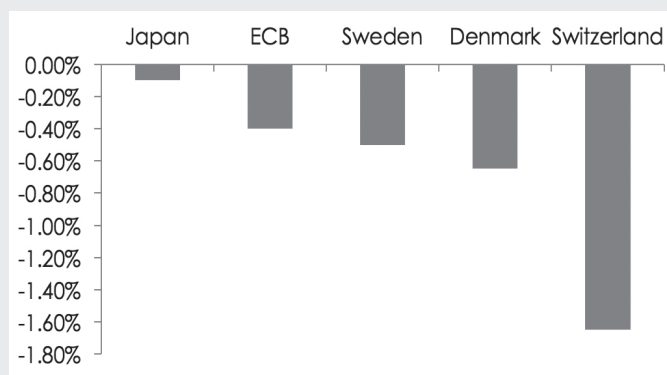# Risks & Rewards

SOCIETY OF ACTUARIES

INVESTMENT
SECTION

The Impact of Negative Interest Rates on Derivatives Markets

By **Capstone Investment Management**

In January 2016, the Bank of Japan (BOJ) surprised investors by cutting its poli-cy-rate balance from +0.10 percent to -0.10 percent. In so doing, the BOJ became the fifth central bank to adopt a negative interest rate policy (NIRP) following the European Union (EU), Denmark, Sweden and Switzerland. Like the EU and Sweden, Japan is using negative interest rates primarily in an attempt to stimu-late economic growth and inflation, whereas Denmark and Switzerland are using policy rates principally to prevent their currencies from appreciating. Naturally, the announcement from the BOJ sparked speculation the Federal Reserve (Fed) would be next. The view was further fueled by a 12 percent sell-off in the S&P 500 to start 2016, and by Federal Reserve Board Chair Janet Yellen's statement that negative interest rates were not "off the table." There has been considerable de-bate around the effectiveness of negative rates as monetary policy, but their effect on the financial system, including the interest rate derivatives markets, is evident.

Exhibit 1. Negative Policy Rates

Source: Bloomberg

Risks & Rewards

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Chairperson's Corner
Are You in the Top 10?

By Jeff Passmore

About 10 percent of Society of Actuaries (SOA) membership volunteers in some capacity: writing exam questions, grading exams, speaking at meetings, serving on a section council or the Board, etc. Consider all the work being done by these 3,000 or so people to advance our profession. Then imagine the potential of what could be done if we could engage the other 90 percent, or even just a significant portion.

By the time you are reading this, the SOA should have rolled out the Member Engagement initiative with just this goal in mind. The Investment Section is doing its part by running a membership drive, where members can get prizes by helping others enroll in the section. Engagement and volunteering go up with section membership.

Right now participation in the contest is running low—we started this drive after most had renewed membership. The good news for you is that low participation improves your odds of winning! Prizes will be awarded for first ($500), second ($300) and third ($200) place recruiters. It only costs $25 to join the section. Do the math, and then sign some people up!

After you have finished recruiting, consider where else you can contribute. Or if you are already one of the 10 percent, encourage one of your colleagues to share their talents with us. Getting involved is rewarding; here are some reasons for volunteering that you might consider and use in your recruiting:

- Developing and exercising leadership skills

- Networking: Volunteering gives you a chance to meet other leaders in our profession and to be recognized as a leader yourself.

- Advancing the profession: both keeping our credentials relevant and giving back to a profession that has been so good to us

WHAT HAVE *YOU* DONE FOR *ME* LATELY—YOU MIGHT ASK THE SECTION
In my opinion, the most important role of the Investment Section is to provide professional development content for our members and other investment actuaries. In 2016 we have done, or soon will do this, through:

- **The Investment Symposium.** Our flagship event, held once a year where we have a day and a half of keynote speakers and three tracks with a total of 18 breakout sessions.

- **Delivering presentations.** We have provided two sessions at the Life & Annuity Symposium, and will provide two to four at the Valuation Actuary Symposium, and 13 at the Annual Meeting this year.

- **Webcasts.** We will have at least three this year—and looking to do more!

The section also has a part to play in keeping our credentials relevant. For example:

- We have a partnership with the Actuarial Research Conference (ARC) this year. The ARC is the annual gathering of academic actuaries, held this year in Minnesota. Academic actuaries help keep our credentials relevant by expanding the actuarial knowledge base with new tools and techniques. Like some of the other sections, the Investment Section is helping to sponsor the ARC this year. In return for our financial support the ARC will write an article for our Risks & Rewards newsletter next February and provide a webcast later this year for our members. This partnership is a win-win, and I am hopeful it can grow to be even more significant in future years.

- Networking also helps keep our credentials relevant. Expanding our circle of influence through meaningful venues with substantial content is a big part of our 2016 plans. For example, we are creating an Asset-Liability Symposium that will run concurrently with the Inaugural SOA China Annual Symposium in Beijing, China, in September.

• Speaking of networking with other organizations, my apologies to PRMIA. My February 2016 chairperson's article misspelled its name as Premia. PRMIA is the Professional Risk Managers' International Association and they have been good partners, co-sponsoring several events with us. Darn that autocorrect!

Further, communicating is an important part of what we do as a section. In addition to our twice-yearly publication of Risks & Rewards, we are using e-blasts and e-bulletins to get information to you in a timely and efficient way. Be on the lookout for and please read them—we promise to keep them brief!

It's also important to have some fun. I hope you are participating in our investment contest this year. We have made significant changes to the contest to make it more realistic. There are now three competitions with real-world-type goals, more asset classes and more frequent rebalancing.

Happy reading, and I hope to see you at the Annual Meeting!

Regards,

Jeff Passmore ■

Jeff Passmore, FSA, EA, a member of the Investment Section Council and current section chairperson, can be reached at *jeffpassmore@hotmail.com*.

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Your Investment Section's Redington Prize committee plans to award a total of $10,000 next year for the best papers on investment-related topics.

• The paper must have been published during calendar years 2015–2016 (not just submitted)

• An SOA member must be the author or major contributor (in case of group projects)

• The paper must be judged to be timely and of substantial value to SOA members and other investment professionals

• The paper may appear in actuarial publications such as the *North American Actuarial Journal* and *ARCH*. The paper may also appear in nonactuarial publications of comparable quality, such as the *Financial Analysts Journal*.

• Previous winners include Irwin Vanderhoof, Luke Girard, Larry Bader, Robert Reitano, Phelim Boyle, Jeremy Gold and other rock-star celebrity actuaries.

More details to come, including the official rules and eligibility requirements. In the meantime, dust off that manuscript and have it published by a recognized journal before the end of the year. That way your work may also receive top peer recognition in the next round of the Redington!

New Research on Pension Assumptions

By Vic Modugno

A Society of Actuaries (SOA) project oversight group recently approved a research paper titled, "Determining Discount Rates Required to Fund Defined Benefit Plans," by John Turner and three other economists. This should be available soon on the SOA website under "Research." This report will be of interest to all investment actuaries because it addresses the challenging issue of what to use for the liability discount rate.

The paper describes a new way to look at pension funding for ongoing plans that is a variant of using expected returns (currently used in public plans). This approach takes into account the risk that contributions will be needed in the future for this year's benefit accruals. This risk arises from both asset returns and liability cash flows. Currently, both the expected return method and the bond rate method (used in private plans) assume the projected cash flows based upon actuarial assumptions are exactly realized.

This new approach (stochastic funding) has an explicit probability assumption that additional contribution for this year's benefit accruals will not be needed (60 percent in models in this paper). It also assumes the existence of an employer to make additional contributions in the future. This could also be subject to a maximum amount of additional contributions. The expected return method used in public plans has fixed liability cash flows and a 50 percent chance of not requiring additional contributions. Both expected return and stochastic funding methods assume that the mean and standard deviation of returns for some historical period will apply in the future. Among other issues, they do not take into account parameter uncertainty in the projections.

The paper has a fairly complete literature review of all of the methods used in determining discount rates for defined-benefit plans. It then goes through a mathematical analysis of the methods. The method proposed in the paper answers the question, "What is the discount rate needed for determining contributions to assure that current contributions will be sufficient c percent of the time so that future contributions will not be needed to pay off the liability?"

The models used for methods in the paper begin with a simple two-period model where either assets or liabilities are risk-free, and move to a more complex, multi-period model where both assets and liabilities are risky. Using a 60 percent assumption of no additional contributions and other simplifying assumptions, the paper runs scenarios with varying investment strategies. These runs showed that increases in returns from a riskier portfolio strategy are offset by the 60 percent requirement; there is no increase in discount rates from moving into riskier investments. One of the perverse incentives in the current expected return method used for public plans is that they encourage these plans to move into riskier investments to lower costs. This is happening at a time when plans are maturing with more retirees and an older workforce, which should be funded with more conservative investments.

The model is then generalized and tested where the 60 percent probability is modified such that contributions are needed if the assets fall below some amount (90 percent and 99 percent are used) such that there is a no more than a 10 percent chance that more than 10 percent additional contribution would be needed.

Even in a non-pension context, the method may have applications for dynamic strategies that benchmark the asset manager's performance directly to a liability index.

Politicians want to provide maximum benefits for minimal taxes. Deferred compensation valued using aggressive actuarial assumptions is one way to do this. Advocates of expected return methods argue that valuing benefits using bond rates and investing in risk assets would result in a windfall to future taxpayers when higher returns are realized. Bond rate advocates argue that a dollar in bonds equals a dollar in risk assets, and any gains in the future belong in the future since those taxpayers took the risk of losses. The paper proposes a method that produces a rate in the middle, by factoring risk into the expected return method. ∎

Vic Modugno, FSA, MAAA, is a consulting actuary in Huntington Beach, California. He can be reached at vicmodugno@verizon.net.

The content to follow examines the impact of negative rates on the derivatives market with a focus on the EU and Japan and discusses how and why investors may need to alter investment strategies as a result. Divided into two sections, the first examines how NIRP has affected short-term swap rates and whether investors should reconsider their assumptions about the behavior of rates. The second lists a number of potential implications for investors from NIRP. The goal is to gather insight for what potentially awaits the United States should the Fed adopt a policy of negative rates.

MODELING INTEREST RATES

A probability distribution is a statistical function that describes the behavior of a random variable. It calculates the likelihood of a given range a random variable can take. In finance, probability distributions are widely used to model the returns of assets.

Exhibit 2. Normal versus Lognormal Distribution
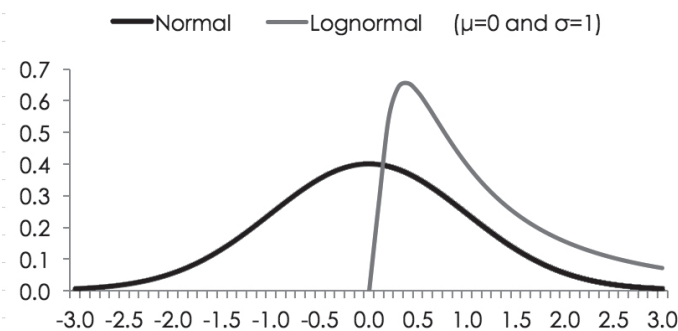
Source: Capstone Investment Advisors

Most investors are familiar with the normal distribution, which is often used to model the return of equities.

Interest rate models have historically been constructed with a lognormal distribution, because of ease of use, and because the short-term forecasts generated from this distribution tended to fit the observed behavior of interest rates. The first observation in such a model is that interest rates cannot be negative. The other is that the volatility of interest rates is proportional to the level of rates, sometimes referred to as the level effect. The level effect is intuitive in an environment where rates have a zero-bound. As interest rates approach zero, there is less room to move, and as a result volatility should be lower. Today, because of NIRP, interest rates appear to be behaving contrary to what is expected by a lognormal distribution, which suggests that investors may have to alter their interest rate models.

IMPACT ON INTEREST RATES AND VOLATILITY MARKETS

It is clear that the first assumption of non-negative rates has been violated, at least for short-term rates. One-year swap rates for the countries that have adopted NIRP are currently negative. What is less straightforward is the impact on volatility. Realized volatility of one-year swap rates in JPY significantly picked up after the BOJ reduced its policy-rate balance to -0.10 percent, and it diverged from its historical, proportional relationship to the level of rates. In contrast, there was almost no impact on volatility for one-year swap rates in EUR, as illustrated in the following exhibit.

Exhibit 3. Realized Volatility versus Spot for One-Year Swap Rates
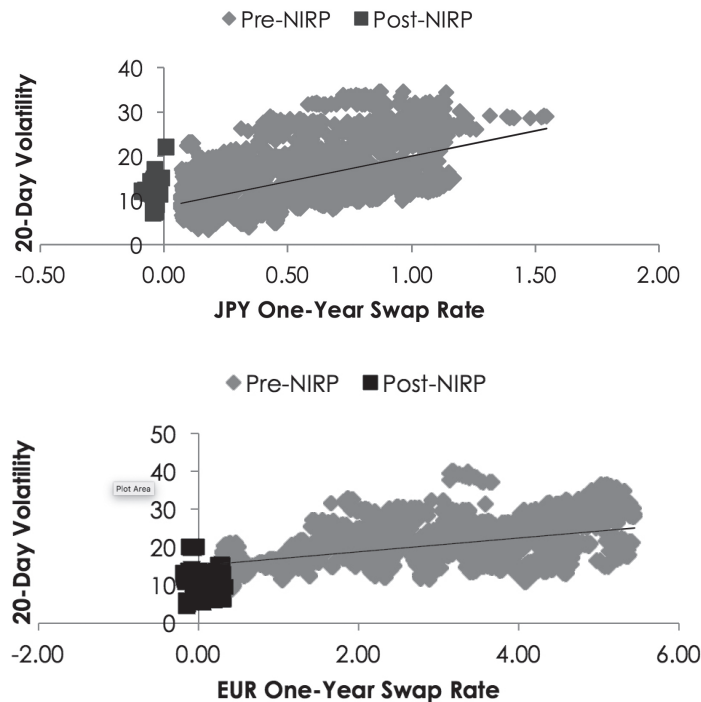
*Volatility calculated as the annualized standard deviation of the daily absolute change in the one-year swap rate

Source: Bloomberg, Capstone Investment Advisors

What is more interesting is the effect of NIRP on implied volatilities. The implied volatility for three-month expiry one-year at-the-money (3M1Y ATM) JPY swaptions jumped after the

BOJ's announcement. In the EU there was no immediate impact when the European Central Bank (ECB) adopted negative interest rates in 2014. Instead, implied volatility slowly ticked higher. The disparity in the market's response was largely due to the fact that the ECB's negative rate announcement was widely expected, whereas the BOJ announcement caught investors off-guard. Only one wee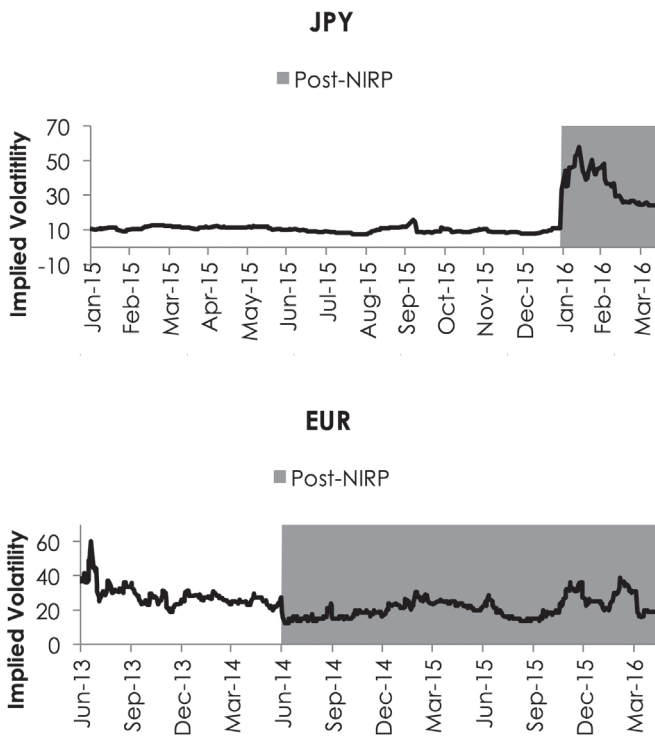k before the BOJ's announcement, its governor had ruled out negative rates. It is also worth noting that after the initial surprise, implied volatility for JPY retreated from its peak and currently trades at the same level as EUR.

