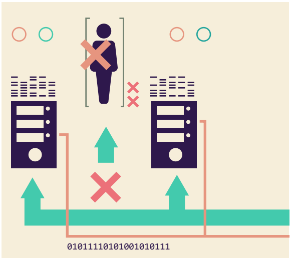

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FROM THE CEO

In recent months, gyrations in financial markets, especially those in China, have brought into sharper focus the reality that the developing economies of Asia have become major engines for global growth. That is, creating greater prosperity for the entire world will depend more than ever on the continuing dynamism of Asian nations.

Since our founding, the Milken Institute has focused on the issues of access to capital, job creation and health. While most of our initiatives are U.S.-based, our perspective has always been a global one, and we have long recognized the special importance of engagement with leaders and people across Asia.

We started our Singapore-based Asia Center three years ago to accelerate this work – and there's been a lot of it since. By the time you hold this issue of the *Review* (or read the pixels on your screen), we will have concluded our second annual Asia Summit, bringing hundreds of leaders from the region (and the world) to Singapore for two days of lively discussions on pressing issues including the integration of China in the global economy and the evolving multilateral lending landscape in Asia.

Another part of our work in Asia is research on major policy issues, and several such reports have been released in recent months. "Best-Performing Cities China" is a path-breaking analysis and ranking of the growth prospects of nearly 300 cities in the Middle Kingdom. It's anchored in the "output-based" approach of our widely cited "Best-Performing Cities" index in the United States.

Another recent Institute report deals with the policies and practices that five Asian nations have used to unlock the human capital potential of their aging populations. And yet another analyzes the state of financing for trade in Asia – a key determinant of economic growth – and makes recommendations for policies to expand it further.

In addition, we're held several of our signature Financial Innovations Labs in Asia in the past three years. The goal is to aid policymakers and other stakeholders in focusing on topics such as the diversification of the Bangladeshi economy and the creation of conservation finance mechanisms for the continent. All these reports can be found on the Milken Institute's website.

A wag once described Brazil as "the country of the future – and it always will be." But Asia really is, without doubt, a region of the future – and we're excited to be helping shape that future in the present.

Michael Klowden, CEO and President

JG, our loyal correspondent who recently returned to her roots in Passadumkeag Maine after an unfortunate stint in Bug Tussle Oklahoma (but that's another story), writes to ask about the style of the *Review*'s prose. "How can it be so clear, but just a little … different?"

I appreciate the compliment, if that's what it was, JG. I think what's distinctive is that I learned syntax following the New York Yankees in my youth. Indeed, my muse was the late Yogi Berra. How can one's editing ever be the same after exposure to this immortal line?

> In theory, there is no difference between theory and practice. In practice there is.

But I counsel patience. After all, the future ain't what it used to be. Meanwhile check out the sheer brilliance of this issue's authors.

Brad DeLong, an economist at Berkeley, offers a guide to the fight over former Treasury Secretary Larry Summers's claim that rich countries have entered an era in which continuing prosperity will require increased government intervention. "The debate over secular stagnation is, I believe, the most important policy-relevant debate in economics since John Maynard Keynes's debate with himself in the 1930s, which transformed him from a monetarist to the apostle of active fiscal policy," writes DeLong. "I think Summers is largely right – but then, I would, since I have been losing arguments with him since I was 20."

Staci Warden, executive director of the Center for Financial Markets at the Milken Institute, explains why the technology underlying Bitcoin – the blockchain – is likely to be far more disruptive than the crypto-currency itself. "Once you start learning about the blockchain," she concludes, "it's hard not to be awed by the enormity of the problem that Satoshi Nakamoto (the anonymous inventor of Bitcoin) solved, the elegance with which he solved it and the possibilities that his solution offers."

Barry Eichengreen, an economist at Berkeley, steps back from the speculation about the prospects for the Chinese renminbi as a global currency to ask what's really important here: "The big question – well, really, questions – are what the Chinese government is prepared to do to make the RMB a true world currency that can readily serve as a substitute for dollars in international transactions, why the slew of reforms that must precede full internationalization are probably more important to China at home than abroad and how internationalization will affect global financial markets now largely tied to the dollar (and to its regulators in Washington)."

Charles Castaldi, a former NPR journalist, uses a trip back to his native Italy to assay the country's prospects in the midst of Europe's financial agonies. "Italians certainly don't lack survival skills," he explains. "Surviving in style is a well-honed tradition. The problem is that Italy's success depends in large part on the kindness – or at least the exercise of enlightened self-interest – on the part of northern Europeans."

William Gale, **Aaron Krupkin** and **Kim Rueben** of the Brookings-Urban Institute Tax Policy Center in Washington examine state governments' flirtation with supply-side tax policy. "The states have no good reasons to believe that tax cuts will bring the desired manna," the economists conclude. "Yet they continue to erode their tax bases in the name of business growth in an era in which few states can afford to cut critical services (that businesses care about) ranging from education to infrastructure repair."

Alvin Roth, a Nobel economist who is the author of the new book, *Who Gets What – and Why*, explores "matching markets," where price alone can't balance supply and demand – think of markets for everything from marriage to college admissions to donated kidneys. "To understand the many ways in which markets fail," he writes, "we must begin even before the beginning."

"Part of making a market 'thick' involves finding a time at which lots of people will participate at the same time. But gaming the system when the system is 'first come, first served' can mean contriving to be earlier than your competitors. That's why, for example, the recruitment of college freshmen to join fraternities and sororities is called rush … and the reason that Oklahomans are called Sooners."

Thomas Krause, a consultant on workplace safety, argues that the first step in reducing unnecessary hospital deaths is to measure the horrific toll accurately. "The sheer size, degree of interest-group conflict and decentralization of the health care establishment make virtually any change exceptionally difficult," he acknowledges. "But, by the same token, the potential rewards have never been greater."

Wait; there's even more. Demographer **Bill Frey** charts the path of America's "browning." Meanwhile, your faithful editor offers pithy remarks on why Karl Marx was right – 150 years late. Who knows, I might just get to like this business of having the last word. Happy perusing. *—Peter Passell*

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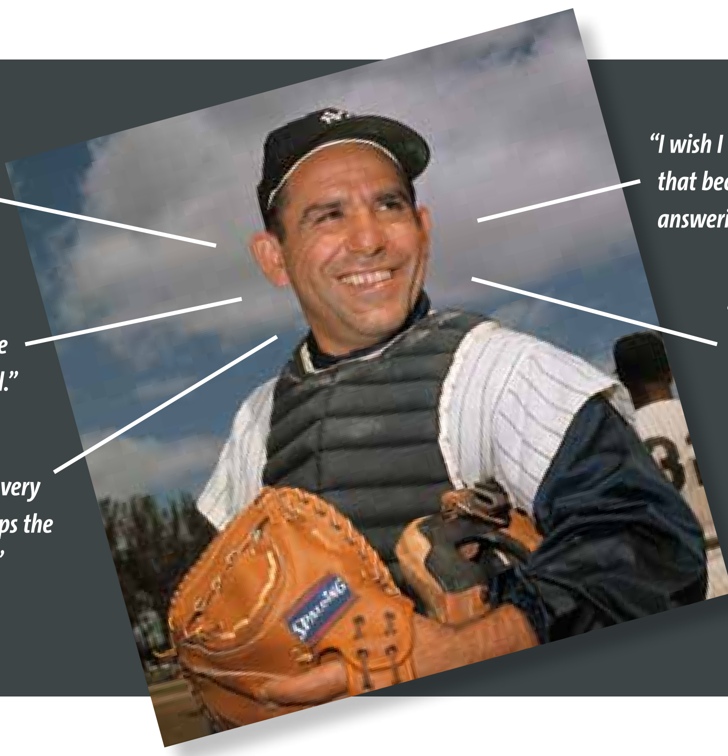

*"I **KNEW** the record would stand until it was broken."*

*"Baseball is ninety percent mental and the **OTHER** half is physical."*

*"Little league baseball is a very good thing because it keeps the **PARENTS** off the streets."*

*"I wish I had an answer to that because I'm **TIRED** of answering that question."*

*"You can observe a **LOT** by just watching."*

BY WILLIAM G. GALE, AARON KRUPKIN AND KIM RUEBEN

Many folks, and from time to time, majorities in Congress, apparently believe that the cure for what ails the economy is lower taxes – in particular, lower tax rates for high-income earners. Now this enthusiasm has spread to state governments that are led by conservatives, offering new tests of a proposition that has generated scant evidence of success elsewhere.

Failure of this idea at the federal level does not necessarily imply that tax cuts would fail to increase output and jobs at the state level. For one thing, lower taxes in one state might lure existing businesses (and jobs) from other states, even if they yield no overall increase in employment or output. But it's also worth noting that the stakes are higher for the states. Washington can finance shortfalls in revenue by selling bonds to the public or by borrowing from the Federal Reserve – in effect, printing money. States are far more constrained by the skepticism of the private credit markets or constitutional prohibitions against deficit finance, or both. Thus, any failure of supply-side economics to work its magic could force punishing cuts in state programs.

PRESENT AT THE CREATION

First, a little history. Ever since the 1970s, when Jude Wanniski (then a *Wall Street Journal* opinion editor) and Arthur Laffer (then a young college professor) came up with the ideas that are now referred to as supply-side economics, conservative politicians have been unable to resist the siren song of tax cuts for big earners. The claim, of course, is not that high-end tax breaks merely serve the interests of groups that support conservative politicians; rather, it is that the tax cuts would serve the broader public interest by increasing incentives to work and to create (or expand) businesses.

In the extreme versions of supply-side economics that thrived through the early Reagan administration years, supply-siders argued that tax rates were so high that cuts would increase the economic growth rate sufficiently to pay for themselves. After decades in which lower tax rates generated less revenue rather than more, today's supply-siders are more inclined to make less immodest claims; many

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The authors thank the Laura and John Arnold Foundation and the Ewing Marion Kauffman Foundation for financing the original research cited in this article. The findings are the responsibility of the authors and do not necessarily reflect positions of the Tax Policy Center, the Brookings Institution or the Urban Institute.

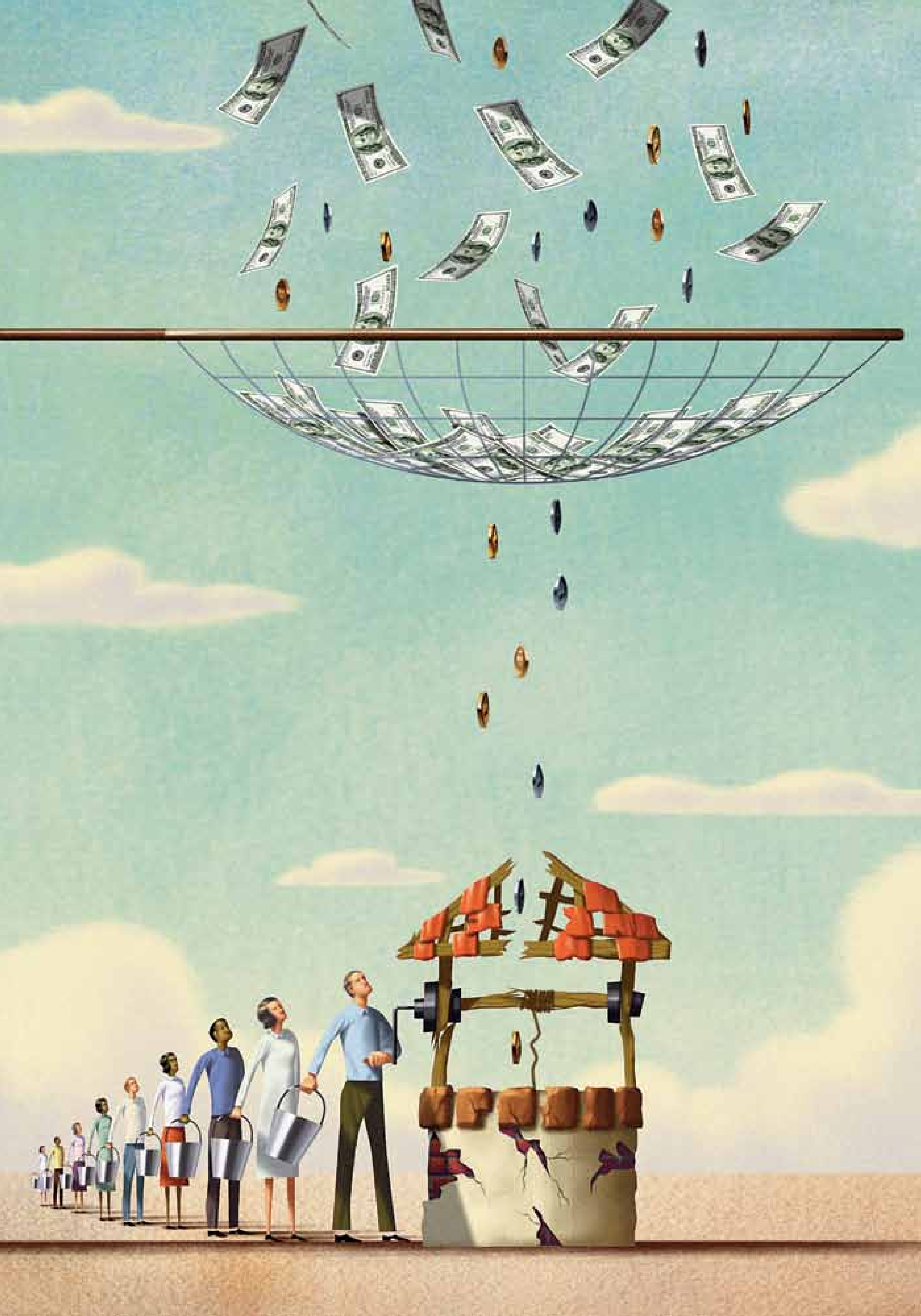
advocates argue that tax cuts will spur growth that will make up for part of the revenue losses as they create jobs and private income, asserting that the loss of some tax revenue is worth it due to the boost in economic activity. However, some proponents still can't help themselves and lapse into the more hyperbolic claims.

INSIDE THE BELTWAY

Many conservatives apparently believe that federal tax cuts have borne rich fruit for the country, or, at worst, that the jury is still out. But this seems to be a case of "who are you going to believe – us, or your lying eyes?" At the federal level, there is virtually no evidence that broad-based tax cuts have had a positive effect on growth.

The vaunted Reagan tax cuts in the early 1980s produced a period of average growth, when growth is (appropriately) measured from peak to peak of the business cycle. Indeed, research by Martin Feldstein, President Reagan's former chief economist, and Douglas Elmendorf, the former Congressional Budget Office director, concluded that the 1981 tax cuts had virtually no net impact on growth. Indeed, they found that the recovery in the 1980s could be ascribed wholly to monetary policy. It's also worth noting that they found no evidence that the big 1981 tax cuts induced people to work more.

Apparently, no one claims that the 2001 and 2003 Bush tax cuts stimulated growth. The two enabling acts did have the word "growth" in their titles (the Economic Growth and Tax Relief Reconciliation Act of 2001, and the Jobs and Growth Tax Relief Reconciliation Act of 2003) and slashed tax rates on ordinary income, capital gains, dividends and estates. Yet growth remained sluggish between 2001 and the beginning of the Great



Recession in late 2007. Again, the gains that did occur are generally attributed to the Fed's easy-money policy.

But the Reagan and Bush tax cuts, each about 2 percent of GDP, were small potatoes compared to the tax increases during and after World War II, when federal taxes rose by more than 10 percent of GDP. That's right, not 10 percent of taxes, but one-tenth of the entire economy. Income tax rates went up for virtually everyone, and revenues and rates stayed higher for decades. In fact, between 1944 and 1963, the top tax bracket never fell below 90 percent. According to supply-side theory, that should have killed the economy. Instead, according to Nancy Stokey (of the University of Chicago) and Sergio Rebelo (of the Kellogg School), real per capita growth rates differed little from the historical averages.

Tax rates as determinants of long-term growth fare no better in cross-country comparisons. Research by Thomas Piketty (Paris School of Economics), Emmanuel Saez (University of California, Berkeley) and Stefanie Stantcheva (MIT) found no relationship between how a country changed its top marginal tax rate and how rapidly it grew between 1960 and 2010.

The United States, which cut its top rate by over 40 percentage points during that period, grew just over 2 percent annually per capita. Germany and Denmark, which barely changed their top rates at all, experienced about the same growth rate.

The story is much the same when total tax burdens are compared. Over the 1970-2012 period, taxes as a share of GDP were 7 percentage points higher in the rest of the OECD countries (32 percent) than in the United States (25 percent). Yet, per capita annual growth was virtually identical in the rest of the OECD (1.8 percent) as in the United States.

So, there is no reason to believe that tax cuts are an elixir for economic growth. When policymakers count on increased business activity and job creation, as well as revenue to partially offset the initial cost, they are risking serious economic dislocation. There's another problem here, as well. As Piketty and company note, with or without the elusive supply-side effect, high-end tax cuts have exacerbated income inequality.

Despite all of this, tax breaks for high earners are prominently featured in contemporary debate over tax policy. Mitt Romney's 2012 campaign proposals included tax cuts for the "job creators." And don't expect Republican candidates to change their tune for 2016. Marco Rubio (along with Utah's Sen. Mike Lee) has come up with the Economic Growth and Family Fairness Tax Reform Plan; Rand Paul has checked in with his Fair and Flat Tax. While the plans are quite different, both cut taxes at the high end of the income ladder.

HARD NUMBERS

The zeal for lowering income tax rates, especially at the top, spread beyond Washington decades ago. In the 1990s, six states cut taxes by more than 10 percent, mostly by enacting significant personal income tax cuts. Their subsequent growth records are mixed. Gross State Product (GSP) did grow faster, on average, in the six tax-cut states combined than in the rest of the country. But that was mostly explained by the explosive growth of the financial sector, which is centered in Connecticut, New Jersey and New York, and was surely more a product of the Clinton-era boom in financial engineering and the dot-com bubble than of state tax policy. On average, the other tax-cut states (Massachusetts, Delaware and Colorado) grew more slowly than the rest of the country. Moreover, employment grew

PREVIOUS PAGE: JIM TSINGANOS

at a faster rate in the rest of the country than in the six tax-cut states.

New Jersey's tax cut was anchored on a 30 percent reduction in personal income taxes from 1994 to 1996. Using county-level data on employment, Robert Reed (University of Canterbury) and Cynthia Rogers (University of Oklahoma) found that New Jersey experienced strong employment growth after the tax cut – but so did counties with similar economic profiles in nearby states that did not have tax cuts. The net effect of the tax cut, measured by the difference in employment gains between New Jersey and the nearby economic regions, was small and statistically insignificant.

Between 2001 and 2007, Arizona, Louisiana, New Mexico, Ohio, Oklahoma and Rhode Island cut personal income taxes. However, there was no discernable impact on economic activity. From 2001 to 2012, these states grew, on average, at virtually the same rate as the rest of the U.S. economy. In fact, extending the measurement period through 2014, four of the six states experienced declines in their shares of total U.S. employment. Two states, New Mexico and Oklahoma, did experience net gains in employment share over the extended period. But a far more plausible explanation centers on the boom in oil and gas fracking, which was hardly related to state income tax policy.

Some states, notably California, Maryland and New York, have retained increases in top marginal income tax rates that were introduced in recent years to address revenue shortfalls. But the supply-side spirit lives on in a number of others, which have cut personal income taxes and corporate income taxes, and provided special breaks for businesses, with the goal of spurring growth.

The most widely reported recent state income tax cut occurred in Kansas in 2012. In the 30 years prior, Kansas' economic growth rate had lagged consistently below the averages for neighboring states and the nation as a whole. Hence Gov. Sam Brownback pressed for a tax cut that would be "like a shot of adrenaline into the heart of the Kansas economy."

Initially, Brownback submitted a revenue-neutral plan that reduced income tax rates across the board and effectively exempted small-business income from all tax. To offset the cost, he proposed to eliminate itemized deductions, make a temporary sales tax increase permanent and cap state spending. But the Legislature passed a bill with quite different provisions. Starting in 2013, the top rate of 6.45 percent was eliminated, the next bracket (income above $15,000) was cut from 6.25 percent to 4.8 percent, and the lowest rate was cut from 3.5 percent to 2.7 percent. Taxes on pass-through income from small

There is no reason to believe that tax cuts are an elixir for economic growth. When policymakers count on increased business activity and job creation, as well as revenue to partially offset the initial cost, they are risking serious economic dislocation.

businesses were eliminated, reducing the effective state income tax rate on those businesses to zero. Brownback adopted the plan as his own, calling the legislation a "real live experiment" in supply-side economics.

The tax cuts did not produce the hoped-for growth, though, and more revenue was lost than originally anticipated. Fiscal year 2014 revenues were $700 million lower than the previous year – $330 million less than expected – in a period in which most of the American economy was picking up steam. Put in context, these numbers are pretty significant: $330 million represents more than 5 percent of Kansas' government spending from general funds. Responding to the gloomy news, both Moody's and Standard & Poor's reduced Kansas' credit rating.

Once progressive income taxes are cut, the political path of least resistance for reversing the revenue losses is to raise indirect taxes that are usually regressive.

Arguably as important, Kansas failed to keep up with the region's pace of job growth. Kansas' *cumulative* job growth rate from January 2011 through March 2014 was 3.4 percent – 39 months in which the United States registered 5.5 percent job growth and employment in neighboring Colorado, Oklahoma and Nebraska grew by 8.2 percent, 5.6 percent and 4 percent, respectively. Even if we focus on the latter half of that period, beginning in January 2013, which was after the tax cut was enacted, Kansas still falls behind. The state's job growth clocked in at 1.4 percent, compared to the U.S. average of 2 percent. Thus, it seems as if the "live experiment" failed to produce the projected economic gains.

Under the threat of large spending cuts, especially for schools, the Kansas Legislature raised taxes in June. However, instead of reversing the income tax changes and the provision that eliminated tax liability for many businesses, Kansas increased its regressive sales tax to 6.5 percent (from 6.15 percent) and increased the regressive excise tax on cigarettes by 50 cents a pack. This suggests yet another way in which the experiment failed: once progressive income taxes are cut, the political path of least resistance for reversing the revenue losses is to raise indirect taxes that are usually regressive.

Over the past few years, other states have also tried cutting income taxes, partially offsetting the revenue losses by raising their sales taxes. Since 2011, Gov. Scott Walker of Wisconsin (who was, as of mid-summer, one of the leading candidates for the Republican presidential nomination) has signed a collection of tax cuts that reduced revenue by roughly $2 billion – a remarkable loss for a state with general-fund spending of about $15 billion. However, the expected job growth and budget surpluses in Wisconsin did not arrive. Gov. Walker recently signed a budget that cut spending on higher education, roads and scientific research.

In Louisiana, many politicians thought that the economic boom and revenue gains after Hurricane Katrina would stand the test of time. The state took the opportunity to cut income taxes to the tune of $700 million, adding to the woes of a budget that is vulnerable to the business cycle and heavily dependent on royalties from oil production. The $1 billion budget surplus in 2007-08 has morphed into a projected deficit of $1.6 billion for the

JIM TSINGANOS

current fiscal year. In response, Gov. Bobby Jindal froze public-employee wages, scaled back tax expenditures, increased the cigarette tax by 50 cents per pack and raised motor vehicle fees.

In April 2014, Oklahoma's governor, Mary Fallin, chose a slightly different approach. She signed a bill that would reduce the state's top marginal personal income tax rate to 5 percent from 5.25 percent by 2016, but only if state revenue projections were larger than expected. Because this trigger was based on projections, it was met in December 2014 and, despite a budget shortfall, the tax cut automatically went into effect. A second cut, to 4.85 percent, will go into effect after 2016, again provided revenue projections exceed targets. However, with oil and natural gas prices in decline, it is unclear whether the second round will occur.

INCONVENIENT TRUTHS

While it is too soon to understand the full effects of the recent state income tax cuts, the examples above hardly strengthen the case for supply-side tax cuts. Moreover, these ambiguous state experiences tend to reinforce the conclusions from a voluminous academic literature. Recent studies have generated almost every conceivable finding: tax cuts raise, reduce or have no clear effect on growth. In addition, the effects of changing different taxes – income, corporate, property and sales – vary dramatically within and across studies.

A variety of methodological factors complicate interpretation of these findings: the econometric studies used different dependent variables, analyzed different time periods, employed alternative measures of tax revenues or rates or both, included different measures of government spending, controlled for different independent variables and used different control groups and identification methods. Additionally, balanced-budget requirements imply that revenues and spending should be closely correlated, making it especially difficult to study the independent influence of taxes or spending.

In our own recent research, we worked to be fair to both sides, making fresh estimates of how state tax policy affects economic growth and entrepreneurial activity. We used a framework that in prior research had led investigators to the conclusion that lower taxes *do* stimulate growth, extending the sample period and performing a variety of tests to see how sensitive the results were to plausible changes in the statistical models. We found that neither tax revenues nor top marginal income tax rates bear any stable relation to economic growth rates across states and over time.

Consistent with these findings, we also concluded that neither marginal tax rates nor tax revenues consistently affect employment. And while the rate of firm formation is negatively affected by top income tax rates, these effects are small. The gist: there is no guarantee – and there should not even be a presumption – that cutting state income taxes will boost economic growth.

WHACK-A-MOLE ECONOMICS

At the core of supply-side economics is Arthur Laffer's back-of-the napkin curve illustrating the undeniable reality that, at some point, higher tax rates will lead to lower revenues as well as fewer jobs and slower growth. But this does not imply there are many real-world examples of tax rates so high that cutting them would have much impact on jobs or growth. That has been amply demonstrated at the national level, where tax cuts have eroded revenue without discernable effect on economic activity.

The states have no good reasons to believe that tax cuts will bring the desired manna. Yet some continue to erode their tax bases in the name of business growth in an era in which few states can afford to cut critical services (that businesses care about) ranging from education to infrastructure repair. Some ideas live on and on, no matter how much evidence accumulates against them. States that accept them as gospel anyway do so at their peril.

BY WILLIAM H. FREY

Most Americans are at least vaguely aware that the nation is "browning" due to the rapid growth in numbers of Hispanics, Asians and multiracial Americans, along with the more moderate growth of blacks and other non-white groups. What is not often appreciated outside global cities like Los Angeles, New York and Miami is how quickly the shift is taking place. The Census Bureau tells us that in about 30 years, whites will no longer be the majority.

This rapid spread of racial diversity is occurring generationally from the younger ages upward, as well as geographically inward from former melting pot regions to the rest of the country. Minorities are now a majority in the nation's public schools. And in less than five years, whites will comprise less than half of the under-30 population.

Two factors are driving diversity up the age range. First, there's rapid growth of young minorities, especially Hispanics, due to past immigration and now mostly high fertility. Second, there's the rapid aging of white America. Between 2015 and 2030 there will be an absolute decline in the size of the white population under age 65. And even among seniors, racial minorities will begin to gain.

The next 15 years will also see a broad geographic dispersion of racial minorities. Projections for all 50 states that I prepared with Ruy Teixeira and Robert Griffin suggest that diversity will be spreading inward from melting pot states like California and Texas which,

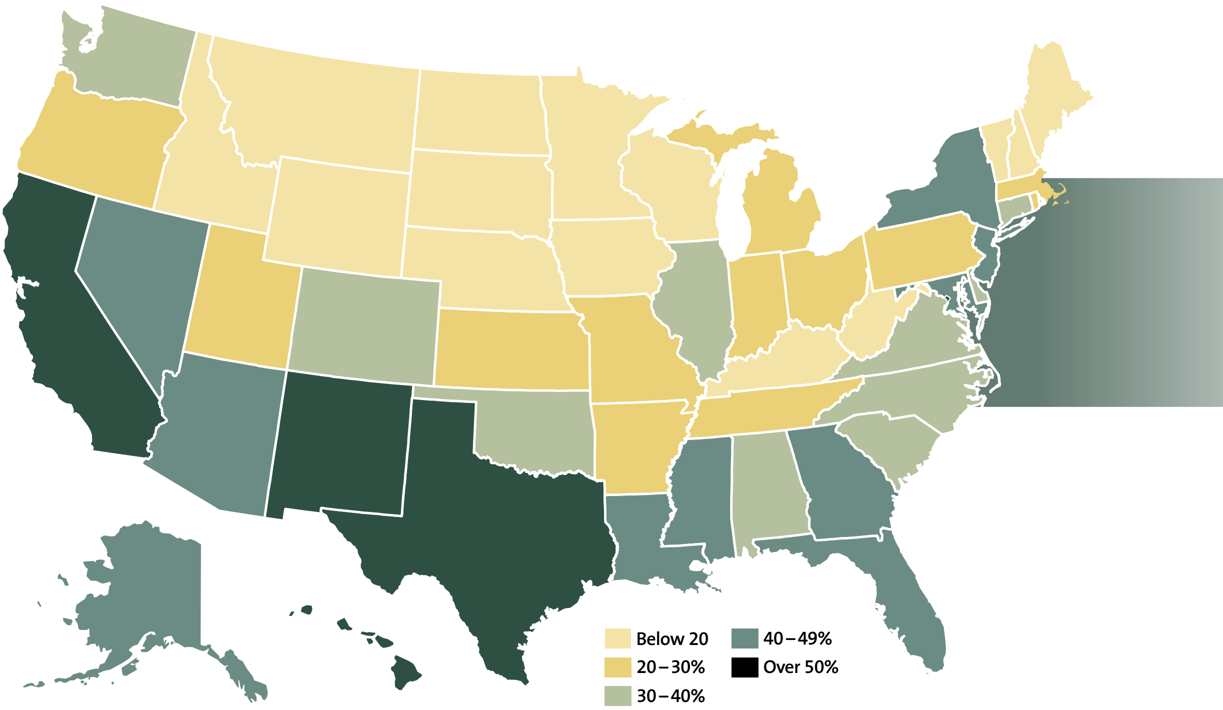
along with Hawaii and New Mexico, are already home to more minorities than whites.

