

THIRD QUARTER 2018

ECON FOCUS

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HELP WANTED

**Employers are having
a hard time hiring.
Not enough workers
or not the right skills?**

Why Countries Avoid
Defaulting on Debt

Measuring Rural-Urban
Differences

Interview with
Antoinette Schoar

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VOLUME 23
NUMBER 3
THIRD QUARTER 2018

Econ Focus is the economics magazine of the Federal Reserve Bank of Richmond. It covers economic issues affecting the Fifth Federal Reserve District and the nation and is published on a quarterly basis by the Bank's Research Department. The Fifth District consists of the District of Columbia, Maryland, North Carolina, South Carolina, Virginia, and most of West Virginia.

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Published quarterly by the Federal Reserve Bank of Richmond
P.O. Box 27622
Richmond, VA 23261
www.richmondfed.org
www.twitter.com/RichFedResearch

Subscriptions and additional copies: Available free of charge through our website at www.richmondfed.org/publications or by calling Research Publications at (800) 322-0565.

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ISSN 2327-0241 (Print)
ISSN 2327-025X (Online)

The Supply Side of Rural Development

The more I've traveled in our district, the more I've learned about the economic struggles in many of our rural areas. Rural areas have been lagging badly in recent years in both employment and output growth. The employment-population ratio for working-age people in our district is about 6 percentage points higher in urban areas than in rural ones. These communities have been hit hard by changes in the economy, including the loss of manufacturing jobs.

The well-being of a lot of people is at stake. Moreover, the country as a whole needs more opportunities for rural Americans so that we can all benefit from the resulting economic growth. Rural America isn't as populous as it once was, but it still makes up almost a fifth of the country's population, or about 60 million people. What, then, should policymakers be doing to foster the economic development of these communities?

Yes, geographic mobility — the movement of workers from distressed rural areas to metro areas with more jobs — has a role to play. But relocation may come at a steep price in terms of family and community ties, valuable in themselves. So we should be thinking about helping rural workers where they already are.

I sometimes encounter arguments that distressed rural economies are a lost cause. But I'm old enough to remember when there was a similar pessimism about our major cities, which appeared during the 1970s and 1980s to be doomed to perpetual decline. They weren't. From my perspective, the first step in thinking about the problems of distressed rural areas is to approach them as solvable — by good policymaking, by markets, and by rural residents themselves.

Rural labor markets have challenges on both sides. On the demand side, they are dominated by low-wage, low-productivity jobs. On the supply side, workers tend, on average, to have less education and to lack skills that are highly valued by employers in other areas. Both are significant: Without high-wage, high-skill jobs on the market, workers lack an incentive to invest in their skills; without a pool of high-skill workers, an area is unlikely to attract high-wage, high-skill jobs.

There are many forms of rural economic development that can boost demand for local labor; depending on the area, these may include tourism and recreation, assembly plants, energy production, and high-value-added agriculture. But I would like to focus on the supply side here. How do we get rural workforces the right skills? The desire for skill acquisition is there: According to survey data, a third of rural Americans believe they need new skills to get or keep their jobs, with computer and technical skills being cited most often.

For many young people, the right answer is a four-year college degree. College grads earn about 80 percent more than those with only a high school diploma, and they're less likely to be unemployed. But there's a stark urban-rural divide in college completion: 33 percent of adults in urban areas have a four-year degree or higher compared to 19 percent in rural areas — and that gap has been growing. University of Virginia research published by the Richmond Fed has found that part of the problem is information. Low-income rural families are less apt to know about the college application process, college choices, the availability of financial aid, and the return on a college degree.

In addition, Richmond Fed research has concluded that high school students are influenced, quite rationally, by their beliefs about whether they'll be able to complete their degrees: Attending college without finishing may mean a pile of debt without much economic reward — and 40 percent of college students don't finish within six years. So academic preparation is critical.

But a four-year college isn't the right answer for everyone. There are well-paying occupations in high demand that don't require a degree, such as truck driving and skilled trades. How will they get those skills? Community colleges play a major part in delivering training (as well as preparing some students for college transfer). Apprenticeships are a small part of the picture for now but hold promise. And a handful of online "boot camps" for entry into coding and related fields now charge tuition in the form of income-sharing agreements, in which students don't pay unless and until they get a job in their field.

Whatever the right option for a particular worker, skill acquisition in rural areas creates a virtuous circle, benefiting both the worker and his or her community. And it will be critical to helping the nation's economy grow. **EF**



TOM BARKIN
PRESIDENT
FEDERAL RESERVE BANK OF RICHMOND



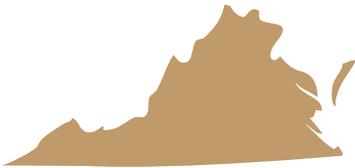
MARYLAND — At a time when cybersecurity breaches seem rampant, Maryland's legislature has passed legislation to help small businesses avoid them. In June, the Cybersecurity Incentive Tax Credit went into effect for Maryland companies with fewer than 50 employees. The law allows eligible small businesses that buy cybersecurity products or services from approved providers to claim a state income tax credit that equals 50 percent of the cost, up to \$50,000. The program is administered through the Maryland Department of Commerce.



NORTH CAROLINA — The Publix supermarket chain announced in October that it will build a \$400 million, 1.8-million-square-foot distribution center in Greensboro, which will be its northernmost distribution center. The center, which is scheduled to open in 2022, is expected to employ 1,000 people by 2025 with average annual salaries of \$44,000. Greensboro was chosen over other locations thanks to incentives, including tax breaks and training programs.



SOUTH CAROLINA — It will soon be easier to hop across the pond from the Lowcountry. British Airways announced in October that it will start two nonstop flights per week between Charleston and London in April 2019. South Carolina officials estimate the economic impact of the new route could be more than \$20 million per year due to job creation and increased tourism. Officials also hope it will help draw more international companies to the state.



VIRGINIA — Less than a year after Facebook announced it would invest \$1 billion in a new data center in Henrico County, the company said in September that it will invest an additional \$750 million and build three additional buildings, bringing the total number of buildings to five. Facebook says the expansion will bring more than 200 permanent full-time jobs and 1,500 construction jobs. Construction is already underway on the two initial buildings and a power substation on the 325-acre site, which are expected to open in the first half of 2019.



WASHINGTON, D.C. — In June, D.C. voters passed a ballot initiative that would have changed wage rules for tipped workers, gradually raising their minimum hourly wage until it matched the standard minimum wage. But in mid-October, the D.C. Council repealed Initiative 77 by an 8-5 margin. Opponents of Initiative 77 say the repeal will help the city's dining scene and keep restaurant owners from cutting hours or staff. The repeal bill voted on by the Council does address some concerns of Initiative 77's supporters, such as a hotline for reporting wage theft, though these provisions must be funded in the district's upcoming budget.



WEST VIRGINIA — State parks across West Virginia will soon receive \$60 million worth of upgrades and improvements, thanks to an early October sale of \$55.2 million worth of excess lottery revenue bonds. The projects are expected to focus on modernizing parks and completing delayed maintenance projects, which officials hope will boost the state's tourism industry. The West Virginia Economic Development Authority issued the bonds, which received AAA and A1 ratings from S&P Global and Moody's, respectively.

Leaving LIBOR

The Fed has developed a new reference rate to replace the troubled LIBOR. Will banks make the switch?

BY JESSIE ROMERO

In 2010, the British bank Barclays came under investigation for manipulating a reference interest rate called the London Interbank Offered Rate, or LIBOR. At the time, LIBOR underpinned more than \$300 trillion worth of financial contracts worldwide. Over the next several years, authorities would learn that multiple global banks, including U.S.-based institutions JPMorgan Chase and Citigroup, were guilty of manipulating LIBOR; the banks would end up paying more than \$9 billion in fines, and more than 20 people faced criminal charges.

The scandal exposed serious flaws in how LIBOR was calculated and spurred international regulators to seek out alternative benchmarks. In the United States, this effort has been led by the Alternative Reference Rates Committee (ARRC), a private-sector group convened by the Federal Reserve and other regulators. The committee has recommended that markets adopt a new reference rate, and although the transition is underway, there are still about \$200 trillion — 10 times the level of U.S. GDP — worth of outstanding contracts based on the U.S. dollar LIBOR. (The rate is also calculated for the Swiss franc, the euro, the British pound, and the Japanese yen; before the scandal, LIBOR was calculated for 10 different currencies.) In addition, new contracts referencing the rate continue to be written, even though it's likely to disappear after 2021. Will the financial sector leave LIBOR in time?

What is LIBOR?

LIBOR is based on how much banks pay to borrow from one another. Each day, a panel of 20 international banks responds to the question, “At what rate could you borrow funds, were you to do so by asking for and then accepting interbank offers in a reasonable market size just prior to 11 a.m.?” The highest and lowest responses are excluded, and the remaining responses are averaged. Not every bank responds for every currency; 11 banks report for the franc, while 16 banks report for the dollar and the pound. For each of the five currencies, LIBOR is published for seven different maturities, ranging from overnight to 12 months. In total, 35 rates are published every applicable London business day.

About 95 percent of the outstanding contracts based on LIBOR are for derivatives. (See chart.) It's also used as a reference for other securities and for variable rate loans, such as private student loans and adjustable-rate mortgages (ARMs). In 2012, the Cleveland Fed calculated that about 80 percent of subprime ARM were indexed to

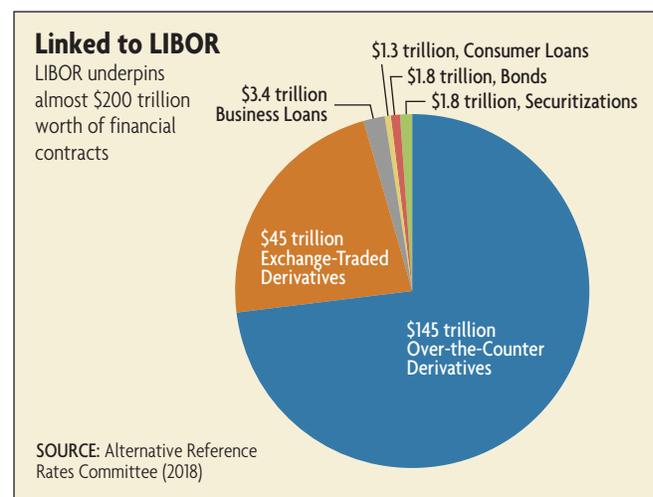
LIBOR, as well as about 45 percent of prime ARM. Prior to the financial crisis, essentially all subprime ARM were linked to LIBOR.

As journalists Liam Vaughan and Gavin Finch described in their 2017 book *The Fix*, LIBOR was the brainchild of financier Minos Zombanakis. In 1969, Zombanakis helped arrange an \$80 million loan to the shah of Iran, one of the first modern syndicated loans (loans funded by multiple banks). The banks involved were nervous about lending at a fixed rate when inflation was on the rise. So Zombanakis devised a system in which the loan would be funded with rolling deposits and the interest rate would be recalculated every few months. Banks would report their funding costs before every rollover, and the new interest rate would be based on the weighted average.

Other financiers adopted Zombanakis' formula, and in 1986 the British Bankers' Association, in consultation with the Bank of England, took over data collection and reporting. To discourage cheating, the association refined the formula to remove the top and bottom quartile of responses.

Around the same time, financial deregulation made London an attractive home for the growing markets in derivatives, bonds, and syndicated loans. These transactions referenced LIBOR, and the rate quickly became ubiquitous throughout the financial system. “As the swaps market developed for banks to hedge their interest rate risk, they needed some kind of reference rate, and LIBOR was already in place,” says David Skeie of Texas A&M University.

In 1997, the Chicago Mercantile Exchange decided to adopt LIBOR as the reference rate for eurodollar futures



contracts, which were a popular way for traders to hedge their positions against other derivatives, and LIBOR's position in the financial system was cemented. "Once LIBOR had become a widely used reference point, it fed on itself," says Matthew Lieber, a vice president in the Markets Group at the New York Fed. "Liquidity begets liquidity."

Zombanakis himself didn't foresee how widespread LIBOR would become. "We just needed a rate for the syndicated-loan market that everyone would be happy with," he has said. "When you start these things, you never know how they are going to end up, how they are going to be used."

Hindsight Is 20/20

In retrospect, the potential to manipulate LIBOR seems obvious. But in the 1980s and 1990s, according to Vaughan and Finch, most regulators thought it was a remote possibility. First, because the highest and lowest reported rates were excluded, any major shift in LIBOR would require mass collusion. Second, because each bank's submission was made public, it would be immediately apparent if anyone were reporting questionable numbers. As the financial system became more complex, however, smaller and smaller movements in LIBOR were worth more and more money. If a bank reported a rate that was thrown out, that had the effect of pushing in rates that would otherwise have been excluded. Even a change of a few basis points could be worth millions of dollars.

The first hints that something was amiss were in 2007, when the research arm of the brokerage ICAP published some traders' claims that the one-month LIBOR was lower than actual borrowing costs. Around the same time, a Barclay's employee emailed a group including several New York Fed officials to say that LIBOR submissions appeared unrealistically low. The following spring, the *Wall Street Journal* published two articles estimating that banks were underreporting their borrowing costs to make themselves appear less risky than they actually were.

Later research has supported these claims. In ongoing research, Skeie, along with Dennis Kuo, a former researcher at the New York Fed, and James Vickery of the New York Fed, has compared LIBOR rates between 2007 and 2009 with other measures of borrowing costs, including Term Auction Facility bids and Fedwire transfers. While LIBOR generally tracked these other measures, it was consistently 20 to 30 basis points below them. The authors considered several explanations for the disparity and concluded that it was consistent with banks trying to avoid the appearance of financial distress.

As regulators investigated underreporting, they learned that banks had another motivation for fudging the numbers: Beginning at least in 2003, banks had been submitting LIBOR reports that would benefit their trading positions. Rate submitters and traders at different banks and brokerages also conspired with each other to manipulate LIBOR,

promising each other steaks, Champagne, and Ferraris (among other perks). Internal emails and instant messages revealed the scheme. As one trader wrote, "Sorry to be a pain but just to remind you the importance of a low fixing for us today." Another wondered "if it suits you guys on hiking up 1bp on the 6mth Libor in JPY [one basis point on the six-month LIBOR in Japanese yen] ... it will help our position tremendously." At least 11 financial institutions faced fines and criminal charges from multiple international agencies, including the Commodity Futures Trading Commission (CFTC) and the Justice Department in the United States. Separately, in 2014 the FDIC sued 16 global banks for manipulating LIBOR, alleging that their actions had caused "substantial losses" for nearly 40 banks that went bankrupt during the financial crisis. The lawsuit is pending in the U.S. District Court for the Southern District of New York.

For the past five years, LIBOR has been regulated and administered by the United Kingdom's Financial Conduct Authority (FCA) and the Intercontinental Exchange Benchmark Administration. The organizations have made a number of changes to prevent false submissions, including developing a new, less-subjective methodology, but post-crisis there's another problem: Banks no longer borrow from each other at longer maturities very often. That means the market underlying LIBOR is very thin; on a typical day, there are only six to seven transactions underpinning the one- and three-month LIBOR, two to three for the six-month LIBOR, and one — if any — for the one-year LIBOR. As a result, banks have to make a judgment call about what rate to report. Even if it isn't intentionally misleading, that judgment could be wrong.

Winds of Change

In 2013, as the investigations continued, the Financial Stability Board (FSB), a global monitoring agency, began reviewing whether and how to reform LIBOR. After a year of work, the FSB issued a report calling for the development of new benchmarks. An effective reference rate, according to the report, should meet three criteria: First, it should minimize the opportunities for market manipulation. Second, it should be anchored in observable transactions wherever feasible. And third, it should command confidence that it will remain resilient in times of financial stress. (The International Organization of Securities Commissions published more detailed principles in 2013.)

The FSB asked international regulators to help engineer the transition. "Reference rates are vital to efficient market functioning," says Lieber. "But they affect a range of market participants in considerably different ways, so different types of institutions might have conflicting incentives. This means there's an important role for the official sector to play in helping develop an optimal rate."

In the United States, the Federal Reserve convened the new ARRC in cooperation with the Treasury department, the CFTC, and the U.S. Office of Financial Research. It's currently composed of around two dozen participants

from the private sector, including representatives from banks, investment firms, trade associations, and other financial institutions. Representatives from regulators and other government agencies serve on an ex officio basis.

As the committee was beginning its work in 2014, the New York Fed was also working with the Office of Financial Research to develop several new reference rates based on Treasury repurchases, or repos, in an effort to create greater transparency in that market. (Repos function as short-term loans; one party sells a security with a promise to buy it back, usually the next day.) In mid-2017, the ARRC decided to recommend one of these rates — the Secured Overnight Financing Rate, or SOFR — as a replacement for the dollar LIBOR.

The committee chose SOFR for several reasons. First and foremost, it's based on a large volume of observable transactions — more than \$800 billion per day, much larger than any other U.S. money market. And because it covers multiple segments of the repo market, it can evolve as the market evolves, according to the New York Fed. In addition, SOFR was designed from the beginning to comply with the new international standards for reference rates.

Some observers are concerned that changing benchmarks could create a disconnect between banks' assets and liabilities; because LIBOR is based on banks' borrowing costs, it enables them to hedge against changes in those costs. As the scandal demonstrated, however, LIBOR is not necessarily an accurate gauge. Moreover, banks are no longer the only users of LIBOR. "When it comes to floating rate loans and interest rate swaps for commercial banks, it does make conceptual sense to have a benchmark tied to a bank funding rate," says Skeie. "But so much financial intermediation is now outside of commercial banking, and LIBOR has become the reference rate for such a vast amount of contracts. For these other players, SOFR is likely a much better instrument."

Keep Calm and Trade On?

The other reason to make a switch is that LIBOR is unlikely to exist in a few years.

Today, many banks participate in the LIBOR panel only at the urging of the United Kingdom's FCA. That's because, after the rate manipulation came to light, banks were wary of being associated with LIBOR. And as the market grew thinner, they became more and more reluctant to essentially guess what rate to submit. In 2013, several banks announced they were planning to quit the panel, and the agency (at the time called the Financial Services Authority) sent letters

intimating that doing so would damage their relationship with regulators. But the agency can't legally make banks participate indefinitely, and it's announced that it won't pressure them to do so after 2021. Most industry observers expect LIBOR to vanish at that time.

The ARRC has estimated that about 20 percent of existing dollar LIBOR contracts mature after 2021, which could create major headaches for the parties to those contracts if and when LIBOR disappears. While most contracts include "fallback language" that applies if the underlying reference rate is unavailable, the provisions are inconsistent, and the language is designed to address a temporary disruption — not a permanent disappearance. "Permanent cessation without viable fallback language in contracts would cause considerable disruption to financial markets," the ARRC has warned. "It would also impair the normal functioning of a variety of markets, including business and consumer lending."

The ARRC and other groups are developing guidance to help financial institutions revise their contracts, but so far, not much progress has been made. "It's very complex and costly to change," notes Skeie. "Since you still have a few years until the real uncertainty hits, it's a lot easier to not go first."

Encouraging market participants to renegotiate existing contracts is one challenge. Encouraging them to write new contracts based on SOFR rather than LIBOR is another. "Because everybody prefers to be in the high-liquidity club, there is a coordination problem," wrote Darrell Duffie of Stanford University and Jeremy Stein of Harvard University. (Stein is also a former Fed governor.) "No individual actor may be willing to switch to an alternative benchmark, even if a world in which many switched would be less vulnerable to manipulation and offer investors a menu of reference rates with a better fit for purpose."

Many observers have voiced concern that the financial system won't be ready when LIBOR goes away. But in some respects the switch is ahead of schedule. For example, the Chicago Mercantile Exchange launched SOFR futures in May 2018, and the clearing house LCH cleared the first SOFR swaps in July — well before the expected timing outlined in a transition plan developed by the ARRC. The growth of SOFR-based derivatives activity has been encouraging, and the participation has been diverse, says Lieber, but "we need to see more take-up for it to become meaningful. It's been good so far but not sufficient." While regulators might lead traders to SOFR, they can't make them use it. **EF**

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Machine Learning

BY DAVID A. PRICE

Customers of online music services have long been able to explore new music, or revisit old music, through the services' playlists. Whether you like '80s pop, '90s rap, or new country, your online music service has had a playlist for you, handmade by music experts. But in 2015, Spotify added something different: individually personalized playlists that each of its millions of users received every Monday. The feature, known as Discover Weekly, gained devotees. One wrote, "It felt like an intimate gift from someone who knew my tastes inside and out."

Of course, Spotify didn't scale up its staff of human music experts to create weekly playlists for what are now reportedly 87 million subscribers. Discover Weekly relies instead on a user's past listening habits and those of others with apparently similar tastes — and on machine learning software that converts this data into predictions of what a user would like.

Music is just one of a range of industries being affected by machine learning technology. Machine learning is likely to improve high-tech products in applications from spam filtering to face recognition. In medicine, machine learning may improve the interpretation of X-rays and other scans, as well as suggest diagnoses based on detailed patient information. Within the financial sector, some applications include detecting fraud, estimating insurance risks, and analyzing investments. In some industries, the adoption of machine learning may change the profile of skills sought by employers and even reduce employment numbers outright.

But what is it, exactly? Historically, it has a number of fields in its family tree: computer science, cognitive science, and statistics, among others. It's sometimes said to be a branch of artificial intelligence, or AI, but not the general, human-like AI seen in the fictional computers of *2001: A Space Odyssey* and *Star Trek*. Rather, it's a type of software that learns from examples — that is, it autonomously constructs models based on data fed into it. The data may represent transactions, images, or anything else in digital form.

Machine learning systems fall into one of two broad categories: supervised or unsupervised. In supervised machine learning, the system receives training data: a set of examples and information about the correct classification of each example. The latter is the "supervision." For instance, the training data could be images of furniture with information about whether each item is, say, a chair, a desk, or a sofa. With sufficient training data, the system would be able

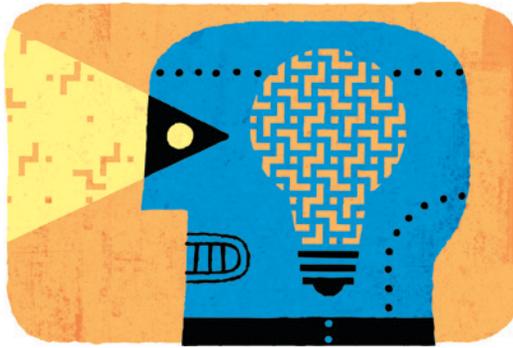
to predict the correct category of an image of an item of furniture it hasn't seen before. Alternatively, the training data could be individuals' financial information, together with an indicator for each individual of whether he or she has a home mortgage default on record. The system would use that data to build a model for predicting whether a loan applicant is likely to default on a loan. (The person creating the system may hold back some of the data he or she has on hand to test the reliability of the model.)

In unsupervised machine learning, the system receives records, such as images or financial information, but no information on how to classify them. The task for the system is to discover categories within the data on its own.

In both supervised and unsupervised machine learning, the potential performance of the system improves as the system receives more data. Commonly, what goes into a machine learning system is an enormous dataset, so-called "big data," comprising millions of observations. Indeed, part of what has fueled the growth of machine learning is the availability of such datasets within technology companies as a byproduct of their operations as they capture data on transactions and other user behavior.

One important difference between machine learning and conventional techniques is that conventional statistical techniques produce models that can be interpreted by humans. Someone can look at the coefficients of a multiple regression analysis and see how it works — which variables count positively, which count negatively, and by how much. In contrast, complex machine learning models are like black boxes and cannot be translated into a form that lets humans understand the model's workings.

Within the discipline of economics, some researchers, such as Susan Athey of Stanford University, foresee that machine learning may become an increasingly important tool, transforming economic research. But for the time being, at least, switching from conventional statistical methods to machine learning comes at a price: Compared to machine learning, econometrics is better suited to asking about causation. Machine learning is about classification and prediction. Econometrics is too, but it also lets a researcher make inferences about whether and how one variable among many has been influencing the phenomenon that the researcher is studying. That distinction could erode, however, as researchers are seeking to combine machine learning with analysis of causation. **EF**



Did the Great Recession Increase Skill Requirements?

BY CAITLIN DUTTA

What you need to know to get a job has changed drastically over time in the United States. Occupations that used to employ many mid-skill workers, such as assembly-line work or typing, now face falling employment shares.

Much of the disappearance in routine jobs like these is attributed to routine-biased technological change — that is, the introduction of technology that substitutes for some routine jobs and complements some more cognitive skills. Routine-biased technological change is related to skill-biased technological change, the scenario in which technology substitutes for unskilled labor. An example of routine-biased technological change is an ATM that can process a check for deposit. This ATM is a substitute for the worker who used to manually process checks, but it is complementary to the labor of a computer programmer who would be hired to program the machine.

While routine-biased technological change has been happening for decades in the United States, a recent *American Economic Review* article by Brad Hershbein of the W.E. Upjohn Institute for Employment Research and Lisa Kahn of the Yale School of Management found that the process was accelerated by the Great Recession of 2007-2009.

Kahn and Hershbein analyzed a novel dataset for their work: about 100 million online job postings in the United States, which included almost all of the online job postings from 2007 and 2010-2015. They calculated the proportion of postings that had requirements in four categories: education, experience, cognitive skills, and computer skills. They found that a job posting was more likely to post a requirement in each of the four categories after the recession than before the recession. From this, they inferred that after the recession, employers were more likely to require applicants to have high skills than before the recession. Such an increase in skill requirements for a job is known as “upskilling”; Kahn and Hershbein endeavored to find out what caused it with a new model.

The model they created explains various employment indicators in metropolitan statistical areas (MSAs) harder hit by the recession relative to MSAs that were less hard hit. They found that the shock of the recession raised the probability of posting skill requirements more in harder-hit MSAs than in less hard-hit ones and that this increase in skill requirements is seen within postings for a given occupation. This implies that firms in harder-hit

MSAs upskilled more than firms in less hard-hit MSAs.

Next, they explained investment in IT, a routine-biased technology, in firms in hard-hit MSAs relative to less hard-hit MSAs. They found that firms in harder-hit MSAs increased their IT investment more than firms in better-off MSAs. They also found that firms with more IT upskilled more than firms with less IT.

Finally, they ran the model to compare the upskilling in jobs denoted as routine-manual and as routine-cognitive. This distinction follows a 2010 National Bureau of Economic Research working paper by Daron Acemoglu and David Autor of MIT in which the authors labeled

jobs that involve routine physical tasks, such as installing a car door in a car factory, as routine-manual and jobs that involve routine mental tasks, such as receptionist work, as routine-cognitive. Kahn and Hershbein found that the upskilling was concentrated in

routine-cognitive jobs. They also found that routine-manual jobs declined in employment share and productivity while routine-cognitive jobs increased in employment share and wages. These findings offer an explanation for the known increase in the probability that college graduates will take a routine job. If routine-cognitive jobs are upskilling and increasing in wages, they will become more attractive to college graduates.

What does this mean for the story of routine-biased technological change? The authors conclude that the recession encouraged upskilling by increasing demand for routine-biased technology. This adoption of technology meant that employers demanded fewer routine-manual workers and demanded more skills from their routine-cognitive workers, accounting for the upskilling seen in the original data analysis. The authors find that these effects continued through 2015, after other employment indicators affected by the recession returned to pre-recession levels.

The authors don’t commit to one explanation for this phenomenon, but they favor the theory of Schumpeterian cleansing. Schumpeterian cleansing, advanced by Joseph Schumpeter of Harvard University in 1939, is an effect in which bad economic times force less-productive firms to shut down, while more productive and modern firms succeed. If this theory is the correct explanation, the recession forced the closure of unproductive firms that were not using routine-biased technology, while new or existing productive firms that were using routine-biased technology succeeded. EF

“Do Recessions Accelerate Routine-Biased Technological Change? Evidence from Vacancy Postings.” Brad Hershbein and Lisa B. Kahn. *American Economic Review*, July 2018, vol. 108, no. 7, pp. 1737-1772.

HELP WANTED

**Employers are having
a hard time hiring.
Not enough workers or
not the right skills?**

By Jessie Romero

Before every meeting of the Federal Open Market Committee, the Fed publishes a new Beige Book, a compilation of qualitative economic information from each Federal Reserve district. In the most recent one, the Richmond Fed's business contacts reported that "labor demand strengthened and job openings increased as employers struggled to find qualified workers." The language would have been familiar to regular readers: Six years earlier, the Beige Book had noted that "[Fifth] District employment improved somewhat, but both manufacturers and professional services firms continued to report problems finding qualified workers."

It's not surprising that employers are having a hard time finding workers today, when the unemployment rate is the lowest it's been in nearly five decades. But why were they having trouble finding workers in 2012, when the unemployment rate had been stuck above 8 percent for several years?

Many people attributed persistently high unemployment after the Great Recession to "skill mismatch" — the idea that the people looking for work didn't have the qualifications employers were seeking — and there was considerable concern that such mismatch would be a permanent feature of the labor market. Today, however, things look quite different: Many lower-skill occupations, once the hardest hit, are now in high demand, and employers are increasingly willing to train. Is skill mismatch a thing of the past?

It's Getting Hot, Hot, Hot

In September 2018, the unemployment rate dropped to 3.7 percent — its lowest reading since December 1969. At the same time, the Congressional Budget's Office estimate of the "natural" rate of unemployment, which is widely viewed as the benchmark for full employment, was 4.6 percent. (Even in a healthy economy, there will always be some level of unemployment as workers transition between jobs. The natural rate is the lowest rate that can be maintained without accelerating inflation.)

That's not the only indication the labor market is tight. In 2000, the Bureau of Labor Statistics (BLS) began tracking data on labor market turnover, including job openings. In April of this year, for the first time ever, there were more vacancies than there were people looking for work, and the gap has continued to grow. (See chart.)

Qualitative data also suggest it's hard to find workers. In recent surveys of business activity in Maryland and the Carolinas conducted by the Richmond Fed, the monthly indexes that measure employers' ability to find workers reached their lowest readings ever. (The surveys began in 2008.) Nationally, nearly 40 percent of small-business owners reported having unfilled job openings in September, according to a survey conducted by the National Federation of Independent Business; the previous peak was 34 percent in 1999.

"A few years ago, our contacts talked about not being able to find people with specific skills," says Sonya Waddell, the Richmond Fed's director of regional research. "Now, they talk about not being able to find anyone at all."

Labor market tightness isn't evenly distributed across industries, however. The job openings rate for accommodation and food service workers was 6 percent in August 2018, for example, while the rate for educational services was just 3.2 percent. Economists at ZipRecruiter, an online recruitment firm, analyzed responses to job postings and found 118 applicants for every administrative position advertised but just 12 responses per truck driving job and nine per nursing job. Even within industries there is variation; in the Census Bureau's Quarterly Survey of Plant Capacity Utilization, just 3.5 percent of textile manufacturers reported an "insufficient supply of labor" as a constraint in the second quarter of 2018. But 32 percent of wood manufacturers were constrained by their inability to find workers.

There are geographic differences as well. Across Virginia as a whole, the unemployment rate has averaged 3.1 percent in 2018, well below the national average. But

in some western and southern counties, the rate has been around 6 percent; in many northern counties, it's averaged about 2.5 percent. In North Carolina, average county unemployment rates for 2018 range from 7.7 percent in Scotland County, which has lost several thousand manufacturing jobs over the past two decades, to 3.1 percent in Buncombe County, home to tourist destination Asheville.

Baffled by Beveridge

Still, 7.7 percent unemployment is a significant improvement from the end of the Great Recession, when unemployment in Scotland County topped 17 percent. Nationally, the unemployment rate reached 10 percent in October of 2009 and remained above 7 percent until the end of 2013. Historically, high unemployment has been associated with few job openings (because employers aren't interested in hiring) and low unemployment with plentiful job openings, a relationship known as the Beveridge curve. But as the economy began to recover in 2009 and firms started posting jobs, the unemployment rate remained several percentage points higher than the Beveridge curve would have predicted.

The position of the Beveridge curve is determined by how efficiently the labor market pairs available workers with available jobs, what economists call "matching efficiency." Multiple factors influence matching efficiency, including employers' recruiting processes, how people search for jobs, and policies such as unemployment insurance or at-will employment. The rightward shift of the Beveridge curve after 2009 suggested that overall matching efficiency had declined significantly. (See chart.)

Skill mismatch made intuitive sense as an explanation for this decline. Roughly half of the job losses resulting from the 2007-2009 recession were in construction and manufacturing, and it seemed reasonable to assume that unemployed roofers and forklift drivers were not finding (or even looking for) jobs in the industries that fared relatively better, such as education and health care. And even as manufacturers, for example, did begin to look for new employees, they frequently said they were unable to find applicants with the necessary skills and training.

In the short term, skill mismatch was a product of the recession. But many observers also viewed it as a symptom of longer-term trends in technology and education that were operating to the detriment of lower-skilled workers — and were unlikely to reverse. "In simple terms, the skills people have don't match the jobs available," said Dennis Lockhart, former president of the Atlanta Fed, in a 2010 speech. "Coming out of this recession there may be a more or less permanent change in the composition of jobs."

Making the Match

How large a role did skill mismatch actually play in the labor market during and after the Great Recession? Although it no longer appears to have been the primary factor driving unemployment, some research suggests its role was

Tightening Up

There are more job openings than people looking for work



NOTE: Shaded areas denote recessions.

SOURCE: Bureau of Labor Statistics via Federal Reserve Economic Data (FRED)

A Bend in the "Beveridge Curve"

After the Great Recession, the unemployment rate was high relative to the number of job openings



● Pre-Great Recession (Jan. 2007-Nov. 2007)
 ● Great Recession (Dec. 2007-June 2009)
 ● Post-Great Recession (July 2009-Present)

SOURCE: Bureau of Labor Statistics via Federal Reserve Economic Data (FRED)

nontrivial. In a 2014 article, Ayşegül Şahin of the University of Texas at Austin, Joseph Song of Bank of America Merrill Lynch, Giorgio Topa of the New York Fed, and Giovanni Violante of Princeton University found that mismatch across occupations and industries could account for up to one-third of the rise in unemployment between 2006 and 2009. The authors speculated that the remainder could be explained by weak demand for labor and extended unemployment benefits, among other culprits.

Regis Barnichon of the San Francisco Fed and Andrew Figura of the Federal Reserve Board also have found a role for mismatch. In a 2015 article, they measured mismatch as dispersion in the labor market, or how much variation there is in the tightness of different submarkets, such as the market for nurses versus the market for construction workers. More dispersion indicates more mismatch. They calculated that rising dispersion contributed to about one-third of the decline in matching efficiency between 2008 and 2012.

The other factor driving the decrease in matching efficiency was a change in the composition of job seekers. In general, during recessions, the pool of unemployed workers becomes more concentrated with people who have a lower likelihood of finding a job, such as workers on a permanent layoff or who have been unemployed for a long time. This was especially true in the Great Recession, when employers were much less likely to use temporary layoffs than in previous downturns and long-term unemployment reached unprecedented levels.

Barnichon and Figura's study covered 1976 through 2012, and they found that dispersion and composition effects increased during all the recessions during that time period. What was unique about the Great Recession was how large those effects were and how long they lasted. Even after the severe recession in 1981-1982, matching efficiency rebounded fairly quickly. But after the Great Recession ended, it remained historically low three years later.

Other research, however, suggests that the decline in matching efficiency wasn't especially large compared to previous recessions. In a 2017 article, Andreas Hornstein of the Richmond Fed and Marianna Kudlyak of the San Francisco Fed studied not only unemployed workers, but also people out of the labor force — that is, people unable to work or no longer looking for work. (A person who has not looked for work during the past four weeks is technically considered out of the labor force rather than unemployed.) Although those out of the labor force are less likely to transition into employment than those who are unemployed, they are a much larger group in absolute terms. According to previous research by Hornstein, Kudlyak, and Fabian Lange of McGill University, people out of the labor force account for about two-thirds of new transitions to employment.

During the Great Recession, the entire pool of nonemployed people shifted more toward people out of the labor force. Once Hornstein and Kudlyak accounted for this change, the decline in efficiency looked comparable to declines in previous recessions. "If the composition of the search pool shifts toward groups who always have a lower job finding rate, average search effectiveness declines," says Hornstein. "This shows up as reduced 'matching efficiency' even though the 'effectiveness' of the labor market in matching vacancies and unemployed has not changed."

Love the One You're With

A few years ago, employers might not have been willing to hire an applicant who didn't check every box

— but they're changing their tune as the labor market has tightened. In the September Beige Book, most districts reported that employers in their regions were devoting more resources to training. In a survey conducted in early 2017 by the *Wall Street Journal* and the consulting group Vistage International, two-thirds of the businesses surveyed said they were spending more or significantly more time training new employees than they had a year ago.

Employers also have been expanding their applicant pool — for example, by relaxing skill requirements. The labor-market research firm Burning Glass Technologies recently analyzed 15 million online job postings and found that the number of jobs requiring a college degree fell from 34 percent in 2012 to 30 percent in 2018, and the number requiring three or more years of experience fell from 29 percent to 23 percent. Amazon, the country's second-largest employer after Walmart, advertises that its hiring process requires "No resume. No interview."

In addition, anecdotal evidence is growing that employers are more amenable to former offenders. The *New York Times* recently profiled a company that is hiring inmates as apprentices even before they are released; similar stories have been reported in Los Angeles, Boston, and Allentown, Pa., to name just a few. In a recent speech, Richmond Fed President Tom Barkin noted that he had spoken with an employer in the Fifth District who had relaxed its views on employees with criminal backgrounds.

Will this continue? In the short term, the economic outlook is rosy. But productivity growth — the ultimate determinant of long-run economic growth — has lagged during the past decade, which suggests the gas currently fueling the economy could be stimulus whose effects might dissipate over the next few years. In addition, although the Beveridge curve has largely looped back to its pre-recession position, it still remains further to the right than it was for much of the postwar era. According to research by Thomas Lubik of the Richmond Fed and Luca Benati of the University of Bern (Switzerland), with each successive recession since the 1950s, matching efficiency has gone down — the unemployment rate implied by a given job vacancy rate has increased. A likely explanation for these successive rightward movements is technological change whose effects on the labor market are hastened by recessions. A large body of research has documented how such change has tended to benefit workers with more skills and more education. These forces might be masked by a hot economy for a time, but if things cool off, some workers, especially the more recent entrants to employment, might once again find themselves without a match. **EF**

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WHEN NATIONS DON'T PAY THEIR DEBTS

What happens when countries can't or won't repay

By Tim Sablik

Treasury bonds in the United States are widely considered among the safest financial assets in the world. But in 2011, a political standoff over the debt ceiling prompted some to call that safety into question. Rating agency Standard & Poor's downgraded U.S. debt for the first time from the flawless AAA to the merely excellent AA+, a rating it maintains today.

To be sure, the downgrade does not mean the United States will face a debt crisis anytime soon. Indeed, the other two major rating agencies, Moody's Investors Service and Fitch Ratings, still rate U.S. debt as triple-A. But in the wake of the political standoff over the debt, policymakers and researchers have discussed what might happen if the United States ever did default. Recent examples from other countries could provide some clues.

In 2010, a crisis over Greece's debt created hardship for the nation and the rest of the European Union. Closer to home, Puerto Rico announced in 2015 that it would not be able to pay its debts, resulting in economic pain for the island territory and some uncertainty in the United States as Congress rushed to implement a solution.

Such episodes are actually fairly common throughout history. In their 2009 book *This Time is Different*, which surveys 800 years of financial crises, Harvard University economists Carmen Reinhart and Kenneth Rogoff found that most countries that have borrowed have at some point struggled to repay what they owe. Even the United States, which has a strong reputation for always paying its debts, defaulted early in its history following the War of 1812. And President Franklin Roosevelt's suspension of the gold standard in 1933 and subsequent revaluation of the dollar also represented a default of sorts because those actions substantially changed the value of the dollars used to repay previous debt contracts.

The ever-present possibility of sovereign default raises a question: How are countries able to borrow huge amounts in the first place? It's a puzzle many economists have attempted to solve. Their research sheds light on what happens to governments that default and helps explain why many of them do honor their debts — eventually.

The Burden of Debt

The weight of public debt can become harder to bear the more it piles up. Several studies have documented a negative correlation between rising public debt and economic growth. While correlation does not necessarily imply causation, it is easy to see how public debt could harm the economy. As debt increases, the required interest payments on that debt become a larger share of the budget, crowding out other spending. This has become a concern in the United States as public borrowing has grown to unprecedented levels.

"Right now, our debt-to-GDP ratio is the highest it has ever been except for a few years around World War II," says William Gale, a senior fellow at the Brookings Institution and co-director of the Urban-Brookings Tax Policy Center.

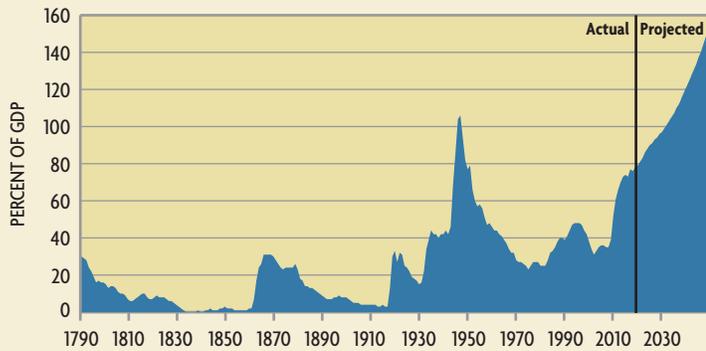
In June 2018, the Congressional Budget Office reported that the amount of federal debt held by the public was 78 percent of GDP, and it is projected to reach nearly 100 percent within the next decade. (See chart on next page.) As a result of growing debt and rising interest rates, federal spending on servicing the debt is slated to soon surpass several other major categories of government spending, such as the military and Medicaid. As the government devotes more resources to interest payments, it leaves less money for everything else.

Mounting public borrowing can crowd out private borrowing as well. As the government issues more debt, it may eventually be forced to offer higher interest rates in order to attract new investors. Rising interest rates make it more expensive for private firms to borrow. They must either offer higher interest payments on their own debt, find other ways to finance their investments, or shelve projects until rates fall. To the extent government borrowing crowds out private investment, it may reduce overall productivity, which is the ultimate driver of long-run economic growth.

"My late colleague Charles Shultz used to say that deficits are not the wolf at the door, they're more like termites in the woodwork," says Gale. "They eat away at the foundation of the economy."

U.S. Debt Moving Toward Historical Peak — and Beyond

Federal Debt Held by the Public as a Share of GDP



NOTE: Vertical line indicates 2018.

SOURCE: Congressional Budget Office

There is no consensus among economists about when public debt becomes a problem for economic growth. But it is clear that as a country accumulates debt, sooner or later it becomes more expensive to continue borrowing. High debt levels can prompt creditors to wonder if the borrowing nation will ever be able to repay its debts. That concern translates into higher interest rates on the nation's debt to reflect the higher risk of default. In addition to making existing debt more costly, this can limit the government's ability to borrow during future emergencies.

Historically, federal debt has risen during economic contractions to fund government stimulus programs. During the last recession, federal debt held by the public rose from 35 percent as a share of GDP to 52 percent. In the past, debt levels have tended to fall during economic expansions. But nearly 10 years after the end of the Great Recession, federal debt continues to rise and shows little sign of changing course. This may leave less room to fund a fiscal expansion to stimulate the economy during a future recession.

Given the costs associated with large levels of public debt, countries might be tempted to simply renege on what they owe. But history suggests the costs of doing so are often much higher.

Enforcement

King Philip II of Spain defaulted on his country's debt payments four times during his reign from 1556 to 1598. Embroiled in war for much of his rule, it is little wonder the monarch accumulated sizable debts. Less clear is how he was able to continue borrowing from private banks after repeatedly demonstrating his unwillingness to repay what he owed. Can creditors actually punish a sovereign nation for defaulting?

Private debt is typically secured by some type of collateral, which exposes the borrower to a cost should they fail to repay. If a borrower defaults on a mortgage or car loan, for example, creditors can claim the underlying house or car to recoup the lost value of the loan. But when a nation defaults, it is less simple for creditors to lay claim to that nation's assets.

"It's not hard to get a legal judgment against a country that is in default validating that they owe you money," says Mark Wright, research director at the Minneapolis Fed. "The problem is actually collecting."

In the case where the creditors are sovereign nations themselves, they may be able to use diplomatic or military pressure on defaulters to collect what they're owed. This sort of "gunboat diplomacy" was more common at the turn of the 20th century than it is today. In a 2010 article, Kris James Mitchener of Santa Clara University and Marc Weidenmier of Chapman University documented a number of episodes from 1870 to 1913 where creditor nations took military action against delinquent borrowers. For example, a group of European nations imposed a naval blockade on Venezuela in late 1902 to early 1903 over delinquent debts.

Evidence on the effectiveness of such direct intervention is mixed. Moreover, it isn't an option available to private creditors. But in a 2011 article entitled "Lending to the Borrower from Hell," Mauricio Drelichman of the University of British Columbia and Hans-Joachim Voth of the University of Zurich described how a coalition of private bankers did exert power over King Philip II of Spain: They cut him off from future borrowing.

Most of King Philip's loans came from the same group of Genoese bankers, giving them considerable power over the monarch's future credit. According to Drelichman and Voth, the bankers would refuse to lend until the monarch resumed payments on his past debts. "The king's borrowing needs were so high that he would eventually have to settle with the Genoese coalition," the authors wrote.

Even in modern times, the pain of credit market exclusion remains a very real cost for governments facing default. In a 2018 paper, Anusha Chari and Ryan Leary of the University of North Carolina at Chapel Hill and Toan Phan of the Richmond Fed found that as Puerto Rico's debt crisis worsened, borrowing became increasingly expensive. This in turn hurt employment growth and increased the cost of capital.

Private lenders may also be able to use legal proceedings to enforce sovereign debt contracts. While it was long believed that creditors had little legal power over sovereigns, a recent paper by Julian Schumacher of the European Central Bank, Christoph Trebesch of the Kiel Institute for the World Economy, and Henrik Enderlein of the Hertie School of Governance argued that lawsuits against defaulting nations have become much more common over the last several decades.

After Argentina defaulted in 2001, a hedge fund that held some of the country's debt refused to accept a restructuring deal and instead filed a lawsuit to demand full repayment. U.S. courts ordered Argentina's bond trustee not to process payments to its other creditors who had agreed to the debt restructuring until it paid the holdouts who had not. The injunction resulted in Argentina defaulting on its restructured debt in 2014 and

ultimately prompted a new settlement with the holdout creditors. The legal rulings that led to that injunction were somewhat controversial, however, so it's not clear that future creditors would necessarily have the same success.

Building a Reputation

Another long-term cost defaulting sovereign nations may face is damage to their reputations, which can affect the terms they receive from credit markets in the future. The incentive to rebuild that reputation can explain why, even in the absence of direct enforcement, governments that have defaulted will restructure debt agreements with creditors and seek to prove themselves as trustworthy borrowers once again.

In a pair of 2017 articles, Phan of the Richmond Fed showed how sovereign debt acts as a reputational signal to investors. Foreign creditors in particular do not have full information about the government they are lending to. Default signals that the government is unreliable, which will dissuade foreign investment. When governments restructure and repay their debts after a default, they are signaling improved political and economic conditions in order to attract new foreign investment. Phan showed that, in theory, some countries may even borrow not because they need the money but because they want to send these positive signals to investors.

“Historically, we’ve seen that countries in default typically don’t borrow a lot, or if they do borrow, it is at very high rates,” says Wright. “That suggests they are facing worse terms as a result of the default. But is it because everyone sees that they are unlikely to repay because they just defaulted and their economy is not doing very well? Or is it because they are being punished?”

Economists disagree about which of the two explanations drives the market response to default. What is clear is that defaulting countries lose access to markets until they are able to restructure their debts and rebuild their reputations, and Wright’s research suggests this can take a long time — roughly seven years on average.

Reputation may also explain why attempting to lighten the load of debt issued in a country’s own currency by engineering inflation or currency devaluation is rarely successful in the long run. Phan’s research shows that the reputational costs of strategically inflating away debt are similar to those of defaulting. Countries that devalue their currencies to escape debt lose credibility with regard to monetary stability and independence. The

loss of this reputation negatively affects a government’s ability to borrow in the future.

Even setting aside the reputational costs, it’s unclear that attempting to inflate away debt is always effective. Some scholars have pointed to the elevated inflation of the years immediately following World War II as instrumental in easing America’s wartime debt burden. Indeed, