Future on Earth?* Alan Wiseman visits many cultures and describes the conflicting drivers that fuel the population growth debate.<sup>25</sup> The solution may be different in each culture as religion, government and self-interest each could play a dominant role.

Other economic costs that could reduce GDP growth are increases in health care costs and defense spending. On the other hand, scientific advances could grow GDP faster than in the recent past, which would allow for productivity growth and demand for loans, both of which would likely drive interest rates higher.

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<sup>24</sup> Randers, Jorgen. *2052: A Global Forecast for the Next Forty Years*. 2012.

<sup>25</sup> Wiseman, Alan. *Countdown: Our Last, Best Hope for a Future on Earth?* 2013.

### 3. Demographics

Perceptions vary over time. This researcher wrote an article in 1999 that spoke of low interest rates and the possibility that rates might trend even lower.<sup>26</sup> At that time the 10-year Treasury bond rate was about 5 percent. Recently it has rebounded to 3 percent, after being as low as 1.4 percent. In the article, it was noted that the period following the build-out of the railroad lines had led to a long period of low interest rates driven by productivity increases. Richard Hokenson has shared his view that demographics could drive a new era of low interest rates. As the world's population ages and many more enter the decumulation phase of their lives, more assets will be converted to cash. This will lower asset prices, growth rates, and ultimately interest rates as supply overwhelms demand. His argument is that young people buy goods and old people buy services. Overall consumption reduces as the population ages.<sup>27</sup>

Another way that demographics drive economic growth is through labor participation rates, especially those for males age 25 to 54. Gordon talks about the increased female labor participation rate as a headwind going forward, which is shown in Chart 3 in the years since World War II. The recent drop actually began following the dot-com bubble (highest recorded female participation rate was 60.3 percent in 2000) and accelerated the drop-off following the 2008 recession. This reduction in available workers has been across the board, except for ages 55 and above, and has resulted in lowering the unemployment rate to 6.3 percent.<sup>28</sup> If the participation rate is assumed to have remained steady at 2008 levels, the unemployment rate would be 11.2 percent.<sup>29</sup> Some workers have given up their search for work, at least temporarily. This could be a source of economic growth if jobs become available.

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<sup>26</sup> Rudolph, Max J. *Low Interest Rates: A Solvency Threat?* LOMA Resource. April 1999.

<sup>27</sup> Barnes, Jonathan. *The Race to Zero*. *CFA Magazine*. March-April 2011. Pages 36-39.

<sup>28</sup> <http://data.bls.gov/timeseries/LNS14000000>.

<sup>29</sup> Romano, Robert. U.S. Unemployment: Retirees Are Not the Labor Exodus Problem. *Forbes magazine*. January Jan. 15, 2014. <http://www.forbes.com/sites/realspin/2014/01/15/u-s-unemployment-retirees-are-not-the-labor-exodus-problem/>.