The continued dispersion of Hispanics and Asians to the Mountain West and South, along with the steady movement of African-Americans to prosperous southern states, will give rise to seven new "majority minority" states by 2030 (Florida, Georgia, Nevada, Arizona, Alaska, New Jersey and Maryland). What's more, a slew of states in the Sunbelt and beyond (including New York and Illinois) will become home to at least 40 percent minority populations.

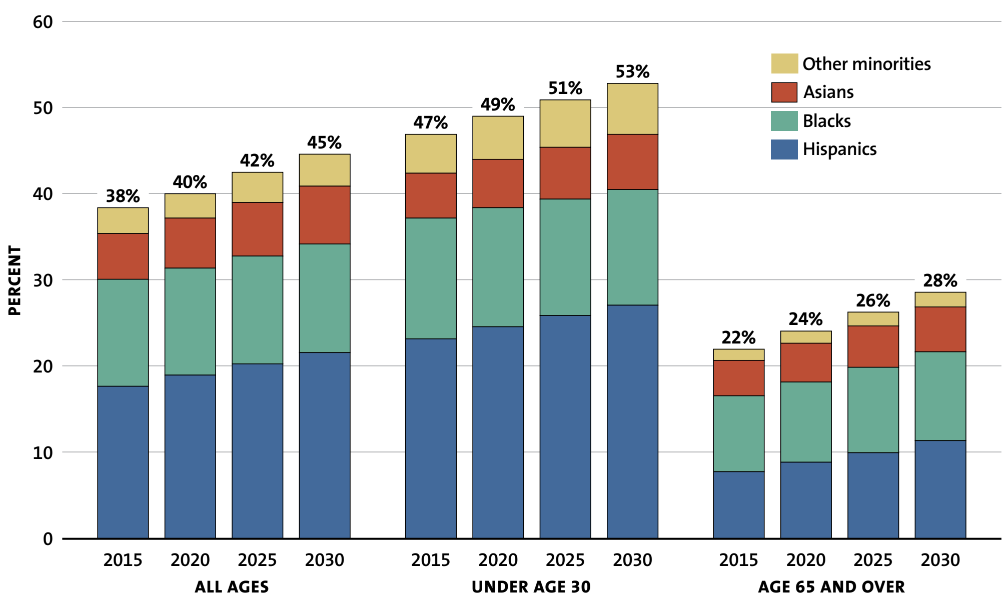
BILL FREY is a senior fellow at both the Milken Institute and the Brookings Institution, and author of *Diversity Explosion: How New Racial Demographics Are Remaking America*.

WHERE WE ARE, 2015

MINORITY PERCENTAGE SHARES OF STATE POPULATIONS.



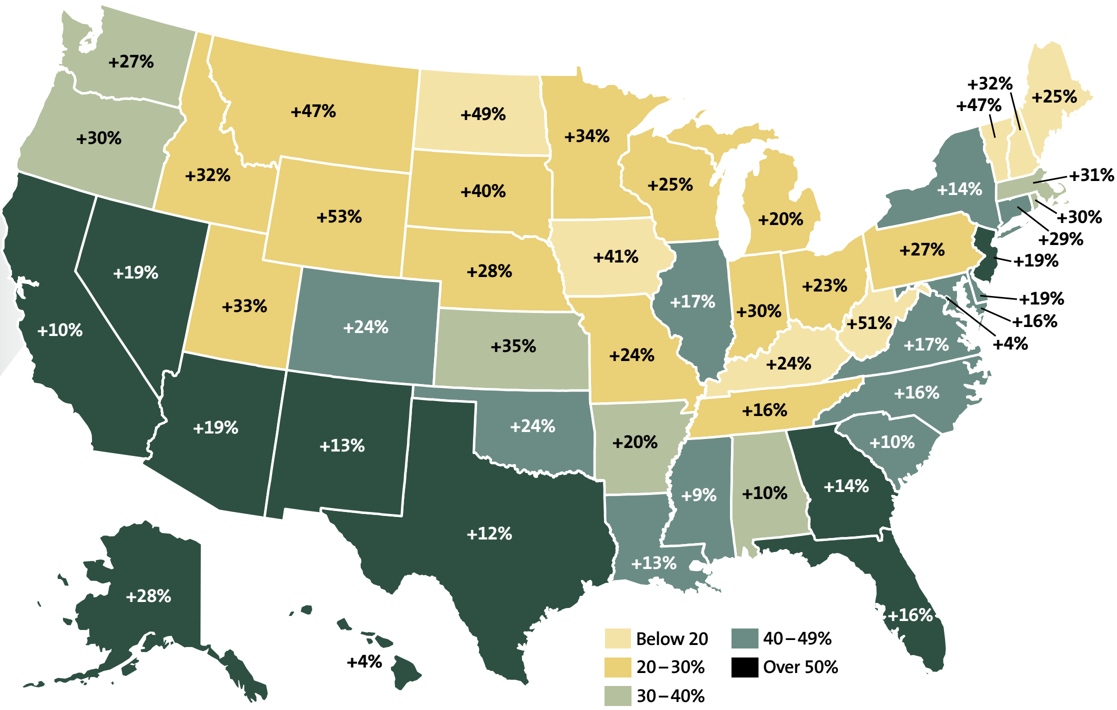
PERCENT MINORITY FOR YEARS 2015-2030



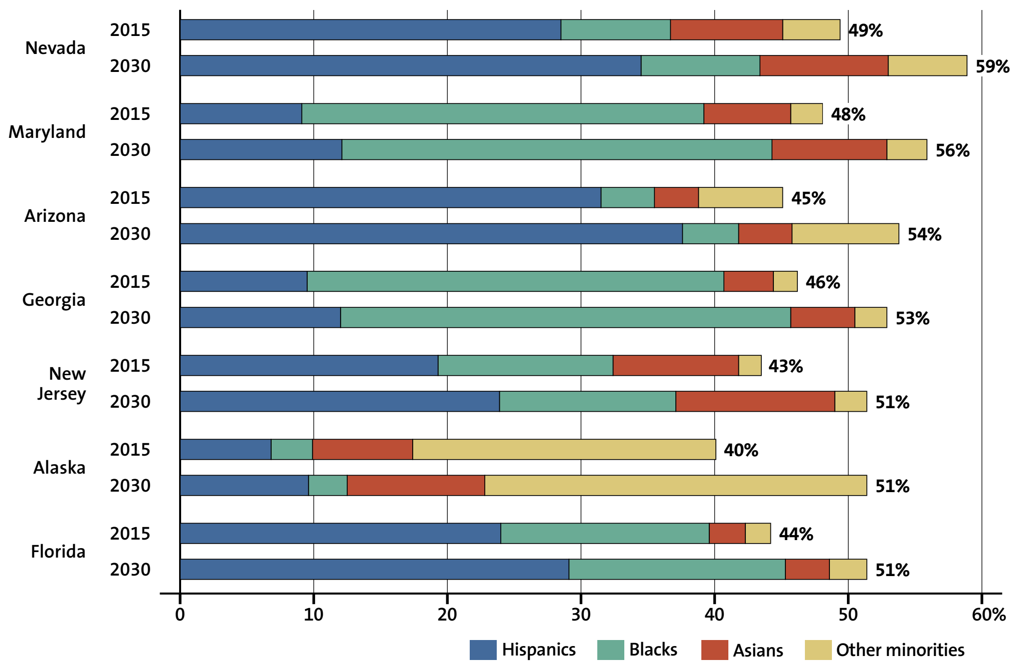
SOURCE: US Census Bureau Population Projections, released December 2014; and the States of Change: Demograhics and Democracy Project, a joint effort of scholars at the American Enterprise Institute, Brookings Institution and Center for American Progress

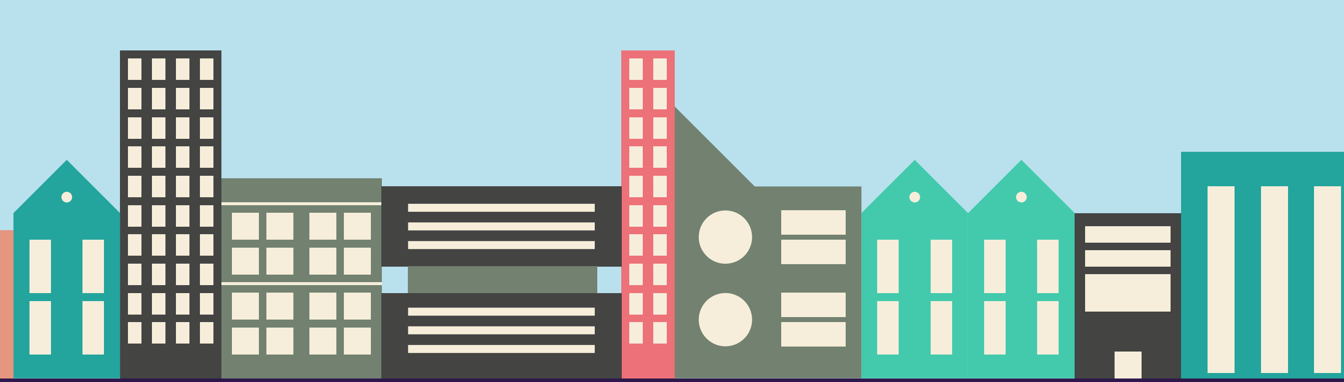
WHERE WE'RE HEADED, 2030

MINORITY PERCENTAGE SHARES OF STATE POPULATIONS AND RATES OF CHANGE



STATES THAT TIP TO MAJORITY MINORITY BETWEEN 2015 AND 2030



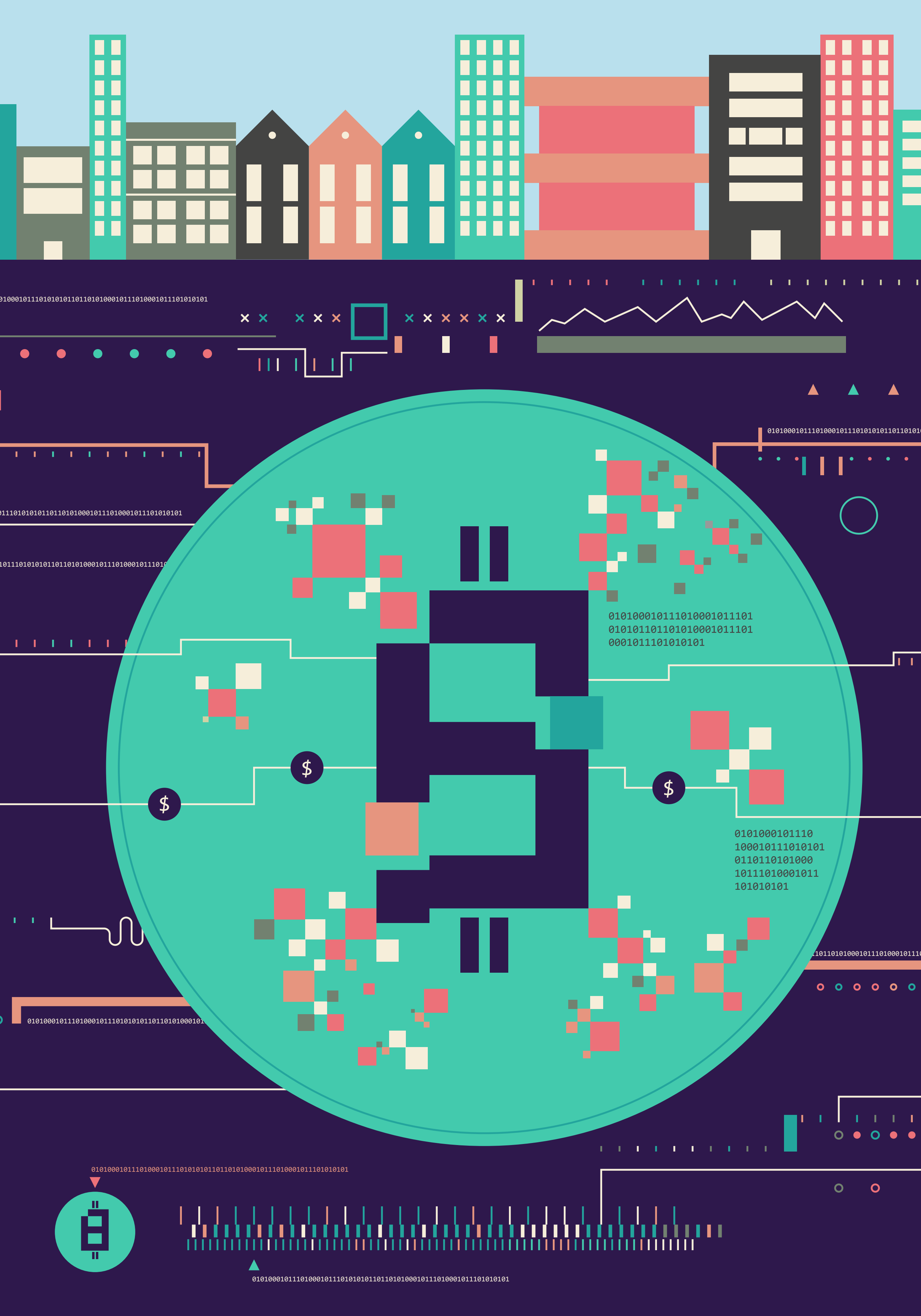


Bitcoin

- Currency for paranoiacs
- An idea that will change the world

BY STACI WARDEN

Bitcoin's emergence in the zeitgeist began in a quiet corner of Europe in March 2013. Reeling from a banking crisis, the Government of Cyprus did the unthinkable for a Eurozone economy: it imposed a two-week holiday on domestic banks, levied a 10 percent tax on uninsured deposits and imposed strict capital controls. With that move, Cypriots, as well as their vulnerable neighbors in the Eurozone's southern periphery, came to realize that no government can be fully trusted to honor the savings of ordinary people.



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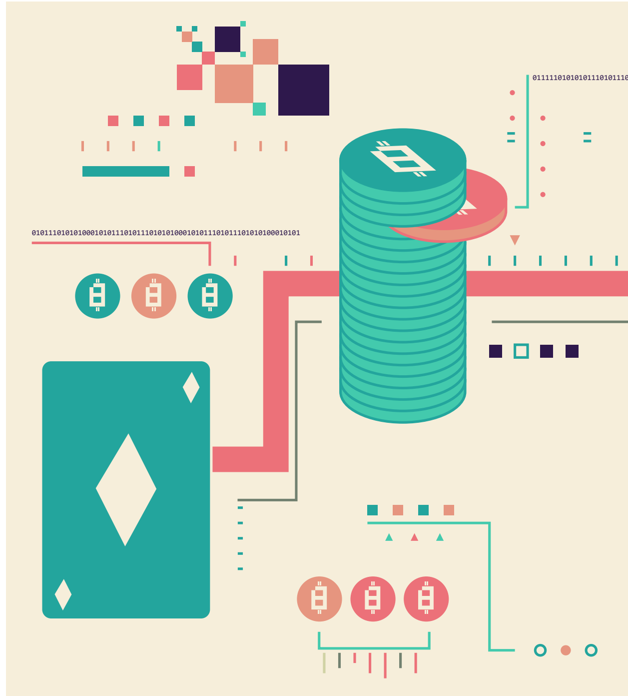
In response, the most wary investors around the world turned to bitcoin and began buying the virtual currency. Its price rose eight-fold and the value of all bitcoin in circulation topped $1 billion for the first time. (Grammarians take note: going forward, we'll use "bitcoin" to refer to the unit of currency itself and "Bitcoin" to mean the concept behind the currency.)

Today, Bitcoin's main features are well-known even to casual followers of the phenomenon:

- It is virtual – there are no actual coins.
- Bitcoin allows you to buy and sell things without revealing your personal identity.
- Your holdings can't be inflated away by government policy (but they can certainly change in value).
- Your money can't easily be confiscated.

Anarchists, libertarians and tech-savvy criminals may have spotted Bitcoin's advantages first. Bitcoin was used to fund Wikileaks when it was cut off by traditional payment processors after the Julian Assange affair. But the currency's ongoing popularity has been driven in part by regular people living in countries in which financial repression is the norm.

Chinese savers, for example, discovered Bitcoin's potential early on. No doubt driven by the opportunity to escape negative real returns on their deposits at state-owned banks and restrictions on hard-currency transactions, Chinese participation fed the virtual currency's meteoric rise throughout 2013. Today, despite a severe government crackdown, 80 percent of all bitcoin exchange transactions are into or out of the Chinese renminbi.

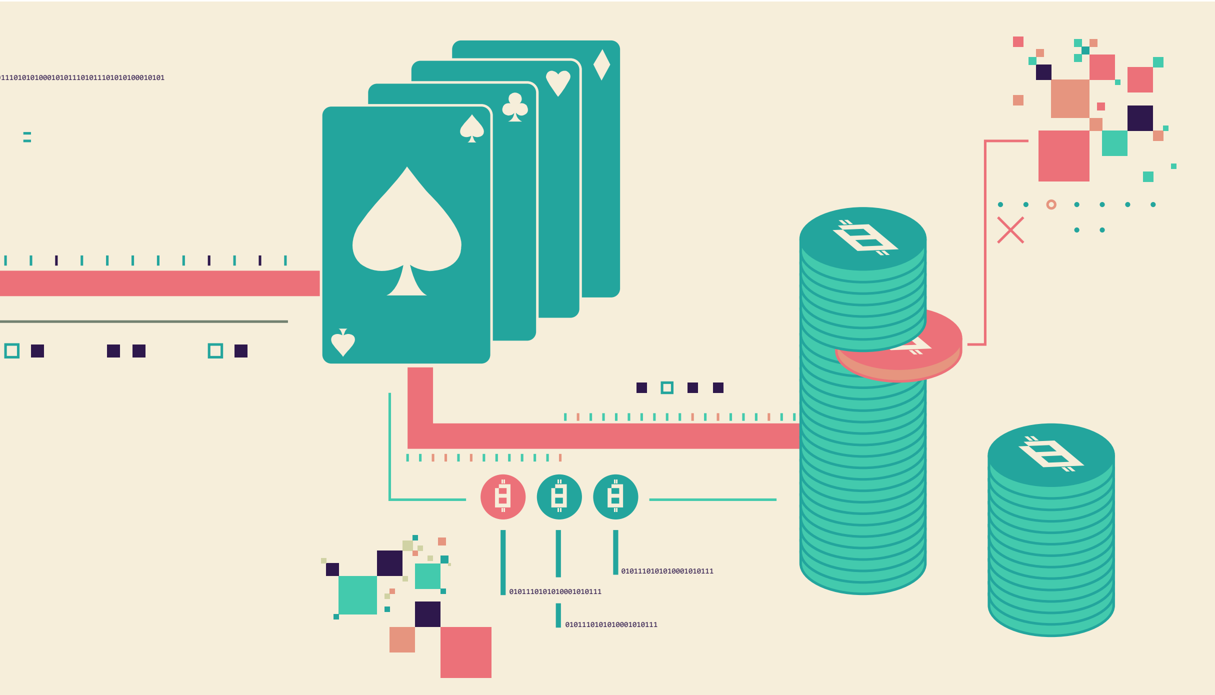


In Argentina, where the peso trades at a deep discount to official rates in the black market and the government levies a 35 percent tax on foreign-currency credit card purchases, bitcoin activity far exceeds that of any other country in Latin America. Back in Europe, bitcoin transaction volume has tracked the euro crisis. The day of the Greek referendum on the European austerity package in July, bitcoin's price rose to a four-month high.

Bitcoin advocates argue that the virtual currency can bring freedom to those living under repressive systems of all kinds, be they political dissidents or women trying to keep earnings out of the hands of husbands or brothers. By the same token, advocates argue, Bitcoin can have a profound social effect by opening the door to the financially marginalized. Some two billion people still operate outside of the formal global financial system. But anybody with a mobile phone can use bitcoin, and these days, a remarkably large number are connected wirelessly. In Africa, for example, two out of three people have mobile

PREVIOUS PAGE AND THIS PAGE: ERIC FROMMELT

STACI WARDEN, a former banker at JPMorgan Chase, is the executive director of the Center for Financial Markets at the Milken Institute and chair of the Rwandan Capital Markets Authority.



You need a pretty strong stomach to hang onto an asset that has seen daily price volatility of 35 percent on more than one occasion.

phone subscriptions, while just 20 percent have bank accounts.

That said, Bitcoin's core value proposition as a substitute for regular currencies is, frankly, questionable. Critics of Bitcoin – and they are numerous – emphasize, first, that unlike "fiat" currencies issued by governments, a bitcoin has no inherent value. The U.S. dollar, as legal tender, can, most importantly, be used to pay taxes, and because of that fact, be thought of as a claim on the U.S. government that is backed by the productive capacity of the nation as a whole. Bitcoin, by contrast, has value purely from the collective will to accept it as payment. And, despite Bitcoin's steady growth in popularity, the community of believers remains small. At the peak, the value of all bitcoins – its total market capitalization – was about equal to the market cap of the stock market in Slovenia.

Moreover, bitcoin's roller-coaster volatility undermines its potential as a store of value. You need a pretty strong stomach to hang onto an asset that has seen daily price volatility of 35 percent on more than one occasion. Anybody who bought bitcoin at its 2014 high of $1,250 has seen 80 percent of that wealth go up in smoke.

Even as a medium of exchange, Bitcoin's convenience factor is fighting the headwinds of a revolution in hard-currency payment technologies, from ApplePay in the United States to WeChat in China to MPesa in Kenya. And last year's IRS ruling that bitcoin is property, not currency, doesn't help. This designation means that capital gains taxes must be calculated (by the law-abiding, anyway) each time bitcoin is used to make a purchase.

More fundamentally, many economists – among them, Paul Krugman – argue that Bitcoin's mechanism for determining the money supply encourages hoarding that not only creates severe wealth inequalities favoring early adopters, but undermines Bitcoin's potential as a medium of exchange. It's true that an outsized amount of bitcoin is, in fact, held for speculative purposes, and the high-profile merchants who have chosen to accept it in payment (Overstock.com, Expedia, Dell) have yet to see the transaction volumes they expected.

Yet, despite these weaknesses – not to mention the Silk Road arrests, the high-profile blowup of Mt. Gox (the once-dominant bitcoin exchange that lost the equivalent of $500 million to hackers), and the wary approach of regulators – the venture capital industry is on track to invest $1 billion this year in the Bitcoin ecosystem. Venture capital is pouring into everything from exchange houses to merchant services to investment funds to retail offerings. In fact, Bitcoin-related businesses and nascent competitors handling other virtual currencies are multiplying so rapidly that it's extremely difficult to keep abreast of them.

SO, WHAT'S THE BIG DEAL?

Actually, Bitcoin's core value proposition is not convenience or even anonymity; it's more fundamental. Satoshi Nakamoto, Bitcoin's elusive creator, explained it in a post on a crypto-currency blog in 2009:

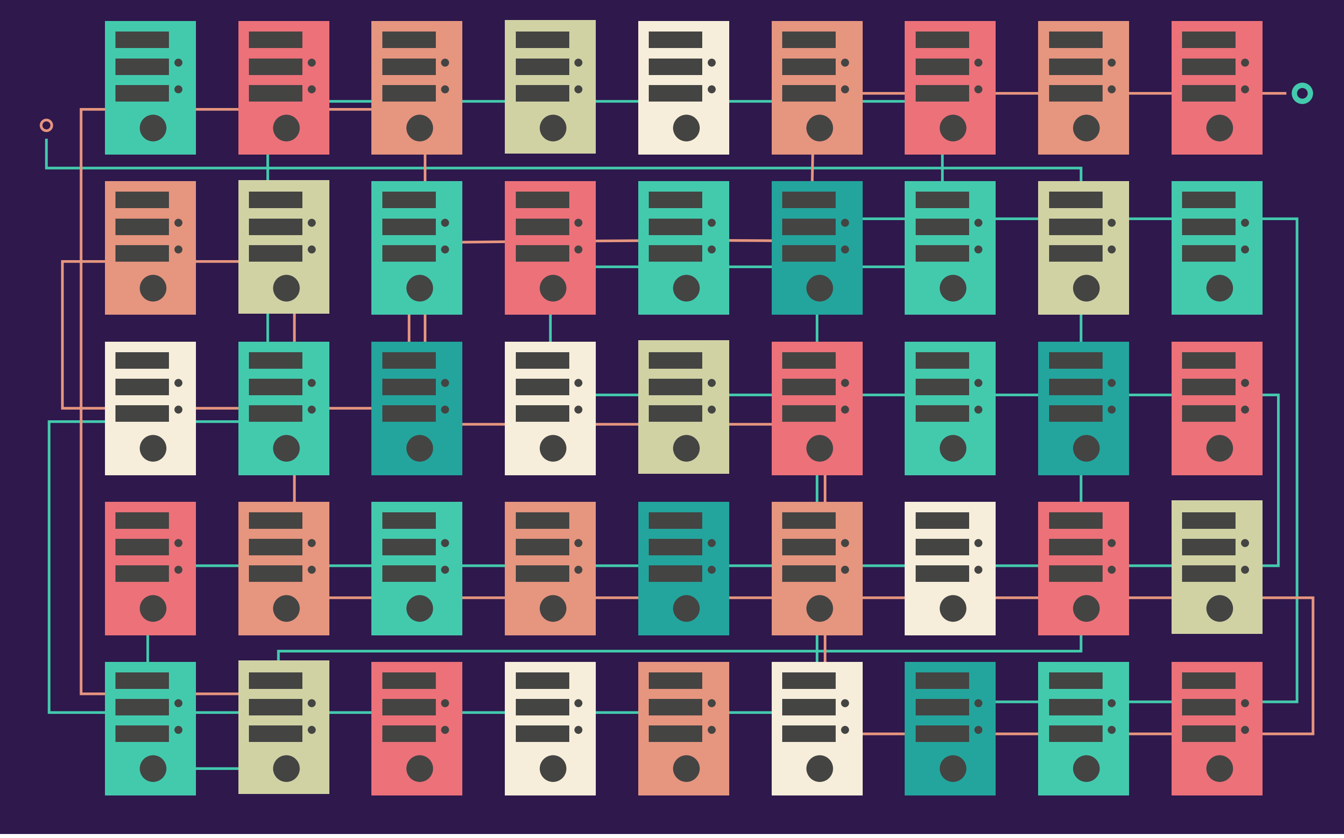
> The root problem with conventional currency is all the trust that's required to make it work. The central bank must be trusted not to debase the currency, but the history of fiat currencies is full of breaches of that trust. Banks must be trusted to hold our money and transfer it electronically, but they lend it out in waves of credit bubbles with barely a fraction in reserve. We have to trust them with our privacy, trust them not to let identity thieves drain our accounts. … With e-currency based on cryptographic proof, without the need to trust a third-party middleman, money can be secure and transactions effortless.

His point was not just that trust is often abused, but that the need for trust itself makes for an inefficient and costly system of exchange. Because people don't trust one another, they need banks to make payments, brokers to transfer securities, lawyers to write contracts and courts to settle disputes. But these middlemen extract fees for these services, and these fees add up to gigantic sums. Gil Luria at Wedbush Securities estimates that trust-based service provision in the United States accounts for about 21 percent (no misprint) of GDP.

If a currency system could eliminate the need for trusted intermediaries, the ramifications would be enormous. The $260 billion that merchants paid in card fees in 2013 would be up for grabs. A global remittance system that functioned without intermediaries would save an estimated $30 billion for some of the world's poorest people. Moreover, the savings would go beyond money. The identities of shoppers would be protected from data breaches at their credit card companies – or, for that matter, at Target or Home Depot.

