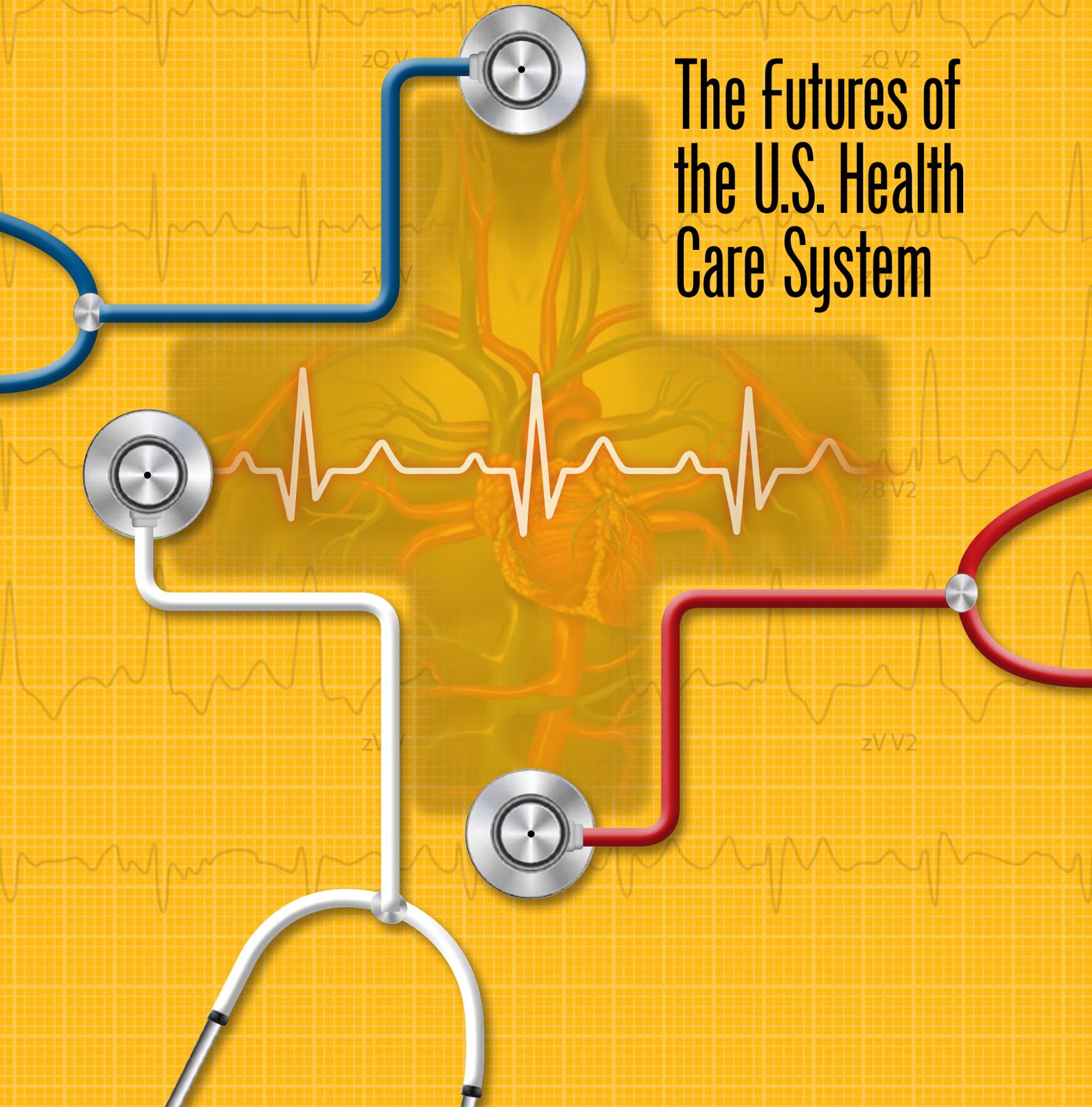




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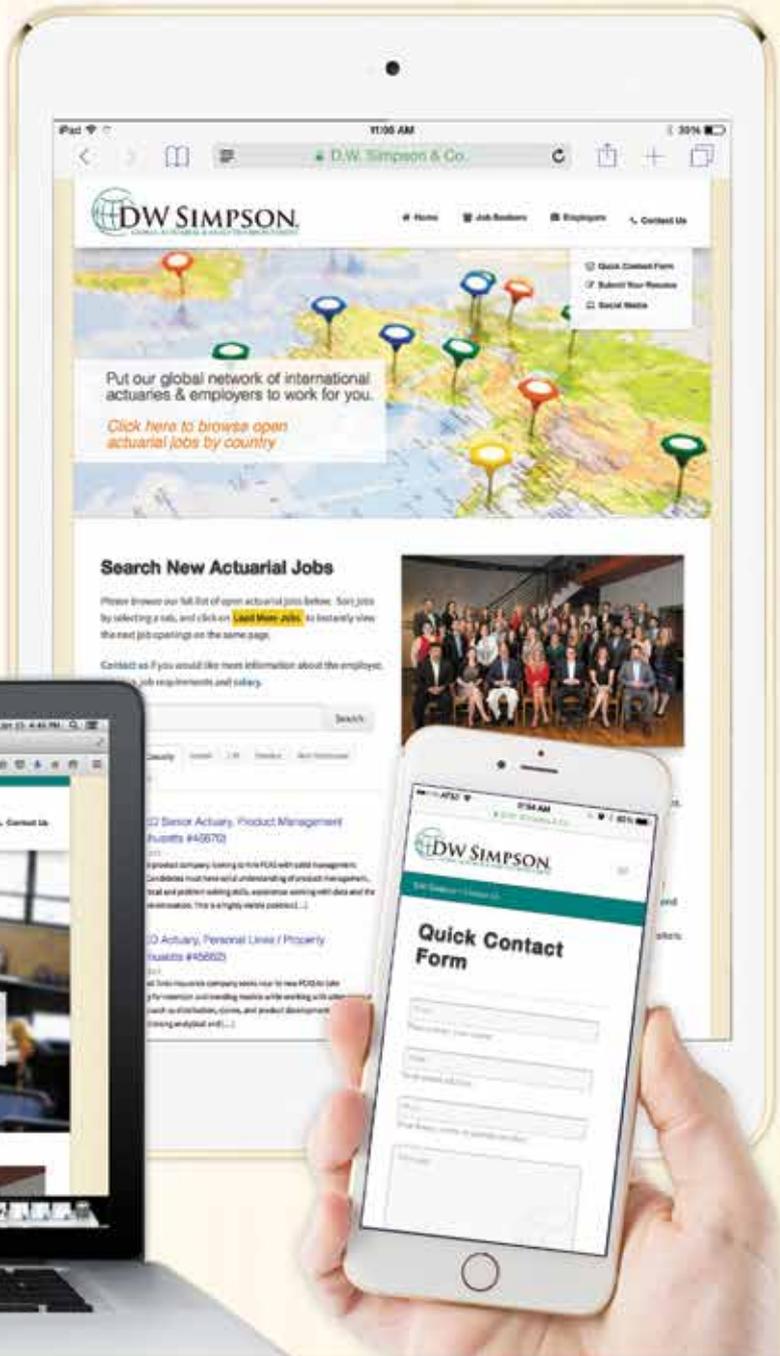


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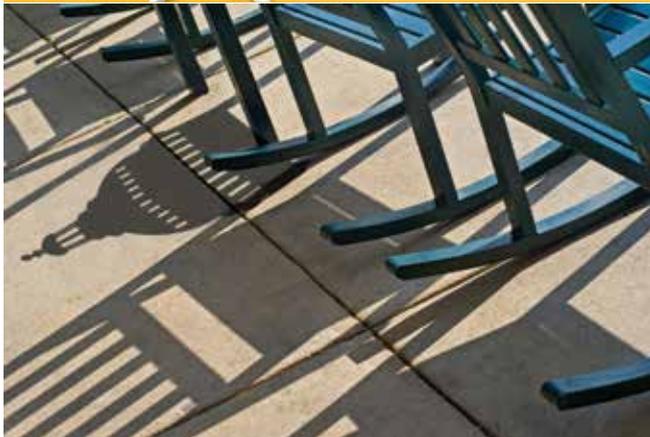
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On Communications

AS YOU MAY HAVE GUESSED BASED ON MY CHOSEN PROFESSIONAL PATH, I have more than a passing interest in communications. I vividly recall the moment when I realized that by simply making a few sounds in a specific order, or scribbling down a few squiggles, I could take a thought in my mind and put it in yours. It was a sort of magic, to be able to share ideas and experiences with others—and it still is.

I have recently been able to witness this magic of language acquisition and communication in my young sons. My elder son is a newly voracious reader, and he gleefully shares the facts he learns; I know more about narwhals than I did at this time last year, for example. And my younger son, at 2 years of age, is a gifted mimic, feeling his way around the practice of asking questions as a way to learn about the world. (He knows quite a bit about narwhals, too.)

The communication landscape in which my sons are learning is very different from the one I experienced as a child—which, to me, offers benefits and drawbacks. We're able to Skype with my Ohio-based parents, which means they get to be a bigger part of my kids' lives than they might otherwise. And our digital infrastructure means my wife can send photos and videos to the kids while she's traveling for work, creating a sense of proximity even if we're temporarily apart.

The speed with which we're able to communicate does bring some downsides. Because email and texts arrive instantaneously, there's no longer the sense of anticipation I used to get while waiting for a letter from a pen pal. (Instead, we're left with mounting annoyance that our missives haven't been answered yet.) And as we take for granted this constant flow of communication, I believe we value the written word a bit less than we used to.

It's in this spirit that I offer the following observation: The September/October 2002 issue of *Contingencies* contained three full pages of letters. The issue you're reading has none, because we didn't receive any correspondence that merited inclusion. The methods we use to communicate have changed since 2002, to be sure—but the importance of hearing from readers has not. After all, *Contingencies* is your magazine, and we need to be sure that we're fulfilling our promise to communicate the latest thinking and research from the actuarial profession. Please

send us your thoughts, responses, quibbles, and reactions to this issue at editor@actuary.org.

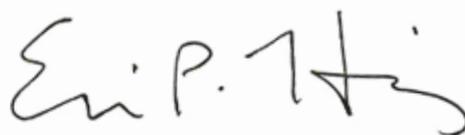
This issue's features are all concerned with communication in its various forms. In our cover feature, "The Futures of the U.S. Health Care System" (page 18), Carlos Fuentes uses the intriguing tool of scenario planning to imagine several possible near- and long-term outcomes for the U.S. health care marketplace, and posits that actuaries can use this practice to help describe—for employers or policymakers—how potential futures may unfold.

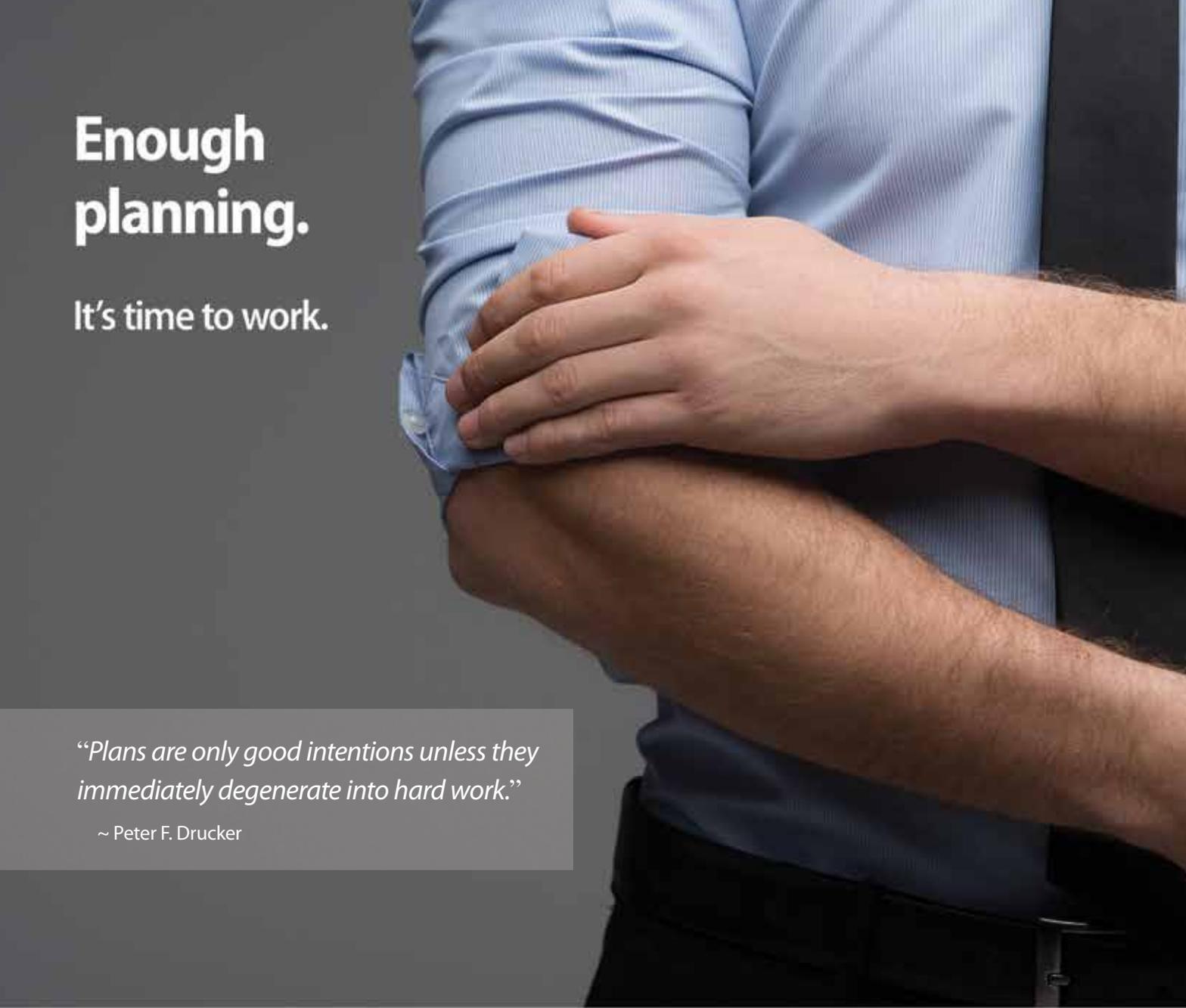
Has the Federal Reserve adequately communicated its course for raising interest rates—and what does that course mean for financial companies' bottom lines? That's the topic of "Fed Up" (page 33), in which Jeff Reeves dives into the Fed's recent rate hike, what that change means for insurance companies and other entities that derive significant income from investment returns, and how risk management actuaries can use their considerable expertise in our changing world.

In "The Real Goal of American Pension Legislation" (page 26), Leslie Lohmann sees a disconnect between the stated purposes of various U.S. pension laws and regulations and their observed outcomes—that is, the lofty aims stated for crafting legislation are not fully realized in the implementation thereof. The author connects the dots from historical beginnings of pensions through economic theory to our present-day environment, and proffers a theory about what drives that disconnect.

Finally, we present our first finalist in our fiction contest, announced in the January/February issue. (See actuary.org/2016contest for more information, and to enter.) "Elevated Risk" (page 46) offers a chilling look at what can happen when you take on more than you should.

Thank you, as always, for reading—and please let me know how we might better communicate with you. □





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~ Peter F. Drucker

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When My Work Crosses the Border

IF I BUILD A CAR IN JAPAN FOR SALE IN CALIFORNIA, it has to meet all of the U.S. and California pollution control requirements. If I build a car in Detroit for sale in Canada, it has to meet all of the Canadian safety requirements. And if I build a car in Canada for sale in England, I need to put the steering wheel on the right side of the vehicle instead of the left. The fundamental principles of physics and engineering may be the same everywhere, but the laws governing the manufacture and sale of automobiles aren't. Carmakers must comply with the rules of any country they want to sell cars in.



The same is true for actuaries. If I do actuarial work in the United States that's intended for use in Canada, I have to comply with the applicable Canadian laws, regulations, and standards of practice. The same would be true for a Canadian actuary performing actuarial work that's intended to be used in the United States. The fundamental principles of actuarial mathematics may be the same everywhere,

but the laws, regulations, and professional standards governing actuaries aren't.

This isn't just a technical requirement; it's a professional obligation. Actuaries don't work in a vacuum. There's a context for everything we do. Each country has its own legal system, economic system, and regulatory philosophy. Tax rules and accounting rules differ, as do local history and customs. Each country has its own unique social insurance systems. Actuarial standards of practice vary from country to country because the context for actuarial work changes. The U.S. Code of Professional Conduct explicitly recognizes "the professional responsibility of an Actuary to observe applicable standards of practice that have been promulgated by a Recognized Actuarial Organization for the jurisdictions in which the Actuary renders Actuarial Services."¹ More fundamentally, standards of practice that presuppose a U.S. context may simply be inappropriate in another context.

How do I know what the standards of practice are in another country and whether or not I'm even qualified to do the work I'm considering taking on? I should look to the national association of the country where the actuarial work is intended to be used; it will be the best source of information on the qualification

standards and standards of practice that apply. Every country with a mature actuarial profession has a national association that typically performs certain nation-specific functions. It:

- Establishes the:
 - Code of conduct;
 - Qualification standards; and
 - Standards of practice;
- Houses the disciplinary process; and
- Serves as the primary voice of the profession to legislators, regulators, and the public.

The national association for Canada is the Canadian Institute of Actuaries (CIA). In Mexico it is the Colegio Nacional de Actuarios (CONAC), and in China it is the China Association of Actuaries (CAA). In the United States, the American Academy of Actuaries (Academy) is the national association for the U.S. profession.

I am very proud of the credentials I have earned here in the United States—but they do not automatically qualify me to perform work for use in Canada or China. In my case, I can affirmatively say that I'm not qualified to do work for use in China, for example, because I simply do not know the laws and regulations that apply there. It would be unprofessional of me to pretend otherwise.

Our world is becoming more global. No nation stands alone, and U.S. actuaries are affected by developments in other countries. The International Actuarial Association (IAA) serves as a "United Nations" for the actuarial profession. The Academy is active at the IAA as the national association representing actuaries practicing in the United States. But just as the United Nations has not eliminated the political, economic, and cultural differences between member countries, national differences are still relevant to the actuarial profession. Appropriately recognizing those differences in context and standards remains an essential element of responsible actuarial practice. □

1. Annotation 3-1, Code of Professional Conduct, American Academy of Actuaries, 2000.



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Economic Inequality and Why It Is Important—An Actuary’s Perspective

IN RECENT YEARS, some risks previously identified as “emerging risks” now no longer fall under this label; the threat of the menace is much more visible (and even personal). Two examples are climate change and cybersecurity. Both of these probably now belong to a different category—“societal risks” (compared to “enterprise risks”)—as the reach of these threats knows no boundaries.

A threat that presently belongs in the “emerging risk” category but is still societal in nature is economic inequality, or rather increasing economic inequality. Depending on how it plays out in an economy, it can severely impact national economic well-being.

Economic inequality refers to the unevenness of “economic well-being” among the population of a country. It made headlines following the publication of the well-acclaimed, best-selling 2013 book *Capital in the Twenty-First Century* by the French economist Thomas Piketty. The book generated important discussions on inequality; many leading economists (Larry Summers, Joseph Stiglitz, Paul Krugman, and Robert Shiller among them) and other important leaders (including Bill Gates and Pope Francis) have weighed in on the topic—so much so that economic inequality has been an important topic at the Davos meetings of World Economic Forum in both 2015 and 2016.