Exhibit 4. EUR AND JPY Swaption Implied Volatility

JPY

■ Post-NIRP

EUR

■ Post-NIRP

*Mid-market implied volatility for three-month expiry one-year at-the-money swaptions

Source: Credit Suisse

A similar story can be found in swaption skew, measured as the difference between +25 bps and -25 bps out-of-the-money (OTM) swaptions. JPY skew dropped significantly and became negative after the BOJ announcement. Negative swaption skew means the "volatility smile" is higher on the left (low rate) side than on the right (high rate) side. This means the derivatives market expects volatility will be higher if rates fall rather than rise, contrary to the level effect. The skew in EUR declined as

well but its move has been more gradual and remains positive. In both markets, skew has not normalized to pre-NIRP levels.

Exhibit 5. EUR AND JPY Swaption Skew

JPY

■ Post-NIRP

EUR

■ Post-NIRP
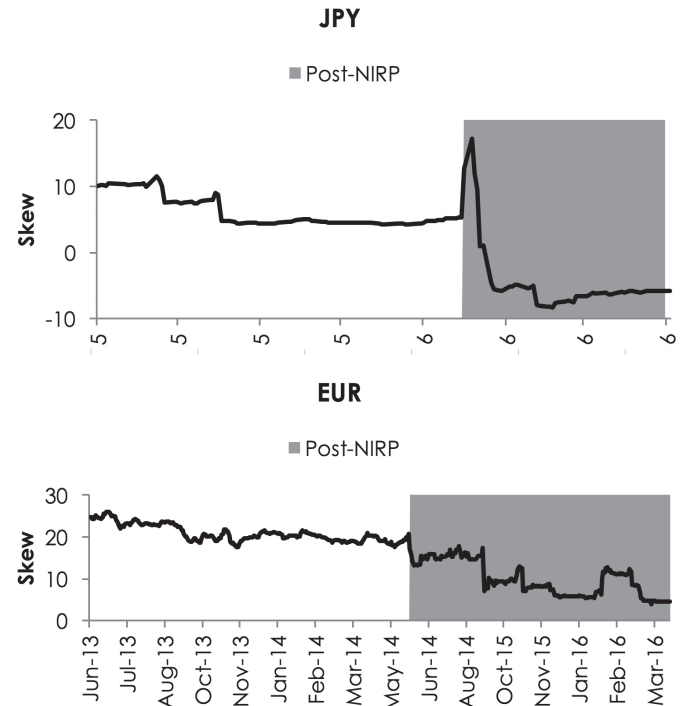
*Difference between the mid-market implied volatilities for three-month one-year +25 bps and -25 bps out-of-the-money three-month expiry one-year swaptions

Source: Credit Suisse

The contrast in the impact on the EUR and JPY volatility markets begs an explanation. While it is difficult to pinpoint the reasons for the varied impact of NIRP, there are several potential causes. First, as mentioned, the ECB's announcement was widely anticipated while the BOJ's was a surprise. The second is the varying degree to which the ECB and BOJ use NIRP as monetary policy. The ECB has banned itself from buying bonds lower than the deposit rate, which currently stands at -0.40 percent. This has effectively moved the lower bound in rates from 0.00 percent to -0.40 percent but has not eliminated it altogether. Furthermore, the ECB has indicated it is more inclined to rely on asset purchases rather than further cuts in the deposit rate to boost its economy given the latter is an implicit tax on the banks. Since the floor has not been removed, it is not surprising the move in realized and implied volatilities has been muted even though one-year swap rates are negative.

In contrast, when the BOJ initially cut its policy-rate balance to -0.10 percent, it did not provide guidance on how low rates could go. In other words it did not specify a floor. Add to the lack of guidance the fact that the BOJ purchases almost 100 percent of the debt the government issues on a gross basis, and one could easily conclude that further cuts are one of the few tools left in its monetary policy "toolbox." Therefore, it is not surprising that not only did realized and implied volatilities jump after the initial announcement but also both retreated from their peaks once the BOJ took measures to soften the impact of negative rates.

So what is the implication for interest rate models? On one hand, the models need to be adjusted to allow for negative rates. On the other, the relationship between volatility and the level of rates appears relatively unaffected. This suggests that lognormal models may not need to be completely discarded. For example, some institutional investors have started to use a shifted lognormal model in which they adjust the shift to allow for a non-zero floor.

IMPLICATIONS FOR INSTITUTIONAL INVESTORS

There are two potential impacts of negative rates for U.S. investors should the Fed follow the ECB and BOJ. First, the cost to hedge against a decline in interest rates will become more expensive. It is a critical issue for pensions, endowments and in-

surance companies that have future cash liabilities because as interest rates fall the present values of their liabilities rise. The experience in Japan immediately after the BOJ's announcement represents the worst-case scenario where implied volatility significantly rose and skew drastically fell. Alternatively, the experience in the EU offers the best-case scenario. The experience for U.S. investors should the Fed adopt NIRP will depend on whether the Fed's policy mirrors that of the ECB or the BOJ.

Another, more positive impact of negative rates would be on asset allocation. Investors have traditionally relied on the negative correlation between bonds and equities to lower the risk of their portfolios. However, historically low bond yields have raised the question whether a traditional equity/bond portfolio can protect investors against large drawdowns in a bear market. Consider the recent sell-offs in the equity markets in the EU and Japan. While 10-year Bunds and JGBs had positive returns in the drawdowns, the magnitude of their gains relative to the Eurostoxx 50 and Nikkei 225 losses, respectively, became smaller as yields fell. In the most recent sell-offs, the return generated from bonds was only a small fraction of the equity losses. The potential benefit of negative rates is that bond returns are no longer constrained by the zero-bound which would help to re-establish their role as a portfolio diversifier.

Exhibit 6. Relative Performance of european and Japanese Equities and Treasuries
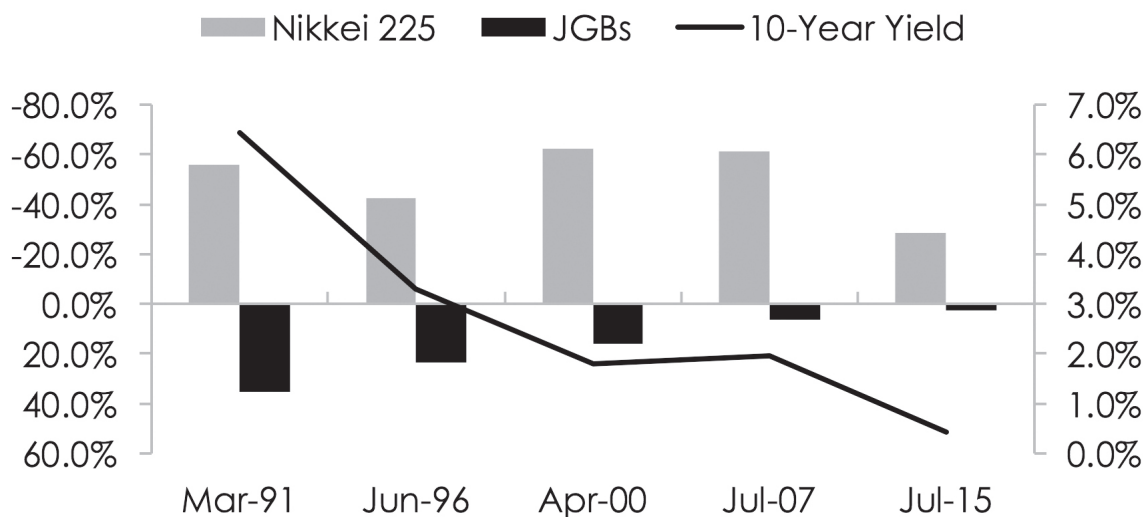
*Returns are for an investment strategy where an investor purchases the front-month contract and then rolls the notional amount to the next-month contract on expiration. The performance does not account for bid/offer spreads and transaction fees.

Source: Bloomberg, Capstone Investment Advisors

Eurostoxx 50 (LHS) ■ Bunds (LHS) — 10-Year Yield (RHS)

Chart x-axis: Jul-98, May-00, Jun-07, Feb-11, Apr-15

Nikkei 225 (LHS) ■ JGBs (LHS) — 10-Year Yield (RHS)

Chart x-axis: Mar-91, Jun-96, Apr-00, Jul-07, Jul-15
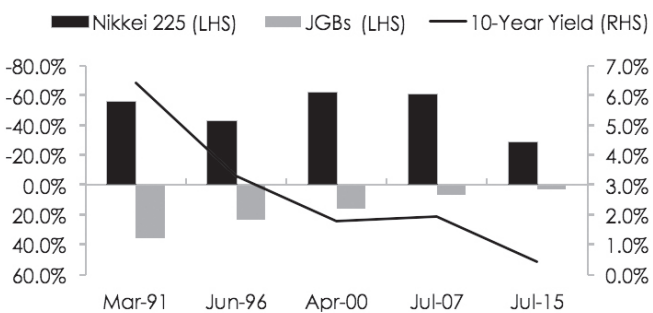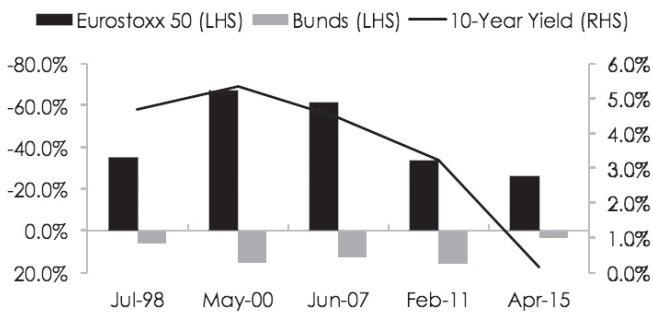
CONCLUSION

The concept of negative interest rates did not exist just a few years ago, yet in 2016 five central banks have key policy rates currently below zero, and there is speculation the Fed could be next. The impact has already been felt throughout the financial system, including the interest rate derivatives market where swaption implied volatilities have increased, in particular for downside OTM strikes. The effect, though, has not been uniform, due in part to the differences in each central bank's approach to negative rates. The initial experiences in the EU and Japan are studies of contrast, and provide a glimpse into the best- and worst-case scenario for investors who actively hedge against a continued decline in interest rates. Notwithstanding, not all of the potential impact is negative. By removing the zero-bound for interest rates, bond returns are no longer constrained and potentially have further room to appreciate, which is good news for investors who use bonds to manage the risk of their portfolios. While it is uncertain if NIRP will have its intended economic impact, it appears more likely that it will have an impact on the financial markets, which may have broad implications on investors and their investment portfolios.

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Correspondents' Report from the 2016 SOA Investment Symposium

By Warren Manners, Evan Inglis, Kelly Featherstone, George Eknaian and Jim Kosinski

The 2016 Society of Actuaries (SOA) Investment Symposium was held at the New York Marriott Downtown in Manhattan this year. The event took place over a day and a half in mid-March and was jam-packed with interesting and provocative topics. We had two keynote speakers: one discussed behavioral finance in the context of other economic theories, and the other presented case studies on insider trading in the hedge fund industry. These sessions were followed by industry experts who presented on a wide range of topics, including new developments in pension fund investing, the influence that changing liquidity conditions is having on risks and opportunities, challenges created by the persistently low interest rate environment, and even a session on how the engine behind programmable currencies might address one of the most pressing concerns of modern times—cybersecurity.

What follows is a brief report from Investment Section Council members on a handful of selected sessions. We hope you enjoy these summaries and are intrigued enough to explore these topics further on your own. [WM]

HOMO ECONOMICUS, BEHAVIORAL FINANCE AND BEYOND (SESSION 1)

Is the rational, utility-maximizing ideal of homo economicus dead? If so, what is to replace him? Does behavioral finance offer the best alternative theory of economic behavior? What other approaches may provide more robust foundations for economics?

In the opening session, George Cooper—author of *The Origin of Financial Crises* and, most recently, *Money, Blood and Revolution*—challenged conventional economic theories. When we look back over human history, we see economic growth is not constant—growth was limited for most of history before taking off in the last couple hundred years. Paradigm shifts causing rapid growth are not achieved by refining old ideas in a logical way, but rather dramatic progress requires new, creative ways of thinking.