THE BITCOIN REVOLUTION

On October 31, 2008, one month after the collapse of Lehman Brothers – no coincidence, surely – Satoshi Nakamoto (a pseudonym for an individual or group) posted a nine-page paper to the Cypherpunk mailing list explaining an electronic cash system that



If a virtual currency is to live on thousands of independent computers instead of on one in-house system, somehow all those computers need to be in constant collective agreement about who owns what, without having to trust one another.

did not require trust. Not in government, not in the banking system, not in credit card companies, not between buyers and sellers. And with that paper, he (she? they?) ushered in the world's first popular virtual currency.

The problem Satosho Nakamoto solved is not trivial. In order to eliminate the need for trust from a financial exchange system:

- Changes in the money supply need to be rule-based, not discretionary.
- Transactions need to be irreversible after a very short period to eliminate the risk of disputed charges.
- The historical record of all transactions needs to be publicly available and thus broadly verifiable.
- The ledger of credits and debits needs to reside "nowhere and everywhere" so that it can't be shut down.
- Most important, the system needs to eliminate any form of centralized authority that makes rules or enforces them.

It's that last part that's really hard. Not technically hard, mind you; decentralization can be achieved with any old peer-to-peer network. And, in fact, both the idea and the core requirements for a decentralized virtual currency – the Internet, databases shared across multiple computer networks, and the public/private key cryptography that enables secure payments – have been around since the 1990s. What's hard about eliminating centralized authorities is that centralized authorities decide things, and, in particular, they

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decide the validity of alleged transactions. If a virtual currency is to live on thousands of independent computers instead of on one in-house system, somehow all those computers need to be in constant collective agreement about who owns what, without having to trust one another, and without any one of them having the authority to lay down the law.

Financial institutions have put in place a lot of sophisticated processes to determine who owns what. But as a general rule, winners in what amount to competing transactions are determined on a first-come-first-served basis. If I have $100 in my bank account and I try to make two payments of $100, my bank will cash the first one it receives and bounce the second. But what if there were no bank? What would stop me from spending the same $100 twice?

In the Bitcoin system, payment transactions are blasted out electronically to all the nodes (computers) in the network, first for verification and then to be added to the collective ledger that stipulates ownership. That's not quite an answer, though. What if I try to spend money I don't have by making two payments in rapid succession (all I have to do, after all, is press a button twice)? What if some computers pick up my first transaction and invalidate the second, but other computers pick up the second transaction and invalidate the first? How could an authoritative record possibly establish that only one of those payments is valid, and how could it do so in such a way that thousands of independent entities would never question that decision, now or in the future?

What Satoshi Nakamoto did was to solve this "double payments" problem. In tech-speak, he created a decentralized database where the order of transactions is agreed upon by everybody. As Richard Brown, who has the job moniker Executive Architect for Banking Innovation in the UK at IBM enthused in an interview in 2013:

> Even five years ago, I would have told you that Bitcoin's core architecture was impossible. You could never solve the problem of coming to a global consensus without trust. But now it's here.

Because Satoshi Nakamoto solved this problem, he (I'm going to stick with the convention) belongs in the pantheon of technology geniuses. But here's the kicker: because he solved this problem, Bitcoin's potential as a paradigm-shifting operating system far outshadows its realistic potential as a substitute for global currencies.

HOW BITCOIN WORKS

As noted, Bitcoin is just a very broadly shared public ledger of credits and debits that records ownership, with the security of payments guaranteed by the use of private/public cryptographic key technology. A user sets up one or more public addresses to receive bitcoin, and can spend that bitcoin if she has the private key to prove the address belongs to her. Back in the day, users would download the entire Bitcoin ledger to their computers and store their private keys on their hard drives. Today, an entire industry exists to make accessing Bitcoin easy for everyday users. Bitcoin exchanges such as Coinbase will store your private key for you and issue you a password-protected "wallet" so that you can access your money. The downside: many also require you to provide personal details.

Now comes the truly nerdy part. Transactions, once made, are blasted out to the Bitcoin network, and every 10 minutes there is a contest among nodes of the network to see who can be the first to add the newest block of transactions to the Bitcoin ledger. (This is why the technology is called a blockchain.)

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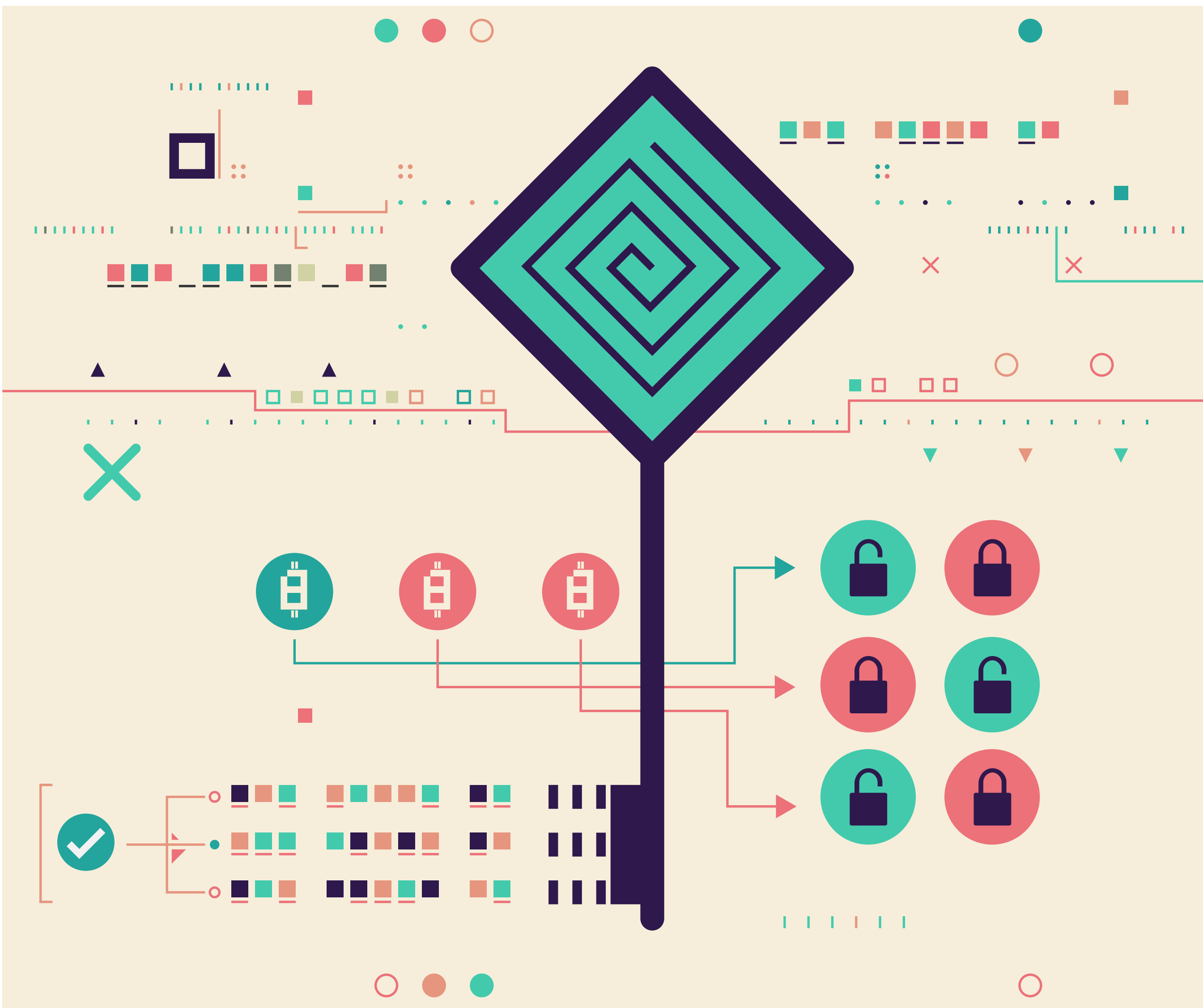
Each node scoops up as many transactions as it can, adds a time stamp, a "pay me if I win the contest" line, and a reference to the previous block in the ledger. It then hashes this all together in a series of cryptographic functions using what is known as a Merkle tree. (Don't ask.)

The first node to do this publishes its hash to the network, and the other nodes check it by running the same inputs through the same hash function. If they get an identical result, they validate the block and it is appended to the ledger. The winning node is then paid in bitcoin. When bitcoin launched, miners were paid 50 bitcoin for appending blocks. That payment is cut by half every four years until all 21 million bitcoins are mined (expected by 2140). Miners are now paid 25 bitcoin, the fixed rate until 2016.

This process of verifying transactions and racing to see who can append them first is called "mining" bitcoin, a term no doubt used to evoke gold mining. This analogy is not, strictly speaking, correct, however, because unlike in gold mining, an increase in bitcoin mining effort does not bring a commensurate increase in the bitcoin supply (which, as noted above, is limited to 21 million).

Bitcoin uses the SHA-256 cryptographic hash function. As you'd expect from any self-respecting cryptographic function, it takes all this transaction information and turns it into



complete gobbledygook. In the case of SHA-256, the gobbledygook is always 64 characters long. In fact, you could run "Hello, world!" or the entirety of *War and Peace* through SHA-256, and in both cases you would get 64 characters of nonsense. The input information is protected because it's impossible to figure out the original content by looking at the resulting hash value. But if I choose to tell you that

You could run "Hello, world!" or the entirety of *War and Peace* through SHA-256...

the output of my hash function is *War and Peace*, you can easily check if I'm telling the truth by getting the book and running it through the hash function yourself. If I am, you will get exactly the same output.

Actually, it's no big deal to run a cryptographic hash function. This is important for minimizing the effort required of other nodes to check the winner's work, but it is problematic for running the contest in the first place. It's just too easy to win. And if it's too easy to win, there will be multiple winners. If I try to make a double payment, the node that picks up my first transaction and the node that picks up my second transaction could both win. This would cause a fork in the chain, and when it came to validating the work, some nodes would validate the first fork and some the second. In an easy contest there would be multiple forks with each block, and very soon we would have complete chaos.

Satoshi Nakamoto's solution to this problem was to make the contest extremely difficult. According to the Bitcoin protocol, the contest should last 10 minutes. So, if the computers get faster and they start solving the cryptographic problem in less than 10 minutes, then the problem is recalibrated to make it harder.

Nakamoto's theory was that, if in order to earn the right to append the next block to the blockchain (and thus earn bitcoin) each node would have to undertake significant effort, the likelihood of ending up with just one winner would be markedly increased. And if there was just one winner, it wouldn't matter how many duplicate payments were sent out. Each node individually knows how to reject

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duplicates and only one node would win the contest. One of my payments would be appended, and the rest would be thrown away.

To make the contest hard, he borrowed a trick that is used to protect email servers against incoming spam. He requires a "proof of work," determined by CPU usage (computer power). In the Bitcoin protocol, the proof of work is this: not only do miners have to create a cryptographic hash value out of all these transactions, but the hash value must be small. That is, it has to start with a certain number of zeros. If the hash value a miner gets after scooping up 10 minutes' worth of transactions isn't small enough, it has to keep adding *something else* to the mix to try to shrink it. Basically, it keeps adding different random numbers, over and over again, until it comes upon one (by luck) that gives it a small enough hash value.

It's not conceptually or technically difficult to find a really small hash value, but it can take a lot of computing power. Nor is it impossible that there will be two simultaneous winners, and thus a fork in the ledger. The beauty of the Bitcoin protocol, though, is that this problem does not endure. In the next round, the new winning miner will simply append its block to one of the forks (it doesn't matter which one) making that fork the longer of the two (or, more accurately, the fork that contains the most amount of work). In the round after that, the miners, by agreement, append to the fork that contains the most work. So after a couple of rounds at most, the runt fork is completely ignored and all the unconfirmed transactions go back in the pool to be picked up later.

and in both cases you would get 64 characters of nonsense.

All of them, that is, except my other, fraudulent, payment. That one is rejected because all nodes on the network can see that those bitcoin have already been spent in a transaction with an earlier time stamp (because it was picked up in a previous block). With every block added, previous blocks become exponentially more secure, so that tampering with the ledger becomes impossible. Even the most prudent users of Bitcoin maintain that

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after an hour (six blocks), bitcoin payments can be reliably said to be irreversible.

Got all that? If you didn't, remember the bottom line: no central referee is settling these disputes. It's just that the rules are clear and everybody has a potent incentive to follow them.

The elegant thing about Satoshi Nakamoto's system is that, by doing this work to verify transactions, Bitcoin miners are maintaining the integrity of the ledger itself. And in return for this maintenance work, they are paid in bitcoin that become part of the bitcoin money supply the way Federal Reserve deposits in private banks become part of the supply of dollars. The contest is fair because every 10 minutes all miners have an equal shot at winning, but the winner is most likely to be the miner that has exerted the most effort in terms of computer processing.

CRITICISMS AND COPYCATS

As a result of Bitcoin's unique incentives to encourage mining, miners worldwide are locked into an ever-escalating arms race of computing power to solve hash functions and win bitcoin. Once the domain of amateur enthusiasts, Bitcoin mining is now a big business requiring expensive, highly specialized equipment. The numbers are mind-boggling. The average hash rate at the time of this writing is 400 million gigahashes per second (a gigahash is a billion hashes!). The total electricity consumption by Bitcoin miners has reached an estimated 1.46 billion kilowatt-hours per year. This is roughly enough electricity to power a small American city.

To keep energy costs low, many Bitcoin miners locate where coal is cheap, or in places with geothermal sources of energy, like Iceland. Critics denounce both the energy wasted and the geopolitical risks associated with the many locations where energy is subsidized (two-thirds of miners are located in China and another 20 percent are in parts unknown). Supporters counter that the energy efficiency of mining is on the rise – and in any case, the energy used to power the Bitcoin ecosystem should be compared to the energy requirements for running the various components of the global banking system.

At any rate, the race continues, and might be on the edge of transformation into a different sort of contest. For example, the tech startup 21 Inc., while extremely secretive about its business plan, made big headlines in Bitcoinland recently by raising a staggering $116 million in pre-launch VC funding. 21 Inc. has released only two tweets in its short corporate history. But the first one reads, "A bitcoin miner in every device and in every hand."

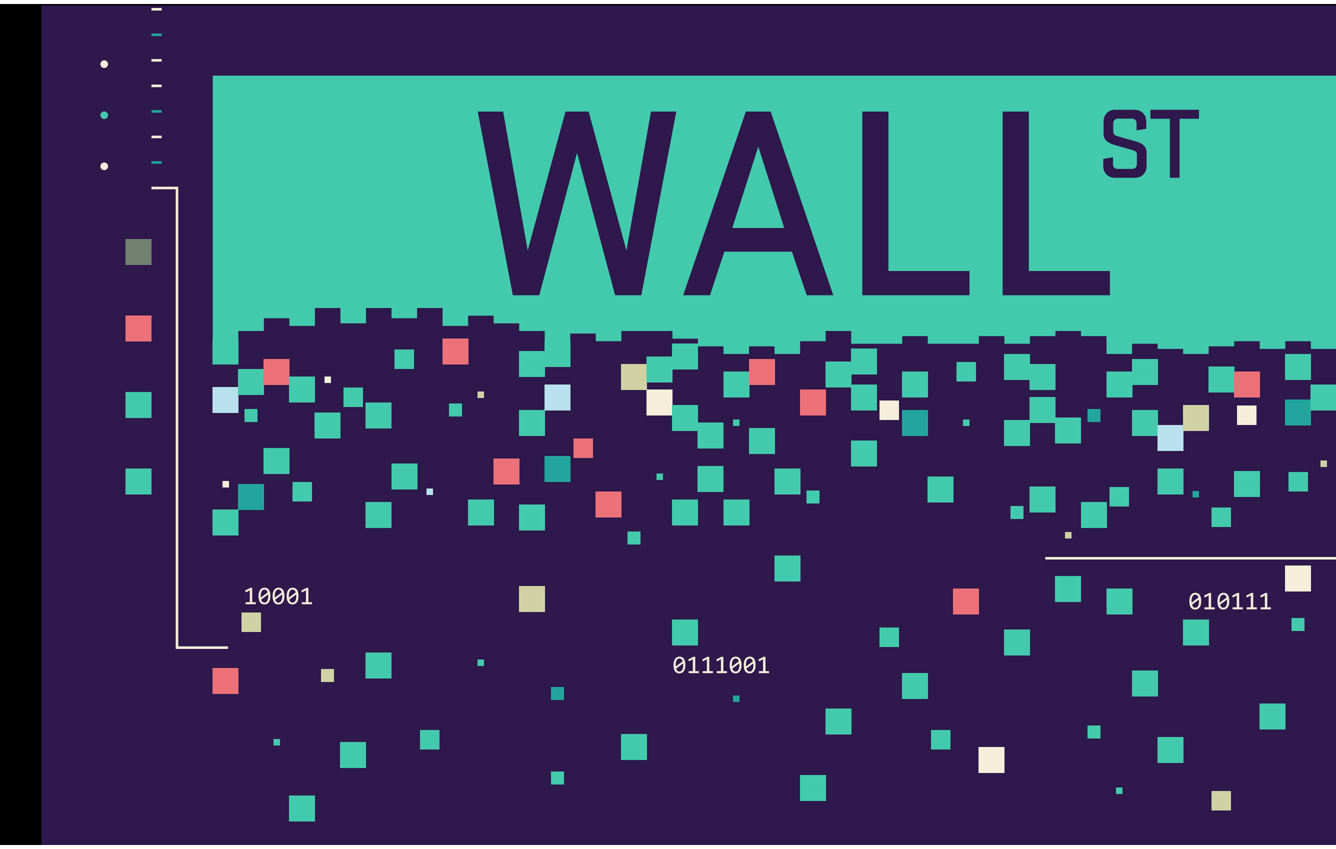
Critics including Kevin Dowd and Martin Hutchinson note that, because each miner ignores the social costs it imposes on the system

The total electricity consumption by Bitcoin miners has reached an estimated 1.46 billion kilowatt-hours per year—roughly enough electricity to power a small American city.

(the arms race) and because there are no social benefits to that arms race (the total bitcoin supply is fixed), the Bitcoin system is subject to economies of scale that will inevitably lead to consolidation. And if a node or group of nodes were to eventually amass a majority of the total computing power, it could control the system, perhaps for nefarious purposes.

The possibility of a "51 percent attack" is the most discussed potential weakness of the Bitcoin protocol, and the Ghash.io mining pool did, in fact, amass 51 percent of the computing power for a few hours in 2014. Several members immediately left the pool, though, in order to reduce its size, and its CEO quickly stated, "We never have and never will participate in any 51 percent attack." Great, but still, doesn't that inject the need for trust into a system that is supposed to operate perfectly without trust?

Much the way the floodgates opened to new runners in the wake of Roger Bannister's shattering of the four-minute mile back in 1954, hundreds of "alt-coins" have now been developed. The idea is to try to improve in some way on the core Bitcoin protocol. Some of the most interesting are Litecoin (which has a proof-of-work script that limits hashes per second to conserve mining energy), Peercoin (which has a "proof of stake" to reward miners for owning Peercoin), Dogecoin (fun, philanthropic and introduces controlled inflation to



Why bother with financial services at all? A company that wants to make an initial public offering of securities, for example, could simply issue its own shares and then sell those shares directly through the blockchain.

discourage hoarding), Freicoin (which has a holding tax to discourage hoarding), Darkcoin and Zerocoin (which make the "audit trail" even more difficult), and Primecoin (which makes the proof-of-work a search for prime numbers, thus making mining scientifically useful).

The most successful variant on Bitcoin, the Ripple protocol, is a decentralized system of nodes that already trust one another, so that group verification is less costly. But Ripple is mostly trying to work within the established banking system, not necessarily to compete with it.

THE POWER OF THE BLOCKCHAIN

One bitcoin is divisible into a hundred million units, thereby enabling extremely small micropayments (0.00000001 BTC is called – you guessed it – a Satoshi). As a result, a whole new world can be opened up to charge for things currently priced at zero that would be more efficiently allocated at very low prices. For example, micropayments can be charged for

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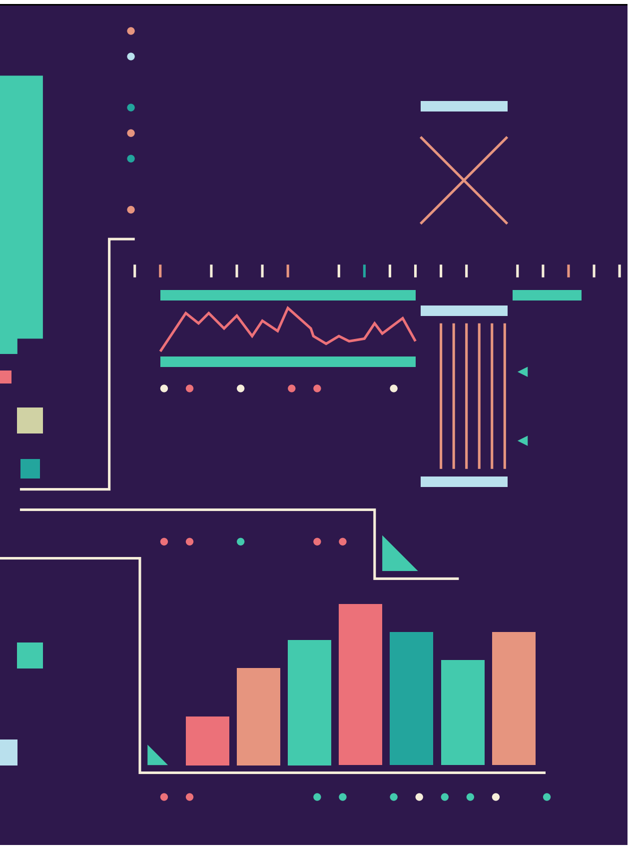


things like webpage or blog views. And, these payments can be automated on the blockchain. So, for example, a coffee shop could automatically start charging by the minute (or, for that matter, by the second) for wifi usage as soon as you sat down with your latte.

But, amazingly, micro-units of bitcoin can be used for entirely different purposes, as vessels for transferring and recording ownership of digital property of all kinds. For example, the owner of a given bitcoin could assert that it now represents something else in addition to the bitcoin itself – say, title to 100 shares of Apple stock, an ounce of gold, or a house the bitcoin owner possessed – and then use the same blockchain technology to register and/or transfer ownership of that asset at extremely low cost in a way that can't be tampered with or reversed. As Marc Andreessen, one of Silicon Valley's most successful venture capitalists, put it:

> Bitcoin gives us, for the first time, a way for one Internet user to transfer a unique piece of digital property to another Internet user, such that the transfer is guaranteed to be safe and secure, everyone knows that the transfer has taken place, and nobody can challenge the legitimacy of the transfer. The consequences of this breakthrough are hard to overstate.

Imagine the possibilities. For starters, any institution that confers ownership, transfers ownership and settles disputes about ownership is in some ways up for grabs. Land registries keep track of titles, custodians keep track of securities and the phone company allocates telephone numbers. On the blockchain, all of these central authorities can be avoided because the job of record-keeping can be done on a decentralized basis. The blockchain effectively crowdsources the validation of ownership and transfer.

Today, trade and post-trade processes (matching, clearing, collateral management, settlement, custody, etc.) require a complex offsetting of credits and debits across multiple balance sheets, subject to multiple access rules, with giant sums to be reconciled at the end of each day. But these agreements and obligations among firms could be recorded on a shared ledger at the industry level. Research by Santander Innoventures estimates that the banking sector could save $15-20 billion by 2022 using a decentralized ledger technology. Blockchain technology would enable direct (and irreversible) settlement, moving settlement times from two days in many cases to milliseconds. Financial institutions are beginning to pour money into these ideas. Indeed, Nasdaq is planning to open a business that will issue or transfer securities using blockchain technology by the end of 2015.

But why bother with financial services at all? A company that wants to make an initial public offering of securities, for example, could simply issue its own shares and then sell those shares directly through the blockchain. A bitcoin in this case could equal, say, 100 shares of stock, and all the rights (dividends, voting) would transfer automatically with it. Going forward, the company would then use the blockchain to track any changes in ownership and pay dividends to the public addresses showing ownership on that date. It would not even need to know the identities of its shareholders (though there is speculation that the SEC might insist). It could issue debt in the same way.

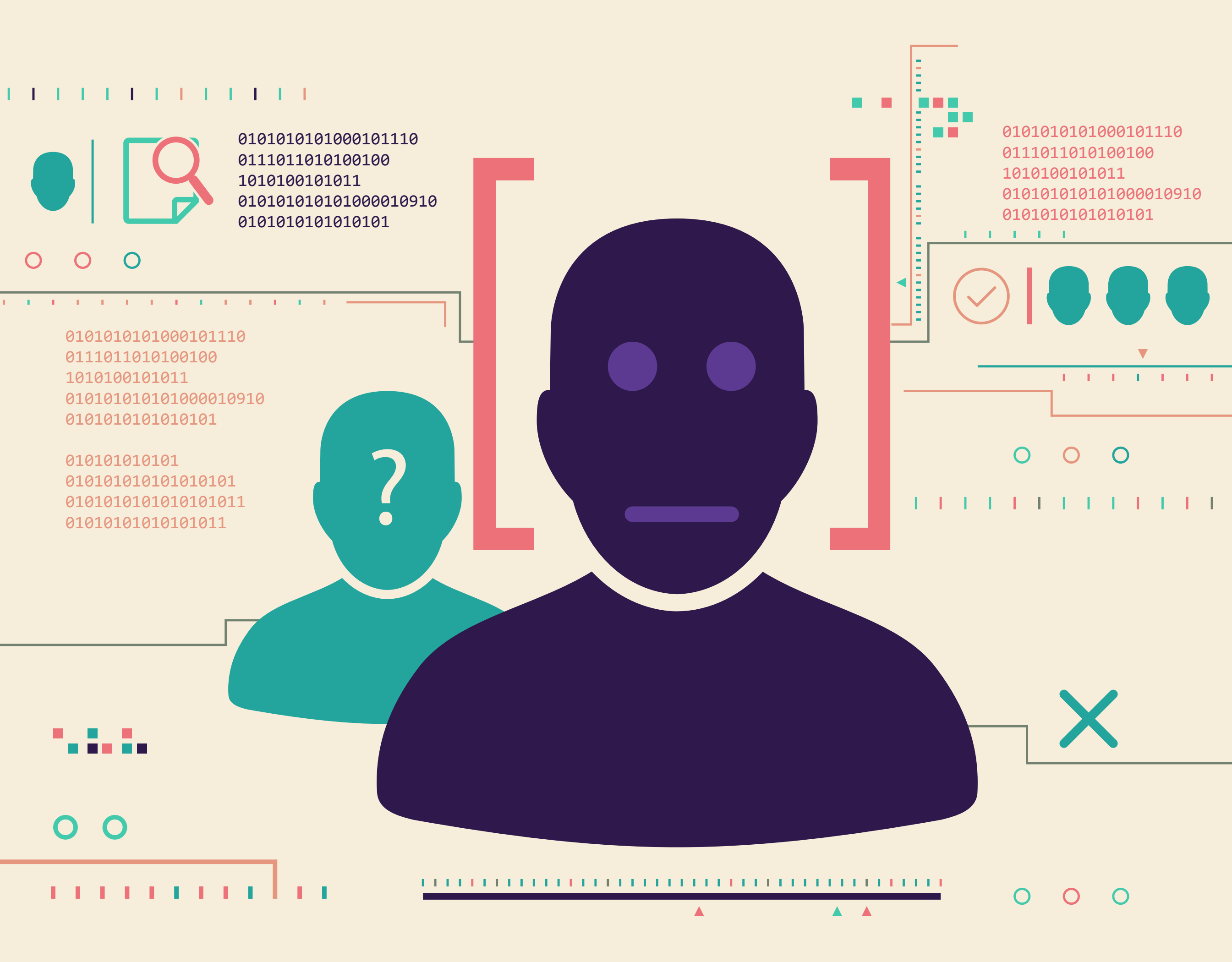
Another possibility, "forward auditing," has lots of interesting potential uses. Philanthropists donating bitcoin, for example, could verify that the recipient charity spent the funds in accordance with agreed terms. Because forward auditing provides important clues to a person's spending patterns and therefore identity, Bitcoin is considered, strictly speaking, to be pseudonymous rather than anonymous. The FBI was able to track down the ringleader of the Silk Road illicit drug marketplace with some heavy-duty blockchain sleuthing (and subpoenaing). The difference between anonymity and pseudonymity has never been lost on the Bitcoin enthusiasts who closely monitor the nearly one million bitcoin thought to be mined by Satoshi Nakomoto in the early days for clues to his whereabouts and identity. Alas, not one of these bitcoins has ever been spent.

Because the blockchain contains a certain and verifiable record of every bitcoin transaction, it could also be useful in verifying an object's provenance and legitimizing ownership, in, say, the art world or for secondary sales of entertainment tickets. In both cases, the blockchain would independently verify that the seller owned and had the right to sell the item in question. In the same way, the transfer of copyright through the blockchain could help avoid intellectual property violation. Most importantly, perhaps, there is an estimated $10 trillion in undocumented assets in developing countries that could be pseudonymously collateralized for credit, if property title could be established, verified and secured.

Because forward auditing provides important clues to a person's spending patterns and therefore identity, Bitcoin is considered, strictly speaking, to be pseudonymous rather than anonymous.

Interestingly, some institutions that are inherently untrustworthy already see the blockchain as a way to tie their own hands in order to instill trust. Start-up software developers speak of using blockchain technology as a way to precommit to delivering service forever (even if they go out of business) because the protocol runs autonomously, once unleashed. Voting is another oft-cited example. To clearly demonstrate a fair voting process, a voting registry could distribute a wallet and a private key to each registered voter. Voters would then "send" their votes to wallets that candidates held in their names. An up-to-the-minute accurate, tamper-proof vote count could be maintained, while still assuring voter anonymity.

One of the earliest and most ingenious ex-



amples of hand-tying was Satoshi Dice. In gambling, one never can be 100 percent certain that the dealer isn't fixing the game. The risk is compounded in online gambling, as the random-number generator program that rolls the dice or deals the cards sits on the gambling house's own server. Using the blockchain, Satoshi Dice was able to provide random and verifiable number generation and payout rules. By 2012, Satoshi Dice accounted for half of all bitcoin transfers in volume terms – not because the odds it offered were better than with traditional gambling platforms, but because they were provably fair.

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BLOCKCHAINS AND SMART CONTRACTS

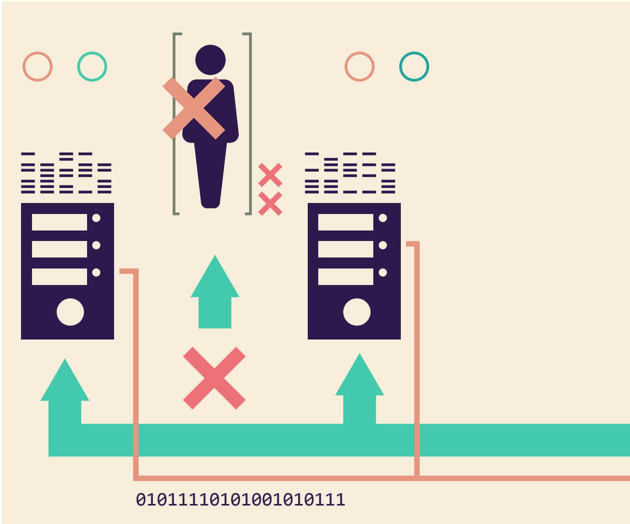
Smart contracts are automated contingency contracts based on "if-then" statements. And because Bitcoin is essentially just computer code, many rules can be written on top of a Bitcoin transaction. One of the most immediately useful is multi-signature authentication. For example, a buyer and seller can stipulate that two private-key signatures are required to make payment on an item that needs to be delivered, and then give a trusted third party the right to one of those signatures. If the item is delivered as expected, the buyer and seller both sign and the payment goes through. But if there is a dispute, the third party provides (or doesn't) the second signature to release the funds. The cost and hassle of formal escrow services are avoided.

In finance, credit default swaps (contracts that pay off when a counterparty defaults on its debt), insurance contracts (that pay off when a state of the world occurs), contracts-for-differences (that pay off based on how the price of an asset relates to a reference price) and assurance contracts (that pay off when pre-agreed funding levels are met) are straightforward examples of if-then contracts that can be designed to self-execute automatically on the blockchain. You could also imagine combining the assurance contracts of crowdfunding platforms such as Kickstarter with equity self-issuance capabilities, so that initial investors could participate in the upside of successful ventures instead of just getting a free tee-shirt.

More broadly, these kinds of automated assurance contracts could turn communities of all kinds into equity holders, potentially becoming an important way to fund public goods. Travellers could fund the construction of a new road, for example, provided funding goals were met.

Things get even weirder when you combine the power of the blockchain with the Internet of Things. For example, you could buy a car on the blockchain (a digital asset representing ownership of the car, really). The car would monitor the blockchain so that it knows when its ownership has been transferred. When you buy it, it updates its ownership information to your public address, and you activate it using your private key to that address.

Of course, you could also buy the car over time. In this case, the car would monitor your monthly payments, and if you skipped one, it would simply transfer itself back to its previous owner and render itself unusable to you. From a financial inclusion perspective this is interesting because people with bad credit histories, or people who live in countries with banking regimes that won't bear the cost of credit assessment, could enter these contracts. As the repo cost is considerably reduced for



sellers, they may be more willing to take on the credit risk. For that matter, they may not even care who you are.

The futurists go further still, pointing out that you don't really need to be a person to get yourself a public address on the blockchain. Any computer that can generate a random number can do that. And this opens up a whole new world of autonomous agents, also referred to as decentralized autonomous corporations (DACs).

Self-running programs have existed for a long time. But on the blockchain they could potentially buy and sell services and enter into contracts without human intervention. A straightforward example is computers trading storage capacity or Internet bandwidth among themselves. In theory, though, your refrigerator could also trade electricity on the spot market with your neighbor's dishwasher. Mike Hearn, one of Bitcoin's core developers, imagines a car that can sell ride services for bitcoin, use its profits to hire humans for upkeep, have children (buy other cars for its fleet) and then sell itself for parts at the end of its useful life. Seriously.

A lot of this is fanciful, perhaps, but Vitalik Buterin, the 21-year-old founder of much-

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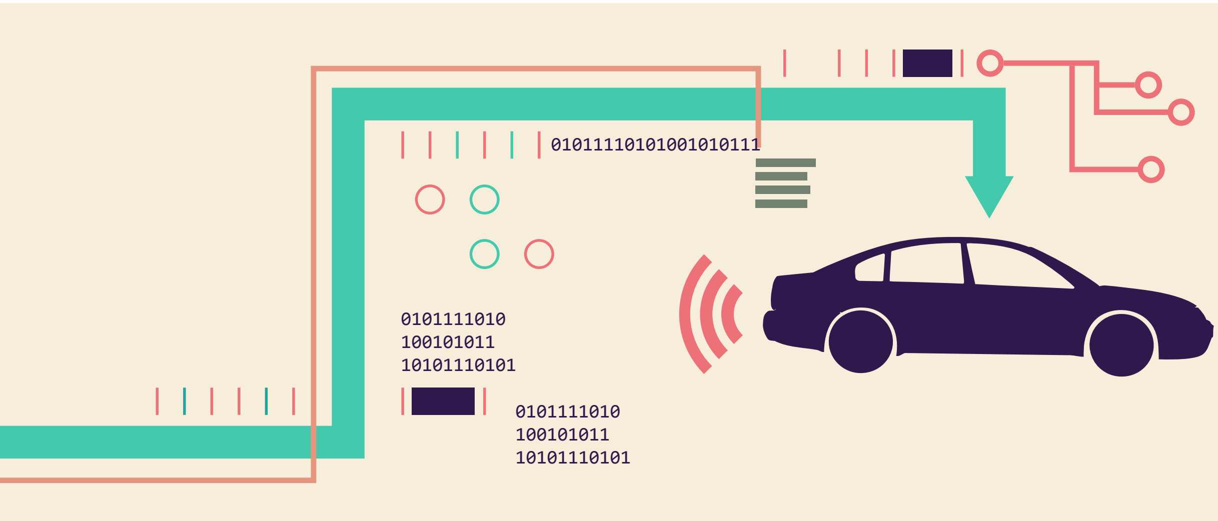

talked-about development platform Etherium, warns:

> If there is a centralized service on the Internet right now, you can bet that it will eventually be replaced by a DAC. Everything from YouTube to Facebook is fair game, and it will be difficult for these centralized institutions to keep up with distributed applications that have little to no overhead.

BEST IDEA SINCE SLICED BREAD?

Most of the above now exists only in the minds of some very clever technologists. But well over a billion dollars in venture and institutional money is being spent on developing applications that either sit on top of the Bitcoin blockchain or build similar decentralized protocols. The Colored Coin protocol (you "color" your coin by declaring that it represents another asset) is the most well known of the former, and Etherium is probably the most exciting example of the latter.

Still, caution is advised. The history of innovation is full of examples of first-mover misfires (witness Marc Andreessen's own Netscape browser venture). And Bitcoin faces formidable challenges as both a store of value and a medium of exchange. It has an outsized environmental footprint and scalability limitations in its current form. It may also have fatal vulnerabilities inherent in its current design, as the recent turmoil over increasing the maximum block size recently demonstrates. The regulatory environment is still uncertain. (And exactly how, by the way, would you regulate that self-owned car?)

Moreover, as the *Financial Times*'s *Alphaville* blog – a reliable critic of everything Bitcoin – points out, the fundamental flaw in the Bitcoin story may be that people actually value real live intermediaries. The whole point of entrusting monetary policy to humans, for example, is that the money supply should not be rule-based, but elastic to changes in aggregate demand. People willingly outsource trust because it's useful to do so.

Only time will tell whether Bitcoin or one of its copycats will become an important global currency, or whether the blockchain will evolve into a truly disruptive core infrastructure. But once you start learning about the blockchain, it's hard not to be awed by the enormity of the problem that Satoshi Nakamoto solved, the elegance with which he solved it, and the possibilities that his solution offers. After all, on the blockchain, nobody knows you're a toaster.

The Scary Debate Over Secular Stagnation

Hiccup... or Endgame?

BY J. BRADFORD DELONG

The first principle of success in practically any endeavor is to move not toward where the ball is, but where it is going to be. Economists, as a rule, ignore this principle, indulging in the likely-to-be-vain hope that policies that would have worked yesterday will still work tomorrow.


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But now there is hope that economists will do better, a hope based on the near-consensus that the modes of thought of the past two generations are obsolete. Ben Bernanke, the former Federal Reserve chairman, says we have entered an age of a "global savings glut." Kenneth Rogoff of Harvard points to the emergence of global "debt supercycles." Princeton's Paul Krugman warns of the return of "Depression economics." And former Treasury Secretary Lawrence Summers calls for broad structural shifts in government policy to deal with "secular stagnation."

Without governments willing to deal with the structural problems, we are doomed to oscillate between asset bubbles and depression.

All of these experts are expecting a future that will be very different than the second half of the 20th century, or even the so-far, not-so-good third millennium. But they are influenced by different inclinations – toward optimism or pessimism, toward cautious repairs or an abrupt break with policy as usual – to diagnose the malady and prescribe the treatment.

The debate over secular stagnation is, I believe, the most important policy-relevant debate in economics since John Maynard Keynes's debate with himself in the 1930s, which transformed him from a monetarist to the apostle of active fiscal policy. I think Summers is largely right – but then, I would, since I have been losing arguments with him since I was 20. What's needed here, though, is not a referee's decision, but a guide to the fight.

The immediate macroeconomic problem is how to cure the hangover from the housing bubble in the middle of the first decade of the 21st century – the still-incomplete recovery in the United States and the non-recovery in Europe. But even a straightforward success that restored the growth rate experienced in the 1990s would not restore the world as we thought we knew it.

Do we also suffer from Bernanke's global savings glut, produced by ill-coordinated national policies toward recovery? His prescription is reform that gives governments better incentives to pull together in harness. Or is it the hangover from Rogoff's supercycle of imprudent debt accumulation that can only be remedied by painful deleveraging while building an effective macroprudential regulatory framework to prevent a repeat performance? Or, as Krugman counsels, is the deeper problem our reluctance to use the full panoply of monetary policy and fiscal tools that Keynes and his disciples developed? Or, à la Summers, are our problems more fundamental, requiring a paradigm shift in the means and ends of economic policy?

Successful management of the business cycle, Summers argues, will also require governments to reduce wealth inequality, stimulate more productive societal investment and bear more of the risk that now weighs heavily on households and businesses. Without governments willing to deal with the structural problems, he says, we are doomed to oscillate

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between asset bubbles in which much investment is wasted and growth is below sustainable potential, and depression, in which unemployment is high and output is below sustainable potential.

Many other economists have contributed to this debate – notably, Martin Feldstein, Richard Koo, Lars Svennson and Olivier Blanchard. However, with Bernanke, Rogoff, Krugman and Summers, we are already juggling four balls, and that is more than enough.

CAN ECONOMISTS LEARN FAST ENOUGH?

It is a truth too often ignored that economic models and rules of thumb have the functional lifespan of fresh fish on a hot day. Approaches that help us to understand (and would have successfully managed) the business cycle in the past are more likely than not useless, or even worse than useless, for managing the cycle in the future.

Pre-World War I trust in the gold standard, combined with the conviction that business confidence with "her magic wand" (in the words of Alfred and Mary Marshall) must be the highest priority of policy, was disastrous in the changed environment of the interwar years. The tool kits built in the 1930s during the Great Depression focused on the importance of decoupling national economies from an unstable world market, the utility of work-sharing and the potential benefits of cartelization in making businesses viable. They had no application during the long post-World War II boom. And policymakers who viewed those golden years as confirmation of Keynesian fine-tuning as the fix for all seasons left themselves deeply vulnerable in the face of the adverse supply, productivity and expectative shocks of the 1970s.

Everybody, it seems, is inclined to fight today's battle with yesterday's stratagem. Think of the economists who came of age in the 1970s. Ever since then, they have seen inflation, currency debasement, low productivity growth and excessive government deficits lurking at every turn. They have had nothing constructive to offer since 1990.

And what of those who took the long, stable boom of 1984-2006 as an indication that the macroeconomy had undergone a "Great Moderation" and could be managed with a very light policy and regulatory touch? They were blindsided by 2007 and thereafter. Why have economists' business-cycle theories almost invariably been wrong? Well, why should their theories be right?

Inertia and hubris drive economics (and so many other disciplines). Because they were successful in answering past questions, economists place heavy bets at unfavorable odds on the proposition that the major shocks will be of the same type and that changing institutions will not materially change the way economic shocks are propagated. Of course, the bettors almost always crap out.

Finally, however, there are signs that economists (the smart ones, anyway) are learning that past shocks doesn't tell us much about future ones. They are instead painting possible "if these trends continue" scenarios of major transformations.

Thus, Thomas Piketty of the Paris School of Economics speculates about a scenario in which wealth inequality brings about the end of the social democratic era that began at the start of the 20th century. Robert Gordon of Northwestern looks toward the likely end of the buoyant GDP growth brought on by the second industrial revolution in the late 19th century and Eric Brynjolfsson of MIT projects a future in which our principal economic problem is not scarcity, but finding useful and meaningful work to do.

THE DEBATE OVER SECULAR STAGNATION

Economists worth listening to are not just saying the future is likely to be different from the past; they are staking out turf as to how it will be different. Of these, the most controversy has been generated by Summers's secular-stagnation thesis.

Summers's analysis is not, however, the right place to start. His interpretation is easier to understand as the most recent in a string of new approaches. The debate really started back in the late 1990s with Krugman's book, *The Return of Depression Economics*. But that puts the cart before the horse. Let's start with what "Depression economics" really replaced.

What might be called "inflation economics" was born of the stagflation of the 1970s and early 1980s and focused on two goals. The first was keeping expectations of inflation low. A central bank that sought to avoid inflation – and all central banks sought to avoid inflation – needed to either keep expectations of inflation low or incur the heavy cost of engineering sufficient unemployment to lower those expectations. Second, subject to that expectations-management constraint, central banks sought to manage interest rates to keep them in the sweet spot where inflation was contained and the gap between actual and

Why have economists' business-cycle theories almost invariably been wrong? Well, why should their theories be right?

potential output was minimal.

Why manage interest rates? Why couldn't a central bank simply set a neutral monetary policy? Because nudging interest rates to the level at which investment equals savings at full employment is what a properly neutral monetary policy really is. Over the decades, many have promised easier definitions of neutrality, along with a rule for thumb for maintaining it. All had their day: advocates of the gold standard, believers in a stable monetary base, devotees of a constant growth rate for the (narrowly defined) supply of money and believers in a constant growth rate for broad money and credit aggregates. All of those theories were tried and found wanting.

The inflation-economics school of thought paid all due respect (and more) to free markets. First, adherents thought that government distorted markets and caused collateral damage if policymakers pursued goals other than maintaining inflation credibility and, subject to that, finding the aforementioned sweet spot for interest rates. Second, and in particular: monkeying with spending and taxes to try to balance the economy was asking for trouble. Indeed, double trouble, if the government sought to accomplish its goals by running large deficits that could produce an unsustainable debt burden.

Third, once central banks became the credible guardians of low inflation and learned to manage interest rates to sustain full employment, there was little reason for maintaining the Depression-inspired straitjacket on financial markets. Financial innovation ought to be welcomed – after all, it wasn't the job of government to play nanny to consenting capitalists.

In broad terms, inflation economics defined the worldview shared by three chairmen of the Federal Reserve, Paul Volcker (1979-87), Alan Greenspan (1987-2006) and at least the pre-2009 version of Ben Bernanke (2006-14). Indeed, that was the consensus view of most economists and financiers of influence during

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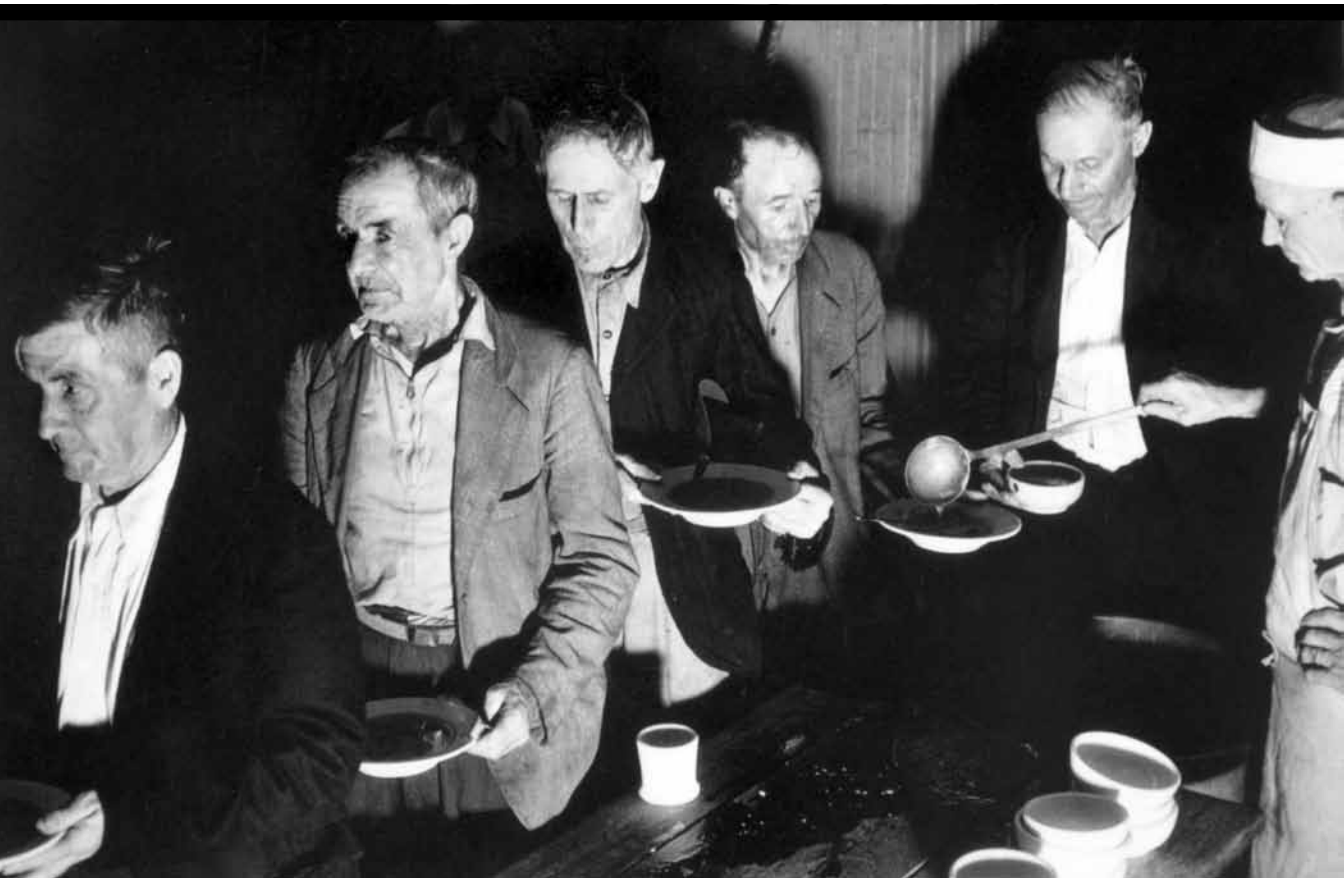

the 1985-2007 period of the Great Moderation.

Across that period, global financial markets bobbed around like rubber ducks in a kiddie pool – remember the 1987 stock market crash, the 1990 savings and loan crisis, the 1994 Mexican crisis, the 1997 East Asian crisis, the 1998 Long Term Capital Management collapse and the 2001 dot-com collapse? Yet the faithful execution of the rule of inflation economics generated solid overall economic performance.

ben bernanke's global savings glut

Although Krugman's warnings of trouble ahead came first, Bernanke's diagnosis in the mid-2000s precedes it in logical sequence. In a series of speeches back in 2005 about the "global savings glut," Bernanke, then a Fed governor (he had yet to be promoted), argued that there was one blemish on the picture of balanced growth of the U.S. economy: the large trade- and current-account deficits. This wasn't a version of your boring uncle's platitudes on being neither a borrower nor a lender. Bernanke saw a variety of drawbacks in an economy in which, on net, more than one dollar in 20 spent was borrowed abroad.

First, developing economies ought to have been investing their wealth at home, rather than in the United States, in order to boost their own productivity and wages. Second, by depressing interest rates and making Americans feel richer, the incoming torrent of capital boosted both home construction and household consumption and reduced domestic savings that might have financed investment in business productivity. Third, the capital inflow pushed American workers out of export manufacturing, even as it increased U.S. international debts that could only be serviced in the long run by exporting more manufactured goods.

The global savings glut, in Bernanke's view, was driven by multiple factors. For one thing, the aforementioned financial crises that rattled the developing world in the 1980s and

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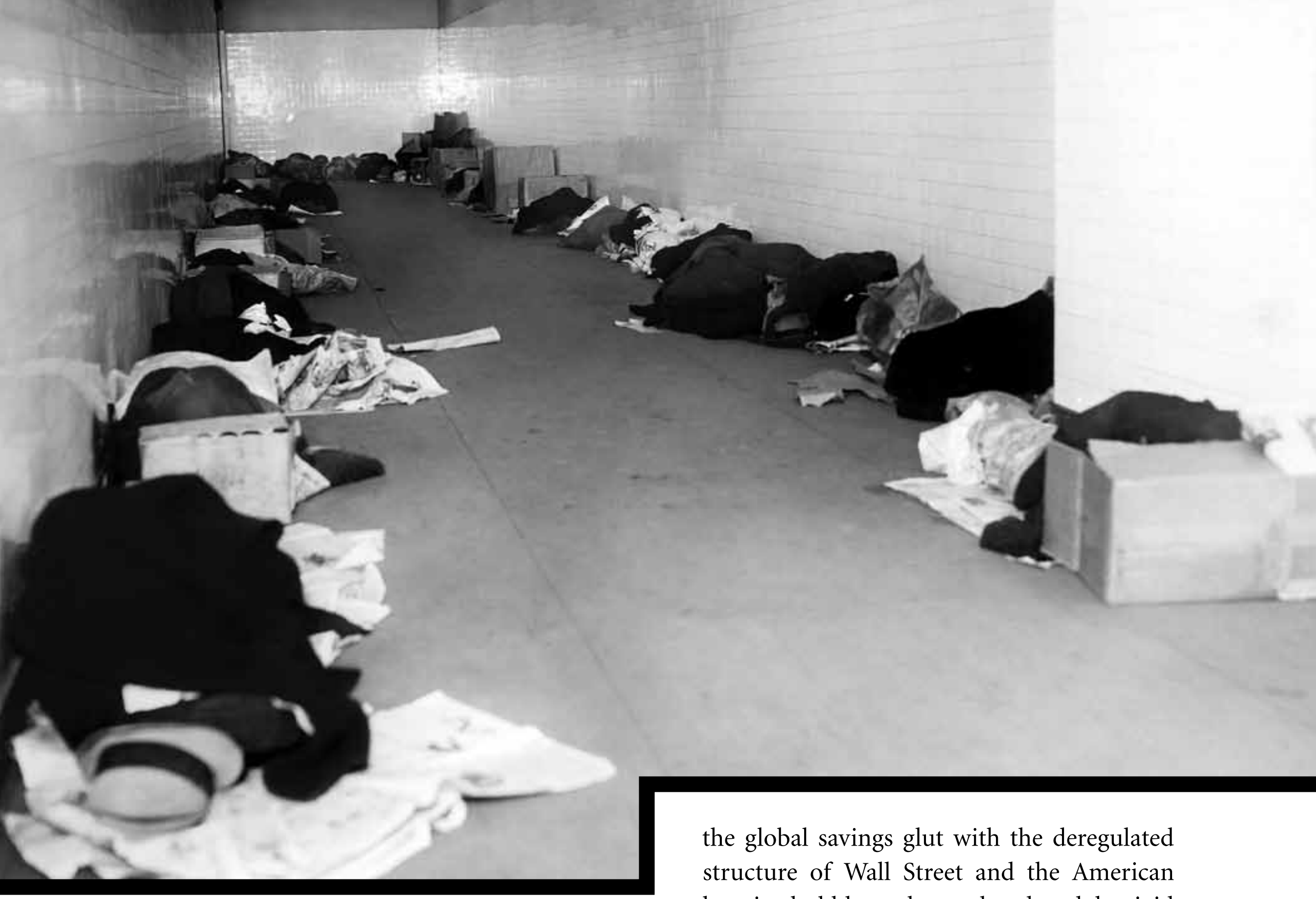

1990s had induced emerging-market countries to borrow less abroad and to park their assets in stable climes. By the same token, financial instability had led the governments of developing economies to conclude they needed much larger liquid reserves. And the natural place to park those assets was the United States, the country with the deepest, most liquid capital markets.

As of the mid-2000s, Bernanke appeared confident that this shift in economic structure was on the whole unfortunate, but not overwhelmingly damaging – and in any event, would be temporary. In a matter of years rather than decades, he suggested, emerging-market governments would acquire the liquid reserves they wanted. Then, international capital flows, and with them asset prices and interest rates, would return to their natural equilibrium.

Bernanke was, of course, wrong in 2005 in his belief that the forces driving hyper-low interest rates were transient. The interaction of the global savings glut with the deregulated structure of Wall Street and the American housing bubble on the one hand, and the rigid structure of the Eurozone and the wash of capital from Northern to Southern Europe on the other, led to a crash and the Great Recession that may prove to be more damaging than the Great Depression.

Yet today, as the North Atlantic economy is still groping its way forward seven years after the crash, Bernanke continues to hold for the most part to his global savings glut diagnosis of 2005. There is one difference. Back in 2005, Bernanke saw the problem as driven by emerging-market economies attempting to accumulate liquid assets. Today, he writes of falling current-account surpluses in these countries (the good news) offset by growing surpluses in Eurozone countries that reflect Europe's self-destructive determination to stick to fiscal austerity.

He's acknowledged, moreover, that one tenet of inflation economics – that the risk of a disorderly adjustment in financial global markets really does necessitate effective macro-

MICHAEL S. WILLIAMSON/THE WASHINGTON POST VIA GETTY IMAGES

prudential regulation of finance – was wrong. But other than that, he's not changed his diagnosis. The global economy, he seems to be saying, suffers from a medium-run distortion in global capital flows and thus of elevated asset prices and depressed interest rates. This distortion could be fixed quickly if surplus countries would adopt more sensible policies. Moreover, even if it is not fixed, it can still be managed.

Bernanke's diagnosis thus falls into a standard pattern for center-right economists. In his view, if only market prices were not distorted, things would be good. But the government-caused distortions can be dealt with by creating a global political-economic environment that gives the Europeans incentives to play nice.