This article will discuss inequality and its risk aspects. In the interest of focusing the discussion on the core topic, the overall emphasis will be on simplicity. Inequality can be measured by income and wealth (and consumption); income inequality is more commonly used in

discussions, as there is more abundant data on it. While income and wealth inequality are often related, this is not necessarily always the case. For example, income inequality may be better in some countries while wealth inequality is much worse (e.g., Switzerland).

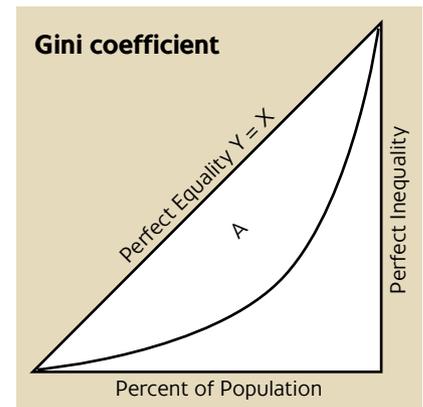
We will discuss the topic in the context of income inequality as it may more readily facilitate the discussion of economic risks from inequality. And we will discuss how actuaries can bring their skills to bear on this important subject.

Measuring Economic Inequality

Economic inequality measures how unevenly the disposable income in an economy is distributed among the population. Graphically, perfect equality is depicted by a $Y=X$ line, while perfect inequality is depicted by a reverse “L” line representing total concentration of income in a single individual. The X axis

represents the percentage of population; the Y axis, the percentage of disposable income.

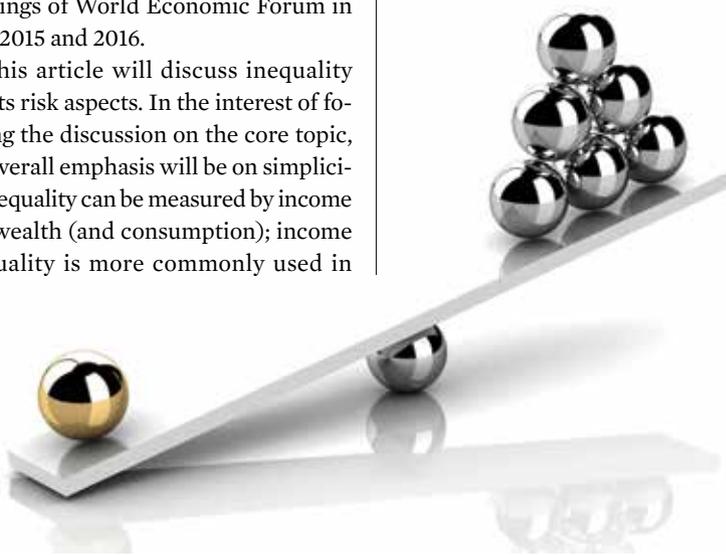
A commonly used metric for inequality is the Gini coefficient. This measure represents the area between the perfect equality line (in the isosceles right-angled triangle of perfect equality and inequality) and the Lorenz curve, which depicts the actual distribution of incomes (A), expressed as a percentage of the area of the right-angled triangle. The value of the Gini coefficient ranges from 0 to 1; the larger the coefficient, the worse the inequality.



A good source of data on historical inequality is the Organisation for Economic Co-operation and Development (OECD), which is a group of 34 generally well-developed countries. It shows many breakdowns of inequality data in member countries. The OECD provides a sortable table that shows post-tax and -transfers inequality over member countries and time, which better reflects inequality than unadjusted data.¹

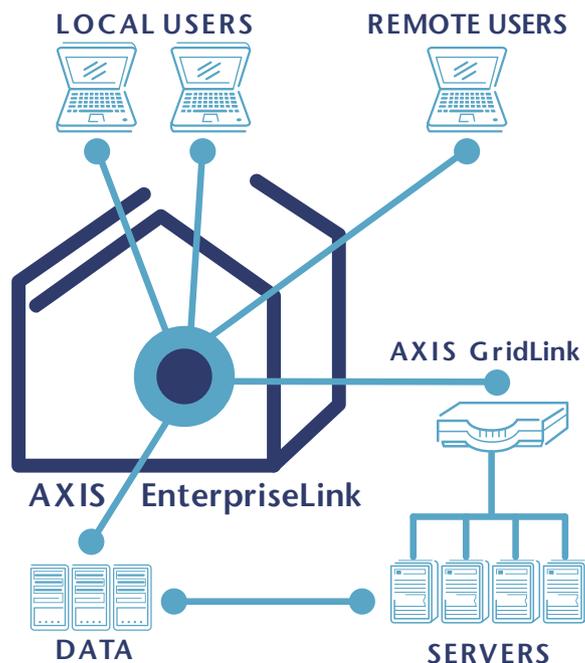
The average Gini coefficient for disposable income of OECD member nations was 0.32 (2012); for the United States it was 0.4 (2013); Chile was the highest at 0.5 (2011).

Other inequality metrics include the





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Palma ratio (income share of the richest 10 percent of the population compared to the poorest 40 percent), 20:20 Ratio (comparison of income share of richest 20 percent of the population to the poorest 20 percent), etc.

Why Is Inequality Important?

Increasing inequality can have severe societal impact.

To be sure, some level of “unevenness” of income distribution is desirable, so as to build in incentives to strive to improve incomes. And some unevenness is natural—as we age, for example. However, it is not clear where the inequality “incentive” cutoff is when the incentives start to weaken. Because gross domestic product (GDP) growth is considered an indicator of the strength of economic performance, some empirical conclusions on the “tipping point” may be possible from review of data, such as the OECD countries’ “normalized” GDP growth rates compared to inequality.

Inequality and Sustainable Economic Growth

The growth rate of GDP, as mentioned, is suggestive of a country’s economic performance; because consumption is a measure of GDP, it is an important factor in its economic performance. World Bank data shows that for many countries, consumption can amount to more than 50 percent of GDP.²

Here in the United States, the Bureau of Labor Statistics publishes a wealth of data on consumer expenditures. In 2011, the most recent published data available, the breakdown of expenditures by income shows that as income increases, the percentage that is attributed to overall expenses decreases.³ For example, at gross incomes under \$70,000, expenditures represented 109 percent of after-tax income; for incomes over \$150,000, expenditures dropped to 53 percent of after-tax income.

The consumer units by gross incomes of under \$70,000 were 68 percent of the

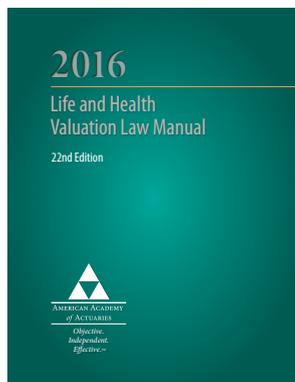
total surveyed, while those over \$150,000 were 7 percent of the total. This is not an unreasonable representation of income distribution across the units at the national level.

Spending from one person translates to income for another, fueling additional spending—creating a multiplier ripple effect in the economy. As the income distribution shifts to the wealthy, there can be a reduction in economic growth from the reduction in total spending, which has been exacerbated by the “reverse multiplier” ripple.

Increases in inequality over time will change personal spending priorities significantly, resulting in cutbacks in discretionary spending. And more income inequality can result in lower governmental revenues from personal taxation (absent any revenue-restorative action), straining social safety nets as people earn less.

The effects of inequality are particularly harmful when it results in increased poverty and/or when middle-to-lower

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income levels do not keep up with inflation in an economy.

The International Monetary Fund's June 2015 report takes a comprehensive look at inequality.⁴ The report notes that inequality has worsened across advanced and emerging market countries. Its work from a sample of 159 advanced, developing, and emerging economies found there is a link between rising inequality and GDP. Their analyses show that if the income share of the top 20 percent of the population increases by 1 percent, GDP growth is adversely impacted by 0.08 percent in the following five years, whereas a similar increase in the income share of the bottom 20 percent of the population increases GDP by 0.38 percent.

The report is a great resource for anyone wishing to add to his or her knowledge on this topic.

Other Potential Effects of Inequality

A catastrophic fallout of significant increases in inequality over time can be

the breakdown of the fabric of society, including:

■ **Significant weakening of the nation's democratic framework.** The wealthy get a greater voice in national matters; the poor are marginalized by the system. This result leads to detachment by the lower-income classes from the political processes, including voting, resulting in what is known as "crony capitalism" or a "rentier economy."

■ **Social costs of inequality.** An increase in economic inequality can lead to overall poor health (absent national health care) due to increased financial and familial stress as individuals strive harder for income. Poor health—both physical and mental—can cause breakdown of families (adversely impacting children's education). Substance abuse increases. In exerting a heavy social toll, inequality can result in a heavy price on the country's future.

Recent findings (published 2015) on mortality of middle-aged white

males 45 to 54 shows that contrary to outcomes in other countries, death rates increased in the United States, reversing the trend in place through 1998; suicide and substance abuse deaths increased noticeably.⁵ While not evidence by itself, the mortality outcomes were thought to be the result of the recent economic situation (financial stress, poor employment outlook, etc.).

■ **Increased lawlessness.** Idle people with basic needs resort to violence; civil unrest can ensue, resulting in loss of lives.

Raising broader public awareness of the dangers of inequality has been difficult in some developed countries. This difficulty may be due to the lack of clarity around the rhetoric on the topic. It comes across as an intellectual concept that roughly translates into "the rich are getting richer" and is not "personal enough" in a big way—yet.

With other, seemingly more urgent

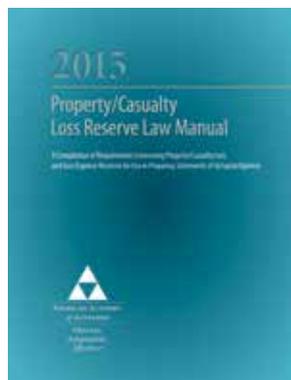
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problems to address—public finances, restoring economic performance, climate change, increasing terrorism, cybersecurity, etc.—inequality is taking a back seat in national priorities and is unlikely to see much attention for some time.

A powerful reminder of what severe inequality looks like is not hard to find. All one has to do is visit a poor country and take a deeper look at its society.

Why Actuaries Should Care

As a societal threat, inequality is a matter of public interest.

Like climate change, rising inequality has societal consequences. The longer it unfolds, the more difficult it becomes to reverse. While some observers may contend that the phenomenon is self-correcting, at least one factor threatens such an outcome: technological sophistication.

Connectivity, big data, machine learning, natural language processing, robotics, sensors, artificial intelligence, 3-D printing, virtual reality, material science discoveries—all of these technological advances are having an impact on many jobs by reconfiguring economic activities in different economic sectors with new, more efficient, less labor-intensive business models (e.g., in entertainment, news media, transportation, legal work, etc.).

An Oxford Martin School study from 2013 on the threat to the jobs market by automation and other technologies estimates that from the type of technologies mentioned above (and based on their then state of art), nearly half the jobs in the United States are susceptible to full automation in a couple of decades, a nearly unthinkable result that would affect a significant percentage of the population.⁶ 3-D printing and drone technologies seem to offer additional potential for disruption as their sophistication and applications increase.

A publication by McKinsey Global

Institute from 2015 offers a different look at the likelihood of job automation.⁷

The only counterarguments to the redundancy of labor from technology position seems to be (i) the “Luddite Fallacy,” referring to the long history of past positive economic outcomes from technology, and (ii) with new technology will come new (and many) jobs. (My actuarial training refuses to allow me to take much solace solely from this “past is a predictor of the future” rationalization.)

Irrespective of the validity of the “Luddite Fallacy,” the problem from advancing technology is not entirely from its sophistication per se, but rather the speed at which it threatens to occur—and hence the extent of labor displacement it can create. Retraining to increasingly higher skill levels will be necessary as skill requirements in the economy ratchet up; catch-up may be hard to achieve for many in the labor force.

Technology advancement cannot (nor should not) be stopped; however, it brings with it the potential for a smaller role for labor in the economy, with consequences for income distribution that come with it. Piketty’s study led him to conclude that inequality increased when the rate of return on capital was greater than the rate of economic growth over an extended time period—such as can happen if labor’s role diminishes. His work has come under widespread critique but has more than held its own.

Because inequality is a function of income irrespective of its driver, its impact can also extend to Social Security/Medicare, defined benefit plans, and other safety net programs’ changing funding needs, and to governmental revenues which in turn affect government budgets and national expenditures. The impact of increasing inequality on the solvency of these programs needs to be studied and understood.

Sustained increasing inequality is an emerging societal risk. The societal

threat from inequality due to sophisticated technologies is potentially so severe that it cannot be left on the back burner. Actuaries have the expertise—longer-term perspective, risk management expertise, appropriate scenario building, modeling, and other skills—to bring to bear and be part of this conversation in a significant way. For that, our “actuarial work” space will need to look different. □

This article is solely the opinion of its author. It does not express the official policy of the American Academy of Actuaries; nor does it necessarily reflect the opinions of the Academy’s individual officers, members, or staff.

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Because I Said So

I USED TO HEAR THE PHRASE “BECAUSE I SAID SO” when I was young. I am not sure why—maybe I was a rebel, or maybe I was just very inquisitive. I tried using the phrase with my niece and nephew when they were young, and although the phrase worked for a while, it didn’t work forever. And for good reason—“because I said so” does not provide any rationale or context.

An actuary knows the importance of providing such substantive information when asked “What?” or “Why?” because the importance of adequate documentation is stressed in the actuarial standards of practice (ASOPs). Although many ASOPs refer to documentation requirements, Section 3.2 of ASOP No. 41, *Actuarial Communications*, states:

In the actuarial report, the actuary should state the actuarial findings, and identify the methods, procedures, assumptions, and data used by the actuary with sufficient clarity that another actuary qualified in the same practice area could make an objective appraisal of the reasonableness of the actuary’s work as presented in the actuarial report.

Actuaries may have different interpretations of the meaning of Section 3.2, in particular the meaning of “sufficient clarity.” Therefore, many actuaries may have differing opinions of what constitutes appropriate documentation. Whether the intended user is a board of directors, an employer, an insurance company client, a regulator, etc., an actuary issuing an actuarial report should not presume that “the intended user understands what I did,” but instead should make sure the actuarial report satisfies the requirements of ASOP No. 41 and other relevant ASOPs.

Let’s review some specific examples of what might or might not be considered appropriate documentation. While the first two examples below relate to specific types of assumptions that

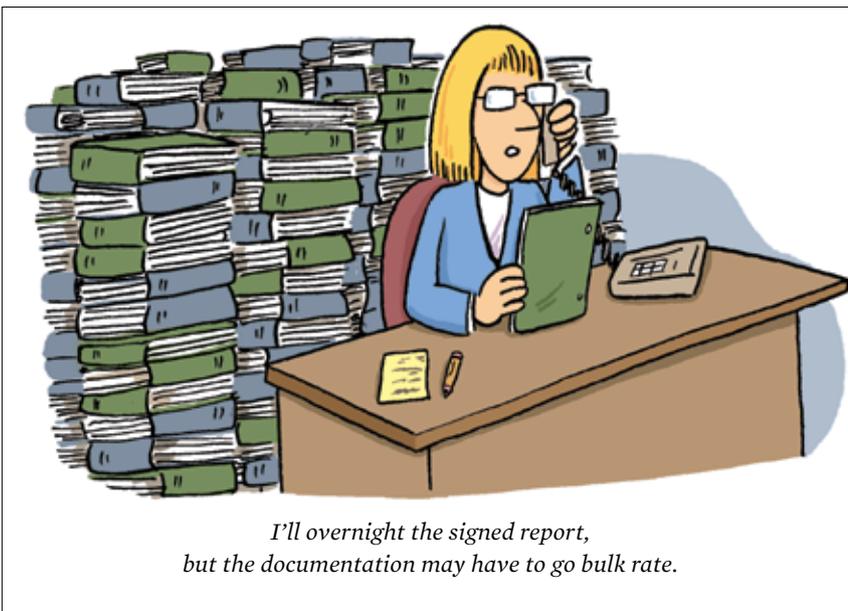
cross practice areas and are typically selected or recommended by the actuary, these are just examples—and the actuary should realize that appropriate documentation applies to all data, assumptions, and chosen methodologies. Appropriate documentation:

- States and demonstrates exactly what was done and why it was done;
- Provides the justification and rationale for each assumption; and
- Is such that another actuary can assess what was done and why it was done to make an objective appraisal of the reasonableness of the work.

Example 1

The choice of mortality assumptions can be crucial across practice areas. Standard mortality tables are updated periodically. Common actuarial practice would indicate that the actuary should use the most current mortality tables and applicable adjustments or relevant experience data. Use of a different mortality table or judgmental adjustments should be clearly documented. Disclosures should satisfy the requirements of ASOP No. 41 and other ASOPs.

For life insurance statutory accounting, mortality assumptions have traditionally been prescribed by law, although actuarial judgment has become more important in the transition to principle-based reserving. ASOP No. 40, *Compliance with the NAIC Valuation of Life Insurance Policies Model Regulation with Respect to Deficiency Reserve Mortality*, provides guidance with respect to a specific situation in which the mortality assumption is prescribed by law, but allows actuarial judgment as well, subject to certain parameters. The model regulation requires use of the 1980 Commissioners’ Standard Ordinary (1980 CSO) mortality tables “as the minimum mortality standard for basic reserves.” The model regulation also includes several tables of



select factors that may be applied to the 1980 CSO valuation tables during the first segment, as defined in the model, for both basic reserves and deficiency reserves. The use of “X factors” applied to the select factors is where the judgment comes in, and ASOP No. 41 provides guidance with respect to documentation and the testing and actuarial opinion required under the model regulation.

Many additional ASOPs, including but not necessarily limited to ASOPs Nos. 10, 24, 35, and 48, discuss mortality assumptions and the documentation and disclosure requirements. This documentation should include narrative and detailed quantitative support as to why the chosen mortality table was used, what adjustments were made and why those adjustments were made, and how those adjustments were determined in order for another actuary to assess the reasonableness of the work product.

Example 2

Trend assumptions can be a significant component of many actuarial communications across all practice areas. Several ASOPs include discussions on trend assumptions and what an actuary should review, consider, and disclose. Support for any trend assumption should include a narrative explanation of the assumption and qualitative and quantitative details. Documentation should be specific regarding each aspect of trend:

- The source data and why it is appropriate;
- Any adjustments made to the source data and why the adjustments are deemed appropriate; and
- Any additional information that was considered and why the additional information is appropriate.

The narrative should explain and support the quantitative details. If there are multiple components to a trend assumption—for example, case mix, CPI,

cost, utilization, benefit plan change, and demographics—the narrative and quantitative details should be explicit for each component. The quantitative support should clearly demonstrate how, for each trend component, the assumption was derived and how it ties to the assumption ultimately used in the actuarial communication. It is not sufficient to state, “We made adjustments to the trend for X, Y, and Z” without demonstrating what the adjustments are, how they were derived, and why they were used.

Some trend estimates are publicly available, and some large consulting firms develop trend estimates based on their own internal data. When using a publicly available trend assumption or a trend assumption from a major consulting firm, an actuary must document why that particular trend rate is appropriate for the given circumstance (for example: Is the population new so that there is no credible historic data? Has there been a significant change in the demographics of the population such that historic information is not relevant? Does an outlook for major economic indicators suggest that the future will be very different from the past?). Regardless, an actuary should not use a trend assumption without a good understanding of what that trend represents and how it was developed.