The various schools of economics were compared based on their views of government intervention in markets and perception of market stability. The most dominant view currently in academia, the classical and neo-classical economic views developed by Adam Smith, rely on axioms of individualism, maximization and equilibrium—implying that the economy is naturally self-stabilizing and self-optimizing. Classical and neo-classical economic theories are in stark contrast to current central bank policies and behaviors such as quantitative easing, which does not work because it injects wealth at the top of the social pyramid, when what is actually needed is to stimulate consumers at the bottom of the social pyramid. Cooper postulated that what is now needed is a paradigm shift that simplifies the field of economics and reconciles apparently opposing world views currently in existence. [KF]

Figure 1: Shiller Cyclically Adjusted PE Ratio
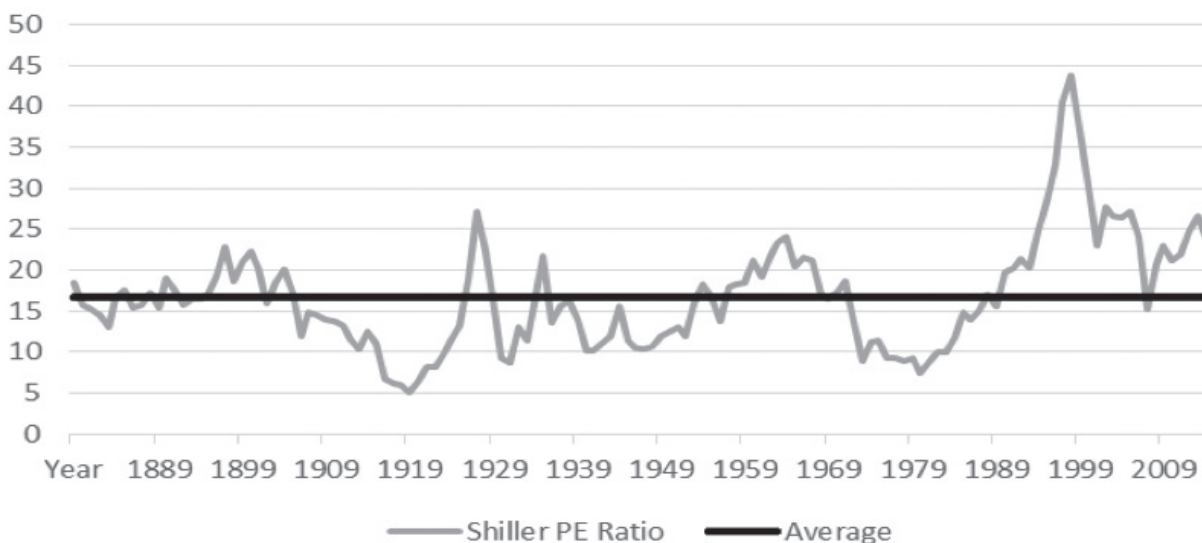
Source: MULTPL.COM from Robert Shiller's Irrational Exuberance

ARE U.S. EQUITY MARKETS OVERVALUED? (SESSION 5)

One of the most important issues in the investment world and for all those who participate in it is the potential for drastically lower returns in the future, in particular over the next decade. With interest rates as low as they are, low returns from fixed income are a given. But what about equity? Session 5 at the Investment Symposium addressed the question: "Are U.S. Equity Markets Overvalued?"

The short answer is probably that U.S. equities may be fairly valued given where rates are, but if rates rise, equity markets could be hit hard and economic growth isn't likely to push equities a lot higher. Figure 1 shows Robert Shiller's cyclically adjusted price-to-earnings (CAPE) ratio through time. The Shiller CAPE uses inflation-adjusted earnings from the past 10 years in the denominator of the P/E ratio and is commonly viewed as a useful measure of equity valuations.

Bill Reardon from Ironbound Consulting Group told the audience that P/E ratios (he focused on the Shiller CAPE) are historically high and presented a chart showing a strong negative correlation between the Shiller CAPE and subsequent 10-year real returns. He also suggested that the aging of the population may present a headwind for future equity returns. The M/O ratio has been highly correlated with P/E ratios in the United States and some other countries (but not all). M is the number of people 40–49, most likely to buy stocks; while O is the ratio of people 60–69, most likely to sell. For the United States, the M/O analysis indicates a P/E ratio of about 9 in 2030, compared to above 20 (trailing earnings basis) today. See *http://www.frbsf. org/economic-research/publications/economic-letter/2014/december/ baby-boomers-retirement-stocks-aging/*.

Reardon presented other headwinds for U.S. equities, including the strong dollar, but also described some potential tailwinds, including the relatively strong U.S. economy, continued innovation in the tech sector, and the potential for strong growth in operating margins in the big technology companies. He tried to present a balanced case, but, in the end, the balance seemed to weigh in favor of valuations being high at the current time.

Cutting to the chase of the other panelist's presentation, David O'Meara from Willis Towers Watson (WTW) presented WTW's three-year forecast for U.S. equity returns to center pretty narrowly around 3 percent (nominal). WTW has wider ranges of potential equity outcomes centered closer to 4 percent for most international markets. Three years seems like a short time frame over which to do a forecast—P/E ratios are most highly (negatively) correlated with returns over eight- to 12-year periods (see *https://personal.vanguard.com/pdf/s338.pdf*). Suffice it to say though that the forecast is for low returns.

Conceptually O'Meara presented the argument for low returns as based on low cash yields plus low risk premia, both due to high valuations. He pointed out that equity price and corporate revenue growth in the United States have come from a small number of very large companies. He also used the high levels of debt in the United States and globally as well as slowing growth in China to support the idea that future economic growth is not likely to push stock prices higher.

No one was predicting financial Armageddon, but it's apparent that we shouldn't be expecting 1990s type returns to repeat anytime soon. Far from it: Lower returns for the future—perhaps low- to mid-single digits for U.S. equities over the next decade—seem like the most reasonable expectation. [EI]

THE "NEW NORMAL" FOR FIXED INCOME LIQUIDITY—IMPLICATIONS FOR INSURANCE COMPANIES (SESSION 15)

There was a very informative panel discussion at the Investment Symposium regarding the current state of liquidity in the fixed income markets. The panel included a great cross section of professionals, including a quantitative professional from an investment bank, a third-party insurance company investment manager and two insurance company executives—one a portfolio manager and the other a risk manager. The moderator of the session also had a background that was different from the panel— a portfolio and derivatives manager from an insurance company. It was great to hear the viewpoints that this diverse panel brought to the table, but all of them arrived at a similar conclusion—fixed income liquidity is not what it used to be, and it is highly unlikely to ever return.

Although some of the change can be attributed to the declining population of active issuers in the fixed income market, much of the change is due to regulatory changes made due to the financial crisis. Bond dealers were much more accepting of holding an inventory of fixed income investments before the crisis than after due to changes in requirements as well as the declining profitability of holding an inventory. The panel presented many quantitative and qualitative examples of how liquidity has been dampened. The quantitative review introduced some new concepts of measuring liquidity, some of which are still being refined.

The end result of this reduction in liquidity? First of all, it makes market value quotations more suspect. There may now be a bigger difference between a market value and the true value of a fixed income investment when it is sold. It also makes determining accurate market prices much more difficult, since there are fewer quotes being provided. This will have knock-on effects for a company's balance sheet.

But the largest impact will be if and when a liquidity crisis occurs in the future. With insurance companies and pension plans utilizing fixed income investments extensively in their respective portfolios, the probability of liquidity crunches is increased if there are fewer counterparties willing to buy. All of the panelists expressed some level of concern with this unintended impact of the changes in the market over the past five years. [GE]

LOW INTEREST RATES: PRACTICAL AND THEORETICAL CHALLENGES FOR LIFE COMPANIES AND OTHER INSURERS (SESSION 19)

Jim Stoltzfus (Milliman), Fiona Ng (Milliman) and Yuan Yuan (GSAM) gave perspectives on insurer views of the current market and how they are adapting their investment strategies in their session, "Low Interest Rates: Practical and Theoretical Challenges for Life Companies and Other Insurers." Stoltzfus moderated the session.

Ng led off by presenting trends in asset allocation data from the SNL database for year-ends 2007 to 2014, with net yields falling and insurers' (particularly large insurers') holdings of riskier assets and Schedule BA assets increasing.

Ng discussed private equity and hedge funds in more detail. She described the life cycle of a private equity investment, from early investments of capital through eventual maturity and exit (through IPO or acquisition). The "J curve" path of net cash flows (negative early, positive later), as well as the lack of public data and the illiquidity of private equity investments, present modeling challenges. Regarding hedge funds, she referenced some recent well-publicized articles pointing out hedge fund underperformance since 2009, but added context by showing the 2000–2009 comparison where hedge funds significantly outperformed, and noted that over the 2000–2014 period hedge funds were still outperforming the S&P 500.

Yuan presented preliminary results of the fifth annual GSAM Insurance Survey, which had 276 CIO/CFO respondents representing property and casualty (P&C), life, multiline, health and reinsurance companies around the world. Over half of the respondents were in the Americas and the rest split fairly evenly across Europe and Asia. He presented a number of interesting sentiment trends comparing results from 2014 and 2015 with this year's survey. Some notable results were that participants have much lower expectations for equity market returns in 2016, now expect rates and inflation to stay lower for longer (a significant reversal from the "higher rates" view in 2014), and are increasingly concerned about deflation. On the macroeconomic side, participants are concerned about a possible recession/slowdown in the United States or China, as well as credit and equity market volatility.

Yuan concluded his presentation with a case study demonstrating how strategic asset allocation could be used to improve results when faced with a very long liability in a low interest rate environment. He laid out three alternatives: one focused on protecting book yield, and two economically focused strategies (one including swaps, one not including swaps), detailing the economic and GAAP trade-offs for each as well as discussing the overall process. [JK] ■

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Private Placement Bond Credit Risk Experience Study Released

By R. Jerome Holman

The Society of Actuaries (SOA) Private Placement Experience Committee recently released the 2003-12 Credit Risk Loss Experience Study on Private Placement Bonds. The full written report and associated fully functional Excel pivot table file can be downloaded from:

https://www.soa.org/Research/Experience-Study/Credit-Risk/2003-2012-credit-risk-loss.aspx

STUDY OVERVIEW

The report covers credit risk loss experience during the period 2003 through 2012 on traditional (generally non-144A) private placement securities held by participating companies (also referred to as contributors) of the life insurance industry. The Private Placement Experience Committee initiated the report as part of its mission to conduct research with support from participating companies. The study seeks to perform analyses and develop insights into the behavior of private placement credit risk, to compare incidence and severity measures to public corporate bond experience and to stimulate further research into credit risk.

The report, also referred to as the study, restarts the review of private placement experience that was last reported in 2006, to cover experience from 1986 through 2002. Previous reports and the current study aim to fill a knowledge gap in private placement credit risk experience. This report is a unique addition to the body of credit risk experience research. While there are many reports published by various entities on the default and recovery experience of public corporate bonds there is little or no other comparable experience published for private placements.

Measurement Basis

The study analyzes credit risk loss with respect to three measures: incidence (the frequency of loss), loss severity (the magnitude of a loss) and economic loss (the product of incidence and loss severity). The study uses the term "credit risk event" (CRE) for these losses. A CRE is more expansive than the definition of default generally used by rating agencies. The CRE definition is designed to capture situations where active management opportunities unique to private placements avoided losses that eventually would have resulted in default. This is intended to avoid

understatement of credit losses. CRE experience is analyzed relative to several asset characteristics, e.g., coupon, current quality rating and time since funding. The analysis of private placement experience by itself is supplemented with a comparison to corporate public bond default and recovery experience during the same time period.

CREDIT LOSS RESULTS

Incidence

The average annual incidence for the study period was 0.56 percent by number and 0.50 percent by amount. Lower incidence by amount than by number of CUSIPs[1] implies the contributors in aggregate benefited from their decisions to allocate different amounts to the CUSIPs they held.

Study Scope

15 participating companies

11,910 CUSIPs

428 CREs

Exposure (years):

76.2 thousand by number

$1.2 trillion by amount

The pattern of annual incidence is consistent with quality ratings supplied by the contributors and National Association of Insurance Commissioners (NAIC) ratings. Average incidence increases with decreasing credit quality. As would be expected in a general default study, incidence is more closely linked to current rating as opposed to earliest rating, and it is higher during economically stressed periods.

The highest aggregate incidence by amount was 1.76 percent in 2009. The highest incidence by number, 2.17 percent, occurred in 2003. Because each CUSIP held by a contributor is counted by measuring incidence by number, a large number of small CREs, held in different CUSIPs from a common issuer, inflated CRE counts for 2003. The next highest incidence by number, 1.52 percent, occurred in 2009. The lowest incidence, 0.12 percent, occurred in 2006 and 2011, by amount and number, respectively. The highest and lowest levels of incidence generally align with stressed and benign economic conditions (Figure 1, pg. 15, top).

Figure 1
CRE Incidence Rates
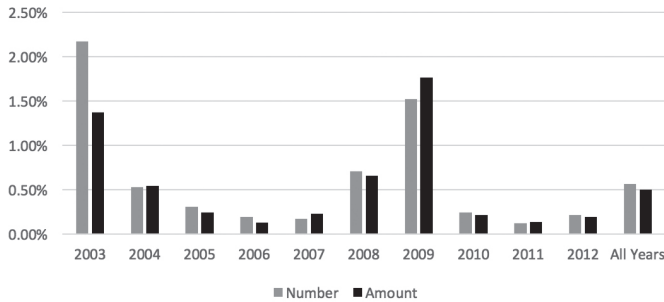
Loss Severity

Average loss severity, 29 percent, shows highly dispersed losses. When loss given default was grouped in 10 percent ranges, only two of those ranges held more than 10 percent of CRE principal amounts. There was a large proportion of CREs that had negative loss severity (amount recovered greater than the amount exposed to loss). Measured by the amount held at the CRE, 33 percent of the CREs had negative losses with an average 12 percent gain (Figure 2).

Figure 2
Loss Severity Frequency Distribution
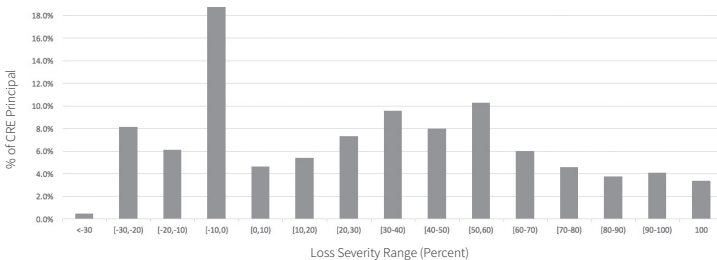
Figure 3. Loss Severity by Seniority and Security

		Senior Secured	Senior Unsecured	Subordinated	Not Reported	Total
All CUSIPS	Loss Sev	31.5%	22.9%	63.0%	41.6%	29.3%
	# of CREs	130	198	12	88	428
One Owner	Loss Sev	30.7%	35.5%	71.0%	51.7%	40.9%
	# of CREs	63	60	11	48	182
Multiple Owners	Loss Sev	33.3%	17.6%	-6.6%	27.3%	20.3%
	# of CREs	67	138	1	40	246

Loss severity varied by structure of the security. Senior securities (combined secured and unsecured) had lower losses, 25 percent, than subordinated ones, 63 percent (Figure 3). But security (secured vs. unsecured) did not reduce losses for senior instruments. Senior secured losses were 32 percent versus 23 percent for senior unsecured positions. This unexpected result is due to very low senior unsecured loss severity, 18 percent, when the same CUSIP is owned by more than one contributor. Loss severity of CUSIPs owned by only one contributor showed a normal relationship of senior unsecured losses being higher than senior secured ones, 36 percent and 31 percent, respectively. There were no discernable effects on loss severity from quality rating or between stressed and benign economic conditions.

Economic Loss

The economic loss rate is the percentage of the amount invested that is lost to CREs each year. Economic loss results exhibit similar, though not identical, behaviors as incidence when quality ratings or economic conditions vary. This is because incidence is closely related to those factors, but loss severity is not. Loss severity has little correlation with quality rating or economic conditions (the major drivers of incidence), which means that economic losses are less strongly correlated with these factors. The average, high and low economic losses were 0.15 percent, 0.46 percent and 0.02 percent, respectively (Figure 4).