KRUGMAN CHANNELS KEYNES

Paul Krugman's analysis differs from Bernanke's in a number of ways. He sees the problems of the Great Moderation-era economy not as easily correctable missteps but as major structural problems that expose different and very dangerous vulnerabilities that predate those of the 1970s and 1980s. He views the policies that created Bernanke's savings glut as rational, given the requisites of successful development. Moreover, unlike Bernanke, he is very worried about the consequent fall in interest rates because it undermines the power of conventional monetary policy. Accordingly, his prescription varies from Bernanke's appeal of collective reason; what's needed, he says, is a revival of old-style Keynesian fiscal intervention.

One root of the problem, Krugman argues convincingly, is that that central banks succeeded too well in anchoring inflation expectations. The folks who brought us inflation economics are thus in the position of the dog that caught the car. By inflicting a short but sharp depression on the North Atlantic economy from 1979 to 1984, central banks convinced nearly all economic actors that they would offer zero tolerance for even moderate inflation. And they had subsequently reinforced


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the hard line by pursuing policies that pushed inflation to 2 percent or less.

That success created a new vulnerability. With 2 percent inflation, the nominal interest rate consistent with full employment would be about two percentage points higher (4 percent). Now suppose some adverse economic shock – the bursting of a housing bubble and a financial crisis, say – temporarily pushed the interest rate consistent with full employment down by six percentage points. Then the central bank would find it impossible to lower interest rates enough to maintain full employment because the nominal rate couldn't fall below zero. The economy would find itself in what Keynes dubbed a "liquidity trap" – a situation dismissed in the postwar years as a theoretical curiosity – with no obvious levers a central bank could use to boost demand back to full employment.

Way back in 1992, in the wake of the mild 1990-91 recession, Summers and I warned against central bankers' hubris with their success at inflation-expectations management:

> Can [monetary] austerity be overdone? … The relaxation of monetary policy seen over the past three years in the United States would have been arithmetically impossible had inflation and nominal interest rates both been three percentage points lower in 1989. Thus a more vigorous policy of reducing inflation to zero in the mid-1980s might have led to a recent recession much more severe than we have, in fact, seen.

It is difficult to read the macroeconomic history of the past decade as anything other than vindication of DeLong/Summers-as-Cassandra. A similar reading of events lies behind the calls by, among others, the IMF's chief economist, Olivier Blanchard, for an inflation target as high as 4 percent.

If the policy announcement is credible, a two percentage point increase in the inflation target would have the same stimulus effect as a further two percentage point reduction in interest rates. A second unorthodox route to that end: mammoth "quantitative easing," in the form of massive purchases of long-term government and government-guaranteed securities with the goal of narrowing the gap between long- and short-term interest rates. With that in mind, back at the start of the 1990s, Summers was willing to trust that technocratic central banks under loose political reins could guard against both the inflationary dysfunctions of the 1970s and the depression-prone dysfunctions of the 1930s.

Live and learn. The consensus has become that quantitative easing works, but only weakly. Reliance on monetary policy as an adequate tool for macroeconomic management thus required that the central bankers could talk the public into raising its expectation of inflation. And because he feared that they couldn't, Krugman believed that Depression economics, complete with the liquidity trap, had returned.

Larry Summers was willing to trust that technocratic central banks under loose political reins could guard against both the inflationary dysfunctions of the 1970s and the depression-prone dysfunctions of the 1930s.

Krugman is not as alone in his fears. For while the economics profession may still be relatively sanguine about the Fed's prospects for guiding us back to full employment, it is

TOP: ©EVERETT COLLECTION INC/ALAMY. BOTTOM: ©RIA NOVOSTI/ALAMY difficult to find many economists who are optimistic about the ability of a central bank to boost a deeply depressed economy operating at the zero lower bound on interest rates by changing inflation expectations.

Central bankers are chosen from among those who are deeply averse to abandoning what they see as the expensive success (in terms of the excess unemployment) of reducing expected inflation to 2 percent. Raising that anchor, they fear, would return us to the bad old days of the 1970s, when relatively small missteps might trigger an inflationary spiral that required a deep and prolonged recession to untangle.

Market observers know that central bankers love their inflation anchors. Thus, as Krugman put it, bankers "promising to be irresponsible" are unlikely to be believed. From Krugman's perspective, then, Bernanke's global-savings-glut assessment is much too optimistic. Krugman has recommended aggressive use of expansionary fiscal policy to get economies out of the liquidity trap once they fall in. He also favors vigorous use of exchange-rate and nonstandard monetary policies in these circumstances, though with less confidence than he has in fiscal policy. And he has called for higher inflation targets to create more maneuvering room to prevent a fall into a liquidity trap in the first place.

But when he wrote the book, in 1998, he had little confidence in the ability of these policy shifts to eliminate the dangers of Depression economics. And with hindsight, it appears that he was 100 percent right.

ROGOFF'S SUPERCYCLE OF DEBT

Rogoff's diagnosis, the third in the logical sequence (after Bernanke's and Krugman's), was originally conceived as a critique of Krugman's interpretation of Japan's lost decades of no growth and no inflation. The problems Krugman described were transitory, Rogoff thought, at least in the medium-run sense. They could have been avoided when they occurred and could be avoided in the future by appropriate macroprudential regulation to avoid the buildup of excessive debt. Once the crisis hit, Rogoff argued, policies to rapidly deleverage economies could reduce the trauma but not eliminate it. In large measure, the situation simply needed to be toughed out.

Rogoff has consistently viewed what Krugman sees as a long-term vulnerability to Depression economics as the temporary consequences of failures to properly regulate debt accumulation. Eventually, a large chunk of debt thought of as relatively safe is revealed to be risky, and financial markets choke on the lump. As the riskiness of the debt structure is revealed, interest rate spreads go up – which means that interest rates on assets already known to be risky go up, and interest rates on assets still believed to be safe go down.

It is the debt-accumulation cycles, Rogoff argues, that cause the stagnation problem. They inevitably end in a morass of distressed loans, which is what creates the economy's vulnerability to the zero-bound problem. The consequences look like those of Krugman's Depression economics, but the cause is simply too much risky debt. Deleveraging can be helped along by government-enforced debt write-downs and other heterodox policies. But it cannot be avoided.

Rogoff argues that this "debt supercycle model matches up with a couple of hundred years of experience." There is, in his view, nothing new or unusual in the post-2008 reaction to the financial crisis. Debt accumulation, the consequent enormous rise in risk spreads and a long depressed slog while the overhang poisons investment and aggregate demand are simply par for the course.

Rogoff's assessment comes with an implicit prediction that interest rates will now rapidly normalize. In his view, the Fed is, if anything, behind the curve in postponing its first hike in the interest rates until the end of 2015. By this reckoning, the Fed's big problem in two years is more likely to be incipient inflation than rising unemployment.

If Bernanke's policy recommendations are a combination of macroprudential financial regulation and exhortation of governments to play by the rules, and Krugman's policy recommendations are a return to Keynesian reliance on expansionary fiscal policy at the zero lower bound for interest rates, Rogoff's recommendations for policy are more complex – and a bit muddled.

Rogoff calls for a higher inflation target, along with a willingness to break the pattern when circumstances change, for he believes that "central banks were too rigid with their inflation target regimes" when the crisis hit. And he calls for aggressive debt write-downs – both private and public – along with aggressive macroprudential policies to prevent a repeat performance.

But Rogoff seems confused (or at least inconsistent) on the role of fiscal policy when the economy is in a liquidity trap. He sounds like Krugman when he says that fiscal policy "was initially very helpful in avoiding the worst of the crisis, but then many countries tightened prematurely." And he still sounds like Krugman when he acknowledges that, "With low real interest rates, and large numbers of unemployed (or underemployed) construction workers, good infrastructure projects should offer a much higher rate of return than usual."

But he hedges, wondering whether the ballooning risk spreads that make safe debt such a bargain and infrastructure investment so tempting reflect economic conditions accurately. "In a world where regulation has sharply curtailed access for many smaller and riskier borrowers, low sovereign bond yields do not necessarily capture the broader 'credit surface' the global economy faces," he says.

I have a difficult time untangling Rogoff's analysis. Surely if good public investments are even better deals in a crisis, mediocre public investments cross the line to acceptable deals. Surely there is little to fear when interest rates are low and the central bank has the power to print money to pay off the debt, if necessary, to avoid a rollover crisis.

Market observers know that central bankers love their inflation anchors. Thus, as Krugman put it, bankers "promising to be irresponsible" are unlikely to be believed.

And you may point out: extraordinary foreign demand today for dollar-denominated securities as safe, liquid stores of value are not just the consequence of a supercycle of excessive debt issue. They reflect the insane austerity and secular stagnation in Europe. They also reflect the global imbalances caused by China's rapid export-led growth and potential political instability.

If you were to say all that, you would not be Ken Rogoff, but Paul Krugman. And you would be well on the road toward agreeing with Summers.

SUMMERS'S LEAP

"Secular stagnation" was a bad phrase for Summers to have chosen to label the position he has staked out. He wanted to evoke association with Keynes's disciple, Alvin Hansen, who in the wake of World War II worried that declining population and productivity growth would reduce the rate of profit and the incentive to invest, and so create an economy that was trapped in Krugman-style Depression economics by a permanent insufficiency of investment to sustain full employment demand. But the mechanisms that Summers points to are different from those of Hansen. He should, at the least, have called it "Secular Stagnation II."

Summers's core worry is not about the immediate aftermath of a crisis. Nor is it just about the medium run of the unwinding of a debt supercycle or of Bernanke's government-reserve accumulation that produces a glut in savings. It is that the global economy – or, at least, the North Atlantic chunk of it – will be stuck for a generation or more in a situation in which, if investors have realistically low expectations, central banks reduce interest rates to accommodate those expectations and governments follow sensible fiscal policies, the private financial markets will lack sufficient appetite for risk to support a level of investment demand compatible with full employment.

Thus economic policymakers will find themselves either hoping that investors form unrealistic expectations – prelude to a bubble – or coping with chronic ultralow interest rates and the associated risks of stubbornly elevated unemployment. Such "badly behaved investment demand and savings supply functions," as Martin Feldstein called them when he taught this stuff to me at Harvard back in 1980, could have six underlying causes:

1. Technological and demographic stagnation that lowers the return on investment and pushes desired investment spending down too far.

2. Limits on the demand for investment goods coupled with rapid declines in the prices of those goods, which together put too much downward pressure on the potential profitability of the investment-goods sector.

3. Technological inappropriateness, in which markets cannot figure out how to properly reward those who invest in new technologies even when the technologies have enormous social returns – which in turn lowers the private rate of return on investment and pushes desired investment spending down too far.

4. High income inequality, which boosts savings too much because the rich can't think of other things they'd rather do with their money.

5. Very low inflation, which means that even a zero safe nominal rate of interest is too high to balance desired investment and planned savings at full employment.

6. A broken financial sector that fails to mobilize the risk-bearing capacity of society and thus drives too large a wedge between the returns on risky investments and the returns on safe government debt.

Hansen focused on cause-one; Rogoff focuses on cause-six, in the form of his debt supercycle; and Krugman focuses on five and six. Summers has, at different moments, pointed to each of the six causes.

It is to Summers that we have to look to see why this confluence of Depression economics symptoms has emerged now – and why it is turning out to be such a deep and stubborn problem. For it is not just one or many of Feldstein's causes – or for that matter, Bernanke's badly behaving governments that don't qualify for the list – that lie at the root of the problem. It is that historical trends right now are driving all of these potential causes together, and are driving them in the same direction.

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Thus Summers seeks to dive deeper. The policy changes he has in mind are different from standard supply-side measures or demand-side reliance on temporary expansionary fiscal policy or raising the inflation target.

Summers dismisses the largely Republican focus on "deep supply-side fundamentals: the skills of the workforce, companies' capacity for innovation, structural tax reform and ensuring the sustainability of entitlement programs," which he calls "unlikely to do much" in any reasonable time frame. He also dismisses the fix of higher inflation targets that would allow central banks to push real interest rates into negative territory via conventional monetary policy: "A growth strategy that relies on interest rates significantly below growth rates for long periods virtually ensures the emergence of substantial financial bubbles and dangerous buildups in leverage." Moreover, he asserts that the idea macroprudential regulation would "allow the growth benefits of easy credit to come without cost is a chimera."

Instead, he wants the government to step up to the plate across a very broad range of initiatives. Why does it have to be the government? Is it really the case that there aren't enough good private investment opportunities in America? Or would it be better to say that there aren't enough good *relatively safe* private investment opportunities in America? Or would it be better to say that there is now a large-scale systematic failure to mobilize the economy's risk-bearing capacity? Yes, yes and yes.

The government should thus be taking advantage of the global savings glut to borrow and spend, Summers argues.

> The [approach] that holds the most promise is a commitment to raising the level of demand at any given level of interest rates through policies that restore a situation where reasonable growth and reasonable interest rates can coincide … ending the disastrous trends toward ever-less government spending and employment each year and taking advantage of the current period of economic slack to renew and build out our infrastructure.

What's more, he says, "If the federal government had invested more over the past five years, the U.S. debt burden relative to income would be lower; allowing slackening in the economy has hurt its long-run potential."

In this view (which I share), more of the risk-bearing and long-term investment-planning and investing role needs to be taken over by governments. We strongly believe that governments with exorbitant privilege that issue the world's reserve currencies – notably, the United States – can take on this role without any substantial chance of loading future taxpayers with inordinate debt burdens. But the government should be doing more to prevent stagnation.

- It needs to take aggressive action to reduce income and wealth inequality in order to get money into the hands of those who will spend it rather than save it.
- It needs to invest more in research to supplement the pace of privately driven technological progress.
- It needs to curtail the power of NIMBY (not-in-my-backyard) interests that make some productive investments unprofitable.

The reason for government investment is not your garden-variety, the-benefits-exceed-the-costs rationale, but because full employment depends on it. Thus, for example, Summers calls for very active environmental regulation. Full employment requires finding something expensive to invest in, and fighting global warming is the most useful thing that is likely to be expensive enough to make a difference.

Some say that investments to fight global warming should be made slowly, postponed until better science gives us a better handle on the problem. Summers finesses this argument, pointing out that the cost of the resources invested would be very low as long as the economy is stuck below full-employment equilibrium. Thus he sees a need for carbon taxes to accelerate the phaseout of coal power, which need to be much more than offset by spending to accelerate the buildup of renewable energy sources and other carbon-sparing energy technologies.

In Summers's view, the experience of the last two decades – the oscillation between a dangerously depressed economy and a dangerously bloated bubble economy, with seemingly no ability to find or maintain the sweet spot – is not inevitable. But the problems are deeper than the market and political dysfunctions diagnosed by Rogoff and Bernanke, and not as easily cured by pure demand-management policies as one might conclude from Krugman.

That does leave a loose end. Why would a higher inflation target – one that would allow monetary policy to pack a bigger punch – not be sufficient? Summers's explanation is a tad esoteric.

In his view, there are worthy private risky investment projects and unworthy ones. Worthy risky projects have a relatively low elasticity with respect to the required real yield – that is, lowering interest rates to rock-bottom levels would not induce much more spending.

In contrast, unworthy risky investment projects have a high elasticity. Thus, when safe interest rates get too low, savers who should not be bearing risk nonetheless reach for yield – they stop checking whether investment projects are worthy or unworthy.

Put it another way: there are people who should be holding risky assets and there are people who should be holding safe assets. The problem with boosting inflation so that the central bank can make the real return on holding safe assets negative is that it induces people who really should not be holding risky assets to buy them.

I would speculate that, deep down, Summers still believes in one tenet of inflation economics: that effective price stability – the expectation of stable 2 percent inflation – is a very valuable asset in a market economy. And with the right sorts of government intervention discussed above, there is no need to sacrifice it. A mix of income redistribution, mobilization of the economy's entrepreneurial risk-bearing capacity and an infrastructure-oriented fiscal policy could do the job.

Is there a strong argument against Summers's reading of the situation or his recommended policies? The alternatives offered above, a nudge in the global adjustment process à la Bernanke or Rogoff (in the hope that "secular stagnation" isn't secular after all) or a Krugman-style fix that relies on more aggressive monetary and fiscal intervention don't convince me.

Full employment requires finding something expensive to invest in, and fighting global warming is the most useful thing that is likely to be expensive enough to make a difference.

NIHILISM IS NOT A POLICY

A better case against Summers's policy recommendations is rooted in general skepticism about his reliance on increased government intervention. The argument isn't that more spending by a competent government would not work, but rather that the government isn't sufficiently competent or is too encumbered by interest groups to make it work. By this reckoning, additional government investment is worse than useless in a contemporary free-market democracy for the same reasons that government investment in, say, hopelessly inefficient steel mills or railroads to nowhere was worse than useless in the crony-Socialist environment of the Soviet Union.

The view that any expansion of the government's role in the economy is bound to make us worse off certainly has its supporters among public-choice economists as well as among red-meat Republican conservatives. But I agree with Summers that the public-choice economists have taken solid explanations for government failure and driven them "relentlessly towards nihilism in a way that isn't actually helpful for those charged with designing regulatory institutions," or, indeed, "making public policy in general."

Nihilism grounded in theoretical first principles is simply not a useful guide to policy. We will not know the limits of government action to remove the structural impediments that have produced our vulnerability to secular stagnation until we try them.

CHINA'S MONEY

THE HOW, THE WHEN

The economic news from China has lately been dominated by the agonies of the stock market, which has been shuddering through high-speed twists and turns worthy of a Six Flags roller coaster.

GOES GLOBAL

AND THE WHY

BY BARRY EICHENGREEN

However, it's best read in the context of the larger issue of China's evolving integration with global financial markets, and, in particular, of the internationalization of the renminbi.

ANTHONY DEVLIN/PA WIRE

"Renminbi internationalization" is a mouthful – but handy jargon for describing the growing use of China's currency in cross-border transactions. Indeed, you'll be hearing it more often, as financial go-betweens around the world scramble to get a bite of the business. By 2011 (the latest year for which the numbers are readily available), more than 900 financial institutions in over 70 countries were doing business in renminbi (aka RMB), and those numbers are climbing rapidly.

This is happening with active encouragement from Beijing. The big question – well, really, questions – are what the Chinese government is prepared to do to make the RMB a true world currency that could readily serve as a substitute for dollars in international transactions, why the slew of reforms that must precede full internationalization are probably more important to China at home than abroad, and how internationalization will affect global financial markets now largely tied to the dollar (and to its regulators in Washington).

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WATCH IT GROW

China's central bank, the People's Bank of China – as well as other key regulators, including the State Administration of Foreign Exchange – are taking highly visible steps to broaden the reach of the RMB. Restrictions on Chinese enterprises' discretion to pay for foreign purchases with RMB have been relaxed. And foreigners on the other end of those transactions are increasingly permitted to use their RMB to buy goods from China and to invest in the country's financial markets.

Consider, too, that Beijing, in cooperation with foreign governments, has designated

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one of China's banks as the "official clearing bank" for RMB-denominated transactions for virtually every important Asian and European financial center. In June 2014, for example, it anointed the giant, publicly traded China Construction Bank as the RMB clearing bank for London. The bank is now authorized to buy RMB from customers in Britain (as well as to sell them), providing a low-cost option for firms that use Chinese currency for trade and investment.

In addition, the People's Bank of China has negotiated credit lines with a number of foreign central banks, including the Bank of England. Under these agreements, it stands ready to swap RMB for foreign currencies on demand. Foreign central banks with these lines of credit will thus be able to lend RMB – which they can't print – to customers in need. They will therefore be more inclined to permit local enterprises to engage in RMB-based business.

MOUNTAINS OUT OF MOLEHILLS

All this has the potential to alter the global financial landscape. The dollar and the country issuing it, the United States, currently dominate that terrain. The dollar accounts for nearly two-thirds of all identified foreign-exchange reserves of central banks and governments. It is involved in fully 85 percent of all foreign-exchange transactions. Indeed, more than 35 percent of cross-border payments are in dollars, despite the fact that the United States accounts for barely 10 percent of global trade.

This disproportionate importance of the dollar in international transactions confers a variety of benefits on the United States. Most notably, it gives Washington geopolitical leverage insofar as the Federal Reserve is the ultimate source of the emergency liquidity that everyone needs in times of crisis.

The RMB poses the most serious challenge to the dollar's monopoly since World War II and the fading of the British pound. China is already the world's largest exporter, and, barring the unlikely scenario in which its GDP growth falls precipitously, it will soon have a larger economy than the United States as measured at current exchange rates (and not just in purchasing power). If China successfully internationalizes its currency, our dollar-centric system will be replaced by a more decentralized arrangement organized around the dollar and the RMB.

The RMB can only take on a dollar-like role if China takes the difficult steps to make its financial markets more liquid.

The existence of rival international currencies would fundamentally change the way the international monetary system operates, or so it is said. Countries would be able to turn to China instead of the United States for emergency liquidity, undermining U.S. financial and geopolitical leverage. But there's a downside for China, too. This transformation would create risks as well as opportunities since internationalization of the RMB can only take place if China opens its financial markets to foreign transactions – something that can have unforeseen, and sometimes unfortunate, consequences.

That said, some financial movers and shakers are inclined to view the current alarm over RMB internationalization as both premature and overwrought. They have a point. The Chinese economy is immense, but China is still a relatively poor country preoccupied with the problems of development at home. For the moment, its financial markets are opaque, volatile and only partially open to the rest of the world. Not surprisingly, then, the RMB is hardly a factor in the machinery of international trade, leagues behind the dollar. Where 95 percent of U.S. imports and exports are invoiced in dollars in its own currency, the same is true for less than 20 percent of China's own trade. China's currency accounts for a scant 2 percent of cross-border payments worldwide. All this could change, but it would have to change dramatically before the RMB began to rival the dollar.

Nor, incidentally, is the dollar's exalted status an unalloyed blessing to the United States that must be guarded at high cost. The country's "exorbitant privilege" as the issuer of the only true global currency may be a source of convenience for U.S. banks and firms able to do cross-border business in their own currency. But that advantage is a wasting asset in a world of ever-cheaper electronic currency trading and FX hedging.

The dollar's standing as a reserve currency does enable the United States to sell government bonds to foreign central banks at bargain-basement interest rates. However, there's a downside: the ongoing demand for dollars as foreign-exchange reserves by those central banks pushes up the dollar's exchange rate, putting U.S. exports at a competitive disadvantage and slowing U.S. growth. All this suggests that the United States may have less to lose from the rise of the RMB than meets the eye.

TWO SIDES OF THE COIN

In fact, RMB internationalization is both more and less important than conventional wisdom would have it. It is less important because it will surely take years, or even decades, before the currency comes to be used in international transactions on anything approaching the scale of the dollar. And it is less important from the U.S. perspective because there is no reason to imagine the dollar and the RMB as being engaged in a zero-sum battle: the global financial system has room for more than one international currency.

On the other hand, the decision to press for RMB internationalization is likely to have more profound consequences for China than are widely understood. The RMB can only take on a dollar-like role if China takes the difficult steps to make its financial markets more liquid, thereby lowering the cost of trading the currency, limiting volatility and reducing the chance that anyone making large purchases or sales in RMB-denominated securities will move prices to their own disadvantage. This will require not just the construction of more-efficient trading platforms, but also the implementation of more effective regulation, as well as success in attracting a more-diverse investor base. China's recent stock-market gyrations are testament to how much things will have to change.

But this is a slippery slope of sorts. The most direct way to enhance liquidity and increase investor diversity is to allow more foreign financial participation. Thus, for the RMB to rival the dollar, China would have to remove the vast majority of its restrictions on cross-border financial transactions, ultimately moving to what the International Monetary Fund refers to as full capital-account convertibility. An open capital account would, in turn, require China to move toward a more flexible exchange rate: experience has shown that free capital mobility and pegged exchange rates are a toxic mix. Moreover, it is hard to see how China could make this transition without dramatic growth in its service sector – in particular, in financial services.

All this would constitute a revolutionary transformation of the Chinese economy, one that de-emphasizes export-led manufacturing growth in favor of a more balanced mix of drivers. Indeed, the prospect of that transformation is precisely why many Chinese reformers back RMB internationalization. They see it as the edge of the wedge for promoting change that rebalances and liberalizes the economy.

Note that this strategy of using monetary and financial policies to ratchet up the pressure for broader change is not unlike the strategy adopted by European reformers in the 1990s. They saw the adoption of a common currency (the euro) as a way to force banking-sector reform and fiscal cooperation as well as political integration, since everyone would come to understood that monetary union without these reforms simply would not work.

But, as subsequent European experience reveals, sometimes the seemingly irresistible is, in fact, resisted. Putting the monetary/financial cart before the reformist horse can go wrong if the reforms required to make the initiative work do not follow. And Greece's problems suggest how badly wrong the denouement can be.

China's Uphill Climb

China's financial markets, it is important to recall, were all but totally closed to the rest of the world as recently as a decade ago. Since then, granting access with an eye toward encouraging international use of the RMB has proceeded on two fronts: trade and finance. On the trade side, a handful of Chinese companies were authorized (starting in 2009) to settle their trade-related transactions in RMB with counterparties in Hong Kong and Macau, as well as in member-states of the Association of Southeast Asian Nations. The following year, virtually all companies in a handful of

Chinese provinces were permitted to settle import and export transactions in RMB. And in 2011, this authorization was extended to the entire country.

Since China is an export powerhouse, it made sense that if the RMB was to be used more widely in international transactions, it would be used first and foremost in trade. In effect, China's very extensive trade relations were harnessed to advance this goal, starting six years ago.

On the financial-capital side, foreign companies were authorized, starting in 2007, to issue RMB-denominated bonds in Hong Kong. The RMB funds thereby raised, principally from companies that had accumulated RMB bank deposits in Hong Kong from the proceeds of exports to China, were used mainly to finance foreign direct investments on the mainland. Then in 2010, "qualified" foreign institutional investors (QFII) – mainly Hong Kong-based banks and overseas banks involved in RMB cross-border trade settlement – were authorized to invest RMB in Chinese securities markets. This was known as the QFII program, for self-evident reasons. In 2012, the aggregate ceiling on qualified foreign institutional investors' investment was increased from $30 billion (US) to $80 billion. In 2013, quota shares were extended beyond Hong Kong and Macau to investors in Britain and Singapore.

A growing list of foreign countries that aspire to capture a slice of the rapidly growing RMB-related pie have received what are referred to as "the three gifts": an RMB swap line with the People's Bank of China, designation of a Chinese financial institution as official clearing bank to settle RMB-denominated transactions, and a qualified foreign institutional investors quota to invest in China's local-currency stock market. The list of recipients currently includes, in addition to the countries already cited, Taiwan, Germany, South Korea, France, Luxembourg, Qatar, Canada, Malaysia, Australia and Thailand. The length and geographical dispersion of this list suggest that if the RMB does make serious inroads as a medium of international exchange, the impact will be global and not just regional.

But for the three gifts to significantly influence international financial practice, China will also have to liberalize access to its domestic financial markets so that foreign investors can use their RMB inside China as well as outside.

This is where loosening of restrictions on the country's international financial transactions comes into play. Chinese officials have repeatedly emphasized that the progressive relaxation of those restrictions is a policy priority. In 2011, Yi Gang, the head of the State Administration of Foreign Exchange, announced that the country was prepared to undertake the transition to full currency con-

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vertibility in a series of "progressive steps" to be completed within five years. While this ambitious deadline could slip, Premier Li Keqiang recently vowed that "China will speed up the basic convertibility of the RMB on the capital account."

Beijing thus seems determined to deliver, if cautiously. To this end, it has unveiled the qualified domestic institutional investor program (which is equivalent to the qualified foreign institutional investors program), through which Chinese residents are allowed to invest abroad. But for the moment, anyway, they must invest through institutional funds, insurance companies and securities brokers approved by the China Securities Regulatory Program.

The government also launched the Hong Kong-Shanghai Stock Connect last November, through which investors in each of the two markets are permitted to trade shares on the other market using local brokers and clearinghouses. But such trades are permitted only up to specified ceilings and only in specified shares. Restrictions on other cross-border financial transactions remain.

Progress is a bit hard to track. But economists have developed summary measures that roughly track the openness of the capital account, among them changes in differences in the prices of identical securities traded both in China and abroad. Their findings vary. There is broad agreement, though, that while China's financial markets are indeed opening, they have a considerable way to go before they are as open as the markets of most other middle-income countries.

THE FINANCIAL CENTER GAMBIT

The Hong Kong-Shanghai Stock Connect is a special case of a more general strategy for promoting RMB internationalization that relies on offshore financial centers and onshore free-trade and financial zones. For some years, China has used offshore markets, starting with Hong Kong and Macau but now extending to others, as venues for experimenting with financial liberalization and integration. Hong Kong was the first place where foreign institutional investors were permitted to buy and sell exchange-listed securities. It was similarly the first place where residents were permitted to conduct personal business in RMB and open RMB-denominated bank accounts. And, as noted above, it was the first place in which foreign companies were permitted to issue RMB-denominated bonds.