Example 3

Sometimes actuaries rely on other individuals for certain data and assumptions. It is not sufficient to state reliance on another individual for data, assumptions, or a methodology without performing tests for reasonableness and/or consistency unless such review is not necessary or practical as outlined, for example, in Section 3.17 of ASOP No. 4, *Measuring Pension Obligations and Determining Pension Plan Costs or Contributions*; Section 3.5 of the current version of ASOP

No. 23, *Data Quality*; and Sections 3.4.4 and 4.3 of ASOP No. 41. The tests for reasonableness should be clearly identified, documented, and demonstrated, including the conclusions reached as a result of the testing.

Example 4

ASOPs or legislation may specifically state assumptions or methodologies that an actuary should use. Many ASOPs refer to prescribed assumptions or methods set by law. For example, Section 3.22 of ASOP No. 6, *Measuring Retiree Group Benefits Obligations and Determining Retiree Group Benefits Program Periodic Costs or Actuarially Determined Contributions*, indicates that an actuary should evaluate an assumption or method set by law to determine whether the assumption or method significantly conflicts with what the actuary believes is reasonable for the purpose of measurement. If the actuary believes it is unreasonable, this belief should be documented.

Section 3.7.7 of ASOP 6 also specifies the methodology that an actuary should use: An actuary should use age-specific costs in the development of the initial per capita costs and in the projection of future benefit plan costs unless the use of the pooled health plan’s premium may be appropriate without regard to adjustments for age. An actuary who decides to use premiums should specifically state and demonstrate why premiums are appropriate and should document the development of all adjustments used in the development of the premium rates.

In summary, actuaries need to state what they did and why they did it. It is that simple—because the ASOPs say so. □

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The futures

A practice from the business world called scenario planning can help actuaries describe how potential futures may unfold.



BY CARLOS FUENTES

of the U.S. Health Care System

An Actuary in Strategyland

WHO WOULD HAVE GUESSED IT?

In 2016 you became the first actuary to hold the position of chief health care adviser to Congress and the president. You are delighted to see that the political apparatus is interested in making decisions that will benefit the country.

Your task, your most important professional contribution, is to inform decision makers about how the health care system might evolve in the next 25 years.

Politicians want to consider the possibility of significant events that are not apparent in 2016. They want to undertake initiatives that are likely to strengthen the system in the long term. Due to the complexity of the task, you decide to tackle the project using scenario planning.

Accordingly, you enlist a group of experts in different fields, many of whom have divergent views not only about the future but also about the present, to consider how the health care world might change over the next several decades.

In other words, you engage in the centuries-old practice of scenario planning.

Scenario planning is a technique used to describe how potential futures may unfold and help prepare for them—but it's not a tool to forecast or predict. To be useful, these futures must be relevant, plausible, internally consistent, and focused on the factors that are truly important. Scenario planning can be applied to situations where a range of possible outcomes are identified, each of which leads to significantly different

strategic decisions. Sometimes the range of possible outcomes is exhaustive, but more often it constitutes representative subsets.

Consider the following two examples: First, in 2015, for their 2016 pricing, health insurers had to make assumptions about the definition of small groups. Without going into detail, the question was whether small groups were going to be limited to up to 50 employees or expanded to up to 100, as originally intended by the Affordable Care Act—two options. The definition impacts pricing, competitive position, and profit much more than typical pricing assumptions. Second, what will the demand level of medical tourism be in the next 10 years? In this situation, it is not possible to produce an exhaustive set of potential futures; all we can do is select a few relevant, plausible scenarios.

To be effective, scenarios should incorporate the input of experts in different fields. The team must uncover the external influences (“forces”) that shape the plots, typically economic, technological, regulatory/political, social, and environmental. All scenarios must incorporate trends that are likely to be universal (such as the aging of the U.S. population), but each scenario should be based on the assumed direction of specific forces (such as the election of a Republican president who works with a Republican Congress).

A good approach to building scenarios is to brainstorm about potential forces and then determine the most unpredictable and influential among them. As an example of how that might work—and what scenarios might emerge as a result—let's go back to our hypothetical case from the beginning of this article.

Your team of experts develops four scenarios, two of which are summarized below. A brief discussion of scenario planning and how it might be deployed in actuarial settings follows the scenarios.



***By failing to prepare,
you are preparing
to fail.***

—Benjamin Franklin

SCENARIO 1

Dancing Past Midnight

There is no reason for any individual to have a computer in his home.

—Ken Olson, president of Digital Equipment Corporation, 1977

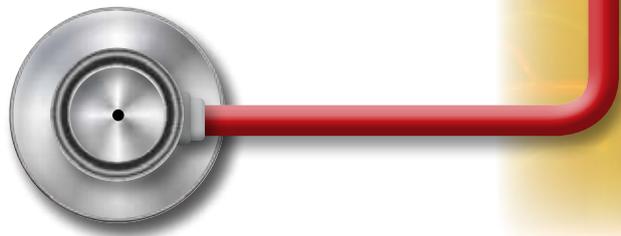
Apple is already dead.

—Nathan Myhrvold, Microsoft chief technology officer, 1997

The United States recovered steadily from the 2007–2009 recession. In 2019, the recovery was accelerated when China, forced by the United States, stopped manipulating its currency, thus bringing an end to the huge trade surpluses it enjoyed for decades. The trade balance became so strong that by 2040 the United States had repaid its international debt and became a lender. In 2025, for the first time in 25 years, the U.S. government ran a surplus that was short lived because the private sector and certain political groups lobbied successfully for tax reductions. Inflation remained low, corporate earnings were strong, and real wages increased—although they were more than offset by the cost of health care.

Efforts to control the accumulated government deficit centered around curtailing the funding of social programs, particularly Medicaid and cash payments to retirees, as well as reducing the number of federal and state employees who, for the most part, found employment in the private sector. Attracted by the billions of dollars in retiree cash benefits, investment bankers lobbied successfully to allow private citizens to choose between the traditional system and private investments. By 2040, 35 percent of the senior population had switched to private accounts. Certain groups believed that by 2050, fully half of retirees would choose private retirement accounts due to the strong performance of the corporate sector, and by 2075 the retirement system would be entirely privatized.

The effects of global warming had been evident for decades, but no catastrophic events occurred in the first part of the 21st century. The international political landscape changed little in that period: sporadic attacks on the West; American involvement in several regions of the world; no serious threat of war except for the slim possibility of conflict with China; and a smooth transition from fossil fuels to solar energy driven by successful research carried out in Israel and the United States. The revenues of oil-producing countries were severely curtailed: By 2050, 25 percent of the energy consumed in Israel, Japan, Western Europe, and North America was solar; this figure was expected to grow to 75 percent worldwide by the end of the century.



Despite the economic problems faced by oil-producing countries, their regimes remained relatively stable, at least through 2050. Wealth in the United States increased at an unprecedented pace, although its distribution became more skewed. The country came to accept social inequality as a condition for prosperity, much as Marxists had believed that capitalism was a necessary evil in human progress.

Depending on the year, health care inflation ran at double or triple the consumer price index (CPI), and by 2040 the share of gross domestic product (GDP) consumed by the health care sector reached an unbelievable 37 percent. Cost-containment rhetoric was as strong as ever. Different initiatives claimed victory for enhancing quality, reducing cost, and making the system more efficient—although in reality these measures continued the longstanding tradition of extracting profits to benefit certain groups, in the process increasing complexity and costs.

The presence of integrated systems, many of which by 2015 were known to be less efficient than independent payers and providers, became conspicuous. Insurance companies consolidated to the point of creating oligopolies in large metropolitan areas, with the natural consequences of higher insurance prices. Like banks in the earlier part of the century, mega-insurers became too big to fail. With the reduction of subsidies, state exchanges lost much of their membership, and by 2045, insurers saw them as unattractive distribution channels due to low volume and high antiselection. Private exchanges remained highly profitable; they either consolidated or were acquired by mega-insurers—a phenomenon that reduced competition and further increased the cost of health care.

Employers of all sizes with good experience tended to self-insure; the rest either adopted a defined contribution approach or didn't offer insurance. Employees with defined contribution plans were not as healthy as those covered by self-insurance schemes; consequently, their cost of coverage kept creeping up. In order to offer products that the public could afford, exchanges developed plans with very high deductibles and limited benefits. These plans ended up supplementing the basic products introduced by a growing number of enterprises, such as travel agencies, gyms, retailers, and drug stores. In some cases, employers hired medical staff—typically a few general practitioners supported by a team of nurses—to provide basic medical

services. Over time, some employers rented the services of their medical staffs to other companies; some of these operations became very successful in their own right.

Drug inflation continued to outpace medical inflation, and by 2035 drugs accounted for 36 percent of medical spending. Insurers and the public complained about the profits attained by drug manufacturers, but the latter pointed out—successfully—that in a laissez-faire system, markets regulate prices. Lifestyle drugs became more common and more profitable, but the placebo didn't solve any health problems (other than perhaps giving a psychological sense of relief to many). Ironically, weight loss medications sold at a record pace while the obesity rate continued to climb.

Policymakers relaxed regulation to allow insurers to experiment with cost-saving measures that, as had been the case historically, at best produced marginal results but had the unintended consequence of creating irreversible niches for unnecessary services, particularly in the areas of wellness, IT, and data mining. System integration remained an elusive goal, and the national health care system became more fragmented and more complex, with a growing number of parties demanding a share of profits.

Medicare was unchanged. However, as tax revenues dried up, states reduced Medicaid benefits and imposed draconian cost controls. Fewer physicians accepted Medicaid patients, and a large number of hospitals—armed with the newly granted ability to decide what type of patients they would serve—closed the doors to Medicaid beneficiaries. To maintain a minimum level of access to facility care, states subsidized hospitals willing (or forced by lack of commercial demand) to admit Medicaid recipients. This initiative alleviated the problems faced by the poor to some extent, but quality of care deteriorated.

The American Medical Association (AMA) grew stronger and successfully lobbied to block initiatives that threatened the livelihood of its members. Services that could have been outsourced, such as radiological studies, remained under the control of physicians licensed and residing in the United States; the role of medical assistants was expanded somewhat, but physician supervision (hence physician fees) was required; robotic surgery, which gained ground in Western Europe, was limited in the United States. Insurance companies promoted the use of medical tourism, but the AMA successfully opposed it. Finally, substantial income differences endorsed by the AMA ensured the oversupply of specialists and the undersupply of general practitioners.

Health care coverage increased, but cost-sharing jumped even more, with the almost universal adoption of very-high-deductible plans and growing employee contributions.

Yet, low unemployment, low inflation, real increases in wages, the availability of basic and catastrophic care, the renewed U.S. prestige in the international arena, the belief in self-reliance, and a renewed sense of destiny—all of these drivers meant that social discontent did not amount to more than frequent complaints followed by cost-control initiatives that didn't work as seen in the climbing share of GDP attributed to medical care.

SCENARIO 3

Swim or Sink

A severe depression like that of 1920–1921 is outside the range of probability.

—The Harvard Economic Society, November 16, 1929

My thesis in this lecture is that macroeconomics in this original sense has succeeded: Its central problem of depression prevention has been solved, for all practical purposes, and has in fact been solved for many decades.

—Robert Lucas, 1995 Nobel Prize Laureate in Economics, 2003 Presidential Address to the American Economic Association

After the Great Recession of 2007–2009, the U.S. economy recovered slowly but steadily. Employment reached pre-recession levels only in 2020, but inflation remained low, corporate profits were high, and confidence improved to the point that the economic difficulties of the early 21st century became a distant memory. In the eyes of influential people, the positive short-term effects of continued deregulation—increased corporate earnings, higher returns for investors—in all sectors (but particularly in finance and insurance) constituted proof that the U.S. economic system should become increasingly unfettered.

In a span of 10 years that culminated in 2030, Congress and the White House moved the country toward a laissez-faire system that was accompanied by draconian reductions in the funding of social programs. Some economists warned that a “Minsky Moment”¹ was approaching.

In the health care area, Medicare contributions were indexed to commercial

medical inflation; funding for Medicaid was capped at 50 percent of the CPI; and subsidies in state exchanges were frozen, with the intention of eliminating them by 2050. Inflation of medical costs remained about twice as high as the CPI; many employers reduced benefits, while others found it more economical to discontinue them and pay fines. For practical purposes, the number of people with access to health care was much smaller than the number of people with insurance due to high cost sharing. Regulation that favored self-funding was expanded, benefit mandates weakened or revoked, and employers of all sizes with good experience self-insured. By 2020 almost 50 percent of employers that did not self-insure adopted a defined contribution approach to control costs, making private exchanges big players in the provision of health care at the same time that membership in state exchanges dwindled.

Payers and providers continued to experiment with a wide range of cost-saving measures, such as wellness programs, IT, and data analysis—areas that continued to over-promise and under-deliver. After years of consolidation, the insurance market became dominated by a small number of national companies and large carriers entrenched in certain geographic areas. A few small and mid-size insurers continued operating in markets that big players considered unattractive. Their membership, concentrated in sparsely populated areas, decreased continuously as government subsidies dried up. Insurers that participated in private exchanges—and all of those in important markets did so as a matter of survival—were forced to reduce their profits ... but the savings were captured by the exchanges, not passed on to consumers as implicitly promised in the early years. Competition in health care insurance, always very imperfect, became more so, notwithstanding marketing rhetoric.

Even though the economic growth accelerated slightly between 2021 and 2030, and despite reduction in government spending, deficits continued to pile up due to deep tax cuts. Economists were concerned about the trade deficit with China and China's continued manipulation of its currency. Yet the business community, seeing strong profits from their Chinese subsidiaries, and the U.S. government, afraid of its inability to roll forward debt, limited their actions to sporadic speeches on unfair trade and empty threats.

In 2027, the world started to experience severe environmental problems associated with global warming, notably crop failures. None could have predicted the 2039 catastrophe when low food production was responsible for the deaths of millions, the spread of disease worldwide, and mass migrations. The United States was not immune, and by 2040 the epidemic had killed hundreds of thousands, mostly citizens with no access to health care. The prospect of future catastrophes depressed world markets. Unemployment skyrocketed in the United States at a time when the social safety net was weak. A record number of people saw their

life savings and homes disappear. Consumption declined sharply, and corporations, struggling to remain profitable, reduced or discontinued health care benefits. Poverty levels not seen since the first part of the 20th century, along with a staggering death toll in the United States, caused violent protests.

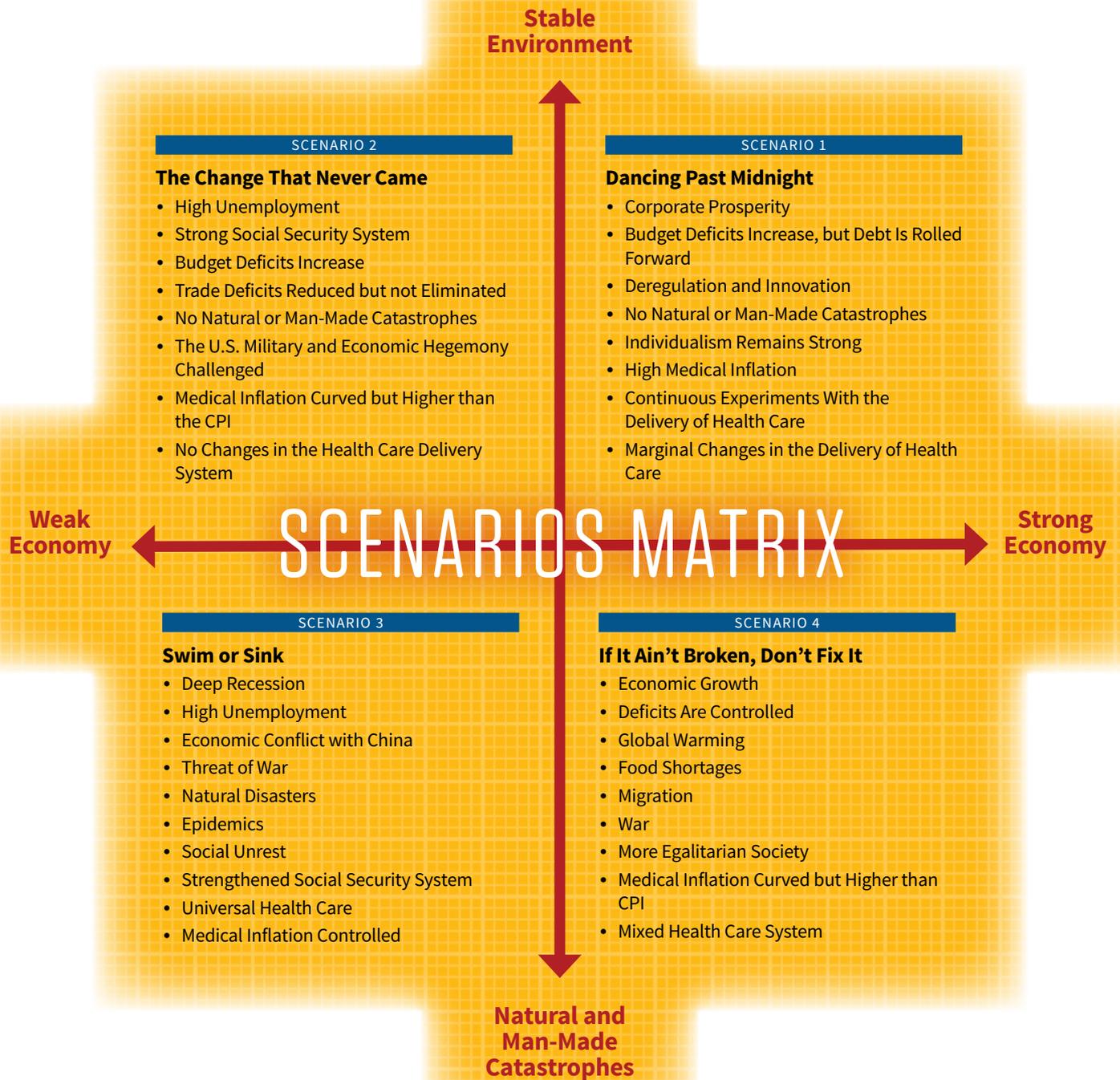
With diminished worldwide consumption and grim long-term prospects of recovery, shortly after entering into a deep recession, China stopped financing U.S. debt. The United States responded by devaluing the dollar to lighten its financial burden. China, in turn, threatened to demand payment, as the obligations became due, for the trillions of dollars in U.S. securities it had acquired, unless the United States revalued the dollar. The U.S. business sector responded by canceling investments, laying off millions of employees, and reducing benefits even more. The U.S. government kept a devalued dollar and reduced spending by laying off workers and curtailing the funding of social programs, particularly medical spending.

Protests in the United States reached unimaginable proportions. Thousands of people died in confrontations with the police or as a consequence of vandalism. As civil unrest intensified, the government was forced to strengthen its social security programs while trying desperately to control costs. Medicaid and state exchanges were eliminated, but Medicare was expanded to cover the entire population. Medicare paid physicians' salaries. Although incomes were reduced, salaries were still the highest in the world. The compensation differences between general practitioners and specialists remained but were reduced substantially. Salaries were adjusted (plus or minus 20 percent) to encourage quality, productivity, and patient satisfaction. Community needs allowing it, physicians could work up to 20 hours in a private practice (but the total work load could not exceed 50), charging as much as the market would bear—but they could not discriminate against non-private patients.