Figure 4. Economic Loss Rate by Amount
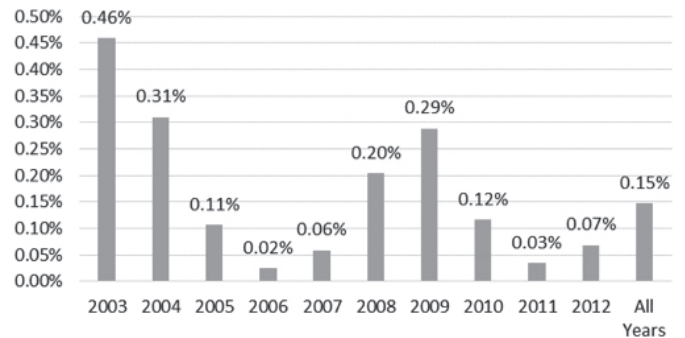
> While there are many reports … on the … experience of public corporate bonds there is little or no other comparable experience published for private placements.

Results varied significantly by contributor. Even though quality of holdings was similar among contributors, annual economic loss, measured in quartiles, for the period ranged from 0.04 to 0.41 percent (Figure 5).

Figure 5.

Company Quartile	Exposure by Amount	% of CREs	Average Quality*	Standard Deviation Quality**	Economic Loss
1	19%	12%	8.0	2.3	0.04%
2	49%	33%	8.2	2.5	0.11%
3	27%	39%	7.7	3.1	0.24%
4	5%	16%	8.8	2.5	0.41%
Total	100%	100%	8.1	2.6	0.15%

* Average Quality expresses A-, BBB+ and BBB numerically as 7, 8 and 9.

** Standard Deviation Quality is in units of rating notches.

ANALYSIS HIGHLIGHTS

Public to Private Placement Comparison

An important aspect of the study is the comparison of private placement experience to public corporate bonds. Private placements showed a 0.15 percent annual advantage relative to public bonds based on economic loss by current rating assuming a senior unsecured instrument. Because private placements held by the contributors have higher average quality than rated public bonds, the advantage was estimated by controlling for their quality differences. The advantage assuming a private placement quality mix was 0.10 percent, and was 0.21 percent for a public bond quality mix (Figure 6). Generally, the advantage is the result of average higher private incidence that is more than offset by lower loss severity, relative to public bonds, for private placements.

Public to Private Incidence and Loss Severity

Comparative aggregate private placement to public bond annual incidence is dependent on the assumed quality mix. The study uses respective private placement and rated public exposure to produce weighted default rates on a consistent basis. Viewed by Investment and Speculative Grade groupings, private placement incidence is higher except for Speculative Grade weighted by private placement exposure. The aggregate incidence is higher for private placements using either weighting (Figure 7).

Generally, senior unsecured private placement loss severity, restated to a basis consistent with public corporate bonds, has the strongest and most statistically reliable advantage compared to public bonds, 37 percent versus 56 percent. The combinations of incidence exposure weightings and senior unsecured loss severity corresponding to respective private and public experience, shown in Figure 7, produce the economic loss values shown in Figure 6.

The other seniority statuses do not show a clear advantage. While there is a similar difference for subordinated bonds, the low number of their CREs does not support credible results and the difference for senior secured bonds is not significant.

Figure 6.

Public vs. Private Economic Loss Rates			
Basis	Economic Loss Rate (bps)		
	Public	Private	Difference*
Public estimated based on study private quality mix	33	23	10
Private estimated based on public bond quality mix	86	65	21

* Average difference of 15 bps

Figure 7

	Incidence* - Issuer Basis				
	Inv Grade	Spec Grade	All rated¤	Loss Severity	Economic Loss
Private Placement Exposure Weighting					
Public	0.12%	3.52%	0.59%	55.7%	0.33%
Private Placement	0.17%	3.38%	0.62%	37.2%	0.23%
Public Bond Exposure Weighting					
Public	0.11%	3.54%	1.53%	55.7%	0.86%
Private Placement	0.15%	4.06%	1.76%	37.2%	0.65%

* All incidence rates are issuer basis annual rates weighted by their respective issuer exposures for 2003 to 2012.

Public to Private Comparison to Prior Study

The amount of the assumed advantage for senior unsecured bonds is dependent on the asset mix assumed. Using the private mix for the comparison, the private placement economic loss advantage decreased 0.16 percent, 0.26 percent in the prior experience study versus 0.10 percent in the current one (Figure 8). The decrease is explained by lower incidence and lower net loss severity advantage in the current study. The bulk of the change is due to lower incidence, a 0.53 percent decrease, which applied to the prior assumed 25 percent loss severity advantage reduces the economic loss advantage by 0.13 percent. The remainder of the decrease, 0.03 percent, is caused by a net reduction of 7 percent in the private to public loss severity advantage.

Figure 8. Comparison to Prior Study—Economic Loss

	Basis	Current	Prior
(1)	Public (Issuer)	0.33%	0.67%
(2)	Private (Issuer)	0.23%	0.41%
(3)	Private versus Public Advantage, (1) - (2)	0.10%	0.26%

Figure 9. Incidence Normalized for Business Cycles
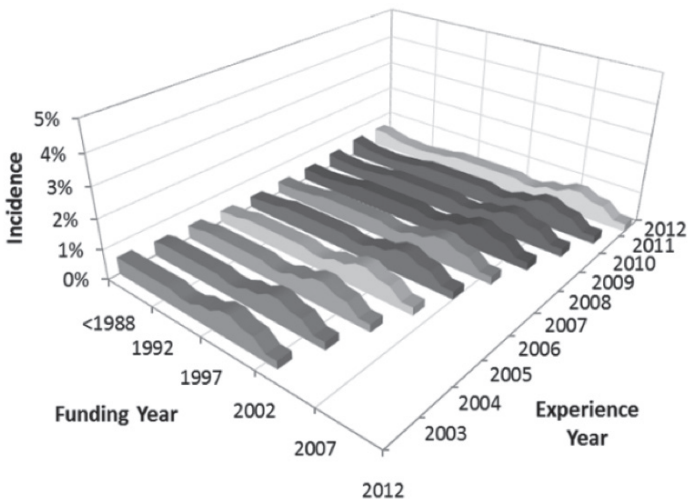
> An insurance company might be able to improve its loss experience by more closely monitoring assets with ratings disagreements.

Seasoning

A seasoning effect consisting of three phases holds across earliest quality ratings. As the underwriting effect wears off, the incidence rate and economic loss rate both rise to a peak before declining to a steady state. In general, the lower the quality, the stronger the seasoning effect is. The seasoning effect is prominent with all qualities combined by number and for BB and lower by amount. The seasoning effect does not appear to be caused by the variation of incidence due to economic conditions. When incidence is normalized for its variation by economic conditions, the seasoning effect was apparent for experience years with high and low incidence (Figure 9).

Rating Consistency

An important part of the study is to analyze the reasonability of the ratings supplied by contributors. These internal ratings are used as the main quality rating in the study because private placements are not usually rated by rating agencies. The internal ratings supplied by the contributors for each CUSIP for all years, were found to be consistent across two dimensions. Based on comparisons of commonly held CUSIPs, ratings were very consistent between contributors. They were also reasonably consistent in comparison to NAIC ratings. The NAIC ratings are determined by the NAIC Securities Valuations Office (SVO) for otherwise non-rated CUSIPs, or a rating agency if the CUSIPs are rated and treated as filing exempt with the NAIC. Consistency relative to NAIC ratings supports the internal ratings as being aligned with ratings determined by an external entity.

Differences of internal and NAIC ratings on CREs were analyzed to test for reliability of one versus the other. In those instances, the internal ratings tended to have more predictive power than the NAIC ratings (9 cells internal rating vs. 3 cells NAIC rating). But there were also some CREs (3 cells) where both ratings understated the likelihood of loss (Figure 10). It is possible that, in those situations, both ratings lagged deteriorating credit conditions. A caveat to these conclusions is that ratings were not supplied on all assets. If assets with no reported rating are more volatile on average, overall results could be affected.

The results in this table should be interpreted with caution because the number of exposures associated with some cells is small. Moreover, even though most recent internal ratings and most recent NAIC ratings are measured as of year-end, it is possible the instances of large differences in ratings arose because one rating was downgraded or upgraded just before year-end and the other was changed just after year-end. Bearing all the caveats in mind, the results imply that an insurance company might be able to improve its loss experience by more closely

monitoring assets with rating disagreements between the NAIC and the insurance company.

LIMITATIONS

Public to Private Analysis

Although private placements are similar to public bonds in some respects (generally fixed rate and often fairly long term to maturity, for example), privates are widely viewed as offering additional protection and value to investors. The report aims to quantify and explain observed differences on a consistent basis. However, it does not provide a complete analysis of all potential sources of incremental value between public and private debt.

Concentration

The data is highly concentrated. Five contributors provided 71 percent of the data, and the contributors have significant experience in the private placement market. Actual experience for any one company, whether new or an experienced market participant, may or may not be in line with the experience results presented in this study.

Data

Although the Private Placement Experience Committee devoted extensive and meticulous attention to the "scrubbing" of the data to ensure they are as clean and reliable as possible, ultimately the quality of the data depends on the contributors and is beyond the control of the committee. The committee performed no audits or independent verification of the information furnished to us. To the extent there are any material errors in the information provided, the results of the analysis will be affected as well.

Figure 10. Relative Predictive Ability of NAIC vs. Internal Ratings

Entity Rating with Better Match to Actual Incidence*					
	Contributor Internal Rating				
NAIC Rating	1	2	3	4	5
1		Contributor	n/c	Contributor	Contributor
2	n/c		Neither	Neither	Contributor
3	n/c	NAIC		Contributor	Neither
4	n/c	n/c	Contributor		Contributor
5	NAIC	NAIC	Contributor	Contributor	

* Rating agreements are not evaluated.

n/c means low CRE count; no credibility.

Credibility

The credibility of results is related to the incidence of unique CREs. There are 428 company-CUSIP CREs and 285 of those are unique CUSIPs. There are 143 unique issuers that experienced a CRE. The relatively small number of CREs limits analysis by some characteristics.

FUTURE PLANS

The next report will present new experience and, as appropriate, link to the analysis in this report. Based on input from contributing companies and the committee, the report will also be modified to include different characteristics or new analyses. Currently, the committee is in the early stages of producing an experience study for 2013 through 2015. Members who may be interested in participating on this Committee should contact Korrel Rosenberg, SOA senior research administrator, at krosenberg@soa.org. ■

ENDNOTES

1 CUSIP stands for Committee on Uniform Securities Identification Procedures. A CUSIP number is a nine character alphanumeric code that identifies a North American security for the purposes of facilitating clearing and settlement of trades. A similar system is used to identify foreign securities (CUSIP International Numbering System or CINS). The use of CUSIP in this article implies CUSIP and CINS in reference to securities in the study.

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2016 Investment Symposium: Sentimentally Speaking

By Frank Grossman

Every year at our symposium, there is much discussion during the sessions and in the corridors regarding the outlook for bond markets. So this time around, when the 2016 Investment Symposium convened in New York City on March 14–15, the organizing committee decided to conduct a brief sentiment survey gauging how attendees thought rates might stand in a year's time.

Treasury yields at the end of February were 0.91 percent for the three-year note, 1.74 percent for the 10-year note, and 2.61 percent for the 30-year bond (refer to graph below). These key

US Treasury Yields (Feb. 29, 2016)
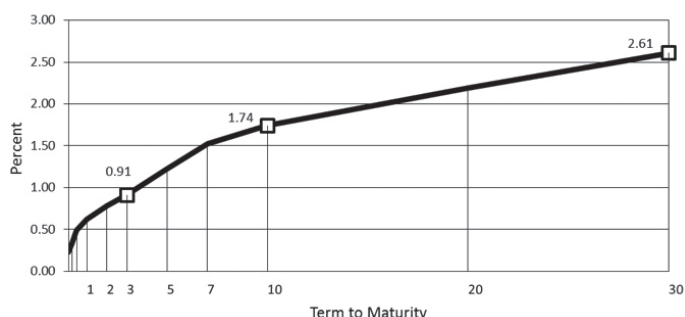
rates moved up during the two weeks prior to the symposium, but since the meeting they have declined by more than 30 basis points due to concerns about weak U.S. job and gross domestic product (GDP) growth, and more latterly the U.K. Brexit referendum on June 23.

Part A of the survey asked attendees the following question specifically targeting yields for the three- and 10-year notes (QA1 and QA2, respectively), and the 30-year bond (QA3):

"From your personal perspective, what's the outlook for the U.S. Treasury rates on Feb. 28, 2017 (i.e., in one year's time) as compared to their levels at Feb. 29, 2016?"

Table A: 2016 Investment Symposium Sentiment Survey—Part A Results

		QA1	QA2	QA3	#	%	#	%
Shift Up		a	a	a	7	11.7	7	11.7
Tilt Steeper	Long-Term Up I	b	b	a	2	3.3	5	8.3
	Long-Term Up II	b	a	a	2	3.3		
	Short-Term Down II	c	c	b	1	1.7		
No Change		b	b	b	17	28.3	17	28.3
Twist Flatter		a	b	c	3	5.0	3	5.0
Tilt Flatter	Long-Term Down I	b	b	c	1	1.7	19	31.7
	Long-Term Down II	b	c	c	4	6.7		
	Short-Term Up II	a	a	b	5	8.3		
	Short-Term Up I	a	b	b	9	15.0		
Shift Down		c	c	c	7	11.7	7	11.7
Other		b	a	b	1	1.7	1	1.7
No Opinion		d	d	d	1	1.7	1	1.7
Total					60	100.0	60	100.0

Four response options were provided for each key rate:

a. Higher (25 or more basis points higher);
b. Roughly unchanged (within +/- 25 basis points);
c. Lower (25 or more basis points lower); and
d. No opinion.

Sixty surveys were completed, and their yield curve outlook is summarized in Table A. Focusing solely on the 30-year yield responses (QA3), there was a modest downward sentiment overall: 19 percent, or 11 of 59 respondents with an opinion, anticipated a higher rate; 25 percent, or 15 respondents, foresaw a lower rate; while a 56 percent majority, or 33 respondents, felt the long rate would remain roughly unchanged. Possibly an interesting result, however, examining responses for all three key rates together has the potential to reveal more about where respondents think rates are going.

Twenty-eight percent of respondents anticipated roughly no change in three key rates year over year. Those 12 percent who saw an upward shift were balanced by an equal number expecting generally lower rates across the entire yield curve—demonstrating that some actuaries certainly felt that rates could indeed decline further with even more valuation pain possible. A flattening of the term structure was indicated by nearly 37 percent of respondents, with either a tilt down in long-term rates, or a tilt up in short-term rates, or a combination of both via a twist.

Given the importance of long-term rates for many actuaries, including duration-matching risk managers, we also thought it worth asking about the attractiveness of ultra-long bonds. Part B of the survey posed a follow-on question about the potential appeal of 50-year sovereign debt:

> "From the perspective of your (current or recent) organization and/or clients, and bearing in mind their strategic investment and/or risk management objectives, would they be interested in purchasing ultra-long (i.e., 50-year credit risk free) sovereign bonds:
>
> 1. If the ultra-long sovereign bonds had **liquidity** similar to 30-year sovereign bonds?
>
> 2. If the ultra-long sovereign bonds had **liquidity and yield** similar to 30-year sovereign bonds?"