Then in 2010 Hong Kong was designated as an offshore RMB business center, authorizing a wide variety of other transactions in RMB. Taipei and Singapore obtained the same privileges in 2013. Other financial centers, including London, Sydney and Seoul, are angling for parallel access.

These offshore centers can be thought of as financial petri dishes in which foreign enterprises can gain expertise in RMB-related business and Chinese regulators can observe their performance. Offshore market participants can build the requisite clearing and settlement infrastructure. They can cultivate customers. They can offer the entire range of contracts facilitating risk management (for example, futures contracts).

All the while, controls on capital flows into China limit this activity to offshore markets. Capital controls, in turn, help to contain the potential threats to financial stability associated with volatile inflows and outflows. Some observers refer to this strategy of relying on offshore markets as "internationalization within capital controls."

Once domestic markets are suitably reformed and made more liquid, the reasoning goes, China's capital controls can be relaxed and the institutions that developed expertise offshore can migrate onshore. Because development of that expertise and those institutions had a head start in offshore centers, currency internationalization will be able to proceed more rapidly than might otherwise be possible without threatening financial stability in China.

Similarly, the Shanghai Free Trade and Financial Zone can be thought of as an experiment with financial integration in a limited area that insulates the broader Chinese economy from unanticipated effects. The Shanghai zone is essentially an offshore financial center onshore. Once it is fully up and running, trade between it and the rest of the world will be free of customs and licensing formalities. Companies there, both Chinese and foreign, will be permitted to open free-trade accounts for use in local and foreign currency transactions. Holders of such accounts will be permitted to freely transfer funds between offshore accounts and onshore non-resident accounts.

The goal, then, is to use the zone as an onshore testing ground for capital-account convertibility and a magnet for foreign financial intermediaries. But there are risks. For one thing, something could go wrong with the Chinese banks and enterprises operating inside this not-insubstantial zone. There could also be leakages between the Shanghai Free Trade and Financial Zone and the rest of the economy, undermining capital controls and

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Offshore centers can be thought of as financial petri dishes in which foreign enterprises can gain expertise in RMB-related business and Chinese regulators can observe their performance.

creating financial vulnerabilities elsewhere. Previous experience suggests that, the longer these walls remain in place, the better financial markets become at scaling them. It is not clear why the Shanghai Free Trade and Financial Zone would be an exception to this rule.

Chinese officials are aware of the risks and have responded by moving deliberately, disappointing the optimists who figured the spigot would be wide open within a year of the plan announcement.

In fact, during the first nine months of 2014, cross-border fund flows in the Shanghai zone totalled just 15 percent of total cross-border flows in and out of Shanghai-based entities. As one observer put it, creation of the zone has done more, it would appear, to facilitate the inward and outward movement of goods than financial services, reflecting the reluctance of the authorities to actually implement their announced financial measures. Another analyst describes the most visible change within the zone as the availability of cheap imported shellfish from Vietnam and Mozambique.

KING OF THE HILL

RMB internationalization will be no walk in the park, and, understandably, Beijing is not prepared to take big risks to get from here to there. By the same token, there's ample reason to believe that displacement of the dollar as the global currency – or, more likely, the sharing of the dollar's status – will be an uphill battle even for a future, better-managed Chinese economy with a much larger global footprint.

The dollar has been the dominant international currency for seven decades. And that persistence reflects habit formation that is self-reinforcing. Economists refer to this phenomenon as a network effect – in this case, the reality that it pays to use the same currency in international transactions used by one's customers and suppliers. The currency everyone uses is the one with the most liquid market, precisely because everyone uses it. And once these conditions are established, no one has reason to do otherwise. These network effects thus give rise to lock-in, in which a dominant international currency, once established, is difficult to dislodge.

To be sure, the dollar could be displaced if the United States sabotaged its own credibility. In particular, if Washington gave foreigners reason to doubt that it would honor its dollar-denominated debts, they might hesitate to accept and use dollars in other transactions. Searching for alternatives, they might then alight on the RMB.

We have heard such warnings before. In 2007, when the financial crisis erupted, a gaggle of talking heads warned of imminent flight from the dollar. In 2013, when the U.S. Congress temporarily balked at raising the limit on the debt that could be issued by the Treasury, the possibility that the government would default on payments to bondholders again prompted warnings that the dollar's days as the dominant international currency were numbered.

Yet on both occasions, the result was flight toward the dollar, not away from it. The best explanation for this paradox is that in periods of high uncertainty there is nothing investors value more than liquidity, and the market in U.S. Treasury securities is the most liquid financial market in the world. The dollar's status as incumbent – as the prevailing global currency – gives it an advantage in retaining that status even when the country issuing it, the United States, is the source of the shocks to the global system. Note, incidentally, that increasing the liquidity of domestic financial markets will be the hardest nut for Chinese policymakers to crack.

Nearly 40 percent of China's newly issued bonds mature in a year or less, presumably because investors are reluctant to commit to long-term finance.

In any event, it's far from clear that China's (very hard-won) success in elevating its currency to reserve status would be especially problematic for the global system. Some observers warn that a system organized around two international currencies rather than one would be unprecedented, and would likely be unstable. In fact, there are precedents. The British pound, French franc and German mark all played consequential international roles at the beginning of the 20th century. The pound and the dollar then shared first-billing on the international stage in the 1920s.

The second of these two systems, referred to as the interwar gold standard, did prove dangerously unstable. But its early 20th-century predecessor, the classical gold standard, performed better. The appropriate lesson to be drawn is that when the policies of the countries issuing the competing international currencies are themselves unstable, as was the case of the United States and Britain in the 1920s, the international system organized around their currencies will be unstable. Before World War I, when policy was better, the operation of the international monetary and financial system was more satisfactory.

A SPRINT TO THE FINISH?

The most important consequences of the push to internationalize the RMB will be felt at home because internationalization depends so heavily on the development of deep and liquid financial markets to which non-residents have full access. This in turn will require fundamental changes in the Chinese economy.

Start with the deep and liquid part.

China's bond market is growing rapidly; it is now the third largest in the world, behind only those of the United States and Japan. But the market's weaknesses are all too apparent. Nearly 40 percent of newly issued bonds mature in a year or less, presumably because investors are reluctant to commit to long-term finance. Corporate issuance is the most rapidly growing segment, but it is heavily dominated by state-owned companies that are implicitly backed by Beijing. A substantial fraction of government bonds are issued by the three state-owned policy banks (the China Development Bank, the Export-Import Bank of China, and the Agricultural Development Bank of China) and formally guaranteed by the central government.

Most tellingly, more than two-thirds of government bonds are held by banks – Chinese banks in particular. This is not the diverse investor base to which architects of deep and liquid bond markets aspire. Banks are not active traders. Their dominance may thus account for the relatively low turnover in the secondary market, where turnover in government bonds is barely one-tenth the rate in the United States. Indeed, bid-ask spreads in the government bond market – a good measure of liquidity – compare unfavorably with those not just in the United States but also in the relatively small markets in South Korea and Thailand.

China is moving on multiple fronts to address these weaknesses. The National Association of Financial Market Institutional Investors, China's trade association of bond dealers and investors, has issued guidelines to enhance the transparency of the interbank market and minimize contracting problems. Meanwhile, regulators are seeking to enhance market transparency by requiring additional legal documentation of transfers of ownership.

A key question is whether China should accelerate liberalization of international capital flows at the onset as a way of increasing the diversity of the investor base and fostering market liquidity. Giving foreign investors unfettered access to Chinese financial markets would certainly solve the buy-and-hold problem at a stroke. But prudence suggests that capital-account liberalization must be accompanied by other far-reaching reforms in policy and institutions – notably stronger, smarter regulation that leaves markets less vulnerable to capital-flow volatility and a widening of regulation to bring the so-called shadow banking system into the light.

To give foreign investors confidence in the fairness and predictability of regulatory and financial policies, those policies would have to be better insulated from politics and interest-group pressure. The principal regulators would have to be granted statutory independence – a sea change for a hierarchical political system like China's.

With finance free to flow in and out of the country, China would have to move quickly to a more-flexible exchange-rate regime, since greater exchange-rate flexibility would be needed as a buffer against the vicissitudes of capital flows. That would make it impossible for the government to hold the exchange rate at artificially low levels as a means of promoting exports and enhancing the profitability of export-dependent enterprises. And that, in turn, would force China to rebalance its economy, shifting away from investment in export-oriented industries to consumption, which now accounts for only a third of GDP – barely half the ratio typical of advanced countries.

These changes more or less mesh with the plans of the current government. But they cannot be completed overnight. And for this reason, any strategy for short-circuiting the laborious process of building liquid financial markets carries considerable risks. Corporations, both non-financial and financial, might respond to the appetite of securities-hungry foreigners by recklessly issuing debt. Banks with easier access to foreign funding would be tempted to lever up their balance sheets. At the same time, increased exposure to volatile international capital flows would heighten macroeconomic volatility, especially if it preceded the transition to a significantly more-flexible exchange rate and monetary policies.

The move to the next stage in China's economic development is bound to be perilous in the best of circumstances. But reliance on capital-account liberalization as a means of accelerating that transition would be far riskier. Internationalizing the RMB, one must conclude, will be a marathon, not a sprint.

And our economist on the spine is...

You guessed it (I'm an optimist): the caricature on the spine of the *Review*'s 2015 issues is **Janet Yellen**, the first woman to chair the Federal Reserve Board. Actually Yellen is quite accustomed to cracking glass ceilings. She was the second woman to chair the White House Council of Economic Advisers (Laura Tyson pioneered that one). And she had a long distinguished career in academic economics (Harvard; University of California, Berkeley), a field that until quite recently was virtually a boys club.

Yellen's views on macroeconomics (she wrote her PhD thesis under Nobelist James Tobin at Yale) are fairly conventional. Or, to put it another way, she has remained a pragmatic Keynesian across decades in which macroeconomic theory became ever more faddish. And, at least in this humble editor's opinion, history has proven her right.

Her one significant policy flub, which she is first to acknowledge, was her failure (as the president of the San Francisco Federal Reserve Bank) to sound the alarm over the rapidly inflating housing bubble. But, then, she's in very good company on that score. — *Peter Passell*

DAVID SMITH

Who Gets What – and Why

BY ALVIN ROTH

Alvin Roth, the author of this excerpt from *Who Gets What – and Why*,* won a Nobel in economics in 2012 for his work on the "the theory of stable allocations and the practice of market design." I know, I know: that's hardly an intro likely to induce you to dive right in. Most Nobels in economics, after all, are awarded for accomplishments that are too arcane for mere mortals to comprehend. And even the prize winners who do have something pressing to say to the public can rarely write their way out of that proverbial paper bag. ¶ But Roth and this book are spectacular exceptions. While he was really trained as a mathematician (his PhD is in a discipline called operations research), Roth's vision has never strayed far from the practical. And he's a natural-born writer to boot. ¶ Roth designs "matching markets," where price alone can't balance supply and demand – think of markets for everything from marriage to college admissions. Indeed, he's even saved lives by helping to design an ingenious way to match more donated kidneys to needy patients. ¶ The chapter excerpted here will give you a taste of his fine mind and formidable ability to make complicated ideas comprehensible.

— *Peter Passell*

To understand the many ways in which markets fail, we must begin even before the beginning.

Part of making a market "thick" involves finding a time at which lots of people will participate at the same time. But gaming the system when the system is "first come, first served" can mean contriving to be earlier than your competitors.

That's why, for example, the recruitment of college freshmen to join fraternities and sororities is called rush. Back in the late 1800s, fraternities were mostly social clubs for college seniors. But in an effort to get a little ahead of their competitors in recruiting, some started "rushing" to recruit earlier and earlier. Fast forward to today, when it is first-semester students who are the targets of fraternity and sorority rush.

And that's not the only way the rush to transact sooner has entered the English language. It's also the reason that Oklahomans are called Sooners. The nickname was born on April 22, 1889, the beginning of the Oklahoma Land Rush, and truly entered the American vernacular four years later, on September 16, 1893, the height of the rush, known as the Cherokee Strip Land Run. In both cases, thousands of people – 50,000 in 1893 – lined up at the border of the former Indian territory and, at the sound of a cannon shot, raced off to stake out free land.

At least that was the plan. And most participants abided by the rules – not least because the U.S. Cavalry was patrolling the Strip with orders to shoot anyone found in the open territory or crossing the line before the signal sounded. To prove the cavalry's seriousness, when one unfortunate soul – perhaps confused by a pistol shot – took off early, they rode him down and shot him dead to the horror of thousands of onlookers.

When, finally, the cannon roared, those same thousands – on horseback, in wagons and even in carriages – surged forward in the most famous photographic image of the era. Fifteen miles away in what would, by afternoon, be the bustling municipality of Enid, America's newest city stood the only public building in the Strip, a land office/post office. About noon, the assistant postmaster, Pat Wilcox, took his binoculars and climbed up on the roof of the building. Looking south, he saw a lone rider, a 22-year-old cowboy named Walter Cook, appear on the crest of a low hill. Tearing toward him, and then rushing on past, Cook jubilantly staked his claim to a plot of land at the very center of the planned city.

Cook had played by the rules, waiting until he heard the signal to take off. But lots of other people, despite the cavalry's draconian efforts, had crossed the line earlier. These "claim jumpers" would come to be called Sooners, for their timing. And in the long tradition of turning pirates, bank robbers and other brazen criminals into lovable rogues, that would also become the nickname for all Oklahomans, and eventually for the University of Oklahoma's football team.

Gaming the system by entering the Oklahoma Territory to stake a claim before September 16 was illegal, but that didn't prevent it from happening. And claim jumping wasn't the only thing that didn't go according to plan in the course of that crazy day.

Take poor Walter Cook. His claim was quickly overrun by 300 false claimants to the

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same plot of land, all taking advantage of the fact that the law wouldn't arrive for hours to validate anyone's claim. In the end, Cook got nothing except a lesson in the dangers of a poorly regulated, lawless market.

Cook might have had a chance if the land office had been open when he arrived and had processed his claim quickly. But instead, the line at the office quickly grew to hundreds of claimants, then thousands from throughout the Strip. Fights broke out; robberies occurred; at least one person died of a heart attack.

There were at least two ways in which the allocation of land failed to work well that day. First, the law-abiding citizens who followed the rules were often preceded by those who entered the territory sooner and marked their claims earlier. Second, the fact that those claims all had to be recorded at the land office in Enid on the same day led to congestion and confusion in which even some of those who had arrived in time to stake a claim, such as Walter Cook, couldn't get it recorded. The market wasn't fast enough to deal with all the claims made that day, and so it couldn't always sort out which claims came first.

Sometimes the problems of going too soon are subtler. Jumping the gun – in Oklahoma it was literally a cannon – can cause potentially thick markets to unravel. They become thin when too many participants try to transact before their competitors are fully awake and present in the market.

Let's look at those other Sooners, the ones who play football for the University of Oklahoma. We turn to college bowl games to see how "too early" can ruin a matching market's ability to make good matches. The matching of football teams to play in the big end-of-season bowl games suffered for many years because the teams that would play in those games were chosen too soon to make for good matchups.

MAKE ME A MATCH, CATCH ME A CATCH

For those who love college football, there is no time of the year more exciting than bowl season, when the top teams from different conferences meet to determine which are better and, ultimately, to determine the national champion. But most college football fans have come to believe – and sometimes argue vociferously – that the system is broken. And unfortunately, they're right.

For a long time, teams and bowls succumbed to the temptation to do deals early. And while college football isn't the most important market in the world (except to its fans), the fact that new information is available every weekend about which teams have won or lost, and that those teams are then ranked according to polls of sportswriters and coaches, shows very clearly how important information can be ignored when the market moves before the results of the final games of the season have been played.

As the television audiences and advertising revenues became important, bowl committees began to recruit teams to play in the bowl games earlier and earlier – indeed, so early that the teams they recruited were sometimes, after an unexpected loss or two, no longer championship candidates by the time the game was played. That's one of the dangers associated with early transactions: they can come well before important information is available. And that can mean bad matches made and good ones missed.

Which teams get to play in which bowls is handled differently today than it used to be. Sports fans can disagree about how well the current system works, but no one disagrees

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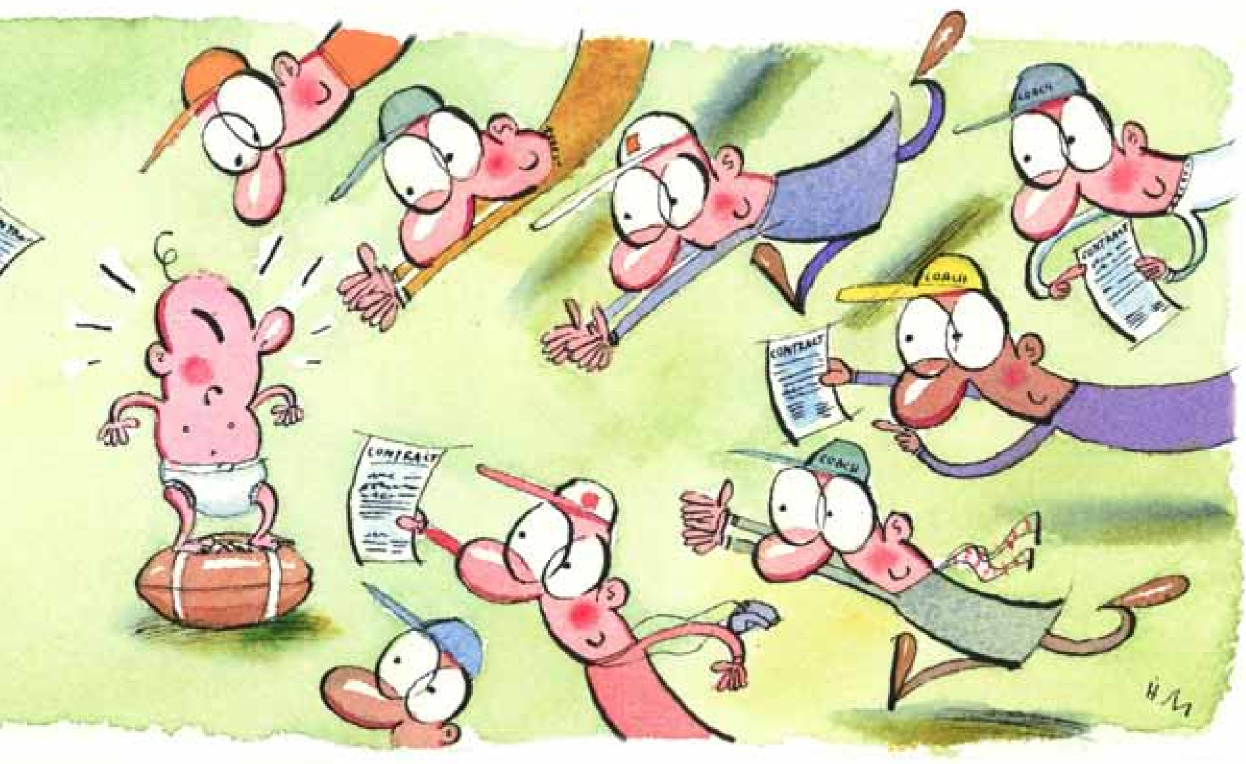
about how badly it used to work before the market was redesigned.

The bowls are independent businesses that control a stadium and make contracts with television networks and corporate sponsors. Each would like to host a postseason game between the two teams that are ranked best in the country at season's end. For many years, the National Collegiate Athletic Association tried to make bowls and teams wait long enough to get good matches. But it consistently failed to do so, and after the 1990-91 season, it gave up trying.

That season there were 19 postseason bowls. The one that paid teams the most was the Rose Bowl, which was "closed." It had a long-term contract with the Big Ten and Pacific-10 football conferences, and each year the champions of those two conferences played each other in the Rose Bowl (and the two conferences shared the bowl revenues of their



champions). So the Rose Bowl wasn't involved in the unraveling we're examining here; it merely waited until the conference champions were determined.

But the other bowls had different arrangements. The Fiesta Bowl faced a unique challenge: as an "open" bowl, it needed to find two teams to play. The other top bowls were all "semi-closed"– that is, they each had a contract with one football conference, whose champion would be one of the teams that would play. Meanwhile, each of these bowls needed to find one additional team to provide quality competition. The available pool consisted of teams that were not in any football conferences (independents) or were in conferences that were not contractually tied to any bowl.

In 1990, the NCAA rule was that teams and bowls couldn't finalize bowl matchups until "pick-'em day," which that year was November 24. But some bowls and teams went ahead and made earlier arrangements. Notre Dame, an independent, had begun the season as the number-one ranked team and had recovered from an early loss to regain that position by early November. Meanwhile, Colorado had overcome an early season loss to become the number-four team in one of the rankings and number three in the other. When Colorado beat Oklahoma State and clinched the Big Eight conference championship, Colorado was ensured a berth in the Orange Bowl and rose to number two in the rankings.

The next day, 13 days before pick-'em day, an agreement was announced between the Orange Bowl and Notre Dame. This meant that the currently first- and second-ranked teams in the nation would meet in the Orange Bowl, and thus make that bowl the de facto national championship.

Virginia's acceptance of a bid from the Sugar Bowl to play the still-to-be-determined Southeastern Conference champion was announced the same day. And following the Orange Bowl agreement, the University of Miami agreed to play in the Cotton Bowl against the still-to-be-determined Southwest Conference champion. At this point, Notre Dame, Virginia and Miami all still had a few games to play. In college football, alas, a few games is forever.

Sure enough, shortly after inking its agreement, Notre Dame lost a game and finished the regular season ranked number five. Meanwhile, Virginia, which had lost only one game before its agreement with the Sugar Bowl, lost two games and finished the regular season unranked in one poll (meaning it wasn't even in the top 25) and number 23 in the other. In the end, no bowl succeeded in getting the number one and number two teams (which turned out to be Colorado and Georgia Tech).

Thus, when the bowl games were over, there was no consensus national champion: Colorado was ranked first in one poll and Georgia Tech in the other. Since they hadn't played each other, the sportswriters and coaches who were surveyed for the national ranking felt entitled to their own opinions.

Faced with such a public failure to enforce pick-'em day, the NCAA abandoned the attempt for the 1991-92 season. The Football Bowl Association (FBA) responded with an attempt to enforce a pick-'em day of its own and voted to levy a fine of $250,000 on any member that violated this understanding. However, the FBA was no more successful than the NCAA, and not surprisingly the 1991-92 bowls also failed to produce a matchup of the top-two teams. Once again the postseason ended without producing a consensus national champion.

In retrospect, it's clear that several problematic market-design features prevented good bowl matches. Because the Rose Bowl dealt with only two conferences, these conference champions risked not being ranked close to each other and would seldom be the two highest-ranked teams nationally. But at least the Rose Bowl had a contract ensuring that the two teams that played each year would be the champs of their conferences.

The unraveling didn't stop until the conferences and bowls figured out new rules that removed the incentives to determine bowl matchups before the final rankings were known.

The other major bowls enjoyed a substantial pool of conferences and teams from which to pick. But because of an unraveling of bids for their open slots, most were filled without the bowl committees knowing the end-of-season rankings of the teams invited to play. And because many bowls had one position reserved for a particular conference champion, this limited the matching flexibility of each of them and of the market as a whole.

It wasn't simple self-restraint that stopped colleges and bowls from going early, nor could a powerful organization like the NCAA stop them. In the end, the unraveling didn't stop until the conferences and bowls figured out new rules that removed the incentives to determine bowl matchups before the final rankings were known. They did this through a series of incremental, almost yearly reorganizations of the market, designed to make more teams available to be matched after the regular season – that is, to make the postseason market thicker.

One way to do this was to enlarge the football conferences, so that the champions of each conference would be the best of a larger group of teams. In 2011, the Pacific-10 conference became the Pacific-12 conference. The Big Ten kept its name but not its number: in 2011 it also expanded to 12 teams, and then expanded again to 14 teams for the 2014-15 college football season. In addition, coalitions of bowls formed to make the market thicker, and eventually the Rose Bowl joined with the other major bowls to create the Bowl Championship Series (BCS) in 1998.

Now the number-one and number-two teams in the country, determined according to the BCS ranking system, played a national championship game, and this game was rotated from year to year among the participating bowls.

The fact that teams and bowls were matched later in the thicker BCS market doesn't necessarily prove that the market was working better. It's often hard to get a quantitative measurement of how well a matching market is performing in some ultimate sense – for instance, how much social welfare it is producing, beyond how well it is serving the participants in the market itself. But if we think of football games as entertainment, then how many people decide to watch the games isn't a bad measure of how well the market is working.

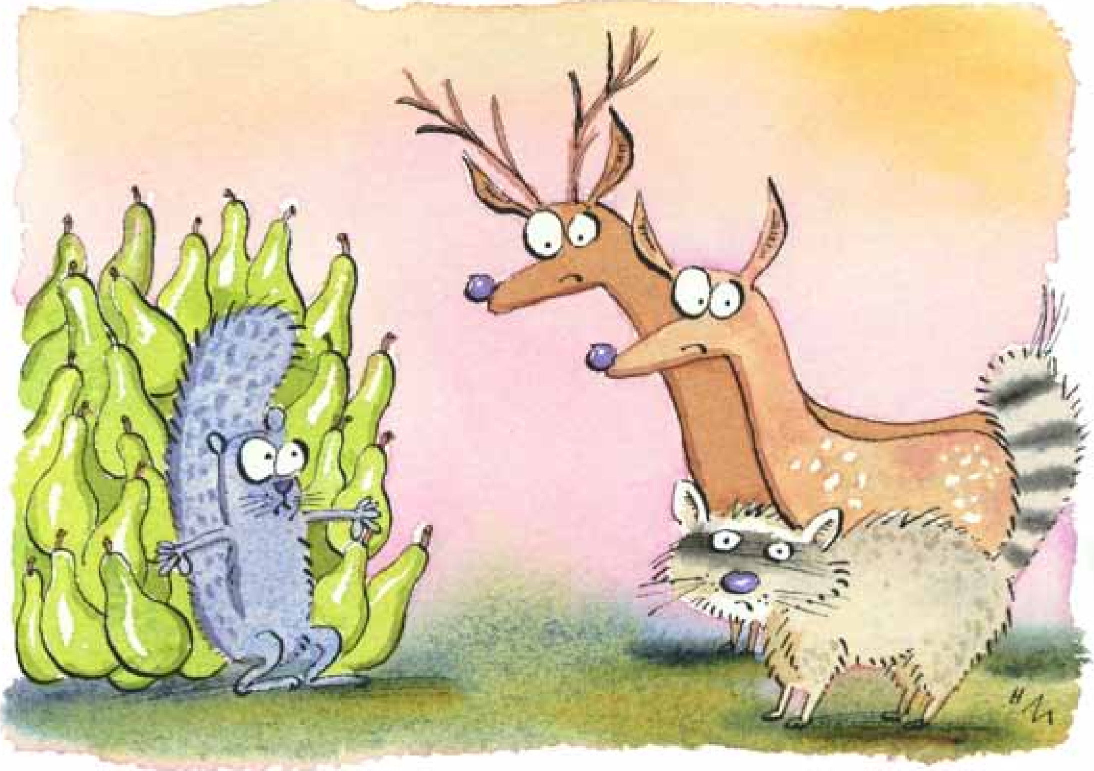
When Guillaume Fréchette, Utku Ünver and I looked at the Nielsen ratings for the televised bowl games over the years, we found that a game between the teams ranked first and second in the nation attracted so many more viewers that it was well worth it for the bowls to rotate such a game among themselves. This is why the BCS worked well when there was a consensus number-one and number-two at the end of the season and less well when there wasn't.

As I write this in 2014, plans are under way for a postseason playoff designed to more reliably produce a championship game that will attract many viewers. Four teams will be selected for the College Football Playoff, with the winners of the semifinals to meet for the championship game. The proposed new playoff model still has some of the old weaknesses of the BCS, but the uncertainty about which four teams to include should be less consequential in picking a national champ than uncertainty about which two teams to include.

The slow, incremental process by which the market for bowls evolved can be viewed as a kind of cultural evolution. Different bits of practice were reshaped over time, in ways that kept all the big players – the successful teams and conferences, the big bowls, the television networks – in business. Lots of interests had to be addressed to achieve any sort of coordination at all and to get some forward motion. Like football itself, that forward motion mostly came a yard at a time.

Incidentally, it's not just football teams that make early matches; often it's the players, too. For example, in 2012, Louisiana State University offered a football scholarship to Dylan Moses, a 14-year-old who had not yet begun the eighth grade and who wouldn't enter college for another five years. Who knows whether he'll be big enough, healthy enough and accomplished enough to play when he is finally old enough for college. But coaches worry that all the other teams are recruiting early, and if they don't do the same, they could miss out on a future star.

This "sooner" mentality isn't limited to the more high-profile college sports. When I meet varsity athletes at Stanford University, where I work, I ask them when they first met



a Stanford Cardinals coach. So far, the earliest answer I've gotten was from a player on the women's basketball team, who met a Cardinals coach when she was in sixth grade. She hastened to add that she'd been a very tall sixth grader on a team with older players, and that the coach had been surprised to hear that she was only in the sixth grade. He was scouting eighth graders.

RUSH TO GLORY

Rushing to be sooner isn't just something in the history books or on the sports pages. If you know a recent college graduate who recently took a job with a big investment bank such as Goldman Sachs, there's a good chance that she'll get a call soon after beginning work. It will be from a big private equity firm such as Kohlberg Kravis Roberts, interested in signing her to a contract that would take effect after she's worked for Goldman for two years. And if you know someone who just graduated from law school and works for a big American law firm, he was most likely hired by that firm initially as a summer associate, about two years before he earned his degree.

Is this a good idea?

Remember the 1991 Orange Bowl. The same thing that happened then can happen to law firms that recruit years before their future employees earn their degrees. That top-notch first-year law student can go through a lot of changes over the next two years. At least the Orange Bowl selection committee knew how many teams (two) it would need for the game. Not so for law firms, which have to guess two years in advance how many lawyers they will need. Guess wrong, and they could be in a lot of trouble.

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When a market's organization predictably leads to trouble, economists start asking whether it might be inefficient, meaning that a different organization might make everyone involved better off. We've already seen that going early can create bad matches, but it also could be that this approach benefits some people while hurting others. The market for new lawyers lets us see how unraveling can sometimes hurt everyone.

In particular, just about everyone could have been better off if that market had been less unraveled during the Great Recession, which reduced corporate demand for outside legal services. Hiring more than a year before the start of employment made it difficult for law firms to forecast their needs. Thus thousands of summer associates at large firms who'd accepted "permanent" offers shortly after their second-year summer associateships in August 2008 saw them rescinded or deferred before they started work in the autumn of 2009.

To maintain their reputations and their relationships, some of the firms paid those deferred employees a portion of their starting salaries and encouraged them to spend a year doing pro bono work – an outcome that was costly for both sides of the market.

If this two-year head start sounds bad, consider that in the late 1980s hiring was even earlier, with some students getting offers of summer associate positions right after they were accepted to a top law school, before they'd even taken their first class. Those firms undoubtedly would have liked to see how their prospective hires actually did in law school. But they worried that if they waited, other firms would snap up the best talent before them. So they told themselves that if Yale Law School wanted a student, that student also had a strong chance of becoming a good lawyer – just as at mid-season Notre Dame had a good chance of being number one when it played in the Orange Bowl.

If making offers very early makes it hard to identify good job candidates, you might think that some firms would take a little more time and make offers to candidates who had already received at least one offer from another firm. But the firms that made early offers prevented this by making their offers "exploding" – that is, take-it-or-leave-it offers of such short duration that they didn't leave enough time for another firm to jump in and compete for the same candidate, or for a candidate to get another offer for comparison.

Exploding offers are common in unraveled markets. These offers are both early and short-lived. So not only are firms making offers before they have as much information as they'd like about how candidates might perform in school, but the candidates themselves are confronted with accepting or rejecting an offer before they know what other offers might become available.

To put it another way, exploding offers make markets thin as well as early. So participants are deprived of information about both the quality of matches and what kind of matches the market might offer. In that situation, nobody has enough information to make an optimal decision.

More than the other sources of market failure that we'll explore, unraveling is a failure of self-control. Participants just can't stop themselves from transacting early, because if they resist the urge, they'll lose out to someone else. It's a little like what happened when my family planted a pear tree in our yard in Pittsburgh, right next to a wooded hillside. Each year, long before the pears were ripe, some squirrel would take them. I don't know whether squirrels like unripe pears or they just feared that if they waited any longer, the raccoons or the deer would get them.

Now, if a market is behaving badly and producing an inefficient outcome, it makes sense for participants to get together (if only for their own preservation) and design new rules to make the market work better. That's what happened in the 1980s. Student organizations, law schools and law firms supported a rule-making organization called the National Association for Law Placement (NALP),

It's hard to make rules constraining lawyers, because many lawyers earn their living by obeying the letter of the law while evading its intent.

which tried to bring some order to the lawless market for lawyers.

Because lawyers like precise rules, looking at these rules gives us a unique window on why unraveling is so hard to control. One rule was meant to give brand-new law students a chance to learn a little law before being confronted with an exploding offer from a law firm. This rule said that if an offer was made to a student who hadn't yet completed the first year of law school, that offer had to remain open until the end of the first semester, in December.

Unfortunately, it's hard to make rules constraining lawyers, because many lawyers earn their living by obeying the letter of the law while evading its intent. So this rule worked for a year or two, until some lawyer, in charge of hiring for his firm, had the bright idea of writing an offer letter that said, essentially, in keeping with NALP guidelines, this offer remains open until the end of the semester. But, the letter continued, the job didn't come with much of a salary. There was a handsome signing bonus, however, which would bring the salary up to the usual level. But that signing bonus would be paid only if the offer was accepted immediately.

Regulating the market for new lawyers soon became an arms race between the rule makers and the rule breakers. As of this writing, the most recent NALP rules say that exploding bonuses are against the rules, too.

RUSH TO JUDGMENT

At least lawyers and law firms make a show of obeying the rules while seeking ways around them. In the most prestigious part of the market for young lawyers, that of federal appellate judges hiring top students as law clerks, many judges openly flout the rules. Or perhaps a more "judicious" way to put it is that federal judges think they can make up their own rules.

Clerking for an appellate court judge is the classiest first job an ambitious young lawyer can have. For one thing, it's a ticket to the kind of career that makes people want to be lawyers. That's one reason the obituary of a retired senior partner of a big law firm often mentions his clerkship of decades before. (The first sentence might read: "Clancy Goldfinger, former managing partner of Catchum, Killum and Eatum, who graduated from Harvard Law School in 1951 and clerked for Judge X and Justice Y, passed away Tuesday.")

So there's a lot of competition among the best students at the elite law schools to clerk for one of the relatively few federal appellate judges. But at first glance, the clerkship market doesn't look like one that should experience unraveling, although it's easy to see why a law student would be tempted to accept an early offer from an appellate judge. Since there are so few judges and so many law students, however, every judge could get a very well-qualified clerk if only he or she would wait to see which law students did well.

But while there are only a small number of appellate judges, those judges realize there are an even smaller number of law students who will win the top awards at their schools or be elected to edit their law reviews. And those appellate judges are organized into circuit courts, not all of which are equally prestigious. Neither are all judges within a given circuit equally likely to have their clerks move up to the U.S. Supreme Court for a second, even more prestigious clerkship there.

So if all judges waited to recruit only third-year students as clerks, when it is clear who will be a law review editor or top student, only the most prestigious judges would be able to hire the best students from the handful of elite law schools. That's a very good motivation for slightly less prestigious judges to make offers before the students' third year.

It takes a brave student to turn down an offer from, say, a judge in the Ninth Circuit Court of Appeals (which covers all of California and more) in the hope that if she waits, she might get an offer from the even more prestigious D.C. Circuit. That could happen if she's lucky. But if she's only a little less lucky, she may have to settle for a much less attractive job than the one she's just been offered – and that she has to accept immediately or not at all.

Of course, the judge is gambling, too: a student who looks likely to win law school honors may fail to do so, and may turn into a clerk who won't live up to her early promise. If the market ran later, the matching of students and judges would be more predictable, with the top jobs reliably going to students who had earned the top honors.

Notice that the law students who get these early offers are hardly facing the prospect of unemployment. But that doesn't mean that they aren't facing difficult decisions. There will be positions for them even if they wait, but maybe not such good positions. They have to make quick, strategic decisions taking into account what the rest of the market is doing.

WEDDING BELLS' TOLL

Few of us will ever get an offer to clerk in a federal court of appeals. But once you understand this kind of strategic decision-making, you'll begin to see it all around you, from marrying to finding a parking spot. Quite a few of us may face such a dilemma when deciding whether to marry a current girlfriend or boyfriend, or to break up in the hope of finding a better match later. That's a different decision when the market is thick, such as when you're in college and there are lots of single people your age, than when the market is thin, such as when most of the people your age are already married. And some marriage markets are tougher than others.

Consider the teenage Bedouin bride in whose community polygamous marriages are common. Just such a woman lamented, "If you are 20 or older, you may be married as a second wife."

But even teenage brides don't face the earliest marriage decisions in the world. In some times and places, the marriage market has unraveled to the point that newborns are betrothed. In developing countries, it isn't unusual to find marriages arranged quite early, particularly for women, and particularly in places where women are in short supply because men compete for multiple wives. Some countries, such as India, have tried to stop this practice with minimum-age marriage laws. But those laws have proved difficult to enforce because private and informal matchmaking arrangements have emerged.

In searching for a striking example of unraveling, Xiaolin Xing and I considered places where child marriages occur, and even primitive societies in which unborn children may be betrothed. The most striking example we found involved the Arunta, an aboriginal people of Australia. Because the Arunta were polygamous, there was a shortage of women.

Marriages among the Arunta were frequently arranged by two men, one of whom had just fathered a baby boy and the other a baby girl. When two such men met to arrange a marriage, however, the union they were arranging wasn't between those two babies – it was much too late for that because the baby girl's marriage had already been arranged. Rather, the two fathers were agreeing that the baby boy would marry the first daughter of the baby girl. That is, they were agreeing that the infant girl would become the mother-in-law of the infant boy. This was a marriage arranged by the father of the infant boy on behalf of his son and the father of the infant girl on behalf of his granddaughter by his infant daughter.

The timing of transactions depends not just on what is available now, but what is likely to be available later.

In Arunta society, marriages could be transacted more than a generation in advance of when they would be consummated. You can understand how, as a responsible young father, you wouldn't feel safe letting your son's – or your granddaughter's – marriage arrangements lag behind their competitors'.

Notice that in many developed countries, ages at first marriage are increasing, not decreasing. As more women seek higher education and professional careers, they wait to get married. When I say it that way, I'm focusing on the choices made by women. But a woman can't simply choose a spouse, and neither is the choice of when to get married entirely an individual decision for either men or women.

Think back to the days when few women went to college. In 1947, for example, there were more than twice as many men as women in American colleges. A lot of people eventually married their high school sweethearts because high school provided a thick marriage market in which one could find a lot of single people of the opposite sex, and those opportunities wouldn't be so abundant later.

By 1980, many more men and women went to college, and in equal numbers, so there were opportunities to make a match there, too, and the pressure to marry early was reduced. Today, the growth of Internet dating sites also offers the possibility of a thicker marriage market for college graduates. Postponing marriage when there is still a thick market in the future isn't so risky, and more-mature brides and grooms might have a better chance of recognizing a good match.

So the timing of transactions depends not just on what is available now, but what is likely to be available later. When you're driving down a crowded street hoping to find on-street parking, you regularly face (for lower stakes) a decision like the one confronting a law school student with an exploding offer or someone thinking about marrying his high school sweetheart. You see a vacant spot while you're still some distance from your destination.

Should you take it? This spot probably will be taken before you can loop around and return, and you may have to settle for parking even farther away or in an expensive garage. Or should you risk waiting for a better choice: a spot right in front of your destination? That

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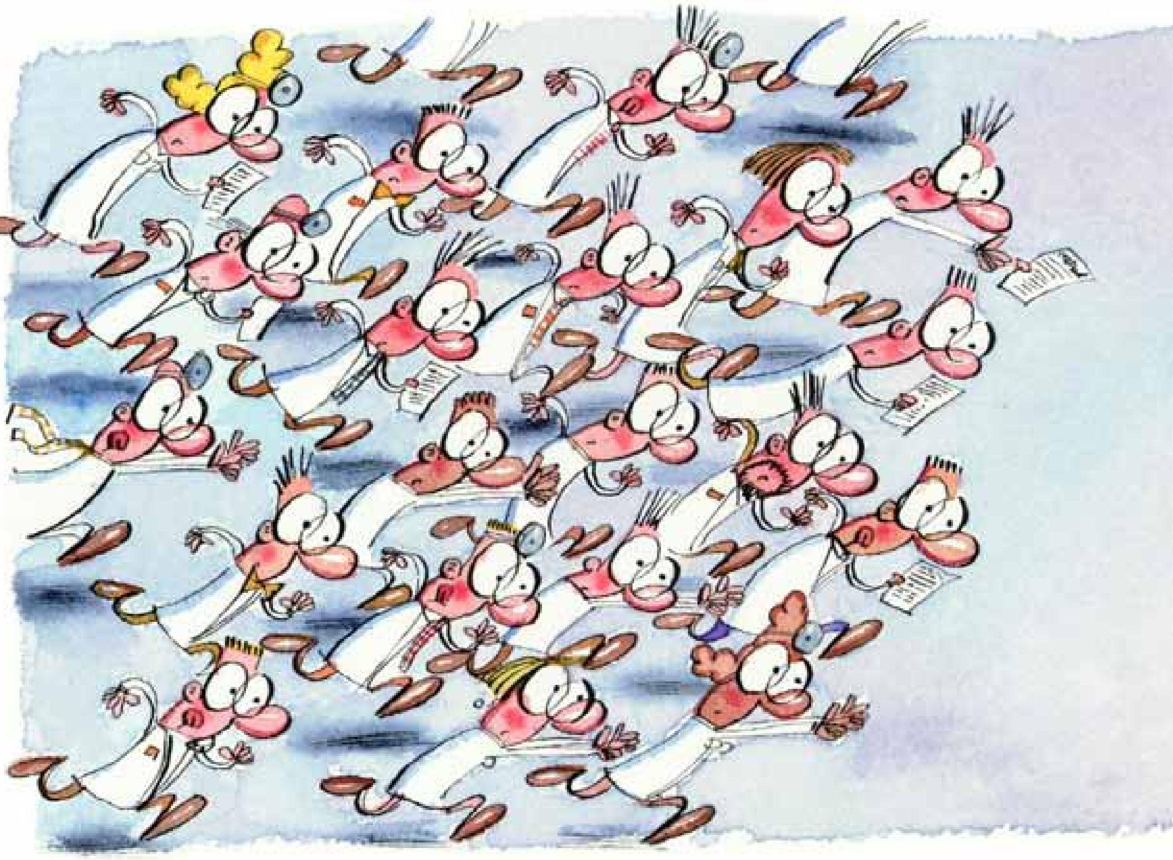
would be a safer choice if you knew that lots of parking was available near your destination.

As you can see, unraveled markets aren't hard to find. We've just seen unraveling in matching markets ranging from sports to law to marriage, and in simple choices from whether to wait until a pear is ripe before picking it to how far from your destination to grab a parking spot.

But this kind of market failure wasn't widely remarked on when I first noticed unraveling in the 1980s, while studying the market for new doctors. Back in the 1940s, medical school students had to line up their first positions two years before they were due to graduate from medical school. Looking at it from the other perspective, hospitals had to hire their new interns and residents from a pool of medical students who hadn't even started on the clinical portions of their medical school education. Each side felt – correctly, given the circumstances – that if they didn't move quickly, the good positions and the top students would already be snapped up. It was a mess.

I first thought that unraveling was unusual, a kind of rare accident that happened in relatively special markets such as that for doctors. But as we've seen, lots of markets unravel. In fact, it's an even more widespread phenomenon than I've suggested thus far. For example,



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many selective colleges now fill more than half of their freshman slots through "binding early admission," a kind of exploding offer in which students apply early and commit to attend that school if accepted, without applying to other colleges.

Meanwhile, some private schools even enroll students at birth. At the Wetherby School in England, a school that Princes William and Harry attended, the spaces reserved by newborns fill up early each month, and the school advises women scheduling Cesarean sections to have them on the first of the month, if possible, to get a place before all the spots are gone.

In fact, unraveling is an ancient problem. In medieval England, it was sometimes a crime, called "forestalling," to trade before the official opening time of a market. It's not a crime today, but try telling that to the vendors who come to the farmers' market near my home and refuse to sell to me if I show up before the official opening time for fear of starting a race with the other sellers about who can set up first.

Those farmers are exerting self-control, maybe with a little help from the city, which licenses them to use the street only between certain hours. But unraveling can't always be limited by self-control. Even if a law firm can control itself and delay its own hiring until some reasonable time, if the firm's competitors hire earlier, it could be caught short. This fear of being left behind is part of what turned pioneers into Sooners.

So unraveling is hard to control in a market that relies on self-control. Even if you have a lot of self-control, all you need is the suspicion that other participants might jump the gun and you will do so, too. It would be irrational not to. In many markets, what we see at first is a slow unraveling that suddenly tips over into a mad dash. It is often only then, when the participants see the profits from going a little early now getting swallowed up by the costs of racing with everyone else to go very early, that a consensus finally grows in support of reversing this unraveling. That's when new market designs might be considered.

Let me tell you about a simple market design solution that halted and reversed unraveling in a market in which unraveling was the only market failure that remained to be solved. The trick was to remove the need for self-control among those tempted to make early offers by handing over some control to the people on the receiving end of the offers.

FINDING THE GUTS TO WAIT

If you're under 50, you probably don't have to know what gastroenterologists do. Let's just say they are doctors who look after your digestive system. And after you turn 50, you're supposed to visit them so they can look for early signs of colon cancer.

To become a gastroenterologist, a doctor must participate in what's called a fellowship, which takes place following his first job, or residency, after graduating from medical school. The market for medical residencies was the first unraveled market I studied. Today that market is no longer unraveled, and new doctors are matched to residencies during their last year of medical school, in a market that is thick, uncongested and safe.

The medical residency that future gastroenterologists must complete for is in the field of internal medicine and takes three years. So gastroenterology fellows could, in theory, be hired after they have three years of medical experience. Unfortunately, the unraveling of the fellowship market led hiring to creep back earlier and earlier, until first-year residents sometimes found themselves being interviewed for jobs that they might begin two years in the future. Once again, this could be costly, both for fellowship directors hiring fellows while they were still inexperienced, and for young doctors having to choose a subspecialty before they'd had time to learn what they liked.

When my colleague Muriel Niederle and I studied the unraveling of this market, we observed that fellowship directors were increasingly hiring applicants who had done their residencies locally, because the only first-year residents it was safe to hire were those for whom those directors could get reliable recommendations from their own colleagues. This restriction in the candidate pool reduced the desirable diversity of fellows. What these directors didn't appreciate – until they saw our results – was that this local hiring was happening to everyone. Only then did they all realize that their own problem was in fact market-wide. As you might imagine, that generated a lot of interest in hiring later.

Muriel and I eventually helped them to plan a clearinghouse that operated later in the careers of medical residents, like the one that matched new doctors to residencies. But those same fellowship directors didn't trust each other to cooperate and wait for the clearinghouse; they all worried that the others would continue to hire via early exploding offers. If they waited to take part in the clearinghouse, they feared all the best candidates would already be hired.

This lack of trust threatened to keep everyone making early offers, just in case everyone else did – even when no one, or almost no one, wanted to. So we asked the four principal professional organizations of gastroenterologists if they couldn't simply forbid their members to hire before the clearinghouse opened for business. They told us they had no power to regulate the behavior of their members, the fellowship program directors.

We next asked those organizations if they could pass a resolution that would empower fellowship applicants who had accepted very early offers to change their minds if, later, at the time of the clearinghouse, they regretted their early decisions. That proposal caused some concern: administrators worried that the market would have many offers accepted and then rejected.

Using several kinds of evidence, we were able to convince them that this wouldn't happen, since the incentive to make an offer before you could tell which applicants were good ones would be eliminated if early offers and acceptances weren't binding. By freeing fellows to change their minds if they accepted early offers, the new approach deprived program directors of the incentive to make early offers and relieved them of the fear that others would do so. Thus they could safely wait and match to a great candidate later when the clearinghouse opened.

It doesn't take a lot of self-control to stop making early offers if they no longer get you what you want.

Part of our evidence came from the market for new PhD students in universities. Almost all American universities have agreed that students shouldn't have to accept offers before April 15 of each year. If students are pressed to accept an offer before that deadline, they can accept and then later decline in order to accept another offer before that date. This single rule has virtually eliminated all exploding offers for PhD candidates in the United States. Another part of our evidence was experimental: when we set up these rules in the laboratory and ran them in a simple artificial market, they eliminated exploding offers.

Still another part of our evidence was theoretical. Exploding offers won't occur when everyone has enough experience with the market to know what to expect. When that happens, economists say the market is "at equilibrium." In this case, equilibrium meant that everyone would expect that fellowship programs would be committed to hiring the young doctors to whom they made early offers but who subsequently performed below expectations. But they wouldn't actually get to employ those accepting early offers who exceeded expectations because those people would take better offers made later. Since the main point of early exploding offers is to "capture" better candidates than you could if you waited, program directors wouldn't make exploding offers if they no longer accomplished that goal. It doesn't take a lot of self-control to stop making early offers if they no longer get you what you want.

This worked for the gastroenterologists: they accepted the arguments and implemented the advice, then successfully organized a clearinghouse that now operates each year much closer to the time that gastroenterology fellows will actually start work. Exploding offers aren't a problem anymore, and so almost everyone succeeds in hiring and being hired in the clearinghouse, which operates later, along the lines of the successful market for residents. That clearinghouse provides a thick market that is worth waiting for, much as a thick marriage market in college makes it less pressing for people to marry their childhood sweethearts, or a lot of parking spaces near where you want to park makes it easy to pass up parking spots that you encounter when you're still far from your destination.

Our solution to the problem of hiring new gastroenterologists highlights one of the crucial facts about market design: successful designs depend greatly on the details of the market, including the culture and psychology of the participants. In the years that followed, we encountered a number of other markets facing problems that at first glance looked identical to the gastroenterology market. But in the end, some of these markets required very different solutions.

CULTURAL SHIFT

One excellent example of this is the market for orthopedic surgeons, which at first seemed to be a near clone of the market for gastroenterologists discussed above.

When I spoke with the orthopedic surgeons at Massachusetts General Hospital, it quickly became apparent that they had an unraveling problem: they were hiring new fellows up to three years ahead of time, when the fellows were still young surgical residents. The senior surgeons weren't too worried that they couldn't assess the dexterity of these residents while they were still so young. But they'd noticed that some of their new hires, when they eventually showed up to take their positions, had matured into operating room bullies who made the nurses and others reluctant to work with them.

This complicated scheduling and was bad for morale. If the senior surgeons could wait until after the young residents had time to grow into chief residents and assume more responsibility, they would be better able to assess what kind of colleagues the new surgeons would be, and not just how good they were with their tools. When Muriel and I began to look into the details, we found that the hiring of orthopedic surgeons looked almost exactly like that of gastroenterologists – early exploding offers, local hires, and all. So, naturally, we suggested to them that the solution that worked for the gastroenterology market might work for them as well. That is, if they could empower applicants to change their minds after accepting early offers, those early offers would cease and an orderly clearinghouse could be organized at a convenient later date.

But the orthopedic professional organizations – which include at least nine distinct subspecialties – quickly told us that they couldn't empower young surgeons to change their minds about agreements they'd made with senior surgeons. That would never happen, they said: senior surgeons were too powerful and imposing for younger surgeons to feel that they could really change their minds, no matter what anyone said.

Self-control is not a solution: you can control only yourself, and if others jump ahead of you, it might be in your self-interest to respond in kind.

They saw no obstacle, however, to imposing sanctions on fellowship directors who made early offers. One of the professional societies even told us they simply wouldn't let those doctors present papers at their annual meeting. So, by way of blunter methods, orthopedic surgeons were also prevailed upon to stop making exploding offers, which allowed some clearinghouses to be organized in orthopedic subspecialties.

Orthopedic surgeons needed a somewhat different market design than gastroenterologists to fix similar market failures because the two professions had distinctly different cultures. But in each case, they were able to find a way to prevent exploding offers.

The problems facing federal judges in the clerkship market are harder to solve because that market culture actually combines the difficulties faced by gastroenterologists and orthopedic surgeons. The organizations of judges – called "judicial conferences"– are like the gastroenterology organizations in that they have no way to prevent judges from making early exploding offers or punish those who do. Meanwhile, as with junior and senior orthopedic surgeons, law students aren't in a position to break promises to federal judges. These things make it difficult for judges to organize themselves in a way that lets them trust one another to obey the rules.

Markets unravel despite the collective benefit of having a thick market in which lots of people are present at the same time, with many opportunities to be considered and compared. Without a good market design, individual participants may still find it profitable to go a little early and engage in a kind of claim jumping. That's why self-control is not a solution: you can control only yourself, and if others jump ahead of you, it might be in your self-interest to respond in kind. These early movers become the equivalent of the Sooners in the Oklahoma Land Rush.

For both gastroenterologists and orthopedic surgeons, success had to do not just with setting a particular time at which the market should operate but also with having a well-designed market available at that time. Making the market operate within a narrow time frame, but without providing something, such as a clearinghouse, that brings order to the market at that time, usually isn't a good enough solution to the problem of unraveling. It can cause congestion, as when members of an unruly crowd all try to stake their claims at the same time – which can result in a different kind of market failure, when people feel pressed to make offers (and demand replies) too fast rather than too soon. A congested market may break down in a way that makes the participants risk the fate of poor Walter Cook, the man who was soon enough to stake a claim but not fast enough to register it – the biggest winner, and the biggest loser, in the Oklahoma Land Rush.

BY CHARLES CASTALDI

MILAN. In 1965, when my parents relocated the family from Italy to the United States, our first stop was the New York World's Fair. It was a futuristic paradise constructed on 650 acres of former marshland in the Borough of Queens. A giant stainless steel model of the earth, called the Unisphere, welcomed us. It had orbit rings around it to celebrate both the Space Age and the Atomic Age.

The theme was "Peace Through Understanding," which roughly translated as prosperity through American products. Computers, an elevated monorail, sleek modernistic buildings, vehicles of tomorrow. Soon I'd be flying to school with my jetpack, vacationing on Mars, and relying on a robot to do my chores.

Fifty years later, I'm back in Italy, and my first destination is the 2015 Milan Expo, as this year's World's Fair is called. Times have most definitely changed. The signature structure at the entrance mimics rolling hills from the center of Italy and is entirely clad in wood. Called Pavilion Zero, it addresses Expo's theme, "Feeding the Planet, Energy for Life." The interior includes a reconstruction of a wood-paneled ancient library where memory drawers hold the history of food production.

Walking through the fantastically elegant structure – Milan is the home of Italian design, after all – one quickly realizes that the futuristic promises from New York are but a distant memory. Steel is out, while wood and fabric are in as the architectural materials of choice.

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No futuristic transportation here. Be prepared to walk a mile to reach the far end of Expo, along what is essentially a covered fairway with pavilions from 145 countries running alongside. There are gardens and vegetable plots galore, small countries celebrating their coffee, their cocoa, their natural wonders. The theme of food and sustainability gazes back on a lost past of grand scale and still grander dreams of technology as savior.

Halfway down the fairway, after marveling at the way the Israelis used a vertical garden of wheat and corn (and some crops I didn't recognize) as one wall of their exhibit, I come to the Eataly pavilion, which is composed of 20 restaurants from all the regions of Italy in a space that dwarfs many national pavilions.

Eataly, the brainchild of Oscar Farinetti, an entrepreneur from Turin who was an early promoter of the slow-food movement, is what the Expo is really about: how to aggregate small producers to make them economically competitive – and how to use the Italian brand to market high-end-niche products. Farinetti is certainly a living advertisement for the concept; he has opened 29 fabulously successful megastores on four continents,

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with at least two more on the way.

Nitpickers question how truly slow-foodish the whole thing is: is this a model for helping small artisanal producers thrive or one for making a boatload of money? Farinetti, who exudes optimism, thinks he can do both. And, I suspect, the hungry mobs that descend each day on Eataly outposts in New York, Istanbul, Turin, San Paulo, Tokyo and parts soon to be announced are inclined to agree.

Expo also embodies the rising optimism palpable in at least some regions of Italy, which finally seem to be surfacing from almost a decade of stagnation, punishing unemployment and Berlin-mandated austerity. Expo might even contribute to the turnaround, stimulating innovation and productivity long after its six-month run. It's (extremely optimistic) promoters project that the fair will generate somewhere around $75 billion in demand for the regional economy over the next decade, after accounting for all the multiplier effects.

Reality check: this being Italy, it was touch-and-go whether Expo would be ready to open on time. This being Milan, it did. Still, a number of officials in charge of construction have been arrested on charges of – what else? – corruption.

GOING HOME AGAIN

A short train ride later, I'm in the center of Milan, and it doesn't take long walking the streets to get the sense that this is a city on the way up. Literally. The landmark monuments – the 32-story Pirelli building and, of course, the Duomo (the fifth-largest church in the world) – are now dwarfed by skyscrapers built in the past decade and designed by architectural luminaries like Cesare Pelli and Arata Isozaki.

Equally striking, the older buildings, like the iconic Duomo, are no longer the soot-stained dirty grey of my childhood; they've been scrubbed to reveal a palette of off-white-and-cream limestone and marble. The Galleria Vittorio Emanuele, which leads to Piazza del Duomo, has been fully restored and is trafficked by multitudes ogling the structure and the high-end stores inside. In fact, much of Milan's center now teems with tourists, many of whom seem intent on feeding their high-end-shopping joneses.

The great contemporary city does not live by expensive baubles alone. Outside the center, companies that include Pirelli and Prada have transformed gritty industrial buildings into museums and cultural centers. At the Prada museum, created by Miuccia Prada, whose Milanese fashion empire has made her the richest woman in Italy, the guards are all young, dressed in elegant eponymous uniforms – and, most astonishingly, all seem to be art-history majors who can talk knowledgeably about the nearby splendors.

Italian tourism has been on the rebound for a couple of years now, and is expected to keep growing briskly in spite of the Eurozone's doldrums, bringing in close to $50 billion this year. More generally, the growth of service businesses is giving Italians hope that dwindling employment in heavy industry like autos and rubber can be offset by office and shop jobs. Florence, Rome and Venice are still the most popular tourist destinations. But Milan, especially with the arrival of the Expo, is giving them a run.

FRIENDS FROM ALL THE WRONG PLACES

But Italy has also become a destination of a very different sort. The Italy I left as a kid, a country of net emigration, is now a magnet for immigrants. The phenomenon has roiled Italian society and stands in stark contrast to the optimism generated by Expo and the signs of renewed growth.

I went to Catholic University of the Sacred Heart to speak to Prof. Laura Zanfrini, a leading immigration expert. "Unlike the U.S. and Canada, here in Europe you're taught that, if you're Italian or German, it is because you have it in the blood," she explained. "We have a very ethnic conception of what it means to be a nation. Given this, I find it a bit of a miracle that in the last few years we've been able to absorb five million immigrants.

Most of these immigrants, who now make up eight percent of the Italian population, have settled in the North, where the jobs are. In this respect, Italy is two countries: the North of the post-World War II boom, where the economy grew at an average of more than five percent until the '70s, and the South, which remains an agrarian society dogged by corruption, organized crime and dependence on state subsidies. Most emigration to the United States came out of the South well into the 20th century. And it continued internally, with Southerners heading to the North after World War II.

Over the years, Rome has vacillated between discouraging immigration and protecting immigrant rights. But the quotas associated with the former are essentially meaningless, since enforcement is so difficult. Italy has asked other European countries to bear more of the burden. The appeal, though, has largely fallen on deaf ears on a continent preoccupied with high unemployment, tight budgets and Greece's ongoing agonies. And it has largely fallen to Italy to accept – and rescue at sea when necessary – untold numbers of migrants who sail from Libya in overcrowded or unseaworthy craft.

"Some of the slack has been taken up at the local level, regardless of ideology, but that reflects the Italian phenomenon of generally strong local government," Zanfrini says. And volunteer organizations like Caritas, an umbrella group for Catholic charities, "have stepped in where public assistance was lacking."

Ironically, immigration may prove part of the solution to another looming social problem. Italy is on a demographic death spiral: Italians, along with the Germans and Japanese, are now the oldest people on earth. Life expectancy for retirees keeps rising, even as reproduction remains stuck far below the rate needed to offset aging.

Throw in youth unemployment (above 40 percent), which means few new workers paying into pension plans, and you have the makings of a serious Social Security crisis in the not-too-distant future. That is, unless immigrants can help take up the slack.

"Here in Milan we have a foreign child for every three or four Italians born," Zanfrini says. "We have this idea that the immigrants will come and do the work that Italians don't want to do, which is discriminatory."

That may be right, but there's good reason to believe that young Italians are reluctant to do the heavy lifting. The universities are packed with students aiming for professions, but those jobs are hard to come by. In the meantime, the fashion industry is struggling to find Italians willing to cobble shoes or tailor clothes. Immigrants gladly take those jobs – if they are permitted to do so.

GROUND ZERO

I leave Catholic University and head across town to the central train station, just a few blocks from where I grew up. The building's Fascist-era architecture seems as imposing as it did as when I was a child. But as I approach, I'm distracted by the sight of hundreds of immigrants hanging out on the steps. Others sleep in corners, under trees and on the lawn.

Inside, in sections of the station that have been cordoned off, entire families are gathered on mats. A plexiglass bubble that had housed a Victoria's Secret store is now filled with immigrants slumped in rows of folding chairs and staring vacantly into space. Under a portico, volunteers are providing free meals to the hungry. Here, it's mostly Eritreans, with some Syrians recognizable by the women completely covered by chadors.

In front of the station, dueling groups of demonstrators are lined up on either side of a police cordon. On one side, the signs read "benvenuti" (welcome), on the other, "basta" (enough) or variations on the theme. Eventually, this current scrum of immigrants will be taken to relocation centers in other parts of the city. But the numbers overwhelm the capacity to house them. Given the rest of the EU's stance of malign neglect, Italy (along with Greece) must bear the brunt of this seemingly endless wave of the tired and poor yearning to breathe free.

WHERE THE OTHER HALF LIVES

Heading north from Milan, travelers pass through the region known as Brianza, one of the most prosperous in Italy. A century ago, silk production and agriculture were the economic mainstays. Today, the economy runs the gamut from furniture to textiles, machine tools, plastics and a smattering of high tech. Just a few miles north of Monza, home of the famed Formula One circuit, the auto-parts maker Dell'Orto SpA typifies the sort of medium-sized businesses so important to the Italian economy.

Andrea Dell'Orto is vice president of the company, which his grandfather founded in 1933. "2009 was the toughest moment for us," he recalls. "We lost 40 percent of our sales. But since 2013, things have turned around. Even

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during the crisis," he said, referring to the Great Recession, "we never stopped innovating and even hiring. Today we make parts for both high-volume customers and for high-end-niche customers." (His clients include Fiat, BMW, GM, Ferrari, Audi and Aston Martin.) As in the food and fashion industries, high-end-niche seems to be the mantra when talk turns to Italy's economic recovery.

Dell'Orto says it was not easy, but his firm has adapted to the dynamic of globalization. "The companies with the best performance are the ones that are open to international markets," he says. He now has divisions in China and India.

SAY "CHEESE"

Further north, on the shores of Lake Como, sits Lecco, a small city with a farmers' market known to Milanese connoisseurs who have frequented it for generations. Dozens of local cheeses are available, all still made on a small scale. It's the Eataly-Expo concept in the flesh. And the flesh seems healthy.

The day I was there was one of the final days of campaigning in regional elections. Walking through the crowd of shoppers, surrounded by a small entourage, was Matteo Salvini, the head of the Lega Nord, a right-wing party founded in 1991 on a platform of greater autonomy for Italy's regions. It grew out of the Lega Lombarda (Lombardy League), which essentially espoused secession of the wealthy Lombardy region, in which Milan is situated, from the rest of Italy. But in particular it expressed the Northerners' wish to decouple from the South and its corrupt, handout-seeking ways.

The Lega, as it commonly known, was an important ally for then-Prime Minister Silvio Berlusconi. But now the party has reinvented itself as the Italian equivalent of Marine Le Pen's right-wing-populist National Front in France, staking its future on an anti-immigration platform and a rejection of the European Union and the euro.

Salvini tells me: "We want an immigration system like the one you have in the U.S. Quotas, laws against entering illegally, the ability to ship out those that do so. That's all we're asking for."

Well, not quite all. "We have enough immigrants as it is," he continues. "If more boats arrive, we should give them food and water, but not let them land." And when it comes to Muslim immigrants, Salvini says their culture is "incompatible" with Italy's – a view widely held not just in Italy, but in much of Europe.

When asked about Italy's prospects, Stiglitz sips from a glass half empty...make that just plain empty.

Salvini isn't your traditional Italian politician. He trolls the crowd in shorts and polo shirt, glad-handing and taking selfies with admirers. An ex-journalist, he knows how to create sound bites that are both controversial and effective. Given the warm reception he gets in the market and the way the immigration debate is heading, Salvini's prospects as a major player in Italian politics seem bright. The elections gave the Lega leadership of the Veneto and Ligurian regions, and the party made serious inroads elsewhere.

Italy has had 61 governments since the end of World War II. But most were merely iterations of the Christian Democrats, a center-right party whose extended rule started with the generous assistance of the United States and was thereafter supported by a CIA-organized campaign to ensure that the Communists, who had emerged as a force to be reckoned with after the war, would not win national elections.

Berlusconi represented the first definite break from clubhouse politics-as-usual, not only in his personal excesses but also because he came to power (in 1994) with a party he founded, Forza Italia. Even though Berlusconi was new to politics, his vast wealth and ownership of much of the Italian media made him a force to be reckoned with.

He advocated free markets, à la Reagan and Thatcher. The economy did well for a while during his reign, but eventually growth sputtered under the burden of increased debt and government mismanagement.

Throughout his tenure, Berlusconi was enveloped in scandal, whether for corruption, conflict of interest or sexual improprieties. Eventually, he was found guilty of soliciting sex from an underage prostitute and then trying to cover it up. He was banned for life from holding office, but Forza Italia was resurrected during the last regional elections. It appears that Berlusconi, a Mussolini look-alike known for Trump-like faux pas, will be around a bit longer – a reality that bewilders outsiders and even some Italians.

One only has to look at the current government's composition to see how much things have changed since Berlusconi's stumble from office. Women, a scarce species in previous governments, now occupy half the cabinet positions. By the same token, the average age of cabinet members in a political system not known for speedy promotions is now just 47.

The prime minister, Matteo Renzi, is the former mayor of Florence and, at age 40, is the youngest man to have ever led Italy. His politics are sometimes described as center-left, but he often refers to Bill Clinton as his post-ideological model.

He came into office at the beginning of

2014 vowing to turn the calcified Italian political system on its head. Indeed, he moved quickly to change until-then-sacrosanct labor laws, giving employers more flexibility to hire and fire. This put him at loggerheads with the labor unions, but he managed to pass the reforms and his standing in the polls went up.

Renzi sold off luxury cars that had been routine perks of state officials, a signal that, in his Rome, bureaucrats really are supposed to be the servants of the people. More important, he is pressing for constitutional changes that he said were needed to make the political system more representative.

The changes would also increase the power of the executive, which has drawn heavy criticism from the left wing of his own party. Still, Renzi's standing among Italians of all political stripes has only improved. He has also staked out a middle ground on Greek debt, advocating relief while managing to maintain cordial relations with the dark princess of austerity, German Chancellor Angela Merkel. For once, it isn't only Italians who seem uncharacteristically positive about their prime minister; even political leaders of the EU seem to be taking Renzi seriously.

WORDS FROM A NOBELIST

I take the ferry to the other side of Lake Como, where Joseph Stiglitz, the Nobel Prize-winning economist, is at the Rockefeller Center in Bellagio, working on a book on inequality.

Before coming to Bellagio, Stiglitz spent some time in Trento at an economics festival attended by Renzi. The prime minister's criticism of Chancellor Merkel's emphasis on austerity impressed Stiglitz, who is an outspoken opponent of Germany's hard line on Greece. "The Europeans don't want to recognize that they put together" a fiscal-austerity program in 2010 that was badly conceived, he believes. "So they are insisting you have to stick to the program," he said, "as if by reaffirming it they're getting the Greeks to agree that that program makes sense."

When asked about Italy's prospects, Stiglitz sips from a glass half empty. The prospect of a serious recovery is very bleak, he says. "Italy's trading partners in the Eurozone are growing weakly, domestic demand is not going to grow very strongly, and the outside source of demand, China, is also not growing very strongly."

Make that glass just plain empty: "I think that Italy, and Europe as a whole, is going for a lost decade," Stiglitz says. The real question, he adds, is whether "it is going to be a lost quarter-century."

When I explain what I saw at Expo and the emphasis on high-end-niche markets, even Stiglitz brightens a bit. "The strategy they have had of very highly tailored goods, this is an important difference between China and Italy," he says. "Over the long run, it makes a lot of sense because the mass production of cheap goods" in Europe cannot compete against China.

I mention Dell'Orto, which is manufacturing precision parts just a few miles to the south. "Italy is finding niches in the world of globalization where you have high-end engineering, high training, lots of tacit knowledge," Stiglitz says. "If they can survive this patch, they could come out in good shape."

* * *

Italians certainly don't lack survival skills; surviving in style is a well-honed tradition, something quite evident in Milan and its surroundings. The problem is that Italy's success depends in large part on the kindness – or at least the exercise of enlightened self-interest – on the part of Northern Europeans. And thus far, there's little reason to believe that Northern Europe will come through.

BY THOMAS R. KRAUSE

You've seen the astounding numbers: hundreds of thousands of Americans die each year due to medical treatment errors. Indeed, the median credible estimate is 350,000, more than U.S. combat deaths in all of World War II. If you measure the "value of life" the way economists and federal agencies do it – that is, by observing how much individuals voluntarily pay in daily life to reduce the risk of accidental death – those 350,000 lives represent a loss exceeding $3 *trillion*, or one-sixth of GDP. But when decades pass and little seems to change, even these figures lose their power to shock, and the public is inclined to focus its outrage on apparently more tractable problems.

In fact, there is little doubt that patient safety could be significantly improved. But the first crucial step to stopping the scourge of health care errors is seemingly the most mundane (and elusive): building a national measurement system that accurately tracks patient harm. With such a system in place, researchers would be far better equipped to test how well various safety initiatives would work in thousands of health care environments, to identify the weak links in hospital safety systems, and to pin down how insurers and regulators might best use their leverage to minimize patient risk.

As a reporter for *Modern Healthcare* summed up last year:

> There is agreement that significant progress has been made on some fronts. But problems remain in many areas, due to a wide range of unproven interventions and inadequate performance metrics. Some clinical leaders doubt hospital safety is much better than it was 15 years ago when the Institute of Medicine issued a landmark report that helped launch the patient-safety movement.

THE CHALLENGE

My own expertise lies in advising enterprises in a range of industries, including chemicals, mining and transportation, on strategies for reducing accidents. Successes have far outnumbered the failures. But by virtue of their size, rapidly moving technology and organizational complexity, health care safety issues are in a league of their own.

The problem is not a lack of statistics, but how to compare and winnow them for clarity and compatibility. Currently, hospitals employ small armies to track myriad patient safety and care-quality statistics, reporting them to a wide range of entities. The process, though, is

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costly, inefficient and often ineffective.

Current estimates suggest the rate of adverse events in the health care setting is higher than in any other. But as alarming a reality as that is, it is even more alarming that we have only a hazy sense of the parameters of the problem because we lack sufficiently robust data to quantify it.

The Institute of Medicine report called on Congress to monitor safety throughout the U.S. health care system. At the heart of the monitoring would be a nationwide mandatory reporting system in which state governments collected information on adverse medical events that resulted in death or serious harm. But the emphasis here is necessarily on "nationwide." Without those numbers, the only way patient safety as a whole can currently be evaluated is through laborious, problematic studies that sample provider records to dig out the number of adverse events.

The failure to assay harm this way is unique to health care safety. Safety on our highways, in our homes and recreation areas, and in virtually all other industries and government agencies is quantified and reported. The data serve as an anchor for prevention research, intervention design and evaluation of improvement strategies.

Health care administrators may be aware of the results of specific projects that address selected types of harm and typically maintain massive dashboards of indicators of their own. But the Balkanization of the process – the decentralization of decisions about what should be measured, who should do the measuring and who should have access to the data – hampers the design of effective strategies for making patients safer.

Consider again the lack of consensus on that most basic concept, the number of fatal adverse events. The Institute of Medicine estimated that in 1997 between 44,000 and 98,000 patients died as the result of medical errors. In spite of initial skepticism, based on

SCOTT ROBERTS

the belief that the IOM had overstated the problem, these data are widely cited today. Indeed, more recent studies by Christopher Landrigan and others in the *New England Journal of Medicine* and John James in the *Journal of Patient Safety* as well as by the U.S. Department of Health and Human Services' Office of the Inspector General estimate that the toll is far larger than the IOM numbers. These later estimates range from 130,000 to 180,000 deaths in hospitals from preventable adverse events and up to 480,000 deaths in all health care settings.

Such wildly varying estimates – based on different definitions of such key terms as "error" and "harm" – have limited value in tracking progress (or lack thereof) or in enabling planning across localities and organizations. Note, moreover, that such planning has become a major feature of the rapidly evolving health care industry as it responds to enormous pressure to get more bang for a taxpayer's and private insuree's buck.

There is no consistent measure of adverse events, preventable or not, that are permanently disabling, life-threatening or fatal.

WHAT'S HAPPENED SO FAR

In the 15 years since the IOM report focused attention on measurement, there has been some movement forward. The Medical Errors Reduction Act of 2000 financed projects to evaluate strategies for reporting errors. The Patient Safety and Quality Improvement Act of 2005 removed some disincentives for accurate reporting by protecting the identity of health care providers who report mistakes. Ten years later, however, problems still abound: not all states report, not all hospitals are required to participate and, as I've made clear, there is no consistent measure of adverse events, preventable or not, that are permanently disabling, life-threatening or fatal.

In 2006, the Institute of Medicine did recommend options for a national performance measurement system. And in 2012, the Centers for Medicare and Medicaid Services (CMS) began implementing a pay-for-performance scheme based on mandatory reporting of specific claims events. That has provided greater transparency, with metrics on hospital performance available on the Department of Health and Human Services' website. Indeed, the Compare website gives consumers an enormous amount of information about local hospitals – and presumably strengthens the hospitals' incentives to shape up.

Two other government agencies, the Centers for Disease Control and Prevention (CDC) and the Health and Human Services' Agency for Healthcare Research and Quality (AHRQ), are also involved in pressing for better data. But none of these efforts, it should be emphasized, has resulted in a national measurement system.

HEALTH CARE ORGANIZATIONS

Not all efforts have been initiated by public agencies. The Leapfrog group, an organization representing a mix of companies providing health insurance to their employees, used 28 measures from the CDC, CMS and AHRQ, along with its own survey of hospitals, to develop a publicly available composite patient safety index. Since survey participation is voluntary, however, scores are not tracked for every state. Moreover, the group offers no nationwide measure, and there is no way of estimating total harm to patients.

Another significant contribution came from the National Coordinating Council for Medication Error Reporting and Prevention, a group of health care stakeholders as varied as its alphabet-soup acronym is long. It developed an index for categorizing medication errors according to severity. Although targeted at medication errors, the NCC MERP severity index has seen broad application in research and adverse event reporting.

The Institute for Healthcare Improvement, a nonprofit funded by a variety of companies and foundations, developed the Global Trigger Tool, a detailed set of instructions for retrospectively measuring adverse events that facilitate the use of patient records for research on health care-associated errors. This is an important innovation, but it leaves individual institutions with the optional task of periodic, time-consuming, resource-intensive research to dig out events.

WHAT HEALTH CARE CAN LEARN FROM OCCUPATIONAL SAFETY

Plainly, health care insurers and providers have gotten the message that error containment must be a high priority. And, equally plainly, a host of initiatives are making a difference – but one limited by the lack of a comprehensive national database. It thus makes some sense to see what has worked on safety data in other fields.

The Occupational Safety and Health Act of 1970 was a game changer. Before that, there was no national standard for reporting occupational injuries. OSHA drives two levels of measurement with common metrics, setting record-keeping standards at the organizational level and monitoring compliance with the standards. Meanwhile, the Bureau of Labor Statistics collects, compiles and analyzes statistics for the nation.

Reporting criteria are relatively simple and provide enough information to gauge the frequency and severity of harm. OSHA audits the records for compliance, while individual organizations use them for internal measurement and benchmarking.

The BLS's Annual Survey of Occupational Injuries and Illnesses provides a national measure of workplace safety. Each year, approximately 200,000 organizations submit their OSHA logs, along with employment information (used as a denominator to calculate injury and illness rates) and demographic information. It's important to note that the BLS survey is confidential.

The BLS and OSHA measurement systems use common definitions and rate calculations. These enable comparisons across organizations, locations and industries. By the same token, OSHA's record-keeping standards for employers facilitate the BLS annual survey process. The impact of a reliable metric that's nationally consistent (supplemented, of course, with regulation that is enforced) has been significant.

From 1940 to 1970 (pre-OSHA), work-related fatal injury rates fell by half, reflecting a mix of regulation and employer-initiated safety efforts. One might have expected the rate of improvement to fall thereafter because the initial gains were presumably the easiest. But that has not been the case. From 1970 to 2000, after the creation of OSHA and its record-keeping requirements, fatal injuries fell by three-quarters. Admittedly, it's hard to disprove the counterfactual that rates would have fallen as much without the rise of national record-keeping that gave regulators easier ways to compare industries, localities and individual plants. But most safety experts give a lot of credit to the reform.

WHAT MUST BE DONE

Financing study after study after study in order to learn the frequency of adverse events has proved ineffective because variation in methods, sampling and scope make it impossible to compare numbers across time and geography. One could argue that some individual hospitals already measure what they need to drive improvement within their facilities. But patient safety is not an individual hospital issue. A federally mandated measure would allow more accurate comparisons that facilitated both competition to improve institutional performance and the information needed to formulate more effective regulation of health care safety.

The building blocks for this national system already exist. The NCC MERP system for classifying harm from medication errors could be adapted for a broad range of adverse events generally. The starting point could be just three measures organized by degree of harm using the NCC MERP classification system:

Fatality Rate. Number of fatalities related to adverse events, divided by hospitalized days.

Serious Injury Rate. Number of adverse events causing temporary or permanent harm and those requiring additional hospitalization, divided by hospitalized days.

Reportable Injury Rate. Number of adverse events causing any harm to a patient, divided by hospitalized days.

As a practical matter, data collection should shield data providers from fallout; without confidentiality, reporting is bound to be distorted. U.S. health care is rife with finger pointing, spurred on by malpractice lawyers and insurers eager to minimize liability. Data collection and analysis shouldn't serve to deepen the sins of the extremely inefficient legal liability system or allow that system to compromise its accuracy.

As important, reporting needs to be mandatory. Since the IOM initially called for mandatory reporting, there has been considerable debate over the relative efficacy of mandatory versus voluntary reporting systems. I think too much is at stake – and the incentives for obfuscating bad news too great – to depend on health care organizations to be pressured by public opinion or consumer approbation into reporting (and reporting accurately).

SEIZING THE DAY

The reality that it's difficult to build a comprehensive error-reporting system for America that readily permits comparison between localities, methods of organization, incentive structures and the like should not be surprising. The sheer size, degree of interest-group conflict and decentralization of the health care establishment make virtually any change exceptionally difficult.

But, by the same token, the potential rewards have never been greater. Digitization makes the management and analysis of vast amounts of data far easier. And as the population ages, the stakes in delivering care safely as well as efficiently will inevitably grow.

As the record of countless experiments in improving patient safety shows, the problem is hardly being ignored. However, hard work alone does not ensure that care organizations are expending effort on the right things.

Moreover, the current culture in health care does not support comprehensive reporting. Unlike other (generally less dangerous) industries, there is no obligation to report. So we can assume that incidents are grossly underreported – but just where and why, we don't know. Note, too, that as health care itself changes, a delivery model that is centered on physicians is becoming a growing impediment. In reality, our health care system is no longer focused on single physicians but on groups of caregivers. And the gaps in patient error-reporting mirror the gaps in recordkeeping as patients negotiate the tortuous paths of modern care.

We have the technical capacity to create a comprehensive error-reporting system and to make good use of it. The question now is whether we have the will.

Into Africa

In July, the Institute advanced its Africa Initiative by hosting two events on the continent. A Financial Innovations Lab in Johannesburg explored solutions to the persistent problem of tuberculosis in the South African mining sector, convening industry executives, government officials, investors and donors to develop a social impact bond model.

The following week, the Institute took part in the Global Entrepreneurship Summit in Nairobi (which President Obama also attended), with Managing Director Mindy Silverstein speaking on the "Financing Entrepreneurship" panel. During the Summit, the Institute also hosted a CEO/investor roundtable attended by U.S. Commerce Secretary Penny Pritzker, as well as a session in our series on financing infrastructure in Africa. These efforts, along with the Center for Financial Markets' work to develop regional capital markets, are part of the Institute's broad initiative to make a difference in the development of sub-Saharan Africa.

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Which way, Cathay?

For nearly 20 years, the Institute has published its annual "Best-Performing Cities" index, scoring U.S. cities on how well their economies fuel job-creating growth. And it's built quite a following: the report's release is greeted with much interest by local political leaders, urban planners and media.

This year, we took our act abroad. Published in September, "Best-Performing Cities China" rates urban areas in the world's most populous country. Like the U.S. version, the index grades metros on purely economic factors including growth in jobs, wages and direct investment. It's an X-ray of sorts of the economies of 34 first- and second-tier cities, along with 232 third-tier cities.

And the winner is? Among first-tier cities, Chengdu, capital of Sichuan province, scores top-10 positions in seven out of the nine index components. Driving the city's success: its human capital, support from the central government and a booming mix of military and electronics manufacturing. The runner-up is Shanghai, coastal China's bustling finance capital. For full results (and a detailed explanation of how we compose the index), check out the Institute website.

I want my M(I)TV

Bored with the offerings on Netflix or Hulu? Yearning for something meatier? Download the Institute's new app, MItv to your smartphone or tablet. It's your port to 600-plus video sessions from various Institute conferences and events, including the annual Global Conference. Best of all, the content is free for the clicking.

Well, actually, what's best is just how many of the videos are chock-full of fascinating analysis of everything from the latest in medical technology to the agonies of the Eurozone. And did we mention … it's free.

Karl Marx has long been an easy target. After all, he famously wrote (in 1847) that "the modern laborer, … instead of rising with the progress of industry, sinks deeper and deeper below the conditions of his own class. … The proletarians have nothing to lose but their chains."

His timing could hardly have been worse; the then-wretched living standards of workers in the UK (and much of the North Atlantic economy) more or less rose in tandem with economic growth over the next 12 decades. And while capitalism has never quite lived up to its press releases – the Great Depression was no walk in the park – there was little evidence that the system was planting the seeds of its own destruction.

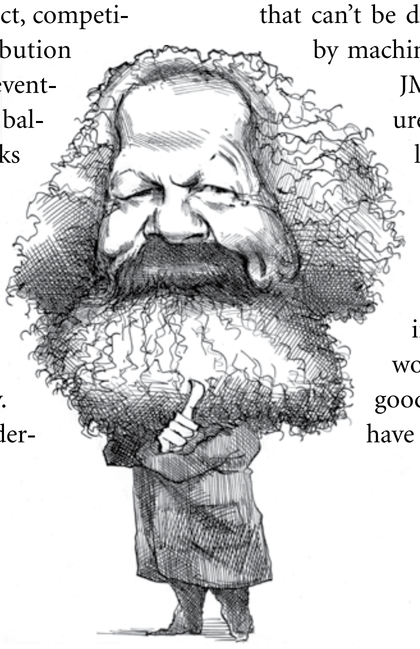
Marx's big mistake was in misreading how wages were determined. The owners of capital, he predicted, would be able to keep all the fruits of rising productivity. Not only would that make life miserable for the working class, it would leave the capitalists with ever fewer folks to buy their stuff. The system would eventually choke on excess capacity – or chew its own entrails as nations fought imperialist wars for new markets. In fact, competitive market-driven distribution did a pretty good job of preventing income inequality from ballooning. And, though shocks (like market bubbles) could still rock the economic boat, policymakers became confident they could prevent the vessel from being swamped.

Or, at least until recently.

While neo-Marxist "underconsumptionist" theories looked pretty foolish half a century ago, they're striking a chord now. U.S. wages have hardly budged since the 1970s, a period in which productivity has nearly tripled. Meanwhile, as if in homage to Marxist theories of imperialism, northern Europe can think of no other way to dig its way out of recession than to export its surpluses. The French economist Thomas Piketty, who is no Marxist, wonders when rising income inequality will rip the fabric of western democracy beyond repair.

Technology could save us. Or not. Where once only farmers' and factory workers' jobs were vulnerable to automation, digital technology is expanding the envelope to include everybody from truck drivers to psychotherapists. The smart money says that within a few decades, there will be virtually no jobs that can't be done better or more cheaply by machines.

JM Keynes, the dominant figure of 20th-century economics, looked forward to the 21st, when machines would end the scarcity of material things. But he was a little vague on why the owners/inventors of the machines would choose to share the goodies. My guess is, Marx would have an opinion. — *Peter Passell*



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