Employers were forbidden from subsidizing the cost of private insurance. Following the UK model, hospital funding was linked to factors such as size and type of procedures performed in the facility, but hospitals were required to meet quality, access, and patient satisfaction standards. Within these parameters, administrators were free to determine spending, but 20 percent of their compensation was tied to performance.

The government imposed strict rules on the pricing of generic drugs. Technology investments were scrutinized carefully, and the salaries of those in charge were linked to performance. IT projects that had become fashionable but showed negative or marginal benefits were canceled; efforts were instead centered around the creation of a national administrative system, much as other developed countries had done 50 years earlier.

Health care spending decreased from 30 percent of GDP in 2040 to 25 percent in 2050 (still the highest in the world), while access to care became universal and life expectancy was



projected to jump to Canadian levels by the second half of the century. Waiting times were regulated based on medical need, which meant they became short for some but long for others. Very expensive procedures with marginal payoffs were not covered by Medicare, but citizens had the opportunity to purchase private insurance that would.

To combat mass unemployment, the long-term prospect of little international cooperation, as well as the dreadful possibility of war with China, the U.S. government started to invest heavily on research and development, environmental technologies, infrastructure updates, and industries seen as key to the economic and security interests of the country.

Decades of accumulated deficits meant that the United States was forced to spend when its debt level was the highest in over a century. Spending in these circumstances depressed the standard of living greatly—but the country had no other realistic option.

As had happened in Europe after the devastation brought about by World War II, stronger regulation that included a shift in the fundamental structure of social security programs and higher progressive taxes encountered little opposition. The powerful voices of interest groups were muted by the suffering of millions that threatened the very stability of American society. The country rallied to tackle the fundamental problems that had been neglected for 75 years.

Scenario Planning and Panglossian Financial Planning

Impossible is a word to be found only in the dictionary of fools.

—Napoleon Bonaparte

The origins of scenario planning go back thousands of years and can be linked to war efforts. Machiavelli sketched the use of scenario planning by describing in *The Prince* the thought process of the Greek general Philopoemen (253 to 183 BCE):

“[W]hen he was in the country with his friends, he would sometimes stop and ask them: ‘suppose there were enemies up in those hills and we were here with our army, who would have the advantage? How could we get at them without breaking ranks? If we wanted to get away, how would we do it? If they tried to get away, how could we cut them off?’

As a result of this constant practice, no unexpected difficulty could ever arise when he was at the head of his army, for which he did not have a ready remedy.”

Examples of modern use of scenario planning in the combat sphere abound, from the U.S. military² and private business consultants³ to individuals in the private sector offering personal protection training.⁴ Fortunately, a select group of scholars and professionals who understood the benefits of scenario planning in the military sphere adapted it to the business world. Fine examples of this effort include a video created by Paul Shoemaker from The Wharton School of Business,⁵ a piece in the May 2013 *Harvard Business Review*,⁶ and work carried out at the Yale Climate and Energy Institute.⁷

Whether in a military or a business setting, scenarios should make use of qualitative analysis. For example, if the problem at hand is to understand the evolution of obesity incidence, its cost as a share of GDP, and its effects on quality of life, the actuary could use System Dynamics to assess the effects of interventions under different scenarios (see “Modeling Obesity,” *Contingencies*, Nov/Dec 2012). Causal diagrams (see “System Dynamics—Building a Better Model,” *Contingencies*, Sep/Oct 2011) are particularly useful because they force decision makers to identify and understand the complex relationships of the problem under consideration.

A good approach to building scenarios is to brainstorm with your team of experts about potential forces and then determine the most unpredictable and influential among them. These external influences become the axes of a 2×2 matrix as illustrated on page 23; we discussed scenarios 1 and 3 in the sections above.



Whereas the list of good scenario-building principles is long, here are a few considerations to keep in mind:

- The plots should focus on the question under consideration;
- The plots should be simple and informative;
- If possible, assign probabilities to each scenario, but resist the temptation to do so when the level of uncertainty does not allow for reasonable assessments. In particular, avoid the natural tendency to focus on the most likely outcome;
- Make sure that each scenario represents a distinctive future and not variations of the same theme; and
- Choose memorable names.

Although scenario planning has been used successfully in certain industries,⁸ it is still conspicuously absent in insurance—and more specifically in the work done by actuaries. There are many reasons for this: unawareness from management, the mistaken belief that the payoff is low, the misguided assumption that scenarios are exercises in creative writing devoid of “scientific” substance, and the lure of what I call “panglossian financial planning”—that is, the attraction toward the false sense of certainty engendered by long-term financial projections.

Panglossian financial planning deserves a few explanatory words because it is pervasive. It can take many forms; a common one involves five-year projections of the income statement that show the results management wants to see (or at least it can tolerate). Growth assumptions, typically provided by the sales and marketing teams, must conform to management’s expectations, not necessarily to reality. Actuaries set rate increases and trends, but if the latter two don’t produce the required earnings, they may be adjusted in a variety of ways, such as by assuming that cost-reduction initiatives will save the day, or that macroeconomic conditions will be favorable, or that competition is just not as good. It is possible, of course, to embellish the projected income statements with minute detail (to add glitter to the fairy), sensitivity analysis (to show a good grip over uncertainties), and performance measures (to be certain that the

final product reflects management expectations). The result is a beautifully imprecise model that by design omits the forces that would cast doubt about the future management desires. Beauty, as it turns out, masks uncertainty and gives a false sense of security—exactly what scenario planning attempts to avoid.

On the other hand, scenario planning can be used to scrutinize management's assumptions about the future. Here the objectives are to develop a broad understanding of the situation under consideration, to identify threats and opportunities, and to craft potential long-term strategies. Scenario planning is also useful to help management understand the current situation and identify near-term strategic choices.

The infrequent use of scenario planning is a missed opportunity because when properly applied, scenario planning—a true strategic tool—helps decision makers discern developments that could transform a company or an industry. □

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Endnotes

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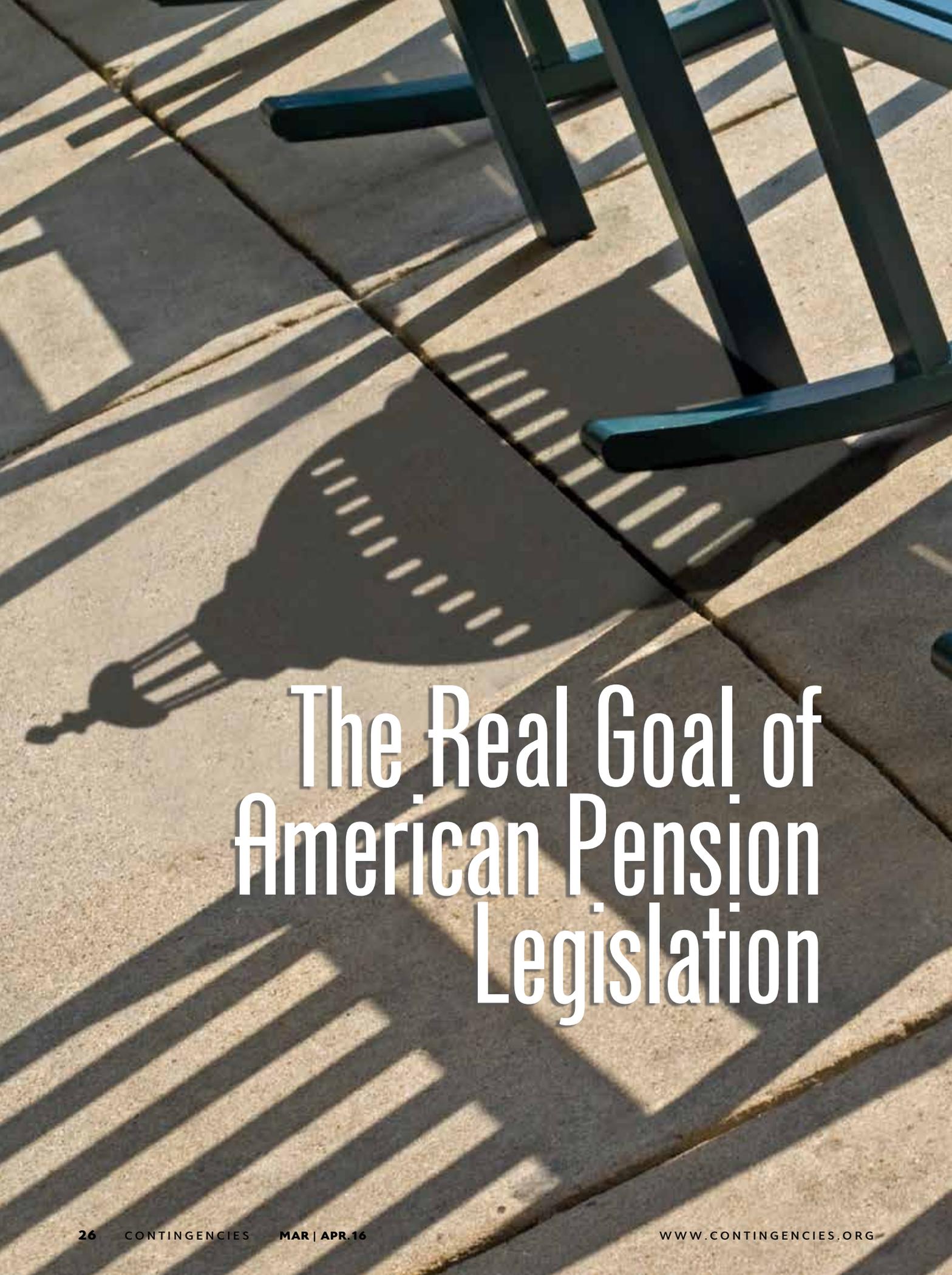
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The Real Goal of American Pension Legislation



U.S. law seems to lead to a disconnect between stated goals and realized outcomes. Why? As one famous whistleblower suggested, ‘Follow the money.’

By Leslie Lohman

I HAVE BENEFITED in many ways from my actuarial practice here in Japan, not the least of which is seeing what a properly designed system of private retirement plans looks like.

My experiences have helped me view the U.S. pension system from a new perspective, to view things from a bit outside the rhetoric that so often clouds true analysis. To that end, I hope to give you an overview of the goals of American pension legislation from the perspective of my Japanese experience.

Private pension plans in the United States are now governed mostly by the Pension Protection Act of 2006 (PPA), with only minor adjustments reflecting the difficult economic conditions since that time, including:

- The Preservation of Access to Care for Medicare Beneficiaries and Pension Relief Act of 2010
- MAP-21 of 2012
- Highway and Transportation Funding Act of 2014
- Multiemployer Pension Reform Act of 2014

But the tent pole of U.S. pension legislation remains the Employee Retirement Income Security Act of 1974 (ERISA). And in the more than 40 years since its passage, there has never been any attempt to correct the true faults of American retirement plans:

- Late information remains useless information.
- No required gain and loss analysis means no ability to mathematically determine the accuracy of the actuarial work;
- Benefits required to be defined as deferred life annuities can never be fair to otherwise equal employees with different life expectancies; and
- Permitting the employer to avoid the liability for the future promised benefit means the benefit can never be secure.

The Pension Protection Act of 2006 and subsequent amendments followed the same traditional path: minor rules designed to speed up tax collections and required contributions to the pension trust, with only the appearance of benefit protection.

Reading Between the Lines

The legislative description of the PPA was: “To provide economic security for all Americans, and for other purposes.”¹

That is lofty, and a bit indistinct.

The IRS had another perspective at the time, saying the PPA “includes a number of significant tax incentives to enhance retirement savings for millions of Americans.”²

I personally wonder whether tax incentives enhance retirement savings? And are “millions of Americans” “all Americans”?

Of course, the IRS is not referring to the defined benefit retirement plan provisions of the PPA, but the IRA, Roth, and other “personal” retirement savings programs. Employers have been able to deduct required contributions to retirement plan trusts since the beginning. If anything, the PPA reduced deductibility of employer contributions and made few meaningful additions to the deductibility of personal savings.

The White House fact sheet said that the PPA “improves the pension system and expands opportunities to build retirement nest eggs”³—and it’s this last phrase that gets to the real goal of this legislation.

Before he signed the law, President George W. Bush said, “Americans who spend a lifetime working hard should be confident that their pensions will be there when they retire. Last year I asked Congress to strengthen protections for the pensions of our workers. Members of both parties came together to pass a good bill that will improve our pension system, while expanding opportunities for Americans to build their own nest-eggs for retirement.”⁴

In discussing a legislative bill that sounds like its goal is to strengthen defined benefit retirement plan promises, why was everyone talking so much about Americans saving for their own retirements?

When you analyze any piece of American legislation, you must address what vested interest is being served. In the case of retirement plans, that interest is the bank’s.

The White House fact sheet on the PPA helps to confirm one of the material differences between retirement plans provided by the funding of an “arm’s length” pension trust in the Western common-law tradition of trusts and a Japanese employer’s promise of a retirement allowance. From the sponsor’s point of view, all American retirement plans are defined contribution plans. The Japanese employer makes a direct promise; there is no trust.

At the signing of the PPA, President Bush went on to say, “The message from this administration, from those of us up here today, is this: You should keep the promises you make to your workers. If you offer a private pension plan to your employees, you have a duty to set aside enough money now so your workers will get what they’ve been promised when they retire.”

The president did not mention meeting the promise of the benefit; he spoke of “setting aside” money to fund the promises

made by the plan. An American defined benefit pension plan is wholly contained in the separate pension trust. No matter what happens to investments in the future, if the employer meets its defined contribution requirement to the defined benefit pension trust as ordered by law, it has no obligation to assure those funds will meet the pension trust obligations to its beneficiaries—the plan participants. In fact, the “promise made to the workers” is that the employer will make payments to the trust as required by law. The plan sponsor has only limited obligations as defined under ERISA, as amended. Those obligations remain contributory under all circumstances.

Many actuaries seem surprised that American pension legislation seems to be killing defined benefit plans. I believe an accurate theory explains all observed phenomena—in this case, the apparent disconnect between stated goals of pension legislation and real-world outcomes.

Japan Tries a DC Approach

In a prior article—the cover article of the July/August 2000 issue of *Contingencies*—I praised the Japanese private defined benefit retirement system, and I warned Japan to avoid defined contribution retirement plans. Among other things, I wrote, “The Japanese are among the best savers in the world. Do they really need defined contribution retirement plans to encourage more savings? And do they need to take on more investment risk in a profoundly troubled market?”

Over the past few years I presume my reputation as a defined benefit retirement plan advocate has been strengthened.

The Japanese move toward creating vehicles similar to the trust used in the West (inherited from English common law) is reducing access to employer assets in employer insolvency and distancing the employer from the future benefit promise made to employees of the employer. Neither strengthens the system for the benefit of the plan participants.

The “Japan 401K” was supposed to produce an economic miracle as the savings accounts of employees increased the demand for corporate stock. I argued that, because trading investments does not produce economic value, there would be no “stimulus” to the Japanese economy. There are many employees in Japan who are much worse off now than they would have been under the old retirement allowance plans at little difference in actual out-of-pocket cost to the employer.

The introduction of Japan 401K weakened the Japanese retirement benefit system for employees and continues to wreak havoc on retirement security.

Money 101

For an employee to benefit from an employer-provided retirement plan, there are three things more important than funding the accrued benefit:

Why does the verbiage around pension law cause such cognitive dissonance?

- The employer must remain in business;
- The employee must remain employed; and
- The employer must continue to provide the retirement plan.

Any legislation that decreases the probability of any of these precepts actually reduces the real security of retirement. Clearly, any legislation creating real or apparent burdens that lead to the termination of a defined benefit retirement plan fails to improve retirement security. And the U.S. pension legislation scheme, especially since the passage of the PPA, does just that.

But why? Why does the verbiage around pension law cause such cognitive dissonance?

We need to go a little deeper. Let's think about what we call "money."

I want you to think about promises, written or not, that one accepts in the hope/anticipation of getting a future economic benefit by presenting and transferring the promise to another—a promissory note, or just "note."

Money includes any promissory note—not just banknotes, but any generalized promissory note whose value changes depending on many factors. Perhaps the most important contingent factor is the probability of being able to obtain downstream economic value when one redeems the promissory note.

In the old days, most money (base metal coin and banknotes) was a promise to provide the precious commodity (in the U.S., first gold coin, then silver) in exchange for the otherwise worthless banknotes or nearly worthless base metal coin; it was redeemable. A tempting moral/ethical problem occurred when the issuer of the banknote ("banker") discovered that customers preferred carrying paper to heavy precious metals. The banker started issuing more promissory notes than redeemable gold on hand, giving birth to hidden inflation. The accumulated amount of inflation could be precisely determined: the face amount of banknotes redeemable in gold divided by the actual amount of gold backing it up.

Now, interestingly, if the issuer produced economic value for the excess banknotes and retired the banknotes, the proportion of banknotes to gold would reduce, resulting in deflation from the preceding period. (An aside: I believe Japan is the first case in history in which consistent deflation has occurred in a banknote-driven economy as debt has expanded.)

But how could a promissory note, a banknote, be issued without an economic transaction? I suppose that the issuer/banker began by using his own issued promissory notes to buy commodities and services for himself. People trusted him to redeem the notes with gold when the promise, the banknote, was presented.

But, the issuer also got into lending. From the earliest times, no lender would actually give the borrower the gold sought as a loan. Instead, a promissory note—a letter of credit, a banknote—would be issued that the borrower would then exchange for the services needed.

Interest on the loans was extremely easy money for the banker; there was no actual loan of economic value, yet real economic value was paid as interest.

Today in the United States, that is how the Treasury's relationship with the Federal Reserve works; the Federal Reserve (our central bank) "buys" a Treasury note with newly created banknotes. There is no economic value backing up the banknotes, but the Treasuries have real value (the belief they will be matured at face) and the interest paid is real economic value also. The Federal Reserve controls the creation of "money"—the supply of liquidity—and charges interest for the service. Sharing that service, especially the related profits, with others is not a high priority. In fact, like every business, minimizing competition is a key goal. Any business transaction that creates money outside the control of the central bank is undesirable competition.

Private bankers would sometimes get into trouble when people saw there was much more money in their economy than there could possibly be redeemed for gold and asked for their gold in large numbers, resulting in runs on banks. Basically, when a run was imminent, the banker would pay out some of the gold, then close down (possibly moving elsewhere to set up shop again).

This unsavory behavior led to demands for higher reserves of gold to banknotes—but a select group of bankers saw a better way to deal with the problem: make their notes "legal tender." This, of course, required politics and money.

Not wishing to share their good fortune, the bankers had to persuade the political leaders not to let anyone else do what they were doing. Money bought those concessions.

The government made it a crime for anyone else to create money for general circulation. But, in fact, all promissory notes create money.

Money is created any time economic value is paid for with a promise to provide future economic value. The moment a promise of future economic value is accepted in return for current economic value, money is created—the value of the not-yet-compensated economic value (work, for example) creating the obligation.

Of course, when the contract is from an employment relationship, the employer has the immediate value of the work,

increasing
receivables or
other tangible value.

It is “free money.” To the degree the employer must “fund” the deferred obligation to the employee, the free money is reduced or can even become negative—a cost—if the funding requirement exceeds the value of the work provided.

Every working person reading this article has created money today: You provided labor to your employers/clients and they have promised to pay you later. You could use that promise to pay right now for immediate economic value—discounted, of course, based on the risks involved in your collecting.

Money is created whenever a promissory note is executed in exchange for real economic value. Banks, having an economic concentration of power over liquidity, are not going to share it easily. Their extraordinary economic power has closed many loopholes, but every loophole has not been plugged.