The second question referred to a 50-year bond that traded flat to a 30-year issuance, providing an opportunity to lock in current yields (thereby avoiding reinvestment risk should future rates continue southward) or better offset long-term liability cash flows. This time three response options were provided for each question—a) Yes; b) No; and c) No opinion—and the responses are set out in Table B.

Table B: 2016 Investment Symposium Sentiment Survey—Part B Results

	QB1	QB2	#	%
Liquidity & Yield	a	a	27	45.0
Liquidity But Not Yield	a	b	6	10.0
Neither Liquidity or Yield	b	b	6	10.0
Other 1	a	c	1	1.7
Other 2	b	c	1	1.7
Other 3	b	a	3	5.0
Other 4	c	a	3	5.0
No Opinion	c	c	13	21.7
Total			60	100.0

Forty-five percent of respondents, and a majority of those with an opinion, indicated an interest in a 50-year sovereign bond with similar liquidity and yield to a 30-year bond. Maybe someone should write a letter to the U.S. Treasury Secretary Jack Lew to let him know? Ten percent said they would take the longer term and liquidity but not the 30-year yield, possibly hoping for better days ahead. One respondent actually wrote, "Yes, please!" beside his/her response to the first Part B question.

Our presumption was that a "Yes" response to the second liquidity and yield question (QB2) would imply a similar "Yes" to the first liquidity question (QB1), and that the converse would hold as well (i.e., not being interested in liquid ultra-long bonds also meant not being interested in a liquid ultra-long bond at any yield including 30-year risk-free rates). But some of our respondents didn't see it that way, prompting us to wonder whether the questions as posed were crystalline for all. Perhaps some symposium attendees had something else in mind?

At this juncture, one might well ask whether the sentiment survey constitutes an auspicious augury of future rates, particularly as the survey was conducted on March 15? But there's never a reliable soothsayer around when you really need one, so we'll simply have to wait and see.

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The Growing Demand for More Robust Economic Scenario Generators

By Hal W. Pedersen, Ken Griffin and Stephan Christiansen

Many actuaries, risk officers and investment professionals use economic scenario generators (ESGs) in their risk analysis applications and have a passing familiarity with their strengths and weaknesses. Today, in response to the more challenging market environment, they need to use ESGs more effectively. Interest rates may become more volatile and divergent, with prospects for continued low or negative interest rates (in Japan and Europe and possibly the United States), juxtaposed with a gradual end to monetary easing policy at the Federal Reserve (despite continued monetary easing in Europe). Risk considerations may be highlighted further with expanding regulatory oversight on capital and solvency, and the increasing complexity and sensitivity to changing economic conditions embedded in investment products and interest-sensitive insurance products. ESGs are in demand today for valuing complex insurance contracts, managing derivatives hedging programs and dynamic asset allocation strategies, and calculating capital requirements.

This raises the question of what characteristics of an ESG are necessary and appropriate for the applications and increasing risk environment that investment professional will be encountering. **The Society of Actuaries** is releasing a major white paper that serves as a practical guide to ESGs, providing both context and technical insights into the makeup and composition of these tools. All investment actuaries are encouraged to review the white paper, both for a refresher on familiar ESG issues and an overview of more challenging ones.

ESG CONSIDERATIONS IN LIFE, PROPERTY & CASUALTY AND PENSION APPLICATIONS

Applications of ESGs for **life insurance liabilities** are primarily focused on the interaction of interest rate changes and policyholder behavior regarding lapses and other optionality. Life insurance enterprise and product results are determined by the interaction of investment performance on assets built up from the collection of premiums, and the payout of liabilities based on events of mortality, morbidity (in health or disability) or policy surrender or annuity payout. Because of the complexity of the interaction of these factors over an extended time horizon, an ESG provides the type of comprehensive tool that is necessary to understand both the range of potential outcomes and the likelihood of scenarios. Representative applications in life insurance best understood through the use of an ESG include life liability valuation, effective duration analysis, stress testing, economic capital (EC) and strategic asset allocation (SAA).

Applications of ESGs in **property & casualty** insurance are more focused on the impact of inflation on liabilities and assets, and economic cyclicality characteristics affecting both exposures and policy pricing. Property & casualty products have different characteristics of liability development, with many casualty products involving significant time lags in settlement or even discovery.

For **pensions**, ESGs can be useful to sponsors looking to compare their options, especially with options where they are still completely in control of the pension plan: choosing to freeze the plan; implementing liability-driven investment (LDI) (whether plan is open or frozen) against options that involve transferring the risks to third parties. LDI is an investment strategy that defined-benefit pension plans use to dynamically adjust equity risk and/or interest rate risk exposure in response to progress in fully funding future benefit obligations.

SOME ESG BASICS

An ESG is a computer-based model of an economic environment or multiple environments that is used to produce simulations of the interconnected behavior of financial market values and economic variables.

An ESG should produce simulation results that reflect a sufficiently comprehensive view of the economy and certain financial variables that are relevant to the need being addressed. The simulation results should include some extreme but plausible results, and the generated scenarios should embed realistic market dynamics that stand up to rigorous scrutiny when validating the model output.

Analysis of historical data is commonly used as the basis for determining principles and facts that an ESG must accommodate, but expert judgment also plays a role in establishing and prioritizing the properties that the ESG model must have to be useful for a given application.

Some examples of these "stylized facts" might include:

- Interest rates can be negative.

- Corporate credit spreads are wider for lower credit quality instruments, but credit costs represent only a fraction of the spread on corporate bonds and this suggests that some portion of corporate bond spreads is due to factors other than credit costs (e.g., liquidity).

- There is a tendency for corporate credit spreads to fluctuate more during recessionary periods.

- The volatility of equity returns fluctuates significantly over time.

- Correlations between modeled economic and financial market variables are not stable over time and can depend on whether monthly, quarterly or annual observations are being used.

CALIBRATION OF REAL-WORLD AND MARKET-CONSISTENT SCENARIOS

Users of these models need to incorporate a view of future market dynamics into their risk modeling environment. The process of reflecting these views into an ESG is referred to as model calibration. More specifically, calibration is the process of setting the parameters of the equations within an ESG model to produce the distributions and dynamics (e.g., volatility, correlations, tail characteristics) of economic and financial variables that are required by the application for which they are being used.

Calibration (also referred to as parameterization) of real-world ESG models requires users to make choices about the future economic environment that they want to reflect in their risk analysis work. Most risk management applications, for example, require ESGs to be capable of producing dynamics (e.g., volatility, correlations) that are representative of the possible future paths of economic variables. Because real-world parameterizations are forward-looking, they require explicit views as to how the economy will develop in the future and, as such, require a significant amount of expert judgment to determine the veracity of the scenarios that result from the parameterization process.

Market-consistent valuation applications require ESGs to be capable of generating scenarios that can reproduce the observable prices of traded derivative instruments. ESGs that are used for these purposes need to adhere to strict mathematical properties in order to satisfy risk-neutral and arbitrage-free conditions. Because the model calibration process is designed to reproduce the prices of traded derivatives, the ultimate calibration is dependent on both the pricing date and the set of traded derivatives used to calibrate the model.

INVESTMENT MARKET COMPONENTS AND CONSIDERATIONS

At its foundation, an ESG is concerned with simulating future interest rate paths, including yield curves. Other components, including equity markets and foreign exchange considerations, and other economic components such as inflation and gross domestic product (GDP) may be considered.

ESG models often span a wide range of market instruments and require complex mathematics to reasonably reflect the behavior

of these instruments in a wide range of economic conditions. The default-free interest rate model is a key component of most ESG models. Its primary purpose is to generate the prices of risk-free bonds and for use in discounting liability cash flows. The collection of risk-free rates at various maturities makes up what is called the term structure of interest rates; this in turn allows for the construction of yield curves and the pricing of all default-free interest-rate contingent cash flows.

An ESG typically builds off core **default-free interest rate modeling,** then considers implications of corporate bond yields and returns that include default, transition behavior and stochastic spreads. **Corporate bond models** are further complicated by the contingency of payments by the issuing name being dependent on both willingness and ability to pay both coupons and principal components of the bond as scheduled. Therefore, prices of a corporate bond will contemplate not only changes in the general level of interest rates, but also changes in the outlook for potential default or for potential recovery from default.

Equity index models allow for a degree of randomness, jump behavior, stochastic volatility and correlation of total return to other factors. Realistic equity models are available today with accurate return characteristics. However, these more robust models may introduce sources of risk that cannot be hedged away by trading in the universe of available assets, and as a result a unique price for cash flows that may be contingent on the equity index by arbitrage-free pricing considerations alone cannot be determined. Whether this is a problem for theory or practice is an open question. Fair value may be a range and not a point. Or, additional assumptions may be needed to price certain derivatives, or to model hedging of a variable annuity.

Often, these variables and their inter-relationships are modeled through a **cascade structure** to maintain model integrity. A **cascade structure** is a framework whereby each subsequent variable depends only on prior values of the variable and the values of variables that lie above them in the cascade structure.

VALIDATING ESG MODEL PARAMETERIZATION

Model validation ensures that the estimation of a model's parameters results in simulated behavior that is a good representation of the variable or market under consideration. Effective validation of an ESG requires comparing simulated output data to some predefined benchmark of acceptance criteria.

An automated validation system is preferable to manual validation. Validation should be repeatable and consistent through time. Before any data is analyzed or validation performed, it is helpful to form the acceptance criteria upon which the model output will be judged. This type of approach to validation, whereby the particular desirable features of an ESG are based on analysis of a firm's risk exposures, is preferable to what might be

Cascade structure of a hypothetical ESG
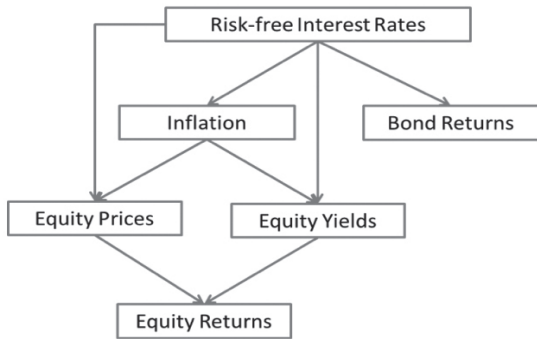
Prepared by Conning, Inc.

Main steps in an idealized validation process
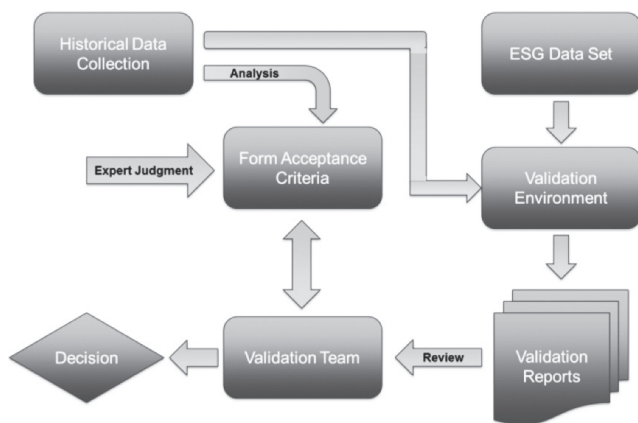
(©2016 Conning Inc.)

process should be retained. Actuarial communications should provide context where needed, to reduce the risk of misinterpretation and misuse of the results of stochastic modeling based on an ESG calibration. The rules of professional conduct and the actuarial standards of practice of the American Academy of Actuaries (AAA) and Canadian Institute of Actuaries (CIA) provide important guidance for ESG users.

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called a "problem discovery" approach. In a problem discovery approach a user first runs the ESG, creating a large output data set, and then tries to discover problems with the output.

LIMITATIONS OF ECONOMIC SCENARIO GENERATORS

While ESGs are extremely useful in gaining insight into future financial risk and rewards, like any model, they have limitations. Modeling the future dynamics of the economy and financial markets presents many challenges, such as accounting for extreme events and regime changes. Users of these models must understand the strengths and weaknesses of any particular ESG to ensure that the ESG is appropriate for the analysis that is being performed.

Professional standards apply to actuaries who calibrate and use ESGs, as in all other aspects of actuarial work. ESG calibrations should be generally understood by the principal, while documentation of the expert judgment applied in the calibration

Should Public Pension Plans Hold Equities?

By Lawrence N. Bader

Before considering the title question of this article, begin with a brief exercise. List the services that you believe a state or municipal government can perform more effectively than its private citizens. Most everyone would start with fire and police protection, with sanitation close behind. Education would be on most lists, as would infrastructure. Libertarians would likely stop there, or earlier; left-leaners could go on a bit longer.

Now we turn to the management of public pension funds. In a recent article,[1] I argued that public plans' use of high investment return assumptions (anything above riskless or very low-risk rates) and equity investments gives current taxpayers the full benefit of hoped-for risk premiums by passing all the risk to future taxpayer generations. Here I present some additional arguments against equity investment in public pension plans.

Irwin Tepper's classic paper[2] analyzed corporate pension plan investment strategy by observing that a shareholder's investment portfolio includes his share of the corporate pension fund. It is most efficient to use the corporate pension fund tax shelter for the shareholders' more highly taxed investments—bonds—than for the more favorably taxed equities. Therefore shareholders will gain if the corporate pension fund exchanges its equities for bonds, while the shareholders compensate by exchanging their own unsheltered bonds for equities. The shareholders' overall pretax returns will not change, but their taxes will drop. Though Tepper was addressing corporate pension plans, the same strategy can benefit the taxpayers who fund public pension plans.

So tax considerations favor public plan investment in bonds, leaving equity investment to be managed by the taxpayers themselves. The Tepper strategy also enables taxpayers to determine their own risk levels and choose equities or alternative investments without putting future taxpayer generations and plan members at risk.

But shouldn't public plans manage equities or select equity investment managers more successfully than individual taxpayers?

Not necessarily. A taxpayer can buy a low-cost index fund, which should match the median return of public pension funds. His expenses would be only a few basis points higher than even the most exemplary public plans and probably lower than most, particularly those paying for active management and using alternative investments.

For readers who remain unconvinced that public pension funds should confine their holdings to bonds, please return to the list you compiled at the start of this article—services that government can manage more effectively than private citizens. How high on your list was "seek equity risk premiums"? ■

Lawrence N. Bader, FSA, is retired and lives in Cary, North Carolina. Since his retirement, he has published numerous articles on pension plans and financial economics. He can be reached at *larrybader@nc.rr.com.*

ENDNOTES

1   Bader, Lawrence N., "How Public Pension Plans Can (and Why They Shouldn't) Ignore Financial Economics," Financial Analysts Journal, September/October 2015, pp. 14–16.

2   Tepper, Irwin, "Taxation and Corporate Pension Policy," Journal of Finance 36-1, March 1981, pp. 1–13.

Asset Allocation Contest Update

By **Jim Kosinski**

The 2016 Investment Section Asset Allocation Contests are underway, with 50 Investment Section members entering 134 portfolios in the three contests, which began on May 1 and will continue through Sept. 30.

This year we decided to replace the traditional three objectives of highest return, lowest standard deviation and highest Sharpe ratio to try to encourage creating more interesting and realistic portfolios. Last year the highest return objective had brought in a number of portfolios that were 100 percent single asset, and rewarded lucky (or skilled?) market timing. The lowest standard deviation objective had brought in a lot of identical 20 percent cash, 80 percent bond portfolios. The Sharpe ratio objective was more interesting but still tended to reward very conservative portfolios.

The three objectives for this year's contests are: Portfolio Manager—Create Alpha, Portfolio Manager—Accumulation, and Drawdown. Participants were encouraged to enter a portfolio in each of the three contests, as the contrasts between the contests presented an opportunity to try diverse strategies.

The Portfolio Manager—Create Alpha contest is a variation on the highest return/highest Sharpe Ratio theme. A 60/40 (60 percent ACWI, 40 percent BND) benchmark portfolio was created, and the return of the participant portfolios will be compared to that of the benchmark portfolio scaled to have the same standard deviation. (We're defining "alpha" to be how far your return/standard deviation point plots above the Capital Market Line through the origin and the 60/40 portfolio.) This contest is intended to encourage diversification to reduce volatility, but using alpha rather than Sharpe ratio should also encourage riskier portfolios (for higher potential alpha), where a conservative portfolio might have an excellent Sharpe ratio but not much excess return. There are 46 entries in this contest.

The Portfolio Manager—Accumulation contest is a highest return contest, but with two twists. First, we assume additional funds come in on a monthly basis over the course of the contest, which allows for dollar-cost averaging into positions, or gradually adjusting allocations through time. Second, and maybe more significantly, on a monthly basis portfolios that have cumulatively underperformed the 60/40 benchmark by 5 percent are cut. The underperformance constraint is intended to encourage

benchmark watching (like real life) and discourage concentrated bets. There are 43 entries in this contest.

The Drawdown contest is about managing a portfolio for a stream of income for as long as possible. Portfolios start with $100,000, and $1,000 is withdrawn each business day until the portfolio is exhausted (or until the end of the contest on Sept. 30). There are 45 entries in this contest.

In addition to changing the contest objectives, we also increased the number of exchange-traded funds (ETFs) available this year, from 10 to 20. Notable additions were high-yield bonds, small-cap stocks and long-dated Treasurys as well as some international bond funds. This also gives us a few more chances to have gains in our portfolios if the market is uncooperative again. (Last year only one of the 10 investment alternatives ended up positive for the contest … and that was short-duration bonds!)

A few observations on the contest entries:

- Thirty-nine of 50 participants entered all three contests; six entered two; five entered one.

- Over half of the portfolios (72 of 134) included four or more assets.

- Thirty-one of the 134 portfolios were single-asset, compared to 28 of 98 last year.

Notable asset allocation observations:

- We see a high allocation to alternative assets (gold, real estate, commodities), particularly gold. Alternative assets made up over 25 percent of the overall asset allocation.

- Most-used assets: gold (17.3 percent), S&P 500 (10.9 percent), high-yield bonds (7.3 percent), U.S. small-cap equities (7.1 percent), emerging market equities (6.1 percent)

- Least-used assets: TIPS (1.1 percent), global equities (1.4 percent), global equities ex-U.S. (1.5 percent), EAFE (2.2 percent), international small-cap equities (2.9 percent)

For the 39 participants who entered all three contests, we see noticeable shifts to the asset allocation across the three contests:

Contest	U.S. Stock	Intl Stock	U.S. Bonds	Intl Bonds	Cash	Alternatives
Alpha	22%	18%	21%	2%	9%	28%
Accumulation	28%	17%	17%	2%	4%	32%
Drawdown	27%	8%	30%	6%	8%	22%

The existence of the benchmark and the monthly portfolio review (with risk of being cut) does not seem to be discouraging risk-taking in the Accumulation contest. In fact, Accumulation

sees higher allocations to U.S. stock and alternatives than Alpha. Drawdown, by contrast, has higher bond allocations than either of the others, with significantly less allocation to international stocks and alternatives.

As of May 18, the market is being almost as uncooperative as last year, with only three asset classes of 20 showing marginal gains thus far. There's still a lot of time until Sept. 30, though. Good luck to all our contest participants, and be watching for updates! ∎

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Quantitative Measures of Bond Liquidity

By Vadim Konstantinovsky and Bruce D. Phelps

For all its importance to fixed income investors, policymakers and academics, bond liquidity is difficult to measure. This article discusses two new ways of measuring bond liquidity and how portfolio managers and researchers can make use of them

Transaction costs enter the decision-making process of all market participants. The trade-off between the cost of trading and the opportunity cost of not trading influences the timing and size of individual trades. Hence, many investors think of "liquidity" in terms of cost. Liquidity Cost Score (LCS) defines liquidity as the cost of trading. It represents the cost of a standard, institutional-size, immediate round-trip transaction and is expressed as a percentage of the bond's price.

Another view of liquidity is the degree to which trades move the bond's price. To accommodate this view, Price Impact Measure (PIM) defines liquidity as the price impact of trades. It measures the ratio of a bond's daily absolute excess return (net of market) to its daily dollar transactions volume.

Both measures can be aggregated across bonds in a portfolio as well as monitored over time. Portfolio managers can leverage these measures to quantify the liquidity of their holdings and compare them to a benchmark. Researchers can use these consistent, quantitative metrics to facilitate rigorous market liquidity studies.

LIQUIDITY COST SCORE (LCS)

The LCS calculation relies on simultaneous two-way quotes from traders. Traders can post bid and ask quotes in two different ways: as yield spreads over Treasurys or as price spreads. As a result, LCS is computed in one of two conceptually identical ways:

$$LCS = (Bid\,spread - Ask\,spread) \cdot OASD \quad \text{if bond is spread-quoted}$$

$$LCS = \frac{Ask\,price - Bid\,price}{Bid\,price} \quad \text{if bond is price-quoted}$$

OASD is the option-adjsusted spread duration of the bond. For every bond, the LCS corresponding to each quote is computed daily, and at the end of the month averaged into the bond's monthly LCS value.

Investors can shop for best execution, so quotes from one broker-dealer do not always represent the "effective" market. Thus, LCS may overstate "best-execution" cost. Nevertheless, LCS is a conservative measure of transaction costs.

The reliability of trader quotes may be uneven across bonds. Actively traded issues are likely to be quoted both at executable levels and uniformly among broker/dealers. The LCS methodology distinguishes between such bonds and those whose quotes are likely to be *indications* rather than transactable, two-way markets. It relies on two criteria: "on-the-run" and "high volume." To be on-the-run, a bond has to meet several conditions —e.g., to be a large and recent issue with a maturity close to one of the main issuance points (2-, 5-, 10-, and 30-year). However, if it has extremely high trading volume (the high-volume criterion), these conditions are waived. When LCS methodology identifies such indicative quotes it widens the bid-ask spread to make it more likely to be executable, in the spirit of making LCS a conservative measure.

Last but not least, a bond may have no two-way trader quotes at all. The LCS econometric model estimates what investors would likely have to pay to trade this bond. The model relies on monthly cross-sectional regression analysis to estimate a statistical relationship between observed LCS of quoted bonds and bond attributes. It assumes that the same relationship holds for non-quoted bonds and calculates their LCS accordingly. Such regression-based LCS are adjusted upward because a bond without a single trader quote in a month is likely to be less liquid than a quoted bond with similar attributes. The LCS models are market-specific. Attributes important for, say, EUR covered bonds, may not matter, or indeed even exist, in the USD credit market.

Investors would find the LCS model intuitive. Recent and large issues are cheaper to trade than seasoned and small ones, so bond age and issue size matter. High-risk securities (i.e., bonds with wide spreads to Treasurys) tend to be costlier to trade than low-risk ones. A trader taking a position in a high-risk bond will quote wider bid-ask spreads, so some measure of credit risk must be among the model variables. In the USD corporate market, for example, a bond's option adjusted spread (OAS) is one of the main determinants of its liquidity. The left panel of Figure 1 shows the historical relationship between bonds' observed LCS (i.e., those of trader-quoted liquid bonds) and their OAS.

Figure 1. LCS vs. OAS and trading volume, usd ig corp, jan 2007 – apr 2016
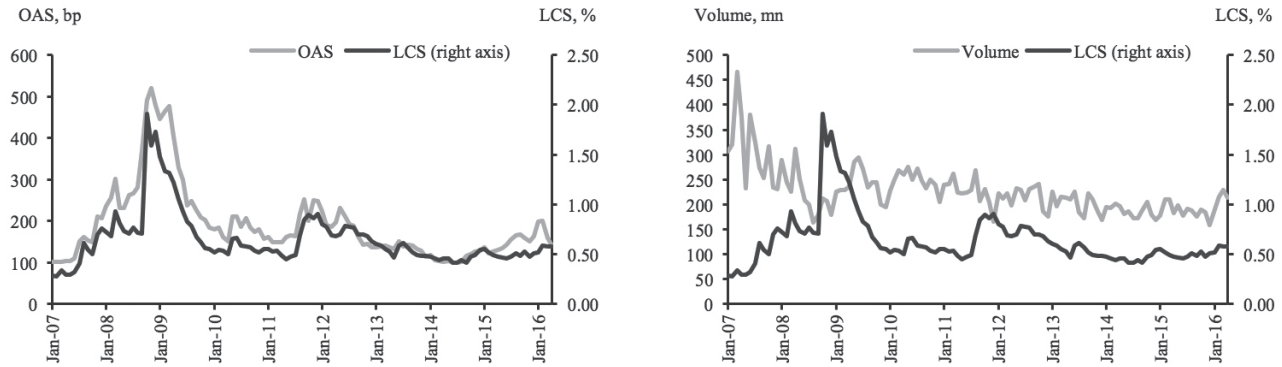
Source: Barclays Research

Figure 2. USD Credit LCS, Jan 2007 – Apr 2016
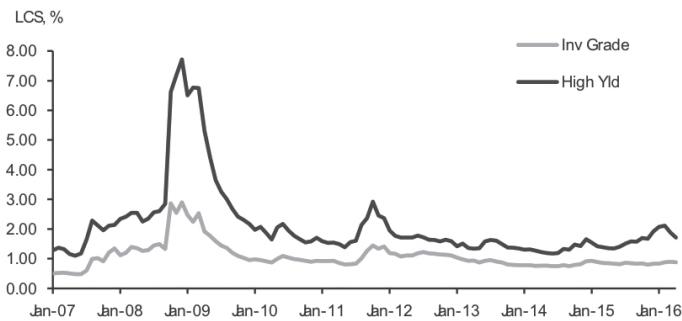
Source: Barclays Research

The model formulation relies on empirical evidence like this. However, intuition is not always accurate. For example, trading volume is often considered a proxy for liquidity. Yet, as the right panel of Figure 1 shows, the historical relationship between volume and LCS has been tenuous. However, during the credit crisis, we do see a negative relationship between LCS and volume, so we chose to include volume in the LCS model as a control for possible market turbulence in the future.

LCS is useful not only as a measure of current liquidity; it can provide valuable insights into past market conditions. Figure 2 shows the historical LCS for the entire USD IG and HY Credit markets. Based on these time series we can draw two conclusions. First, the credit crisis was to a large extent a liquidity crisis. Second, despite the often-heard sentiment of today's poor liquidity conditions, the objective reality is that, over recent years, LCS have been only modestly higher than pre-crisis levels.

MEASURING BONDS' RELATIVE LIQUIDITY

LCS is an absolute measure that fluctuates with overall market liquidity, so for a particular bond, a time series of its LCS does not show where the bond has stood relative to its peers. Another liquidity measure, Trade Efficiency Score (TES), is an intra-market bond-level liquidity rank ranging from 1 (best) to 10 (worst). TES helps investors to quickly judge a bond's liquidity relative to similar bonds, both currently and over time.

TES blends LCS and trading volume into a single relative score that reflects both cost and flow and comes close to how traders think about liquidity. As a relative measure, TES can serve as a liquidity filter in portfolio construction. It also helps with back-testing investment strategies. Using only low-TES bonds in a back-test shows how realistic the strategy is in practice, and how achievable are its promised returns.

Figure 3. Trade Efficiency Score (TES) Buckets, USD IG Corp ex 144A, April 2016

Vol Decile + LCS Quintile	TES	# bonds	# bonds %	MV %	Age, yr	Issue size mn	OAS, bp	OASD	LCS, %	Vol, mn
2 and 3	1	764	13.62	29.86	2.3	1,700	133	7.90	0.531	371.6
4 and 5	2	595	10.60	14.37	3.2	1,052	136	6.67	0.705	106.8
6	3	397	7.08	8.06	4.0	874	143	6.69	0.925	70.6
7	4	439	7.82	7.93	4.0	780	143	6.78	1.016	52.5
8	5	463	8.25	6.84	4.6	630	140	6.65	1.103	34.5
9	6	453	8.07	6.74	5.1	627	143	7.04	1.206	22.5
10	7	543	9.68	6.62	5.2	515	149	6.97	1.244	13.9
11	8	521	9.29	5.82	5.3	471	158	7.11	1.286	7.8
12	9	507	9.04	5.08	6.0	419	168	7.59	1.436	3.7
13-15	10	921	16.41	8.49	7.9	375	184	6.78	1.559	1.1

Source: Barclays Research

Figure 4. Estimated Autoregression Coefficients by TES Bucket, Feb 2007 – Sep 2014

	Intercept	Lag(-1)	Adj R²
TES1 ER	0.02	0.17	0.02
	(0.11)	(1.32)	
TES2 ER	0.07	0.28	0.07
	(0.34)	(2.14)	
TES3 ER	0.08	0.34	0.10
	(0.41)	(2.75)	
TES4 ER	0.06	0.37	0.13
	(0.34)	(2.87)	
TES5 ER	0.07	0.39	0.14
	(0.40)	(2.98)	
TES6 ER	0.05	0.43	0.18
	(0.29)	(3.27)	
TES7 ER	0.05	0.43	0.17
	(0.27)	(3.17)	
TES8 ER	0.03	0.44	0.19
	(0.17)	(3.40)	
TES9 ER	0.03	0.50	0.24
	(0.14)	(3.89)	
TES10 ER	0.06	0.48	0.22
	(0.38)	(3.67)	
Corp ER	0.05	0.34	0.11
	(0.26)	(2.58)	

Source: Barclays Research

Based on the AIC, we estimate the model using one lag. Standard errors are Newey-West with a truncation parameter of 3. t-statistics are in parentheses. Coefficients in bold are statistically significant at the 5% confidence level.

To compute TES, each bond in a particular market is assigned to an OASD-adjusted LCS quintile, and to a monthly trading volume decile. (LCS is a product of the bid-ask spread and OASD, so the duration adjustment is necessary for relative-liquidity comparison of bonds with different duration.) Then, these two values are added, and the sum is mapped to a TES ranking from 1 to 10.