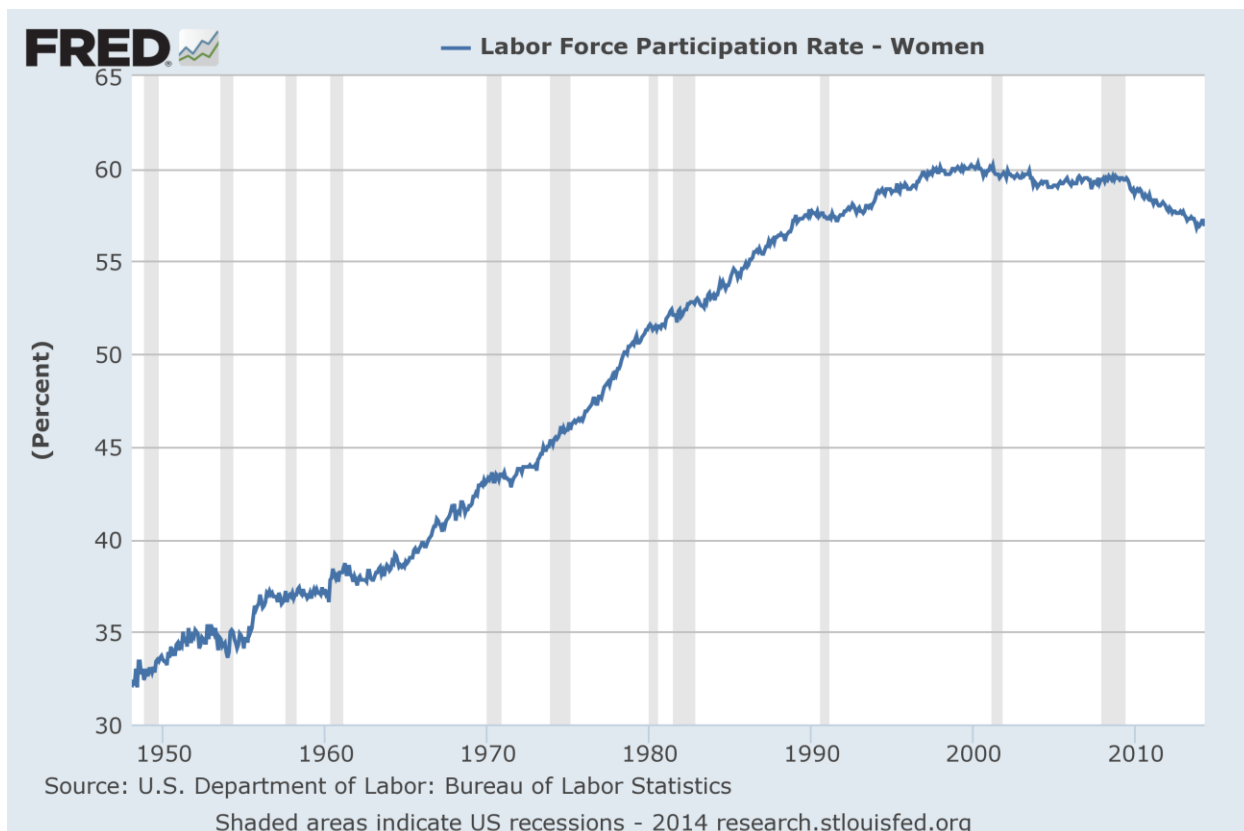


Chart 3<sup>30</sup>

#### 4. Confidence and the Velocity of Money

Monetarists assume that the velocity of money is stable, but data over the past 50 years shows this not to be the case. When debt is high it seems to lead to conservative practices by lenders and consumers, which slows the economy along with the velocity of money. A slow economy means demand for loans is low, and interest rates follow. As described earlier, currently the velocity of money is at historically low levels.

<sup>30</sup> Data Source: FRED, Federal Reserve Economic Data, Federal Reserve Bank of St. Louis: *Labor Force Participation Rate—Women*; U.S. Department of Labor: Bureau of Labor Statistics; <http://research.stlouisfed.org/fred2/series/LNS11300002>; accessed May 11, 2014.

## ***C. Considerations to Deal with Interest Rate Scenarios***

### **1. Investing as Support Function or Driver**

Balance sheets are often described as having a left side, driven by the firm's assets, and a right side, holding liabilities and equity. Manufacturing companies generally manage these separately, but insurers attempt to manage the interactions between assets and liabilities. This practice at various times has been called asset-liability matching, asset-liability management or liability-driven investing. It requires a decision about how to manage an insurance organization, including consciously determining a risk appetite. In many long-duration insurance contracts, additional premiums are collected in the early years beyond what is needed to pay claims. This money is invested and the principal repayments, along with investment income and additional premium, are used to pay claims in later years. These monies collected in advance are called float, and are comparable to borrowing money from policyholders (leverage). Float can be short-term too, especially when the combined ratio is stable, less than 100 percent, and rolls over each year. In that situation the float remains stable, can be invested to earn income, while claims are paid from ongoing premiums.