For example, in return for a small premium, insurers help spread and share risk, reducing the catastrophic impact to an individual. Because of the growing nature of the business of insurance, people who wanted to earn interest on money they didn't actually lend—like banks do—discovered they could do that with an insurance company's accumulated funds. Insurance companies, actually providing the economic value of insurance, did not have the flexibility of a bank, but it was sufficient.

Bankers, through their significant influence on the political process, forced reserve requirements (the substitution of banknotes for promissory notes) on insurance companies, significantly reducing the ability to earn handsome returns creating money through loans, just like a bank.

Which brings us back to retirement plans and pension plan legislation.

When you work for an employer and he or she promises to pay you in the future, you and that employer have created money. In the early days, an employee could monetize that promise of future compensation already earned by borrowing against it, using that promise as collateral for a loan. (A similar phenomenon is unfolding today with the rise of so-called payday loans.) The employer would pay the note bearer instead of the employee.

The retirement promise—deferred compensation—was the same: An employee could monetize the future value by borrowing against it. Even when totally unfunded, many early plans permitted employees to “borrow” using their future benefits as collateral.

Of course, under the excuse of protecting employees from themselves, borrowing against future defined benefit retirement benefits became (and remains) pretty much against the law in the United States. Indeed, the prohibition against borrowing against future retirement benefits favors the banks; the employee must borrow from a bank instead of the plan.

Who Benefits?

America is putting significant pressure on Japan to prohibit the retirement allowance lump-sum system that has grown up here and works so well for employees and employers. The lump-sum payout system has many great advantages over the annuity approach encouraged/required in the United States:

- The retiree is in total control of his or her deferred compensation;
- The lump-sum system has no gender bias;
- It satisfies the economic need and Japanese cultural habit to retire debt at retirement (essentially a reverse annuity); and
- It is tax-favored.

And the Japanese private book reserve retirement system creates liquidity/money for the employer—when the employer makes the promise of future benefits to his employees and the employee provides economic value in return for that promise of deferred compensation, the employer has the use of the economic value until actual retirement without any actual cash outlay (the immediate liability does show on the balance sheet).

A Japanese employer's promise to pay a future retirement allowance is also an increase in the money supply. It is money the

Most employees are not aware that their employer makes no promise about future benefits—that is the job of the trust, and it can only pay benefits as long as it remains solvent.

employer doesn't need to borrow right now to use in the business. The employer received current economic value for his/her promise of a future payment to the employee.

So, what is really going on in a retirement plan? Each increase in an employer's promise to an employee is an increase in the money supply, but it has conditions, making its value difficult to ascertain by both the employer and the employee. But the employer got immediate economic value when the employee provided that economic value to the employer. There was an immediate gain (money was created in favor of the employer) or loss (money was created in favor of the employee) depending on the difference between the present value of the retirement promise and the value of the employee's labor.

Because many jurisdictions and plans prohibit the employee from using the retirement plan money until actual retirement, the computation difficulty creates a problem for the employer wishing to plan—and very few problems for the employee. The value of this money changes according to how the factors affecting present value change. (Frankly, that is why we actuaries have jobs; we are the best at determining the fluctuating value of money that varies with contingent circumstances.)

One of the problems holding money that has varying value is preserving that value, especially the principal value. The public face of most U.S. retirement legislation has been to preserve that value for the future retiree. Actual results of U.S. legislation prove that the legislation failed to help employees preserve that value.

American law emphasizing trusts as the funding vehicle for private retirement plans aggravates the risk of the loss of "promised" benefits. Most employees are not aware that their employer makes no promise about future benefits—that is the job of the trust, and it can only pay benefits as long as it remains solvent. (The original purpose of using trusts to fund retirement plans was not to provide any kind of protection to the employee, but to permit the employer to deduct any funding payments it made as irrevocable business expenses, which, of course, they were. No private employer in America has ever promised ordinary employees anything more than the money contributed to and accumulated in the trust.)

To summarize using familiar terms, employees seek:

- No retroactive reductions in accruals;
- Plan closing accrual and plan protection;
- Meaningful vesting rules;
- Final pay benefits;
- Indexed pensions;

- Timely disclosure and independent review;
- Meaningful guarantees of payment; and
- Timely disclosure when payment may be at risk.

ERISA began the process of appearing to try to achieve some of these goals. But ERISA failed in two areas—disclosure and guarantees. It failed these because ERISA made disclosure a tax requirement. And that's because tax policy drives the U.S. legislative decision-making process.

Because ERISA is tax law, the required disclosure is far too late to allow anybody to benefit from the knowledge of the event. Even Title IV reportable events were too late to be meaningful information for those needing the information. And, even if timely, what tools does an employee have to respond to shortfalls or other reportable events?

Did American actuaries help? Well, no. The valuations were being done at the beginning of the plan year and reported with the tax filing. In those days, there was at least the appearance of matching; the data and the assets were both determined as of the same date—the beginning of the plan year, which was often the beginning of the tax/fiscal year. Of course, the tax filing was typically more than nine months after the end of the plan year.

The balance sheet is an "end of the year" statement. Because assets could be measured accurately at the end of the fiscal year, the accounting rules properly demanded they be used. The actuarial shortcut of projecting the unfunded one year hence from the beginning of year valuation was not acceptable for the reconciliation of funded status; actual measurement date assets had to be used.

In reaction, many actuaries, in my opinion, took an untenable choice: They projected the beginning-of-the-year liabilities to the fiscal year-end and used those in the reconciliation of funded status, adjusted for actual benefit payments. This is a significant violation of the matching principle, yet still a popular method today because it seems easier.

But the disclosure required by the accounting rules did not help plan participants in their quest to know the actual funding status of the plan in a timely manner.

ERISA was the first major legislation seeking to protect the value of retirement plans using forced funding rules. As demonstrated, all promissory notes are/create money, including deferred compensation promises, such as retirement plans.

ERISA changed who benefited from the new money created in the retirement plan promise; it moved more of it from the employer's control to the control of the repository—the bank—out of the employer's reach. But, in trying to change who was the

guarantor of the promise, did ERISA do anything to increase the probability of actual payment?

Subsequent accounting rules brought the retirement plan actuarial liabilities of the trust to the sponsor's balance sheet—even though, legally, those liabilities were not and still are not liabilities of the sponsor when a trust has been properly established, which, under ERISA, the employer must do.

Financially, this change in the law removed the liquidity advantage from the plan sponsor, giving it to the sponsor's bank.

U.S. retirement plan law remains driven by the desire to increase the speed of collection of taxes, thus many laws affecting U.S. retirement plans have been passed since ERISA. In nearly every case, rules were established tightening the meaning of “underfunded.” Rules were established requiring earlier funding payments, payments required even before the actuarial valuation was due to be reported. More rules were established defining special underfunding situations. There has been some relaxation since the last economic retraction, but much of the latest legislation shifts the investment loss burden to the pension plan participant by reducing what were “promised” benefits when there is a perceived funding shortfall.

All of these “tightening the funding” rules did little to protect real benefit security, but they did shift the liquidity advantage to the banks.

But none changed the basic flaw of U.S. retirement plan legislation—valuation reports were done too late to provide meaningful information to plan participants. A second flaw—the lack of any way to determine whether a retirement plan valuation was done correctly—has never drawn any kind of attention by U.S. legislators or regulators. The third flaw is based on the incorrect belief that any portfolio can fully fund retirements under all conditions.

The reality of prefunding retirement benefits is this: Funding can never be completely accurate. Any advance funding will either be too little or too much; it will never be exactly right. If it is too little, the retirees and other beneficiaries will be self-insured or a third party must make up the difference. If the advanced funding is too much, capital needed for the business was wasted—a real crisis for workers if it led to the bankruptcy of their employer and plan sponsor.

The only way to fund a retirement promise perfectly is for the employer to be legally required to stand behind the promise of the future benefit. That is not the case in the United States. And I don't see how it ever will be.

Read these points expressed on the White House PPA fact sheet. The legislation:

- Requires companies that under-fund their pension plans to pay additional premiums;
- Extends a requirement that companies that terminate their pensions provide extra funding for the pension insurance system;
- Requires that companies measure the obligations of their pension plans more accurately;

- Closes loopholes that allow under-funded plans to skip pension payments;
- Raises caps on the amount that employers can put into their pension plans so they can add more money during good times and build a cushion that can keep their pensions solvent in lean times; and
- Prevents companies with under-funded pension plans from digging the hole deeper by promising extra benefits to their workers without paying for those promises up front.

None of the items on that list puts a legal connection between the defined benefit promise made by the plan to the plan participants in the trust and the employer that wrote the plan and benefits from employees believing in that promise and providing economic value in anticipation of those future benefits.

While a Japanese employer can avoid some of the responsibility of the promise of a benefit in the future, the defined benefit itself is an enforceable promise of the employer, even having priority in insolvency. Even with the changes over the past several years, Japanese retirement plans represent a promise of a tangible future benefit—not merely the legally required funding related to the present value of those future benefits.

The real goal of U.S. pension legislation has been to remove the liquidity advantage from the plan sponsor and to give it to the banks.

Prefunding has not increased retirement security. Prefunding has created high administrative costs, it has increased the cost of doing business because of the loss of the liquidity advantage, and it has made defined benefit plans much harder to understand.

U.S. legislation has decimated defined private benefit plans. If the attempts to impose prefunding on municipal and state retirement systems is successful, they, too, will disappear.

As one president observed about the Social Security assets; “There is no trust ‘fund’—just IOUs that I saw firsthand.”

The reality of our U.S. economy is that all purchases are made with IOUs, and nearly all savings are just IOUs. Prefunding merely alters whose name is on the debt instrument and who gets the liquidity advantage. □

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FED UP



The Federal Reserve raised its benchmark interest rate—what does that mean for financial companies' bottom lines?

BY JEFF REEVES



By now, it's old news: On Dec. 16, the Federal Reserve raised interest rates.

"This action marks the end of an extraordinary seven-year period during which the federal funds rate was held near zero to support the recovery of the economy from the worst financial crisis and recession since the Great Depression," said Janet Yellen, chairwoman of the Federal Reserve Board of Governors, in her remarks at the time. "It also recognizes the considerable progress that has been made toward restoring jobs, raising incomes, and easing the economic hardship of millions of Americans. And it reflects the Committee's confidence that the economy will continue to strengthen."

Those are weighty words from a powerful financial institution that many have watched very closely over the past few years for guidance in these uncertain economic times.

But what does an interest rate increase really mean? How does it affect businesses and consumers, borrowers and lenders?

These questions are of particular interest to many actuaries, given the profession's deep connections to banking, insurance, and other interest-rate-sensitive industries.

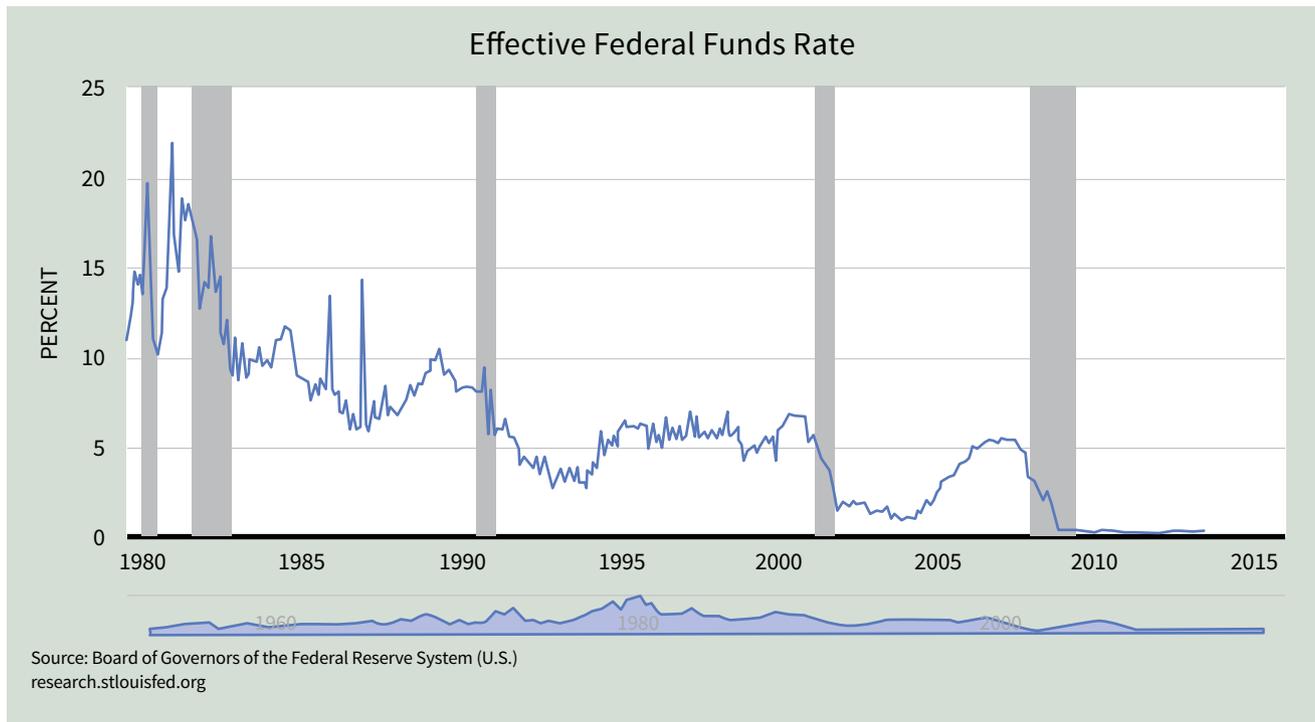
Unfortunately, the typical blog post or 60-second news report does little to explain what's really going on.

So for those looking for more than the typical soundbites and vague explanations, here's an in-depth look at the changes under way in the nation's central banking system—and what it means for actuaries, their employers, and the U.S. economy.

How Interest Rates Change

The mechanics of an interest rate increase are a bit arcane, but they're an important starting point. That's because contrary to some oversimplistic headlines, the Fed actually doesn't have the power to directly influence the interest rates that regular Americans are most familiar with—car loans, mortgages, or credit card rates, for example.

What technically happened on Dec. 16 is that a group of economists at the Federal Reserve voted 10-0 to raise the central bank's target for the "federal funds rate" from a range of zero to 0.25 percent to a range of 0.25 to 0.50 percent.



This federal funds rate determines the amount banks charge each other for very short-term loans, and thus determines the very nature of how cash flows through the economy at large.

U.S. regulations require banks to keep some cash in reserve as a kind of cushion to backstop any loans, and active lending may cause a bank to briefly dip below that threshold. When this happens, the institution borrows money overnight to remain above its dictated reserve level until new deposits come in; the borrowing bank pays the aforementioned federal funds rate in interest to the lender for use of those funds.

This may seem like a mundane exercise on the surface. But in fact, Greg McBride, a senior financial analyst at Bankrate.com, calls changes to this key interest rate “setting the price of money” for the rest of the economy.

“This is the stone that causes the ripple,” he said.

After all, if it’s easy and cheap for a bank to get access to extra cash, then it can lend to prospective homeowners and car buyers aggressively. But if those short-term loans between banks are more expensive, banks become less aggressive—both in the volume of loans and in the interest rates they demand to backstop the risk of default.

“The Fed is significant because their benchmark interest rates really touch every financial asset in one form or another,” McBride said.

Still, don’t confuse that with the power to set rates on loans or other rate-sensitive instruments. Rates are always changing based on the debt type, the duration of the loan, and the circumstances of the borrower, among other factors.

“It’s competitive forces in the marketplace that lead to changes in the pricing of loan products or investment products.

You’re always going to have those day-to-day fluctuations based on the market or macro environment,” McBride said. “There is no universal rate, and even individual rates can move significantly over time—and not in a straight line.”

What Is ‘Normal’ for Rates?

These factors make it all the more confusing when Federal Reserve uses the term “normalization” in regard to interest rates. What is normal for one asset is not for another, and over time even the very same financial products can look very different.

For instance, “normal” interest rate policy in decades past involved a federal funds rate many times higher than the current level, even after the December increase.

The effective federal funds rate has been nearly zero—0.25 percent or lower—since early December 2008, when the Federal Reserve hoped emergency rate reductions would stimulate the economy in the wake of the financial crisis. These were the lowest in the history of the central bank by a wide margin; the prior low-water mark on rates was when the effective federal funds rate briefly edged down to just under 1 percent back in 2003–2004.

But more broadly, from 1980 through the end of 2015, the average effective federal funds rate was 5.01 percent; the median fed funds rate was 5.17 percent for the same period.

In other words, we are a long way from any definition of what has historically been “normal,” said Andrew Henry, chief operating officer of online loan marketplace Credit IQ.

“A 25-basis-point rate hike from the Fed, from zero to 0.25 percent? In historical context that’s almost laughable,” he said.

In fact, the Federal Reserve itself expects it to be quite some

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In its so-called dot plot that polls Federal Reserve officials on where they expect rates to be in the future, policymakers expect the benchmark fed funds rate to be around 1.375 percent at the end of 2016. Furthermore, there is now a median forecast of 2.375 percent at the end of 2017—down from previous forecasts in June that predicted a 1.625 percent rate by the end of 2016 and 2.875 percent rate by the end of 2017.

It also should go without saying that if rates have historically been much higher, action taken by the Federal Reserve has most commonly been to reduce rates, not increase them. So in some ways, the very act of a rate increase is out of step with what's typical.

So what, precisely, is “normal” in a world like this?

“I would call the ‘new normal’ something more like 2 to 3 percent for fed funds from where we sit today,” said Henry.

Tom Girard, head of fixed-income investing at NYL Investors, agrees.

“When you look at the market, fed funds futures and things of that sort, Wall Street is probably thinking maybe only 75 basis points of tightening next year” to a final rate of around 1.0 percent, Girard said.

Even if we do follow the path laid out by Federal Reserve forecasts, he adds, that doesn't mean that rate increases will continue as frequently in the long term.

“We are going to be in a lower rate environment for the next several years, compared with a historical basis of what's normal,” Girard said. “For people thinking we're going to get to a fed funds rate of 3 or 3.25 percent, I think that's pushing it. We're going to see a little bit more of a stair-step approach.”

And he added that, of course, depends on what the global economy does in the next year or so.

“It wouldn't even surprise me if that in 2017, the Fed needs to reverse a little bit,” Girard said.

Impact on Risk Management Actuaries

Given the complexities of how rates change and uncertainty around how the Federal Reserve will drive policy in the long term, it's very difficult to make predictions about the performance and risk level of assets.

That means actuaries who work in investing and risk management have their work cut out for them, and must remain extra vigilant at this time.

In the era of rock-bottom interest rates, many investment models had to overlook previous definitions of risk by asset class, said Scott Bishop, director of financial planning at STA Wealth, a Houston firm with \$750 million in assets under management.

Low interest rates “totally made the market risk-on, and made people chase yield in traditionally aggressive assets,” Bishop said, because investment-grade corporate bonds and U.S. Treasury bonds offered so little.

And now, with the landscape of rates and risk changing, these actuaries will have to adapt once more.

For instance, some investors who flocked to traditionally risky assets were lulled into a false sense of security as widespread demand for these investments caused a measure of stability—and in some cases, significant outperformance of other alternatives.

Take high-yield corporate bonds, colloquially known as “junk bonds,” that were built on debt extended to smaller, riskier energy companies. Because interest rates have been so low, a host of investors flocked to the higher interest rates in this asset class in a quest for better yield—but they didn't properly assess the risk they were exchanging as they chased those higher bond yields.

As energy prices have collapsed in the past year, some of these oil and energy firms have defaulted on their loans. And the resulting fallout in junk bonds has been severe.

Take a fund operated by Lucidus Capital Partners as the most extreme case. A high-yield credit fund with heavy exposure to junk bonds was forced to liquidate its entire \$900 million portfolio to satisfy redemption demands. Or consider the Third Avenue Focused Credit Fund, which blocked redemptions until it can find an orderly way to unwind and return what little capital is left to its investors.

These dramatic examples show the importance of accurately assessing risk and protecting investors during this time of change, Bishop said. And going forward, it will be crucial for risk managers to watch the Federal Reserve for a continuation of rate increases and continue to adjust their approach.

“If the pace of Fed changes are slow, then people and institutions can de-risk without a lot of dislocation,” Bishop said. “There are a lot of investors that want yield and have put on more risk than they really want, so the real question is do they want to be the first man off the ship or the last man off the ship.”

For his part, Girard of NYL Investors ultimately believes the breakdown of junk bonds is a good thing in the long term because now some shaky loans are priced accordingly after Wall Street has been jolted awake by the recent rout.

“The reality has been that in this low-rate environment, there hasn't been a lot of high yield in high yield. You were getting high risk, but you weren't getting high yield,” Girard said. “Now, at least, with some of the correction that the market has experienced, you're getting some yield back in the portfolio.”

But he's quick to add that a bet on chasing an 11 percent yield in debt issued to an unprofitable oil exploration company is still far from a sure thing.

ALL ABOUT RATES AND THE FED



EVEN ABSENT DISCUSSION of monetary policies or economic growth, the Federal Reserve System or the movement of the bond market can be bewildering.

If you've never really understood why bond prices move opposite of their yield, or you've never really wanted to ask someone to define quantitative easing, here are some basics about interest rates, the Fed, and the bond market:

THE FED'S "DUAL MANDATE":

In 1977, an amendment to The Federal Reserve Act set the policy objectives that govern the institution today. Specifically, a key part of that amendment dictates that the Fed should "promote effectively the goals of maximum employment, stable prices and moderate long-term interest rates." That balance between modest inflation and low unemployment is often referred to as the "dual mandate" of the Fed—and, simply put, is the entire purpose of the institution. Much of the focus since the financial crisis has been on the "maximum employment" part of that mandate, as inflation has remained quite low. (In fact, the latest data from the Bureau of Labor Statistics shows consumer prices actually declined modestly in December.)

FEDERAL FUNDS RATE: A key interest rate set by Federal Reserve officials that determines how depository institutions lend money to each other in the very short term—and thus affects the interest rates of a host of other products based on how easily money can move through the financial system.

QUANTITATIVE EASING: A central bank buys securities, mostly consisting of government bonds, from banks. The quantity of assets that the bank purchases is then injected into the financial system as a result of the transaction. Theoretically, a bank with this extra cash has fewer hurdles to lending it out across the economy, and the bank will deploy the cash from its bond sale throughout the economy at large. Several rounds of QE in America were conducted over the course of the financial crisis and the latest quarterly report from the Federal Reserve shows approximately \$4.2 trillion in assets on its balance sheet as a result.

"OPERATION TWIST": In 2011 and 2012, the Federal Reserve deployed a targeted form of quantitative easing, buying longer-duration bonds and selling shorter-duration ones. The demand for long-term bonds drove up their prices and drove down their yields, while extra supply of short-term bonds did the opposite.

PRICE VS. YIELD: It's a truism that there is an inverse relationship between bond prices and yields. This is because of simple market dynamics. Say an investor buys a \$1,000 bond that yields 5%, or \$50 in annual interest payments. If interest rates rise to 5.5%, new investors can easily take \$1,000 and get \$55 in annual interest payments. So if that first investor wants to sell his \$1,000 bond to someone else, he will have to do so for at least a \$5 discount in order for that transaction to make it worth his while. The converse is also true—if rates drop to 4.5%, that first investor can demand a premium for his 5% bond on the open market because market rates are less attractive.

Actuaries in risk management must remain vigilant, balancing the need for returns in this low-interest-rate environment with the need to be good stewards of company investments.

Impact on Insurance Funds

Another area where some actuaries will personally experience the impact of Fed policies is via their employers’ financial stability.

Consider an insurance company that takes in billions in premium payments and has an opportunity to invest those premiums—in a limited, responsible way—before it must pay out claims to policyholders. Even a modestly better return in low-risk investments such as investment-grade bonds or U.S. Treasuries can make a big difference in the corporation’s finances.

This is particularly true for companies heavily reliant on life insurance or annuity products, which pay out over a long time period and allow the issuer to invest in longer-term and less “liquid” securities.

Unfortunately, thanks to persistently low interest rates, managing those funds to produce decent returns in a responsible way has been “extraordinarily challenging,” said Tom Girard of NYL Investors.

And he should know—NYL is a wholly owned subsidiary of New York Life Insurance Company, and the majority of its roughly \$225 billion in assets under management come from New York Life’s general fund.

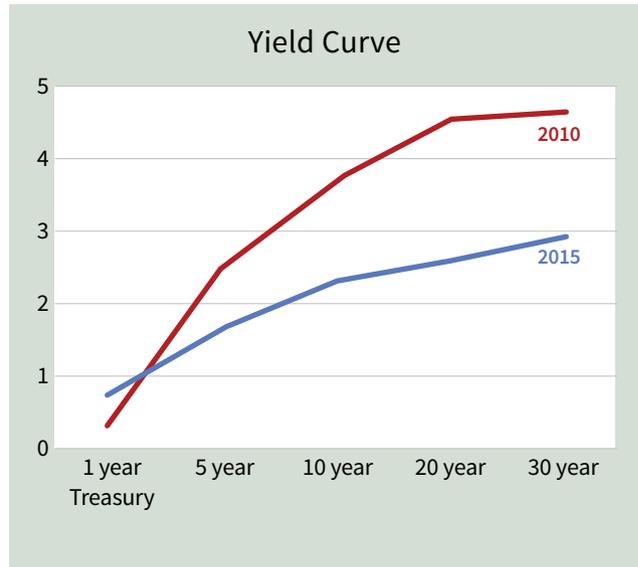
“The fact that yields are so low puts increased pressure on you to find yield somewhere. Yet certainly, as stewards of the general account of New York Life, we are very focused on sticking to our discipline,” he said.

If firms can properly navigate the short term, however, there is actually a light at the end of the tunnel should the Fed’s schedule of slow and steady interest rate increases hold true.

If firms can properly navigate the short term, however, there is actually a light at the end of the tunnel should the Fed’s schedule of slow and steady interest rate increases hold true.

“With the insurance assets we look after, we closely watch our asset liability management to avoid short-term interest rate risk,” Girard said. “So rates moving a little bit higher would not be a bad thing at all. And I know that goes against the whole ‘yield is up, price is down’ mentality of fixed income. But what we need to see, if you’re a long-term investor in this asset class, is yields move higher on a gradual basis in the long term.”

A look at the flattening of the so-called yield curve right now illustrates the challenges of the current environment. Just



a few years ago, longer-duration bonds—which offer a longer time period during which trouble might arise—offered investors a premium for their risk tolerance. But in the current environment, the difference in returns between shorter-duration investments on the front-end yield curve and those on the back end is much smaller.

There are a host of reasons behind the current state of yields, including an effort by the Fed across 2011 and 2012 known as “Operation Twist” to drive down long-term lending rates and prop up short-term rates through targeted bond purchases. There’s also the general notion that inflation is not a concern, and thus investors are willing to settle for lower yields in even longer-duration bonds because they aren’t worried about inflation eating into those returns over time.

But if the pace of rate increases hold and economic growth provides support under prices and wages, the yield curve may slowly steepen in the long term.

And that could be seen as a tremendous boon for long-suffering companies like those in the insurance sector that have had to settle for rates far below historic norms, said Andrew Henry of Credit IQ.

“They need to be able to go out on the longer end of the curve to get their business model working well again,” Henry said. “There’s massive amount of insurance fund money that really hasn’t had much of a home for about eight years because there just isn’t any yield even on the long end of the curve.”

Time will tell, of course, whether that actually comes to pass—and how much insurance funds and others benefit from this trend.

What Does the Future Hold?

Of course, when it comes to economic outlooks and central bank policy forecasts, things rarely ever go as expected.

In fact, there is plenty of recent precedent from central banks around the world that backed off rate increases like the one just

THE PLAYERS

FEDERAL RESERVE BOARD OF GOVERNORS:

The main governing body to oversee the Fed system, consisting of 12 members appointed by the president of the United States and confirmed by the Senate. Fed governors serve 14-year terms and cannot be reappointed.

FEDERAL OPEN MARKET COMMITTEE:

A group of 12 Federal Reserve officials, including all seven members of the Federal Reserve Board and five bank presidents chosen in rotation from the regional banks. The FOMC meets eight times a year and holds press conferences for about half of those events.

CHAIR OF THE BOARD OF GOVERNORS:

The executive who must report to Congress on Fed policies twice a year. The current chairwoman is Janet Yellen. In the modern era, the chair is also the public face of the Federal Reserve System. While chairs do set meeting agendas and determine how economic issues are prioritized, they have only soft powers and are not true executives. Rather, they are a first among equals on the board. In fact, other members can and often do dissent publicly from the chair in their opinions.

enacted by the Federal Reserve, returning quickly to previous low-interest-rate policies.

In October 2009, with the financial crisis still fresh in the minds of many investors and businesses, Australia thought the nation's economy was strong enough to support higher rates. Over the next few years, the Reserve Bank of Australia raised its key "cash rate"—similar to our federal funds rate—from 3.0 percent to a high of 4.75 percent until November 2011. Then, as pressures mounted, Australia backtracked with a series of aggressive rate cuts that took place across 2012, with rates back to 3.0 percent by year-end 2012. The rate currently sits at record lows of 2.0 percent—with some demanding the cash rate move even lower to boost growth.

Though Australia's decision to become the first major economy to raise interest rates in the wake of the global financial crisis proved premature, that didn't stop other central banks around the world from also jumping the gun on rate increases of their own.

In 2011, there was a crisis in Europe as nations including Greece, Ireland, and Portugal suffered under crushing debt loads

and falling tax receipts thanks to weak economic conditions. But the European Central Bank (ECB) raised rates anyway. The debt crisis got even worse, and the chilling effect of increased borrowing costs for both consumers and businesses led to a dreaded "double dip" recession for the eurozone that began at the end of 2011. The ECB backpedaled from its increases and began to steadily cut rates in November 2011, but it was too late—the euro-area economy was already in decline and would continue to contract for 18 months until mid-2013.

The United States is very different than Europe or Australia, obviously. But the Federal Reserve still runs a risk of making a similar policy error that ends up undercutting the recovery if the economy reacts poorly to tighter access to capital.

And if the Fed has to quickly reverse course next year, it could mean dark things for the U.S. economy.

"If the economy is unable to withstand moving up 25 basis points and they have to reverse course, we have bigger problems with the economy than people think right now," said Tom Girard of NYL Investors. "Then you'd have to ask yourself, 'What do we do from here?' since there's not a lot of room to lower rates and Fed has already blown up its balance sheet to over \$4 trillion thanks to quantitative easing [QE]. QE has pretty much been exhausted."

But Girard is quick to add that there is a big difference between an immediate reversal from this first round of interest rate increases to a modest cut in 12 to 18 months after a series of steady increases.

"The Fed has in its sight that we've got to get this funds rate back with a 1 handle on the front of it," that is, a fed funds rate of at least 1 percent. "So if they tighten all the way to 2017 and then have to reverse course, that's going to be a different message," Girard said. "We need to remember it's not going to be a straight line."

Whatever the pace of changes in benchmark interest rates, however, it seems certain the Federal Reserve will tread very cautiously.

All we can do, then, is keep our eyes on Janet Yellen and her colleagues for a signal of what's to come ... and hope that the recent rate hike in December goes as planned, that the planned rate increases in 2016 follow, and that brighter days both for the U.S. economy at large and the global economy in general support these moves.

"I think it will stick," said Greg McBride of Bankrate.com. "At least, I hope it does—for business, for investors, for everybody." □

JEFF REEVES is executive editor of InvestorPlace.com and a columnist for both *MarketWatch* digital network and *USA Today*. His commentary has appeared in numerous financial outlets, including *CNBC*, the *Fox Business Network*, the *Wall Street Journal*, and other publications.

The Open Source Software Revolution in Actuarial Science

MOST ACTUARIAL DEPARTMENTS ARE “MICROSOFT SHOPS” or “SAS shops” or “AXIS shops.” That is, they rely on those proprietary software applications to meet their modeling and reporting needs. The vendor that developed the software controls all aspects of the application, including the source code, distribution, and upgrade cycle. The end-user then purchases licenses to use the proprietary application from the developer.

But it has not always been this way. Technology firms were initially hardware-focused. The earliest “software” was code developed in the academic community. That code was freely shared so that research could be both advanced and reproduced. Ironically in those early days, open source software was assumed to not be malicious because the code was included.

In this article, we explore the return of this “open source” software model.

The Evolution From Proprietary Applications to Open Source

The proprietary software model evolved when technology firms recognized the revenue potential of software. Through the introduction of the Lisa and Macintosh computers, Apple showed the world that software sells hardware rather than the other way around. Commercial software applications became a revenue stream. The graphical interface of Microsoft Windows 2.0 (and the improved interface of Windows 3.0) opened the floodgates of that revenue stream as software could now be used by and sold to the masses. That is, with the graphical interface, the use of software no longer required any programming knowledge.

Actuarial firms were not blind to this sea change. Eventually, actuarial consulting firms developed proprietary applications. For some firms, actuarial software (and the associated support) was not a side business—it was their only business.

While this phenomenon of course did

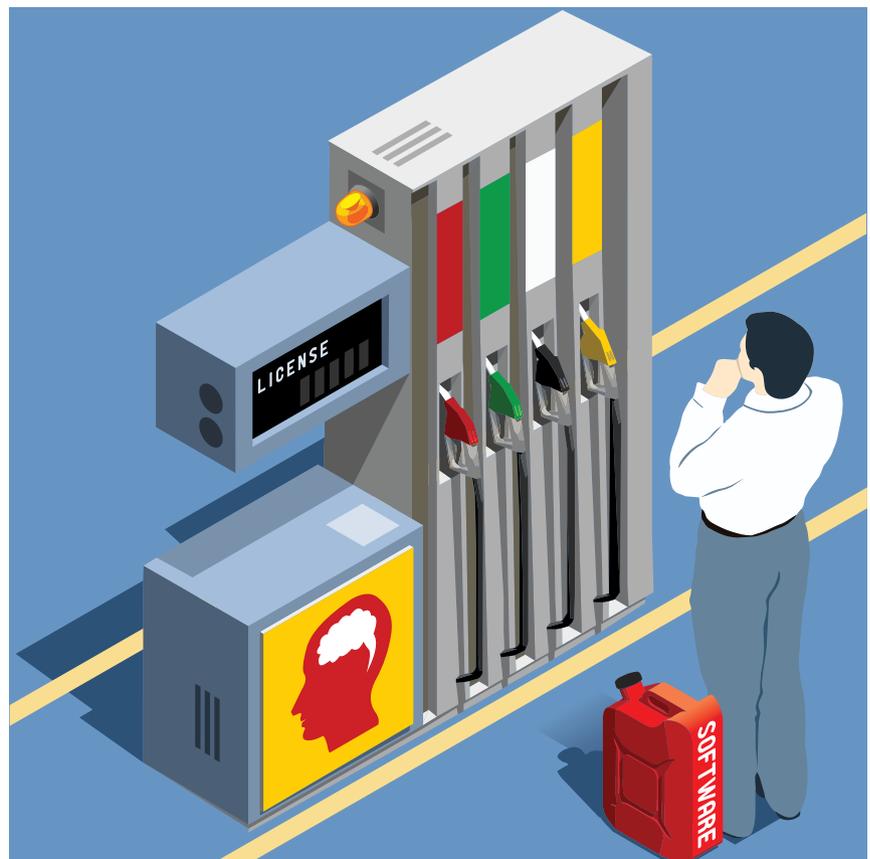
not only occur in the actuarial community, the development of domain-specific software was an indication either that “platforms for the masses” did not include all of the functionality required or that there was value in creating applications built on those generic platforms that facilitated specific types of analysis. For many, the development proprietary domain-specific software applications meant that their problems were solved.

But there are always skeptics. Those skeptics want to be able to test that the software is performing the calculation that they are expecting. They also want to be able to modify the functionality to meet their specific needs. They do not want to rely on a commercial vendor to improve capabilities or implement enhancements.

Open source software addressed these concerns.

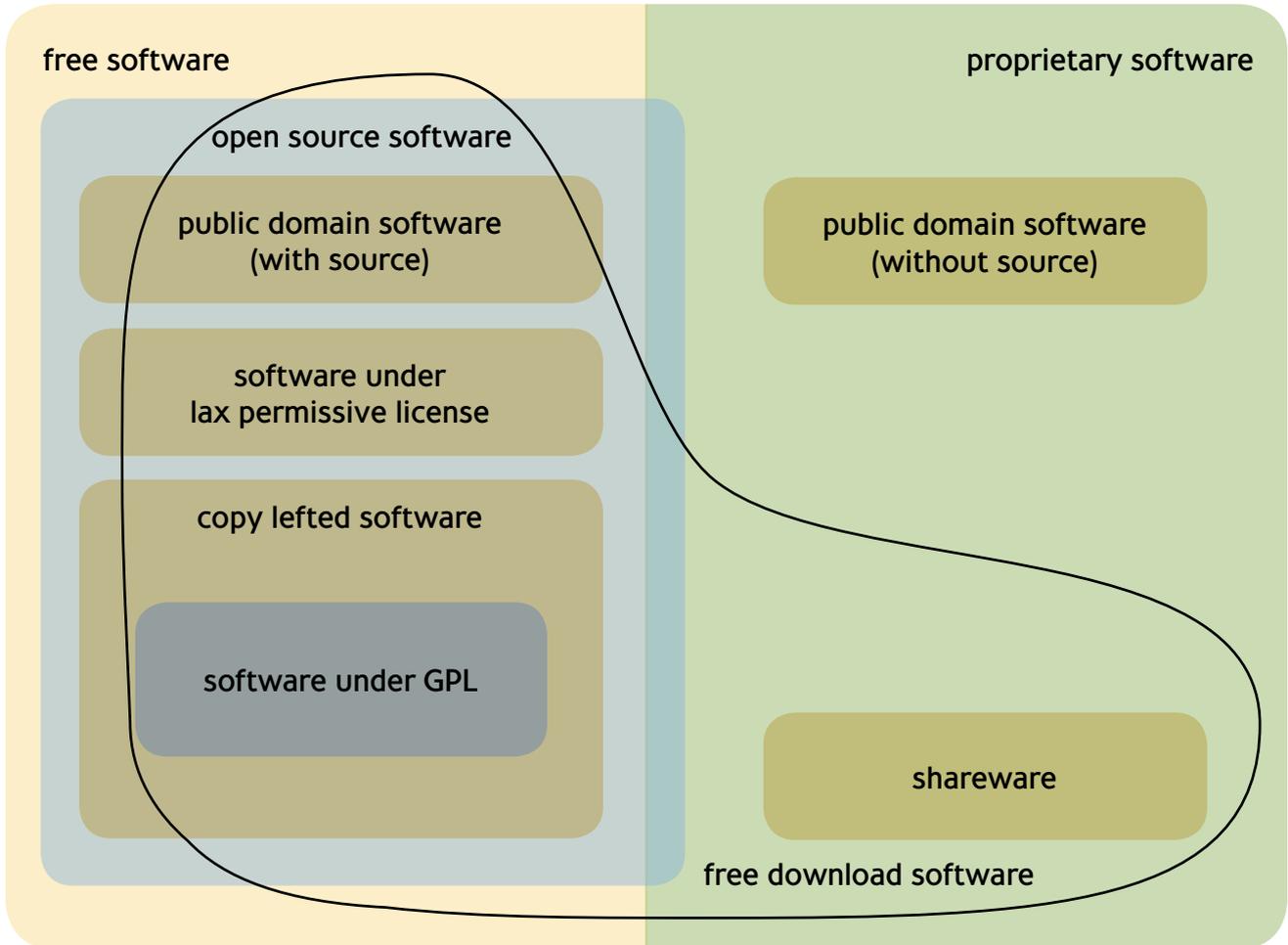
What Is Open Source Software Is Open Source Software Free?

“Open source” refers to a program in which the source code is available to the general public for use and/or modification from its original design. Open source software is generally—but not always—free of charge. There are semantic



ISTOCK

Figure 1: Software Application Categories



differences between the terms “open source software” and “free software.” The former refers to the condition that source code for the software is made available to the licensee. “Free” in the latter term refers to freedom, not cost. (A more through discussion of the semantic differences of various types of free and open source software is available on the website of the Free Software Foundation.)¹

The Venn diagram in Figure 1 may be useful in understanding the differences between various categories of software.

This article uses “open source software” to refer to applications that are distributed with the source code, with or without cost. This principle is embodied in the licenses that accompany open-source software. Two of the more

common licenses are the GNU General Public License (commonly referred to as the GPL License) and the MIT License which include the following.

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The Benefits of Open Source

The primary benefit of open source software is that it allows a disjointed community of programmers to work collaboratively to improve the code and share the fruits of their labor. This was one of the rationales for the open source movement. That is, that a larger group of programmers not concerned with

proprietary ownership or, in many cases, financial gain will produce a more useful and bug-free product for everyone to use. Due to the larger programmer base of the community and the “as-is” licensing, needed fixes might be identified earlier and improvements implemented more quickly.

Common applications that are open source include the Android and Linux operating systems and the Mozilla Firefox browser. As a result, open source is a good alternative in situations in which internal resources to support a specialized group are limited.

Open Source Tools Used by Actuaries

The most common open source tool used by property/casualty actuaries is R. Training courses offered by the Casualty Actuarial Society (CAS) using R commenced as early as 2006 and continue today. Articles started appearing in

the actuarial literature shortly thereafter. Today, in addition to dedicated training seminars, other CAS meetings and seminars offer workshops to train actuaries in R.

The use of R includes some well-known packages written by actuaries, including the chainladder package (for loss reserving) and actuar (for loss distributions and other functions). Actuaries also leverage more commonly used packages in R, including data visualization and geospatial capabilities. However, R is not the only tool. Python is growing in popularity, particularly for Web searching, and other tools like Julia and F# may be leveraged.

For life and health analyses, there are several commonly used applications that contain open source components. These include Towers Watson’s MoSes and Prophet from Sungard. Both of these must be licensed from the vendor. Code is provided in the form of libraries or

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packages, which can be changed to suit the organization's needs.

Commercial Support

While open source offers flexibility and accessibility to a large code base, it is not necessarily consistent with all of the needs of an enterprise development environment. This gap is filled by commercial software providers. These providers supplement open source with in-house developed functions, sometimes enhanced for big data and/or parallel processing. Software maintenance, technical support, and access to experts are available as part of the license or as an add-on service. Support is also available in the community at large, through message boards and websites, some of which are maintained by the commercial company.

Compliance Issues

The use of open source software raises compliance issues—both as respects

internal company standards and, more broadly, actuarial standards of practice promulgated by the Actuarial Standards Board. In both areas the primary issue relates to the reality that most actuaries are not programmers.

Internal Standards: Peer Review

Whether open source is used primarily in the actuarial group or throughout the entire company, steps should be taken to see that the internal needs are met. This includes correctness of the code, security, and protection of intellectual property. Issues related to security primarily fall to administrators, sometimes with assistance from the commercial vendors. Issues of intellectual property are generally addressed by legal departments and senior management. This leaves the code to the actuarial department.

Those departments generally have peer-review requirements. As a result, this requires that departments identify

“coder-actuaries” and develop standards for the review of code. The coder-actuary group generally evolves into an internal community.

Effective independent peer review requires that some members of the community remain independent of each project so that they may provide a “fresh set of eyes.” It also requires that the department establish processes and procedures for code review similar to those that generally exist in IT departments but may be unknown to actuarial departments.

Professional Standards

Actuarial Standard of Practice No. 41, *Actuarial Communications*, states that

“In the actuarial report, the actuary should state the actuarial findings, and identify the methods, procedures, assumptions, and data used by the actuary with sufficient clarity that another actuary qualified in the



cutting through complexity

same practice area could make an objective appraisal of the reasonableness of the actuary’s work as presented in the actuarial report.”⁵

Much of the success of productivity software suites (such as Microsoft Office) is due to their ability to facilitate exhibits and documentation production that are “universally reviewable.” That is, generally they require no specific programming knowledge to use. That, in a sense, is why those suites have been many actuaries’ preferred tool for the production of actuarial reports that comply with ASOP No. 41.

Many open source tools were designed around principles of reproducible research. If you are not familiar with this concept, it is discussed on R-Website (known as CRAN, The Comprehensive R Archive Network) as follows:

■ The goal of reproducible research is to tie specific instructions to data analysis and experimental data so that scholarship can be recreated, better understood and verified.

■ R largely facilitates reproducible research using literate programming: a document that is a combination of content and data analysis code. The Sweave function (in the base R utils package) and the knitr package can be used to blend the subject matter and R code so that a single document defines the content and the algorithms.

That is, they are intended to allow another user to reproduce—and more importantly, to test—the results of the original researcher. That ability should naturally allow for reports produced to comply with ASOP No. 41—but do they? Those reports will provide the commands compiled by the software to produce the analysis and the associated results/output. As such, the algorithm presented in the report will be “code-based” rather than “exhibit-based.”

However, is it fair to assume or expect that another actuary qualified in the same practice area should be able to interpret the code-based algorithm? Bottom line, this may be an issue that

the profession will need to deal with in the future.

Considerations

Open source software, at one time an oddity that was primarily found in academia, is now becoming a feasible tool in the business world and specifically in the actuarial community. It’s important that the profession keep pace with these developments, as these tools may become the standard for the future of data analysis.

Proper usage can accelerate the development process, possibly at lower costs. Due diligence must be exercised, however, to ensure that critical issues—creating a secure environment and maintaining professional standards chief among them—are met. Actuaries should evaluate on a case-by-case basis whether open source is the best choice for their group. □

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Endnotes

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Elevated Risk

THERE IS A RISK OF MATERIAL ADVERSE DEVIATION. Why is it this phrase that keeps repeating itself? Hypoxemia and exhaustion are well-known to cause one's brain to work in strange ways, but why this? This is hardly the thought that you want repeating itself in your ear when you are trying to summon all your courage, strength, and concentration just to take your next step.

You've written this phrase about unpaid loss amounts countless times—surely figuring out precisely how many times in your current situation is not likely to happen. Just clinging to the Lhotse wall at 7,200 meters requires all the positive thoughts you can summon. Certainly not the very mixed message in the phrase—a risk of material adverse deviation. A wrong step can start you sliding down the face, 1,200 meters to certain death, clearly an adverse deviation.

Why are you even here? This seemed like such a grand idea when it first started to become real, four years ago. When salary increases assured that there was enough money coming in that it became a real possibility that some of it could be wasted on daydreams—the incongruous daydream of a person who rode a desk for a living climbing the highest mountain in the world. No real technical climbing skill needed. Just a fit body, an overwhelming desire to do it, and \$45,000. The guides and the Sherpas would do most of the heavy work; you were just along for the ride, and the sightseeing, and the bragging rights. “Really? Wow!” was the most common reaction when you told friends what you proposed doing, although your wife and kids weren't as awed as some of those friends. More skin in the game for them than there was for mere acquaintances.

Keep moving. What's that? Yes, yes, had I stopped? The ultimate single-file march and one of us has stopped to consider the danger and stupidity associated with the surroundings. The risk of material adverse deviation. Two more hours

of step, step, rest, and repeat until we've reached Camp 4, where each of us will be in for a sleepless night filled with terrible dreams in this freezing nightmare. The death zone. Your job is to provide advice on how to identify, control, and quantify risk—isn't that how the risk management folks identify it?—and now you're here, trying with all your might just to get one foot to go in front of the other, like some 86-year-old stroke victim trying to cross the street before being crushed by a car. So you can make it to Camp 4, in the death zone, and spend another sleepless night. So you can repeat the entire process beginning at 2 a.m. tomorrow on the push to the summit.

And then the descent. How often have you heard in the past four years that most deaths occur on the descent? Doesn't everybody now believe that Mallory made it to the top and died coming down? Haven't you had enough issues with just the descents from the acclimatization climbs? Descents when you were only “mostly” exhausted? You're a man acquainted with risk and probability. What do you give right now for your chances that at 2 p.m. tomorrow you'll be in complete control of your descent back to Camp 4? You were always pretty good at sniffing out the likely survival odds of some of those out-of-control insurance companies you used to work on as a junior—although you never were so crass as to say you were quoting odds. Poor decisions led them to their predicament—what do you call the decisions that got you to this spot? Brilliant? Or equally poor? Some of the managers

Editor's note. Below is the first finalist in our 2016 fiction contest announced in the January/February issue. See actuary.org/2016contest for more information and to enter.

you worked with didn't seem to know anything about running an insurance company. Well, didn't you already excuse yourself for not knowing terribly much about the technical aspects of climbing? You certainly didn't go out of your way to understand exactly what it would be like trudging along here on the Lhotse wall at just this moment. The risk of edema. The risk of frostbite. The risk of snow blindness. The risk of falling to your death.

The risk of a material adverse deviation.

Maybe this is what happens to everyone—is happening to everyone around you right now. Is it possible that the damage 7,000 meters does to your system robs you of your ability to avoid having the worst negative thoughts? Is quitting despite being this close to the goal what is on the mind of every one of the people in this group? But didn't they all seem so upbeat and ready to go just three days ago on our last descent to the oxygen-rich environment of base camp? Didn't our group leader tell you that for a person who had never done any climbing this serious, you were doing great? Was he just blowing smoke? Isn't that his job, to tell us that sort of thing to keep us going? Don't we all do too much of that sort of cheerleading when we're getting paid to perform a service? Like writing “risk of material adverse deviation” on all those pages.

Suppose this isn't just your mind acting up? Suppose this is the result of serious issues in your lungs ... in your brain? Do you really want to risk permanent damage to the thing that you use to make your living? Saying you thought about that before you started out for Kathmandu doesn't answer the question in the here and now. You haven't had a clear thought in days, you haven't been able to take a deep breath in days, and it's still going to be days until you're



down low enough that everything won't be cold and fuzzy and sore and achy and too damned bright.

Isn't it time to end this madness? There's still time enough today to begin a descent and get back down to Camp 3. No one will think any less of you. Not everyone summits, sometimes even the strongest climbers don't make it. Back home you can proudly brag of being at 7,400 meters—higher than the cruising altitude of most of the puddle jumpers from the local airport.

Wait, what are you saying? Quit? If that's not a material adverse deviation, then what is? You're not going to die, and you're not going to suffer permanent brain injury, and the frostbite that you have already is minor—certainly not the kind of damage to your feet and fingers that is going to keep you off the golf course. What are you talking about? There's good money invested here, and

the goal was to summit, and it doesn't matter who else doesn't make it—you're going to do it! Yes, that's more like it. I may be wrong, but I see a turn coming here—that's the first positive thought you've had since we left Camp 3 this morning. Might be the first positive thought you've had in days. Just because that phrase continues to repeat itself in your ear doesn't mean that you have to pay it any attention.

What are you saying? I'm not sure I understand. You don't think I'm doing terribly well. I'm fine. I was just congratulating myself on having a positive thought. No, not just one thought—a stream of positive thoughts. Convincing myself all over again that I will be on that summit tomorrow. What are you saying ... that I'm not making terribly much sense? No, I'm fine. My face is half frozen and I'm having trouble moving my mouth, but I'm fine otherwise.

You think I should turn back. Is that what you're telling me? That going on introduces the risk of an adverse outcome? That's not the proper phrase you know—you mean "deviation," right? That's the phrase, you know, adverse deviation. Yeah, I know because I've been using it a lot lately—and it's one of the common phrases among the people that I work with.

I'm not going to turn back now. We're almost to Camp 4—I'll have plenty of time to recuperate then. I'm fine.

No, I don't think I should turn back. I understand your concerns but I'm OK.

No, I'm fine.

Really, there's no risk.

I'm fine...

WALTER HANER, MAAA, FCAS, is a consulting actuary based in Cooperstown, N.Y. He's a golfer, not an alpinist, though he has a collection of some 20 books on climbing.

Penthouse

THE INSTRUCTIONS TO THIS MONTH'S PUZZLE couldn't be easier. Below are 40 clues, each leading to a five-letter word. Enter the answers into the five penthouse apartments shown at right. The apartments would be 4x4 word squares, but as befits a penthouse apartment, each one has 8 terraces. The clues are shown in random order, so it is left to the solver to determine where the answers go. All letters of the alphabet are used at least once.

There are four proper nouns. Everything else is playable in Scrabble, including a word that many dictionaries call slang or obsolete slang and another that I've encountered only as part of a legal phrase. All the other words are common, although there's one variant spelling. Ignore punctuation, which is designed to confuse.

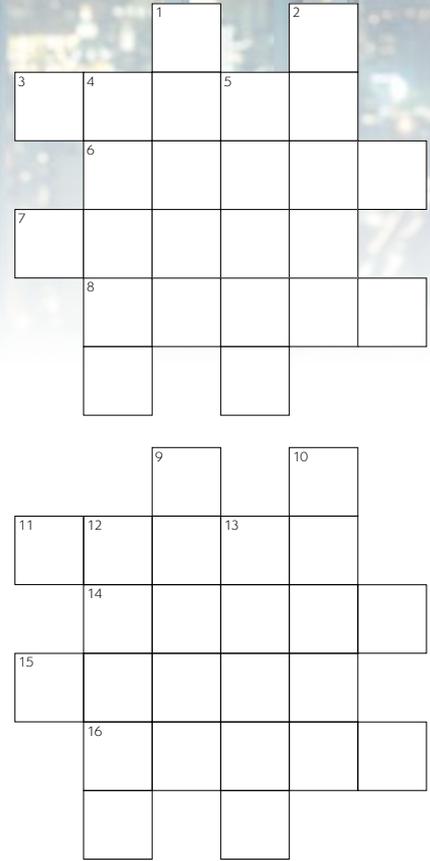
This puzzle may be hard to solve with no hints. The first level of hints groups the answer by penthouse. The second level of hints ties each answer to its position. Let me know whether you used any hints, so I can group you accordingly when the solvers list is published.

Thanks to Eric Klis, Bob Fink, and Jerry Miccolis for test-solving and editorial suggestions.

Clues

- a. Grain, bananas, and a Chardonnay, perhaps
- b. Stick a fork in poached pears
- c. Famed recluse appears in Dress Circle
- d. Flinging terns' crap
- e. Six take a seat and stay a while
- f. Football official in the pseudo-French undergarment
- g. Vicious iron, Ralph, but coming up short
- h. Soft rock peripheral to choirmaster's talk
- i. Clumsy avant-garde plays

- j. Shaken? Or the alternative?
- k. Shoddy adobe hut
- l. A show at the Met with some art from the Sixties' generation
- m. Limits on terms of power announced
- n. Penny, with effortlessness, they may be split
- o. Someone from Casablanca Flynn flipped over
- p. Chill at California airport following a drop of golden sun
- q. Question and answer about unsatisfactory Hebrew bible assignment
- r. Virginia, porn for the most part is hot air
- s. Tries to find Punjabis on the radio
- t. Little favorite with the computer department
- u. Ballet move originally rendered by Yankee great
- v. British grain travels by water
- w. Unfortunately, Eden's packed
- x. Police called to wooded area
- y. Little echidna harboring bloodsucker
- z. All is invariably unknown
- aa. Strenuously question Greek adversity
- bb. True things from false pretenses
- cc. Little House on the Prairie with toilet paper, I hear
- dd. Lee, I'd better cancel
- ee. Loud attire in what respect?
- ff. Detected an odor of small fish



- gg. Irish enduring a slaughter
- hh. Herb's on the border, by the way
- ii. Carrying too much for one delivering from San Francisco to Miami
- jj. Messing with young society woman, rather adroit at first
- kk. Harmful conglomerate offering a token
- ll. Blush at rogue treatment
- mm. Love an opportunity to be heard
- nn. Landing in the French Riviera at three

TOM TOCE is a senior manager for actuarial services with Ernst & Young in New York and is a member of the Jeopardy Hall of Fame.

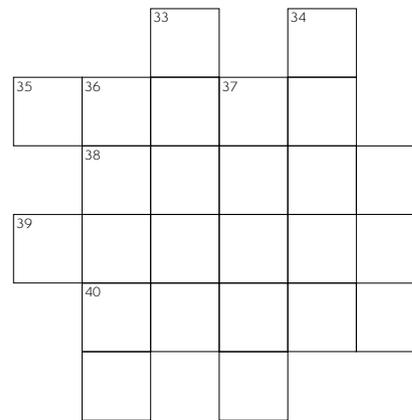
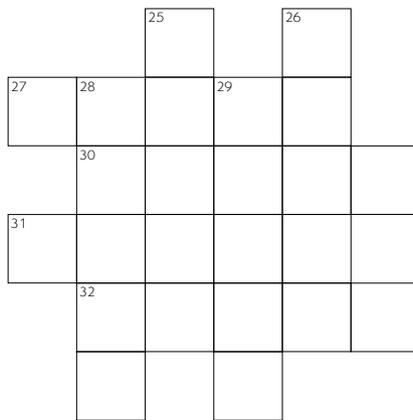
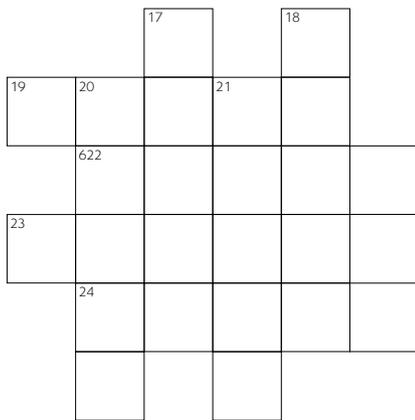
Solutions may be emailed to thomas.toce@ey.com. In order to make the solver list, your solutions must be received by March 31, 2016.