As Figure 3 shows, TES buckets differ in the number of bonds and market value allocation. The attributes of bonds in different TES buckets also vary, substantially and predictably. By construction, low-TES buckets contain bonds with low LCS and high trading volume, mostly large, recent issues. Average issue size decreases dramatically in higher-TES buckets, while average age increases.

How to Test the Quality of a Liquidity Measure
In a liquid market with many potential buyers and sellers constantly inquiring, quoting and trading, prices and excess returns quickly reflect news and changing investor views. In other words, the market is informationally efficient. In contrast, limited quoting and trading activity slows the propagation and evaluation of new information. Hence, one way to assess efficiency is to check for "price inertia." In other words, do past returns help explain current-period returns? If so, then the market for the bond may not be very liquid. We measure price inertia by regressing current-month excess returns (ER) on previous-month excess returns:

$$ER_t = \alpha + \beta \times ER_{t-1} + \varepsilon$$

To investigate informational efficiency of the USD IG corporate market, we partition it into liquidity strata based on TES. A comparison of price inertia in various TES buckets can reveal whether low-TES buckets are indeed more efficient than high-TES ones.

Figure 4 presents the results of this regression analysis. For the corporate market as a whole, the one-month lag coefficient (0.34) is statistically significant, and 11 percent of the variation in

the current-month returns is explained by the previous-month excess returns.

However, price inertia is not uniform within the corporate market. In low-TES buckets (i.e., high liquidity), lagged excess returns have little explanatory power, which attests to their information efficiency, while in high-TES buckets (i.e., low liquidity), we see significant coefficients that explain a meaningful percentage of the bucket's excess return volatility, demonstrating strong price inertia.

We conclude that market efficiency varies significantly within the corporate market and is correlated with liquidity. The results also suggest that TES, and hence, LCS, does a good job partitioning the market by liquidity.

PRICE IMPACT MEASURE (PIM)

An alternative way to measure liquidity is to see how transactions affect bond prices. Order flow exposes market makers to the possibility of facing better-informed counterparties. To avoid being stuck with an undesirable position, market makers adjust prices of illiquid bonds more than those of liquid ones, so issues whose prices are more sensitive to transactions might be considered less liquid than those whose prices are less sensitive. We have constructed a bond-level price impact measure (PIM) for USD investment grade corporate bonds. PIM complements LCS and, like LCS, is available since January 2007. PIM captures a bond's price change (i.e., return) per dollar of transactions volume and is calculated on the daily basis as the ratio of the bond's absolute excess return (net of the Corporate Index excess return) to its daily dollar transactions volume in millions:

For each bond, we average these daily R values over the month to arrive at a bond's monthly PIM. Aggregating across bonds provides a useful market-wide measure of market impact.

Figure 5. Price Impact Measure (PIM), USD IG and HY Corp, Jan 2007 – Apr 2016
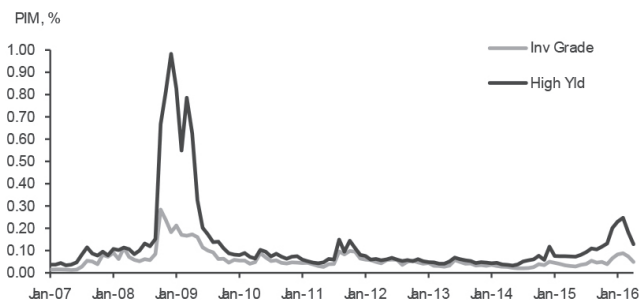
Source: Barclays Research

The market PIM (Figure 5) is dynamic. We see large movements, in the expected direction, during the 2008 financial cri-

$$R = \frac{|Daily\ ExRet|}{Tvol}$$

sis, the European sovereign crisis, and the credit market volatility of late 2015. The market PIM was remarkably low prior to the 2008 crisis, approximately one-third of today's magnitude, reflecting a unique period in our financial markets. PIM began to rise at the onset of the mortgage crisis in mid-2007. We do not observe any secular increase in PIM in recent years.

Relationship of PIM with LCS and Bond Attributes

We observe that the market PIM follows the moves of market attributes in an intuitive way (Figure 6, pg. 32, top). Increases in market risk (OAS) are associated with rises in price impact costs. What is the relationship between PIM, a price-impact liquidity measure, and LCS, a transactions costs liquidity measure? Despite their very different approaches to measuring liquidity, we see a close relationship (Figure 7, pg. 32, middle), with a monthly, market-level correlation of 0.92. However, the coefficient of variation for PIM is more than 1.75 times that for LCS, suggesting that PIM may contain some additional information.

ESTIMATING RETURN IMPACT OF CORPORATE BOND PORTFOLIO REDEMPTIONS

One potential application of PIM is to estimate the return impact of portfolio redemptions. If a fund manager has to redeem a portion of the fund, the PIMs of the positions to be liquidated can be used to estimate the net market impact (assumed to be negative) on the portfolio's return.

To construct redemption impact curves, we assume that managers hold "liquidity sleeves" within their portfolios, composed of diversified baskets of highly liquid bonds, sufficiently large to meet redemptions and constructed to have a beta of 1 versus the portfolio's benchmark. Using bond-level PIM, we estimated redemption impact for two $10 billion corporate funds, IG and HY. Figure 8 (pg. 32, bottom) shows these redemption impact curves for two different months representing very different market conditions.

Figure 8. Estimated Portfolio Return Impact Curves, USD IG and HY Corp, $10 Billion Fund

For example, in January 2016, a 10 percent redemption (i.e., $1 billion) in the IG Corp fund would produce a negative, portfo-

Figure 6. Average Monthly Correlations of PIM with Bond Attributes, USD IG Corp, Jan 2007 – Sep 2015

Attribute	PIM
Age	0.06
Size	-0.11
T-vol	-0.11
OAS	0.30
DTS	0.36
LCS	0.37
TES	0.18

Source: Barclays Research

Figure 7. PIM vs. LCS, %, USD IG Corp, Jan 2007 – Apr 2016
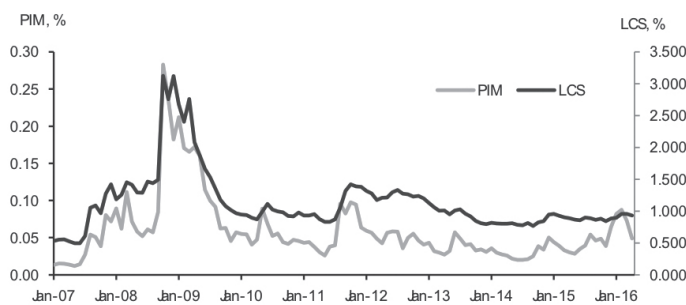
Source: Barclays Research

lio-wide return impact of approximately 2.5bp net of market. In November 2008, however, the same 10 percent redemption
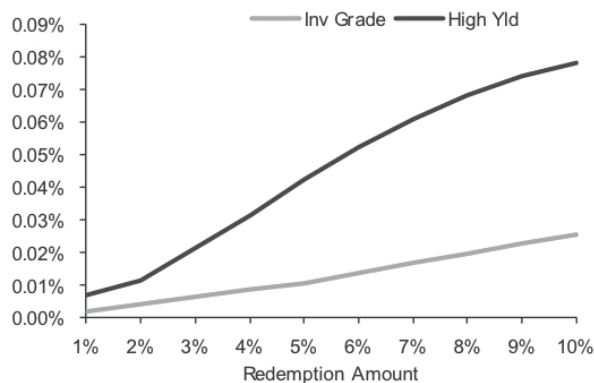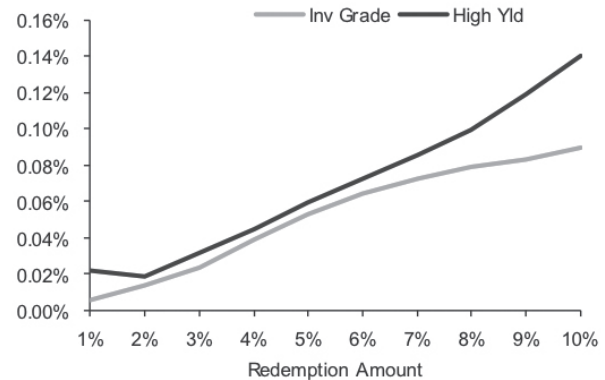

Figure 8. Cont.

November 2008

would entail a 9bp impact. Other redemption strategies can be analyzed in the PIM-based framework as well.

Finally, while each redemption strategy has its own expected redemption impact cost, it also entails an often-overlooked on-going cost. To maintain a satisfactory redemption impact curve, a highly liquid basket needs to be periodically refreshed (to remain highly liquid) and rebalanced (to keep beta = 1), with the attendant transactions costs. Moreover, the liquidity sleeve creates an opportunity cost as this portion of the portfolio is unavailable for expressing and harvesting the manager's alpha generating views. Using LCS and the manager's historical alpha, it is possible to quantify and compare the cost of employing a particular redemption strategy versus the estimated impact cost in the event of redemptions. ■

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The Effects of Decades of High Inflation in Argentina

By Jorge Lopez Airaghi Edited by Thomas J. Egan, Jr.

Investment professionals in the United States understand inflation at a distance in their professional activities but rarely experience it in their lives as consumers. This paper describes the day-to-day effect on consumers and companies in a country with extremely long periods of inflation, such as Argentina. It will illustrate how government policies can control or exacerbate the effects of high inflation on the economic and social aspects of the country's population.

MONETARY CAUSES OF INFLATION

The French economist Jacques Rueff was one of the first to alert the world to the era of inflation after World War I. His book, *L'âge de l'inflation* (1964), stated that the transition from the gold standard to the capacity of each central bank to issue its own currency was the initial cause of the monetary inflation since not all central banks have the discipline not to issue currency above their gold reserves.

Money Creation's Effects on Levels of Inflation

Most central banks have the capacity to control their money supply and have sometimes used it to cause the destruction of their own currencies, either through negligence or the force of circumstances. Assessing cause, effect and blame is difficult though. Having lost World War I, Austria assumed the debts and reparations bill for the much larger Austro-Hungarian empire. Similarly, the German hyperinflation of 1923 wiped out the middle class and impoverished the working class. It sowed seeds that sprouted when the depression that followed the 1929 crisis led to National Socialism and Hitler's totalitarian power. Perhaps paradoxically, Japan's debt is 245 percent of gross domestic product (GDP) today and hyperinflation has not reappeared (yet).

Money creation can have an immediate impact on the growth of inflation. If the population is not willing to hold the country's paper money, inflation will increase as the velocity of money accelerates. When the government administration has to deal with extraordinary situations (like the U.S. financial crisis in 2009), there might be a temporary need to create money to cover deficits. If such economic intervention is done on an exceptional

short-term basis, the population will retain confidence in their currency as a savings unit. The newly issued money will not have an inflationary influence since the key issue—velocity of use—will not have an impact on aggregate demand. People will retain the excess money and prices will not be impacted. If a government regularly increases the money supply to fund expenses that exceed the country's capacity to support them, citizens will lose confidence in the local currency. Money velocity will increase and result in inflation.

Argentina's Currency

Decades of inflation in Argentina have caused the local currency to completely lose its power as a savings unit. Most long-term savings are held in U.S. dollars. It is estimated that more than US$400 billion are held as savings and remain outside Argentine investments. The figure is the equivalent of 62 percent of Argentina's 2014 gross national product (GNP). This is a rational outcome when the excess money supply greatly exceeds the increase in the GDP and causes an increase in prices. Argentina´s half century of inflation is perhaps the most devastating experience ever of money supply exceeding domestic growth.

Until recently, every Argentine government for over 50 years has had more expenses than income. Governments have tried to cover the fiscal deficits by issuing more currency and using foreign debt. These actions have created a monetary and social phenomenon: a country with almost five decades of permanent medium/high inflation, with self-generated peaks of hyperinflation.

Argentine administrations have often controlled exchange rates to try to contain inflation, which is a form of tariff. The combination of inflation and the fixed exchange rates has caused the prices of local food and essential products to be close to the prices in the United States and Europe—despite the fact that average wages and salaries are 40 percent less than in the United States and in most European countries. As internal prices rose the exchange rate needed to be devalued to keep export prices on a competitive basis.

INFLATION LEVELS IN ARGENTINA

Tables 1 and 2 illustrate the levels of inflation in Argentina over the last 70 years. The tables show the level of inflation for various five-year periods from 1945 to 2015. The inflation for the period 1975 to 1994 is shown separately in Table 2 because of the hyperinflation during that period. The average inflation rate was 27 percent for the period 1945 to 1974, which was immediately prior to the hyperinflation period. The average inflation rate was 514 percent for the period 1975 to 1994, with inflation at nearly 5,000 percent in 1989 at the transition to a civilian government.

Table 1
Argentina
Average YoY Inflation (%): 1945 to 1974 and 1995
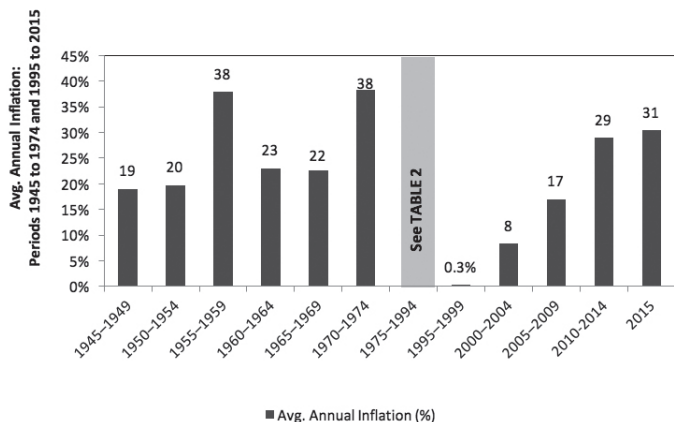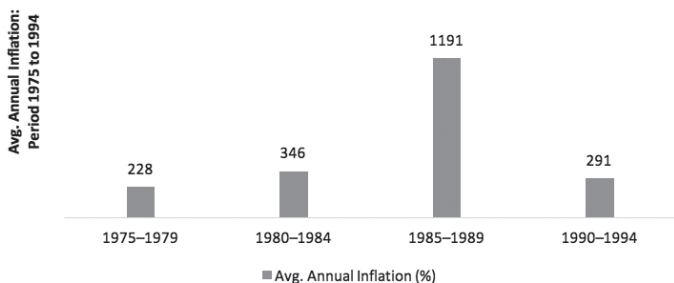to 2015

Table 2
Argentina
Average YoY Inflation (%): 1975 to 1994

This all took place amidst a background of political uncertainty and struggle. After the world's first female president, Isabel Perón, was deposed in 1976, Argentina experienced bitter civil internal hostilities caused by terrorism until 1983 and lost the Falklands War in 1982.