Consider a simple liability that collects funds today and pays them out in five years. Supply and demand will dictate the price you can charge. If the same nominal amount is expected to be paid out as was collected, then the cost of float is zero. It is free. If it is expected to pay out  $(1+2\%)^5 = \$1.104$ , then the cost of float is 2 percent annually over that time period. Some contracts expect a negative cost of float, meaning that less is paid out than is collected. Ignoring for a moment any potential deflationary environment, consumers would not enter into a contract with this expectation if it was a pure investment. But when insuring a home against loss from fire, a homeowner will probably be willing to pay more than the expected value of the loss to an insurer who can aggregate the risk and effectively use the law of large numbers to mitigate the downside risk for a large group of homeowners. This type of analysis is more commonly used by casualty and health insurance writers but can aid the understanding of long-term accumulation contracts too.

An insurer needs to determine where its primary expertise lies. Most focus on the liability side of the balance sheet and invest to support the policies sold, with some additional room built in for surplus assets to be more aggressive. Those who integrate both sides of the balance sheet, which includes most life insurers, still find that liabilities drive asset purchases (the order of the words in liability-driven investing is very descriptive). A few insurers feel they have investing acumen that can outperform the market and use it to manage assets independently from liabilities. These are generally casualty insurers who look at their assets and liabilities independently, with no desire to manage them together. Their goal is to minimize the cost of float while maximizing investment returns. This can work because future premium collections act as an asset that is matched against short-term liability outflows.

An example of a firm that feels it has expertise to manage both assets and liabilities is Berkshire Hathaway, the firm run by Warren Buffett with casualty business ranging from vehicles (GEICO) to reinsurance (Gen Re) to special opportunities (Berkshire Hathaway Specialty Insurance). Its cost of float is typically negative, and Buffett's investment skills are legendary. When private equity money enters the insurance market with this business model in mind, but lacks liability experience, their firms often contribute to market cycles through mispricing.

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

Interest rate generators are not designed to create 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. Historically we have seen periods of negative nominal interest rates. Recent experience often drives our perspective, and our surprise. 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 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 would be told to expect asset devaluations and problems with products having an interest rate floor. 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.

## **3. 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, more inflows from premiums, reinsurance claims, investment income and asset maturities need to be received 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, holding enough reserves to support the liabilities without impacting profitability and marketability. For example, cash holdings improve liquidity but hurt returns.

Bond prices 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 the value of a bond. 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 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 1 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 incorporates changes in cash flows due to interest rates. This calculation 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 (although the measure is theoretically defined as an instantaneous change it is usually approximated by averaging results from 1 basis point (0.01 percent) changes up and down).

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 are the reason that modelers are great sources of 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 of 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 to drive interest rates gives concentrated KRD results.

#### **4. Ties to ORSA**

Starting in 2015, at least 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 prudent insurer risk profiles. It is expected that insurers will provide reverse stress test scenarios, and low interest rates should be strongly considered by many in the industry for this purpose.

This will allow the insurer to see how this particular scenario impacts its specific and evolving risk profile.

## ***D. Impact on Financial Institutions***

### **1. Notional Segmentation of General Account**

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 assets to continue to legally support all product lines, rather than segmented into separate accounts where the assets are contractually limited to support just those liabilities. Companies may segment based on duration into asset portfolios that are short, medium and long, or based on product design requiring liquidity or choosing to accept additional credit or other risk to enhance returns. Large blocks of liabilities often have their own notional segment, but segments can't be shared across legal entities.

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 into a portfolio rate after five to 10 years.

Insurers who use a portfolio rate to price their products have had an advantage recently over those who use a new money IYM process since new money earned rates are lower than earned by assets purchased earlier. There have been times in the past where this relationship has flipped, with new money products taking share from portfolio-driven offerings. While theoretically this evens out over long periods of time, it tilts the competitive landscape in unintended ways.

### **2. Reinsurance**

Many insurance products are reinsured. Some contracts will mitigate the excess claim risk (e.g., mortality, morbidity, casualty risk), and others share the entire risk with the reinsurer as a proportion of the total risk (proportional). Sharing a risk does not absolve the direct writer of the obligation to the policyholder as counterparty risk is present. If the reinsurer becomes unable to pay, the direct writer remains responsible for any claims to the insureds. Financial reinsurance can provide temporary relief, and captives and offshore reinsurance provide regulatory arbitrage opportunities. Many of the risks associated with low interest rate scenarios apply to reinsurers as well since it is a systematic risk that is not reduced through the law of large numbers.

### **3. Insurance Products**

Low interest rates pose a challenge for insurance products, particularly those with interest rate guarantees and policyholder options regarding liquidity. While general insurance products like



homeowners' insurance are susceptible to unexpected inflation, the types of insurance most at risk when interest rates are low are those with long-tailed liabilities such as accumulation life and annuity products, payout annuities and long-term care.

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. For example, statutory accounting generally requires immediate expensing of acquisition costs, while U.S. GAAP allows deferral and amortization. Analysis of insurance products 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.

Nominal interest rate guarantees are dependent on macroeconomic factors that are not impacted by insurers. Insurers should be proactive with the NAIC and other stakeholders, perhaps using real rather than nominal rates. Nominal interest rates, both on new business and in-force, could consider reducing or eliminating guarantees on fixed accounts. Today the solution is to wait until the firm is insolvent to lower guarantees, and then only for that firm. This seems reactive and not consistent with an alignment of incentives among all stakeholders.

#### **a. Life Insurance**

Life insurance products can be split 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.

U.S. GAAP methodology varies by type of contract. Fixed contracts have assumptions locked in at issue unless a loss is expected, while flexible contracts like universal life and deferred annuities adjust (unlock) based on actual historical results and current expectations of the future. This determines the price (premium) charged, and can vary by characteristics such as sex, age, health status and year of issue. Prices for coverage rise as interest rates fall. Aggregate reserves are tested each year through cash flow testing regulations to determine if they are adequate. Many life insurers have posted additional reserves due to the low interest rate environment based on this testing.

Assets typically backing life insurance products are 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 using changes in market value consistently for both assets and liabilities. If the cash flows are perfectly matched, then a market value analysis will

show no volatility as both assets and liabilities adjust in the same amount and direction as interest rates change.

A firm may focus on being duration matched, but even when using effective duration this is only 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 found in each. For example, convexity and other higher-order metrics are not captured. 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 seem to compound. A long period of low interest rates driven in part by government manipulation, such as is present currently, is likely to result in surprises.

### ***Term Life***

At one time, individual term life was primarily annually renewable term (ART). Some used the product to “buy term and invest the difference.” It is sold in both the individual and group markets. By its nature, the ART product is not very interest-sensitive and is invested with a short duration target. However, today’s term life includes policies designed to be in force with level premiums for five, 10, 20 years, even to age 65. These products act much more like cash accumulating whole life products as the maturity period extends and the assets are often commingled with those products. Future iterations of these products developed in a volatile interest rate environment might have shorter guarantee periods or a guarantee that rolls over every few years based on the investment strategy.

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

Included in this subset of life products are 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. This section discusses products where the premiums and cash value buildup are defined at issue. Participating policies collect higher premiums and return them, with interest, if conditions permit as dividends. 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.

When interest rates are below expected levels in a whole life policy, the portfolio interest margin decreases and could become negative. This compares actual investment earnings to the growth in the accumulated cash value due to interest credited (rather than additional premium received). As interest rates drop, the portfolio rate grades toward the new money rate, quickly if there is little cash value buildup and more slowly as the policy ages and the buildup is larger relative to the new premium received. Once the theoretically supportable new money rate is lower than the credited rate the contract holders have a very good deal and will do what they can to continue

with the policy in force. This increases the interest rate sensitivity. Behavioral finance plays a part in this discussion, as many policyholders do not efficiently act on the options they have been granted. Some will surrender because they need the money, while others may be incented by an insurer to replace the policy with one having lower guarantees. There is a risk in a low interest rate scenario that a policy becomes worth more than its cash surrender value, making a life settlement (where investors buy these policies and maintain them until death) more likely.

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

Universal life (UL) 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) policy passes most of that risk to the buyer of the contract. Investment performance “passes through” 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 existing to support product. As product reserves increase, specific portfolios are created for a 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. It provides underlying interest rate guarantees but also promises to pass along any higher investment earnings (leading to interesting 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) come primarily from the interest and mortality components. The mortality charge is based on current age and is applied to the net amount at risk, the face amount net of the tax-deferred buildup of account value.

Managers of a UL block should think about 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 a 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 of the contract. Expenses related to issue and selling commissions generally combine to an amount 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 to back the policy, 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.

When interest rates drop some companies reduce the credited rate more quickly than the portfolio rate (increasing the spread) due to lack of good alternatives for the policyholder, and some have taken capital gains to income but not adjusted the interest spread. This has not been challenged by regulators in the past, and is only possible until the credited rate equals the guaranteed rate.

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

When the assets are legally segmented from the general 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 to 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 with 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 (CDs) sold by banks. They are generally interest rate sensitive, especially for single premium deposits sold in a competitive marketplace. Some reset based on current interest rates every three to five years. Surrenders adjust with the current level of interest rates. If rates available in the market are higher than is being credited, surrenders will exceed a base rate. 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 at that point the product is shopped and rolled into a more competitive product. Taxes are deferred through inside buildup features and paid when the contract is surrendered or annuitized. Policies have interest rate floor guarantees. At one time the lowest possible rate allowed was 3 percent. This rate now floats down to 1 percent, but mature policies continue at higher credited rates

based on the original issue year. An astute policyholder will maintain these higher-yielding policies as long as possible.

Investing for a deferred annuity can be tricky as its characteristics change over time. At issue the policyholder has five to 10 years of surrender charges and is unlikely to surrender the policy during that time, but after that there is little difference between a deferred annuity and a money market fund 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 eventually the portfolio rate becomes too low to support the guarantees. Regulators should consider this growing issue and research long-term solutions such as limited duration guarantees or guarantees that reset periodically based on current conditions.

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

Payout annuities have both interest rate risk through reinvestments and longevity mortality risk. If interest rates drop after issue, then future cash flows 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 or cyclical interest rates, so a long period of low interest rates impacts pricing negatively. Reduced mortality is another risk, as payouts are generally life-contingent. 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 a CPI index. 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. Alternatively, if interest rates were to spike and the COLA has no ceiling there would be shortfalls in cash flows and income. Structured settlement products that satisfy court judgments often have long durations. Conservative assumptions should be used. Perhaps conservative assumptions could be built within a participating annuity product.

Some companies in the past that focused on duration matching have engaged in barbell investment strategies, combining a short block of deferred annuities or GICs with a long block of payout annuities. This assumed interest rate risk was linear, ignoring convexity and other higher-order effects. Generally, as interest rates move away from current experience 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, while in reality they have increased the risk of non-parallel interest rate movements. Regulators should be careful to avoid this situation, focusing on potential cash flows as their primary oversight tool. 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.

## **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 GICs, paying to an institutional investor (e.g., 401(k) short account) either simple or compounded interest, fixed rate or floating, over a stated period such as three or five years. 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 (GA) in 2000. The GA product had a seven-day put option that was widely exercised after GA experienced a rating drop. If a floating rate funding agreement were put (returned) to the insurer they would have the option of selling the asset or selling a matching liability to meet the liquidity need. Inflows can provide cash for outflows, especially in a crunch. This would also be an option if rates rise and there is a run on the bank, selling new business to provide cash for surrendering policies. This serves a liquidity need but will have longer term 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. Variable annuities 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. A simple example would hold general account reserves for a death benefit that is in the money (worth more dead than alive). 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 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. Property/Casualty Insurance**

Property risks (e.g., home and auto) usually cover a single year's exposure (longer-term run-outs for single-year casualty exposures use ALM strategies), and are repriced annually using a combined ratio (loss ratio plus expense ratio). Interest rates factor into the expected combined ratio in the pricing process to earn a specific total return. If interest rates are high then the combined ratio can be higher due to higher investment returns. On the other hand, if rates are low and there is little contribution to profit from investments then premiums will be higher,

resulting in a lower combined ratio. 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 of 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 to include selectively adding volatility (stocks), interest rate risk (going out on the yield curve) or liquidity risk (investing in non-liquid assets).

In a low interest rate environment, casualty insurers must rely on underwriting results to drive profits. Technology, such as the use of telematics (e.g., wireless computing used to monitor actual driving practices), can be used to create a better match of risk and premium to help offset lower investment income.

Property/casualty risk can provide diversification benefits to external investors, making cat bonds popular. This provides insurers with an alternative to reinsurance 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>31</sup>

#### **d. 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 have a major interest rate risk component. Others are driven by age, type of illness, and disease or injury onset.

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

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 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.

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<sup>31</sup> Kandell, Jonathan. Insurers Retool Their Businesses to Adjust to Low Interest Rates. *Institutional Investor*. Oct. 21, 2013.

### ***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 for individuals age 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.

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

Group and individual disability income 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 already on claim. Group policies are issued to most employees so 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***

Long-Term Care (LTC) insurance has been around for over 20 years. The product 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, 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 created downward pressure on the product's profitability. Rate increases are an option for management to offset some of the downward pressures to income.

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 are 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 metrics.



## e. Pensions

Many insurers offer defined-benefit (DB) benefits to employees, 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. 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, 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. Another tool is to match cash flows for 15 to 20 years and manage the remaining assets to maximize total return.

## 4. Asset Class Review—Bubbles Forming?

According to a May 2013 ING Investment Management 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>32</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 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 in a low interest rate environment and is not meant to cover all aspects of each offering.

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<sup>32</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>.

## **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 lower discount rate results in higher asset values. Since the inflationary spike in 1980 above 13 percent, the drop, while not continuous, has been steady. Recent risk-free interest rates have been below 2 percent. 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 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 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 becomes callable, 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, with market values dropping as current rates are higher than the coupons.

### ***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. 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, and this lowers 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 the current status of 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***

Many think of Treasury Inflation-Protected Securities (TIPS) as a hedge against future inflation concerns, but they also provide the market's current implied expectations about inflation. By

netting the rates in Chart 4 (10-year TIPS) and Chart 1 (10-year Treasury), an estimate for inflation expectations can be calculated. For example, at the end of April 2014 the 10-year CMT was 2.67 percent and the 10-year TIPS 0.49 percent, so expectations were for inflation of 2.18 percent.



Chart 4<sup>33</sup>

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

When underlying collateral is pooled 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, car loans and Bowie bonds (where music royalties for an artist are securitized, with the initial offering involving David Bowie). Securitized assets may be sold to investors as a proportion of the total block or tranced based on prioritized principal repayments that vary the creditworthiness of the asset. Securitized assets are sometimes combined with other securitized assets of the same type, with the 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

<sup>33</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 29, 2014.

systematic risk. In normal times, defaults and interest rate optionality tend to be the primary drivers of volatility. Capital requirements are driven by rating.

### ***Mortgages/RMBS***

Residential mortgages and complex securitization packages using them were an initial driver of 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 ratings and lower loan-to-value metrics. 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 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.

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 cash flows or long-term cash flows if the desire is to have a portion of the mortgage cash flows. They are tranching, and principal payments go first to the shortest tranche. Interest rates drive prepayments, but at low stable 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 options granted.

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

Stocks are impacted by interest rates through the discounting process and through the impact of rates on debt and profitability of the underlying business. This affects 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 to that improves 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).

### **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 reduce. 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 as well as counterparty risk.

### **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 commonly found at insurers, so it is common to outsource using external investment managers. Fees can be high, sometimes over 2 percent of invested assets, and investment mandates generally ignore liability characteristics. This makes these assets a better fit for surplus portfolios.

## **5. Interactions between Asset Classes**

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 the 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 due to liquidity risk. Results 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) makes a challenging situation much worse.

## 6. Strategies to Improve Yield

There are a number of strategies commonly used to improve yield when interest rates are low, but it is important to recognize that each option likely 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. As is said, cash flows are real and accounting-based income statements are opinion. A 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 fees 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 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 if the current environment reflects investor opinion 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>34</sup>

Insurers have less liquidity risk than others who compete for institutional assets so have an advantage in asset classes like private equity, where investors are paid higher returns in return for accepting higher liquidity risk.<sup>35</sup>

Equities must hold higher required capital than many other asset classes, making equities 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 for 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. 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 or other equity-type exposures (e.g., preferred stocks), but capital requirements are

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<sup>34</sup> Siegel, Michael H., and Farzana Morbi. *Navigating Low Yields: Opportunistic Credit for Insurers*. GSAM Insurance Asset Management. December 2012.

<sup>35</sup> Earley, Mike, and Lloyd Ayer. *Asset Allocation Strategies for a (Still) Low Interest-Rate World*. Deutsche Asset and Wealth Management. September 2013.

high for these asset classes. With interest rates near historical lows, additional research is needed to determine if the traditional capital requirements where bonds generally hold less capital than equities is reasonable. For example, portfolios hold the same capital for 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 have been known to spur demand bubbles. 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 and earn good returns (think of a start-up hedge fund for comparison purposes). As high returns draw more money in, the marginal asset investments become less likely to create strong returns. Eventually the “smart money” leaves 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.

## **7. Strategies to Manage Risk**

There are many things an insurer can try when managing through a low interest rate scenario, but each adds new risks. It’s not easy. There are no silver bullets. Formal documents describing investment policy (IPS) and risk appetite provides a road map to management as they work together to build a specific set of risk exposures, identify scenarios to be mitigated as part of an overreaching 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 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, 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 adding analysts whose job is to think of ways to take advantage of policy features as sophisticated skeptics.

### ***Regulatory Changes***

This section describes author recommendations for regulatory consideration of areas impacted by low interest rates. Focusing on only the current regulatory regime, the NAIC and state regulators (along with the Internal Revenue Service (IRS) for tax issues and the Federal Insurance Office for international issues) should be considering the risks of relatively high guaranteed interest rates in a low interest rate scenario. Consideration should be given not only to the potential risks faced by individual life insurers, but to the prospects for widespread industry challenges from a long-term low interest rate scenario. This should include non-level pricing spreads based on the current environment, and outside experts could be engaged for their unbiased opinions.

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 German-based actuarial organization, DAV, has recommended that its regulators revisit the appropriate level of interest rate guarantees in 2014, suggesting that the current rate needs to be lowered but stopping short of eliminating these interest rate floors.<sup>36</sup> Likewise, regulators in the United States should seriously consider changes to the current system of interest rate guarantees. Timely actions could allow relief for new policies to address the systemic risk, but if interest rates hold at unsustainable levels for a long period creating industry-wide solvency issues, then changes to in-force policies might need to be considered.

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. Holistic analysis and principle-based methods that consider the initial environment and the entire financial entity would be helpful. The NAIC's Solvency Modernization Initiative may provide an opportunity to start this important collaboration.

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

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

Will interest rates rise, fall or stabilize? As Howard Marks stated in an August 2013 newsletter,

*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>37</sup>

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<sup>36</sup> Sues, Oliver. German Actuaries Recommend Life Insurance Guarantee Cut. *Bloomberg*. Jan. 8, 2014. <http://www.bloomberg.com/news/print/2014-01-08/german-actuaries-recommend-life-insurance-guarantee-cut.html>.

<sup>37</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).

Volatility seems to be the most likely of scenarios, with the current practice of a slow, upward trending interest rate scenario as the base seemingly least likely and often best case. Unfortunately, this is the scenario most often presented as “best case.”

### ***B. Potential Causes of a Low Interest Rate Scenario***

This paper has laid out potential reasons for a sustained low interest rate environment and the resulting net impact on an insurer’s balance sheet. This report has discussed a number of drivers that could lead to long-term low interest rates, including demographics, sustainability and the impact of government actions.

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

Insurers should test their specific risk exposure and strategy against scenarios to determine any potential impact. For those products without interest rate guarantees the ramifications seem minimal, but for an insurer with material floors on credited interest, or reserves/pension plans that accumulate over time based on pre-funding, a long period of low interest rates could be a worst case scenario. If interest rates spike, some insurers may become insolvent due to policyholder disintermediation, asset losses and ALM/liquidity issues, but a low rate scenario could systemically doom many more life insurers if the states do not provide relief from the legal guarantees. As the Federal Reserve considers systemic risk applicable to insurers, the implication of a low interest rate “Japan” scenario should be considered. Transparency will be important in this discussion as conflicts abound, with the Federal Reserve considered a driver of the extreme scenario with monetary policy influencing the outcome.

As portfolio yields for insurers have fallen they 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?” Many insurers are taking a bet that the returns will offset the risks, ignoring the characteristics of the liabilities. Historically this has been a poor bet. What is different in today’s environment?

Insurers and their trade organizations should talk to regulators about both systematic and systemic risk (regulators may use the term macroprudential) associated with mandated interest rate crediting floors and utilizing a principle-based approach to capital requirements. Federal regulators are becoming more involved in what has traditionally been the purview of the states, especially when international issues are being addressed, so they and the IRS should be engaged as well. 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 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***

A number of concerns described in this paper could come to pass simultaneously. For example, it should not be considered an extreme scenario if all of the following were to happen at once: the velocity of money remains low; population growth and aging demographics combine to stress economic growth; and resource depletion and climate change make the environment volatile and challenging. If that scenario presents itself, the world will be a difficult place to maintain, let alone grow. Surprises will be everywhere for the unprepared. Long-term trends toward low interest rates might be disturbed by short-term pressures toward higher interest rates, and if this happens regulators and financial institutions should recognize that the risk of low interest rates has not gone away but timing has allowed solutions to be put in place (much like the cyclical nature of markets provides periods where pension plans are fully funded).

One of the risk manager's jobs is to share bad news with company management. Sharing these types of stress scenarios, and how they might impact an insurer's specific risk profile, is one of the most important tasks of the risk team. Proactively addressing these risks, and publicly encouraging governments and other firms to do so too, may help to mitigate them.

In *A Christmas Carol*, Ebenezer Scrooge shared a deep wisdom when he so famously asked the Spirit of Christmas Yet to Come, *Are these the shadows of the things that WILL be, or are they shadows of things that MAY be, only?*<sup>38</sup> Some risks are too big, timing too uncertain and options too costly to mitigate, like the impact of an asteroid or eruption of the Yellowstone Caldera. The events described here are not nearly so far in the tail of possible outcomes. They should initially be qualitatively considered, and if their likelihood increases then more time spent discussing them strategically and mathematically. No one knows the future, but this is an era of just-in-time science that must continually overcome Malthus-type forecasts of resource depletion and overpopulation. One misstep could be disastrous. Adding to this a governmental environment with no consensus path, people with long time horizons are needed who can reasonably consider alternative futures.

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<sup>38</sup> Dickens, Charles. *A Christmas Carol*. 1843. <http://www.stormfax.com/dickens.htm>.