40. w	35. f	30. cc	25. b	20. ll	15. ff	10. d	5. c
39. e	34. bb	29. i	24. aa	19. a	14. z	9. nn	4. k
38. y	33. h	28. j	23. q	18. g	13. p	8. jj	3. kk
37. m	32. gg	27. x	22. l	17. r	12. hh	7. o	2. n
36. dd	31. h	26. s	21. t	16. n	11. ee	6. v	1. mm

Second level hints

Penthouse 33-40: e, f, m, w, y, bb, dd, ii
Penthouse 25-32: b, h, i, j, s, x, cc, gg
Penthouse 17-24: a, g, l, q, r, t, aa, ll
Penthouse 9-16: d, n, p, z, ee, ff, hh, nn
Penthouse 1-8: c, k, o, u, v, jj, kk, mm

First level hints



Previous Issue's Puzzle—Patchwork

“Patch” Clues

- CONSTERNATE: Anagram of “entrances to”
- PAYLOAD: Homophone of “pale” (“colorless”) + “ode” (“ballad”)
- DESTINIES: Anagram of “densities”
- EXOTIC: Reversal of “cite” (“quote”) surrounding X (“hug”) and O (“kiss”)
- DISCOLORED: DISCO (“dance club”) + LORE (“legend”) + D (“Donna’s crown”)
- GATHERS: Hidden in “ginseng at her store”
- REBOUNDED: Anagram of “nude bored”
- LEADER: Hidden in “style a derby”
- DESERTION: Anagram of “resident” surrounding O (“hole”)
- STONEWALLED: STALLED surrounding ONE + W (“week”)
- DEFILED: DEED surrounding FIL (part of Chick-fil-A)
- ACQUIT: ACT surrounding QUI (Roman “who”)
- AGGRESSIVE: Anagram of “sarges give”
- JAILED: J (center of “perjury”) + AILED (“felt bad”)
- NOISEMAKER: Anagram of “senor Mike” with A added inside (“given”)
- OVERSTAFFED: Double definition
- EQUALIZES: Anagram of “quiz Leesa”

“Thread 1” (Outer) Clues

- QUERIES: Anagram of “esquire”
- DEMOS: Hidden in “seaside mosque”
- TOXIC: TIC (“spasm”) surrounding OX (“beast of burden”)
- TASSEL: Anagram of “steals”
- TOWERED: Every other letter of “Otto’s wee friends”
- JARGON: JAR (“jerk”) + GONE (“departed”) – E (“empty”)
- CANTINAS: Remove “edges” (“mendi” and “erape”) from “mendicant in a serape”

“Thread 2” Clues

- LAGER: Reversal of “regal” (“splendid”)
- QUICKEN: QUEEN – E (“heartless”) surrounding ICK (“last third of drumstick”)
- IDOLIZE: Homophone of “idle” (“lazy”) + “eyes” (“lookers”)
- RoaSIDE STREET: Anagram of “trees” surrounding ID EST (“that is”)
- LISTENS: GLISTENS (“sparkles”) – G (“after commencement”)

“Thread 3” Clues

- FEARED: Initial letters of “Friendly effervescent and really engaging David”
- COLE: Homonym of “coal” (“pitch”)
- STAPLES: Double definition
- HANDED: Hidden in “epitaph and editorialized”
- AGILE: FRAGILE – FR (“finer edges”)

“Thread 4” Clues

- LAYOFF: Change P (“profit”) into L (“loss”) in PAYOFF (“compensation”)
- STEADIED: Initial letters of “she took Excedrin after drug interaction episode Darvocet”
- DEVOID: DEVO (“punk rock band”) + ID (“undisciplined force”)

“Thread 5” Clues

- ENDEAR: END (“final”) + EAR (“musical ability”)
- DEVOUR: Reversal of ROVED surrounding U (“university”)

“Thread 6” (Inner) Clue

- BORE: Double definition

Solvers

Solvers at the Excruciating Level:

Michael and Jina Accardo, Steve Alpert, Stephen Bates and Tim Buckner, Braze,

	A	B	C	D	E	F	G	H	I	J	K	L
1	U	Q	S	A	N	I	T	N	A	C	N	O
2	E	Z	E	S	I	D	E	S	T	R	E	G
3	R	I	L	E	S	T	A	P	L	E	E	R
4	I	L	O	S	F	F	O	Y	A	S	T	A
5	E	O	C	T	O	V	E	D	L	H	L	J
6	S	D	D	E	U	R	E	R	D	A	I	D
7	D	I	E	A	R	O	B	A	I	N	S	E
8	E	N	R	D	E	N	D	E	O	D	T	R
9	M	E	A	I	E	D	D	E	V	E	E	E
10	O	K	E	F	E	L	I	G	A	D	N	W
11	S	C	I	U	Q	R	E	G	A	L	S	O
12	T	O	X	I	C	T	A	S	S	E	L	T

Bob Campbell, Lois Cappellano, Laura Cremerius, Jonathan Currier, Todd Dashoff, Mick Diede, Sean Donohoe and Josh DenHartog, dba T.O.C.E (The Thousand Oaks Cryptic Enthusiasts), Greg Dreher, Deb Edwards, Phil Gollance, Pete Hepokoski, John Herder, J & J Holloman, Ruth Howald, Paul Ivanovskis, Ruth Johnson, Paul Kolell, Ken Kudrak, Tim Luker, Dave McGarry, Lee Michelson, Jim Muza, David & Corinne Promislow, Danny Rhodes, Bill Scott, Andrew Shewan, Jon Shiley, Tyler & Evelyn Somer, Tom Toce, Jon Turnes, Dave Wallman

Solvers using some hints (or not saying):

Arlan Aakre, Dean Apps, Karl Baker, Bob Buck, Mathew Eberhardt, Bruce Fuller, Jason Head, Wade Hess, Brian Klimek, James Lamenza, David Lovit, Jeff McLane, Jon Michelson, Stephen Pearce, Karen Skoglund, Doug Szper, Art Zaremba, Frank Zaret

500 Questions

IT'S THE OFFSEASON HERE IN COLUMBIA, MO. That's right, *Family Feud* is in reruns (even the workaholic Steve Harvey deserves a break or two to embarrass himself on additional hosting gigs), and everyone in town seems to have a lot more free time on their hands. So instead of watching the *Feud*, my brother and I tried to come up with other activities to do during the cold winter season.

Since watching the *Feud* isn't an option, we started flipping channels, in hope of finding a different show that could sustain us through these dark and gloomy days. We weren't looking for perfection, just something palatable. One day we discovered the game show *500 Questions*. After watching for 30 minutes or so, we both came to the conclusion—*500 Questions* just isn't very good. To be blunt, it stinks. But it bothered me that I couldn't figure out why the show was so bad.

I asked my brother if he had a theory, and he immediately knew what was wrong with the show. Instead of telling me, he said that he'd rather tell an executive in charge of the show. Amazingly, my brother knew an ABC executive who happened to be here in town and arranged a sit-down.

Once we met, we immediately got down to business. The executive talked about how much potential the show had and was open to ideas about improving the product. Seeing the opportunity, my brother minced no words and bluntly told her what's wrong.

The general premise of the show—where you keep answering questions until you miss three in a row—is a great one. And the idea of there being a big

prize if a contestant somehow makes it past question 500 is another keeper. Unfortunately, the show is slow and confusing. There are all of these unneeded bells and whistles. Get rid of the "Battle Questions," the "Top 10 Challenge," the "Triple Threats," and every other gimmick, and suddenly you have yourself a nifty product. The show should be rapid-fire questions, with the only break occurring when someone misses three in a row.

The executive pondered the idea of getting rid of all the fluff, and commented that the network can create questions such that someone good at trivia can answer questions with 85 percent accuracy. But she wondered whether this might lead to too many people making it through to question 500? For some reason, the executive expected me—the actuary/math guy—to answer that question for her. I told her that I'm just the puzzle writer, not the solver, so I'll leave it up to the reader to answer the questions at hand:

Assuming that each question is independent and gets answered correctly 85 percent of the time, to the nearest tenth of a percent, what's the probability of the first contestant making it through question 500 and winning the show?

The network has decided to purchase insurance from Nefarious Insurance Company (NIC). The insurance company will reimburse the network in case someone makes it past question 500 and wins the grand prize. However, as a condition of the insurance, NIC gets to write questions 491 to 500, and will create



those 10 questions so that a contestant answers them correctly only 70 percent of the time. How does this new wrinkle affect the answer above?

Last Issue's Puzzle—3x3

As a warmup, count the number of distinct blocks that are magic squares; that is, the sums of the three rows, three columns, and two main diagonals are all equal to one another. Justify your answer.

Since the sum of digits from 1 to 9 is 45, the common sums must be 15. There are only eight sums of three different digits from {1, 2, ..., 9} equal to 15. Of these, 5 is found in four sums; 2, 4, 6, and 8 are in three sums; and 1, 3, 7, and 9 are in two sums. Thus 5 must be in the center cell, the four even digits in the corners, and the four odd digits other than 5 in the four sides (including top and bottom). So 1 must be in one of the four sides; assume it is at the top. This makes the top row 6-1-8 or 8-1-6. Assume it is 8-1-6. The entire block is now determined to be

8	1	6
3	5	7
4	9	2

We had eight choices along the way—four for the placement of 1 times two for the direction of the top row—so there are eight blocks that are magic squares.

Solutions may be emailed to cont.puzzles@gmail.com.

In order to make the solver list, your solutions must be received by March 31, 2016.

(Without the diagonal constraints, there are 72 such squares. Observe that the six permutations of whole columns and the six of whole rows and the flip about the main diagonal generate a group of order 72.)

Find a block where the term-by-term sum of two rows equals twice the corresponding terms of the third row, and at the same time the same relationship holds between the columns.

One of the first 3x3 matrices I played with was:

1	2	3
4	5	6
7	8	9

There are many others.

Find a block whose determinant is largest among the determinants of all blocks. Sketch your method.

The determinant of a block is the difference of two sums of the form $A = abc + def + ghi$, where a, b, c, \dots, i is a permutation of the nine digits 1 to 9. It is not difficult to show that A_{max} , the maximum value of $A = 9*8*7+6*5*4+3*2*1=630$. With a lot more effort, one can show that A_{min} , the minimum value of $A = 214$. However, if M is a block with the largest determinant then $\det M \neq A_{max} - A_{min}$ because the two permutations don't fit together into a block.

One way to find M is to calculate the determinants of all $9! = 362,880$ blocks, which some solvers did. The point of mathematics is to reduce the number of calculations, if we are lucky, to just one. We can reduce the calculations to 36 by starting with the determinant of a block based on A_{max} :

9	6	3
1	8	5
4	2	7

We continue by permuting the off-diagonals 6-5-4 and 3-2-1. There are six of each, for a total of 36. For

9	4	2
3	8	6
5	1	7

the determinant = 412 is maximal. There are others.

Solvers

Robert Bartholomew, Bob Byrne, Samantha Casanova, Bob Conger, Andrew Dean, Bernie Erikson, Mark Evans, Bill Feldman, Yan Fridman, Ron

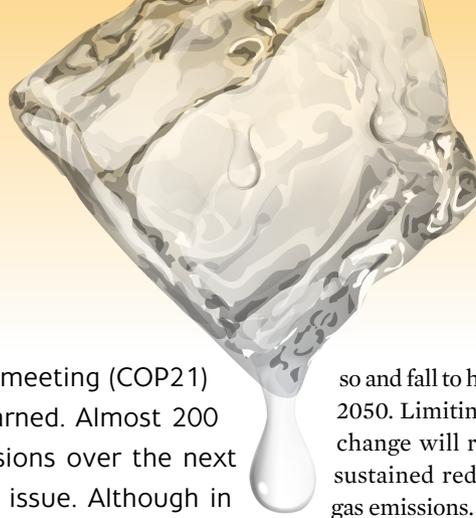
Goldthorpe, Rui Guo, Anna Hoover, Eric Kovach, Caterina Lindman, David Lovit, Lee Michelson, Scott Parker, David Promislow, Dennis Reddington, Mat Sedlock, Noam Segal, John Snyder, Lenny Shteyman, Al Spooner, Doug Szper, and Daniel Wade.

JOSH FELDMAN, a member of the Academy and an associate of the Casualty Actuarial Society, is an actuary at Shelter Insurance in Columbia, Mo.

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Climate—The Long Term

NOW THAT THE DECEMBER PARIS climate meeting (COP21) is behind us, it's time to go over the lessons learned. Almost 200 countries committed to limit their carbon emissions over the next few decades, confirming the importance of this issue. Although in some cases the commitments are aspirational in nature, they were made in recognition that this is a significant worldwide issue.

It is difficult to incorporate long-term costs into everyday decision-making. This lack of socialization of future environmental costs (by ignoring them, assuming others will pay, or greatly discounting them) makes a future disaster more likely unless we take effective mitigating efforts to control them, regardless of the extent to which we adapt to changing circumstances. The costs will be borne unequally, with the most vulnerable likely to suffer most.

This is not to say that the adverse effects are inevitable. The national commitments have shown that progress can be made. There remains, however, a great deal of uncertainty associated with the effects of our future climate, how mitigating actions will affect the course of our future and how we adapt to them. Who knows—technological advances may come to our rescue. Nevertheless, even with the current commitments, significant risks remain about our grandchildren's future.

The uncertainty relates to the extent and timing of environmental degradation, not whether it will happen. Scientific views about climate change have been converging: The remaining questions include how much worse it will get and by when. The mean forecasts are scary—adverse tail scenarios would be worse. Priorities will need to continue to be reassessed.

A fundamental problem is that the full cost of the adverse effects on our environment will not be borne by those primarily contributing to the damage. Some refer to this as a failure of the markets. Arguably, the discount rate applied

to these future costs of environmental damage has been too high, which, even when they are included, cause us to substantively ignore the effects on current and future generations by implicitly assuming that benefits from economic growth will more than offset future damages. In fact, global growth has had and will continue to have serious adverse effects on our environment (e.g., global annual carbon dioxide emissions are higher than they have ever been).

The warming of our climate system is unequivocal—many of the observed changes are unprecedented over millennia. Last year was the warmest the globe has seen since recording of temperature began—but one year or even one decade doesn't constitute proof. The atmosphere and ocean have warmed, glaciers have shrunk, sea levels have risen, extreme weather events are more common, and concentrations of greenhouse gases (including carbon dioxide (CO₂), methane, and nitrous oxide, primarily fossil fuel emissions and land-use changes) have increased—at some point there may be no backtracking on the amount of these emissions.

Most aspects of climate change will persist for centuries, even if emissions of CO₂ are stopped. The human influence on the climate system has been a primary cause of climate change since at least the middle of the 20th century.

To adequately reduce the risks associated with a 2° C increase in temperature—the level at which most climate scientists believe catastrophic damage could occur—global emissions will have to peak in the next decade or

so and fall to half their current level by 2050. Limiting the effects of climate change will require substantial and sustained reductions of greenhouse gas emissions.

So what should these environmental trends mean to actuaries? We are well established in the quantification and management of financial risks. Climate change will be crucial to actuaries 1) on an individual level, as it affects ourselves, our children, and grandchildren; 2) because it affects the institutions we serve as either decision-makers or expert adviser; and 3) as members of society.

We owe it to ourselves and future generations to be concerned with the long term. We also owe it to our employers and clients to identify and quantify, where possible, the financial implications of current and future actions that affect our environment. We need to apply our actuarial training in risk management to these issues. This means not only keeping our knowledge in this area up to date, but also considering future benefits and costs of actions and inactions in a holistic manner.

We should promote carbon-free and responsible investments to promote sustainable growth that can better the quality of our lives and the lives of future generations. We as a society have to better incorporate long-term costs into our decision-making processes. As actuaries, we are used to addressing long-term financial sustainability issues and the uncertainties affecting financial institutions—we also need to pay attention to other long-term issues, such as climate change.

Opportunity: immense. Challenge: great. Action: necessary!

SAM GUTTERMAN, a member of the Academy and a fellow of the Society of Actuaries and the Casualty Actuarial Society, is a director and consulting actuary with PricewaterhouseCoopers LLP in Chicago.



*It Takes One to Know One...
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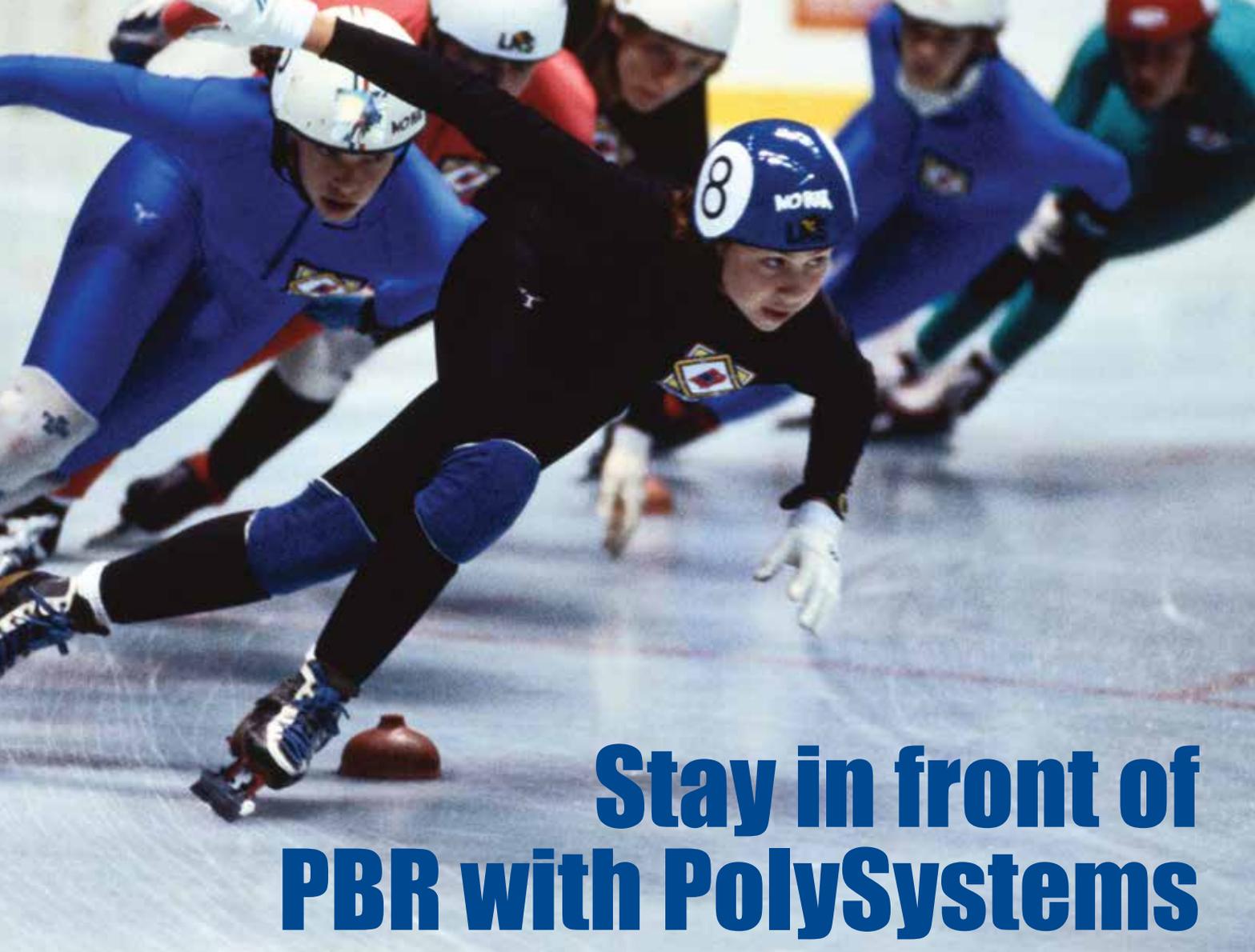
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