In 1991, Argentina established a comprehensive stabilization program, the Convertibility Plan, to eliminate inflation, restore macroeconomic balance and end the long history of high inflation. The program was based on a strict exchange rate rule, where the parity was fixed by law at one peso per U.S. dollar. The program required the monetary base to be fully backed by international reserves, and the central bank was restrained from financing budget deficits—breaking the mechanism that caused inflation. The government also privatized large, state-owned firms in the telecommunications, airline, railway, petroleum, mining, steel and defense sectors in an attempt to cut losses and

the subsequent fiscal deficit that caused the mismanagement of these state enterprises. Attracted by the sale of state-owned firms, foreign direct investment increased dramatically (even though much of it focused on natural resource extraction and services).

Inflation was essentially eliminated during the 1995 to 1999 period. However, external shocks affected the Convertibility Plan: the Mexican crisis of 1994 to 1995, the Asian crisis of 1997, and the 1998 Russian financial crises together with the Brazilian crisis of 1999 had overwhelming effects. Interest rates increased, the U.S. dollar appreciated, and a slump in the world prices of primary products stalled the Argentine economy. Argentina's comparative advantage (low-cost production) in world markets was brutally hit. A new government administration decoupled the peso from the U.S. dollar beginning in 1999 in an attempt to aid the very poor, most hurt most by the currency strategy. Inflation in the following 15-year period from 2000 has averaged about 20 percent.

Consequences of High Inflation in Argentina
The whole population of Argentina has experienced every stage of inflation for their entire lives. Counting outliers, the average inflation rate has been over 140 percent annually over the past 70 years. Even excluding the hyperinflation period, 1975 to 1991, the inflation rate has averaged about 20 percent, with a few brief periods of low inflation and deflation. No Argentine has ever had a day during his lifetime without worrying about inflation. Political and economic decisions were drivers of inflation and have made a major impact on the social, political and economic development of the country. The political institutions in Argentina have failed to control inflation. The political consequences were inevitable as many governments fell during that period.

Double-digit annual inflation for more than three decades has had a sociological impact on every Argentine. Even the most financially illiterate have learned that inflation means powerful income transfers from the poorest to the richest (who have access to power and resources outside the system) and to the government administration through higher nominal taxes. They understand that the local currency cannot hold its value, which is a self-fulfilling prophecy. Clearly, this stressed lifestyle has triggered certain typical and dysfunctional social behaviors, which are utterly peculiar to Argentina. These issues have deeply affected the citizens in their day-to-day actions.

Human beings want to be able to control their lives and plan for their future. High inflation rates reduce the ability of people to properly plan their personal finances—causing feelings of insecurity, uncertainty and fear. Inflation in Argentina requires constant analysis of costs and prices; it makes long-term planning

impossible. The lack of certainty about meeting daily expenses also has a high impact on self-esteem and personal relationships.

Some sectors can force an increase in income much faster than other sectors (for example: salaries negotiated by unions with the price-setting companies). This leads many to feel their personal situation is unfair and to resent other sectors of the population that fare better under inflation. High inflation has resulted in mass social confrontation. Wage struggles are expressed in wild-cat strikes. The population is under permanent stress because of the effect of such strikes on various supplies.

The high level of inflation in Argentina has also caused unique economic and social behavior. Citizens have relaxed views about their tax obligations to the government, creating an enabling environment for corruption. Those who evade paying their taxes are seen as acting in legitimate defense of their assets and income against the effects of extreme levels of inflation. The public sector finances become even weaker due to this behavior.

Lending is concentrated in the state as loan taker, crowding out the private sector from banking loans. Most enterprises are only able to get credit marginally for very brief periods. The ultimate source of credit is the credit from suppliers to customers, both domestic and foreign, and loans from international banks to finance import and export trade. All loans carry monetary tightening through interest rates compatible with inflation or other corrections, according to indexes. Medium and small companies finance their sales with their own assets and supplier credits.

All cost increases are immediately passed through in selling prices to preserve productive assets. Because of Argentina's permanent high inflation, adjustments are always somewhat higher than expected inflation. The frequent periods of high inflation lead banks to lend at extremely high nominal rates. Monetary corrections combined with tight deadlines can be extremely dangerous for the survival of small companies.

Public services like transportation, police, education, health, water and electricity supply have failed to keep their tariffs up to meet their costs. Equipment maintenance and new investments have been delayed and do not meet the required needs to support depreciating assets. This has caused severe disruptions in their normal operation.

During the last 40 years, the U.S. dollar has performed the monetary function of storing value, and is the means of payment and saving. Any individual in Argentina with saving capacity will use dollars to price and pay for houses, land and any other durable high-cost asset. Bank deposits in local currency never exceed 30 days. Real interest rates have been usually negative against inflation. Citizens use bank deposits in the short term only when there is an expectation that interest rates will exceed inflation

and peso devaluation—something that rarely happened until the new administration recently took over.

A real victim of high inflation is the very small, practically non-existent Argentine capital market. Short-term deposits, between seven and 30 days, cannot effectively support a market of equities, bonds and mortgage loans in the national currency. The stock market cannot develop in both the number of investors in companies and the daily volume of transactions.

Fixed interest rate obligations like mortgage loans for financing long-term housing are totally nonexistent, regardless of government subsidies for these purposes. Because the cost of credit is high, it is nearly impossible for the middle class (not to mention the lower-income population) to purchase or even rent a home. The uncontrolled issuance of money, which increased the monetary base by 13 times since 2013, also created a gap between property prices and wages.

Economic Actions of New Administration
On the back of the global decline in the value of commodities, which reduced foreign demand for Argentine goods, a new president was elected at the end of 2015. The new administration quickly learned that official economic figures were unreliable. They also found that the outgoing administration left a scorched earth policy—a last-minute strategy targeted to hide or even destroy anything that might be useful to the new administration. The level of available foreign currency reserves was negative. The fiscal deficit was an unprecedented 6 percent of GDP, and the money issued to cover the deficit exceeded all reasonable limits. During its last 30 days the outgoing administration increased the total number of government employees by 15 percent with no specific job duties. The strategy was intended to modify the tax redistribution and force the new government to increase the money supply.

The overall panorama was discouraging; poverty levels exceeded 15 percent, 1 in 5 young people was neither studying nor working, the inflation rate was greater than 30 percent (the third highest in the world), the currency was artificially overvalued by 40 percent, and 43 percent of the economically active population was working for the government. The country had the largest global tax pressure in its history.

The new administration acted immediately to stabilize the economy. It successfully restored the country's ability to borrow from foreign sources, cut down on unnecessary government expense, and made an agreement with labor unions to control wage increases until the production levels increased.

Several measures were instituted to start gradual and moderate medium-term corrections to reduce inflation: increasing production from the private sector, decreasing taxes and opening the controlled exchange market. The currency was allowed to

float, which initially resulted in devaluation. The actions were taken gradually to avoid a strong economic shock. However, the first impact has been an increase in the inflation rate. This is the textbook example of inflation of external origins, which appears after devaluation.

Summary and Conclusions

No country escapes the forces of inflation; however, not all inflation is bad. A persistent low level of inflation is seen as optimal by policymakers in Europe, the United States and Japan. In that Goldilocks scenario, the expansion cycles are long; contractions are generally short and bearable. Individuals can save without the fear of loss of purchasing power. Capital markets finance the capital investment needs and any deficit of the public sector. Social struggles are peaceful and the informal economy is only marginal. At a low level of inflation, wealthy savers stay in the system and help fund the dreams of young debtors. The world economy is dominated by countries with low inflation rates. These industrial countries practice close monetary cooperation to contain the expansive inflationary forces with hikes in interest rates and limited intervention in exchange rates among their currencies—especially the U.S. dollar against the British pound, the Japanese yen and the euro. Monetary and exchange policy is the main instrument to contain the risk of an overheating economy in these countries.

In 70 years, hyperinflation has occurred in just nine countries *and no country other than Argentina has ever suffered 50 years of high inflation*. The price of goods and services has been a constant concern of the Argentines since the mid-20th century. It is no exaggeration that inflation has influenced the social, political and economic development of the country. The new administration has made some positive initial strides to control inflation and gain support for the local currency. Only time will tell what effect these actions will have on the level of inflation and the lives of Argentine citizens.

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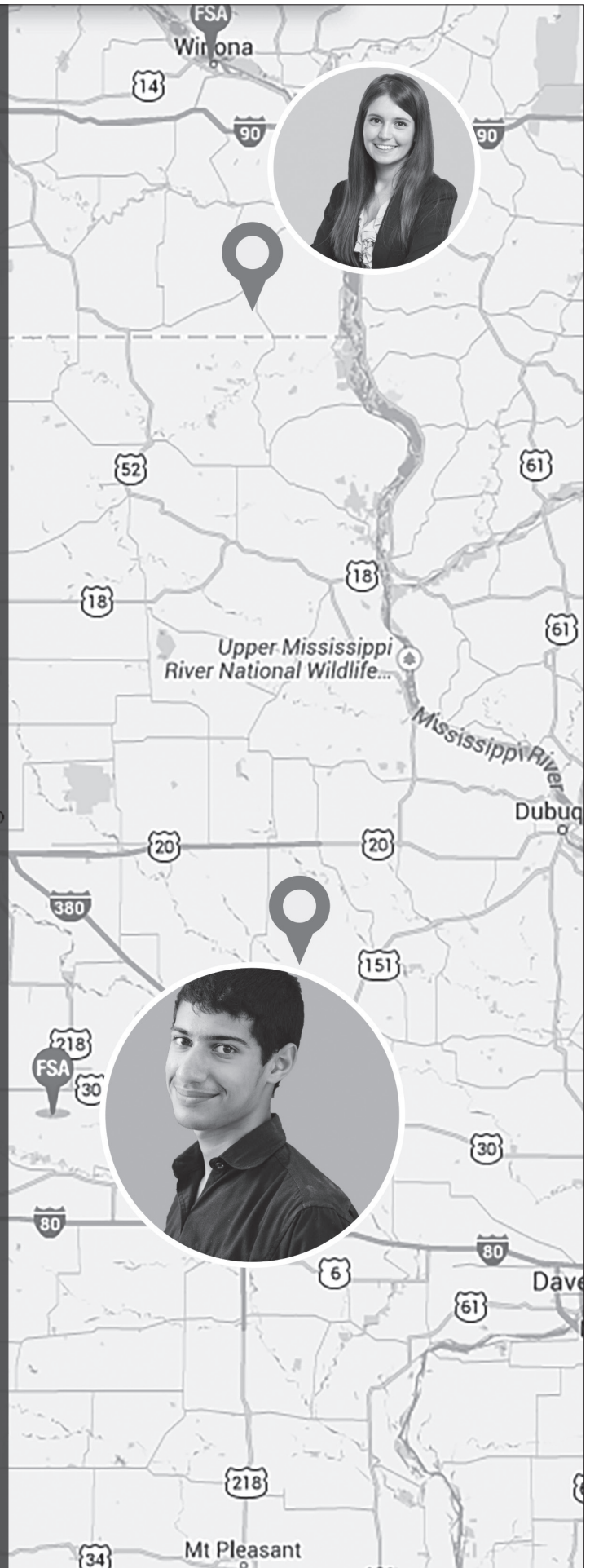
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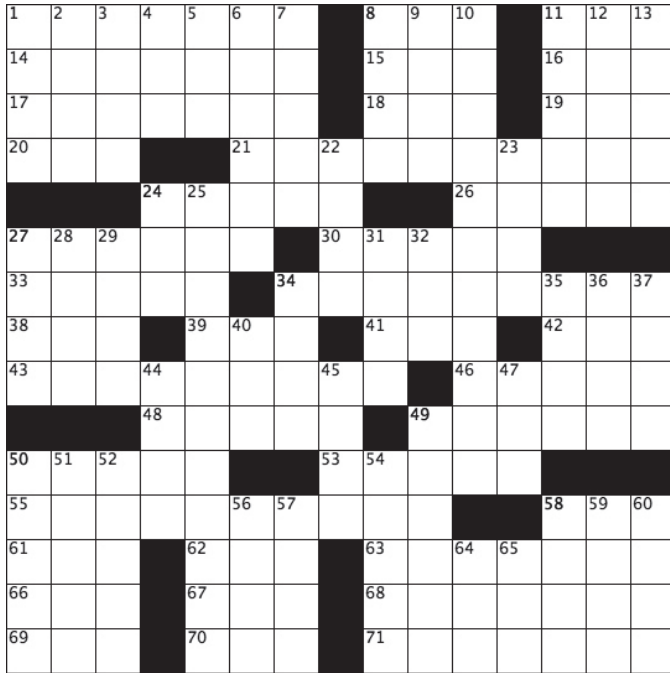
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SOCIETY OF ACTUARIES

Risks & Rewards Crossword Puzzle

"Oh no EU didn't!"

By Warren Manners

Across
1. Vials
8. Kind of lamp
11. Horace's "___ Poetica"
14. European elitest?
15. Messi is one of these
16. New Zealand bird
17. Amin subject
18. Took off
19. Crash site?
20. Nitwit
21. Baltic bolter?
24. Common quintet
26. Celtic Goddess of horses
27. Nitwits
30. Casual pair
33. Appraising
34. Scandinavian separatist?
38. Profits
39. Twice, a teletubby
41. Neath's opposite
42. Maven
43. Occidental obstinate?
46. Adult insect
48. Idaho town
49. Pad
50. Mexican marinade
53. Elysiums
55. Iberian isolationist?
58. Specialized Wall St. trader
61. Mellow
62. NATO cousin
63. Like some stops, linguistically
66. Dora's special helper
67. Successor to GMT
68. African asocialist?
69. Rochester-to-Harrisburg dir.
70. Made a lap
71. Unable to smell

Down
1. Marine shade
2. Tavern items
3. Innermost layers of the meninges
4. Arg. top engineering school
5. Bristol boy
6. Oil for Aristotle
7. Irish playwright
8. Rhine feeder
9. Victrolas, e.g.
10. 100+
11. PABA part
12. Samurai with no master
13. Arabian capital
22. Caracter'istica de vino tinto
23. Aut
24. United sponsor
25. Humdrum
27. Bill of fare
28. Court cry
29. Lady in a Beatles song
31. Cupid
32. Veneration
34. Capture
35. Girasol
36. Push
37. It's a blast
40. ____-Buddha
44. Roughneck (British slang)
45. Cassini
47. Brit. medical degrees
49. Report, kid-style
50. "Smart" guy
51. "L'Absinthe" painter
52. Bilinga wood
54. Cannabis
56. "Cheerio!"
57. Afr. Amer. Army regiment
58. Whit
59. Millet
60. Voting alliance
64. Plains dweller
65. Some Audis

The solution will be provided in the next issue of *Risks & Rewards* along with the names of those who were able to successfully complete it. Submissions should be made to *warren_manners@swissre.com* by Oct. 31, 2016. For submissions received before the posted deadline and 100 percent correct, a winner will be selected at random and awarded a $25 Amazon gift card. Note, previous winners will not be eligible to win the very next issue's prize.

Solution to the February Crossword Puzzle

No completed submissions

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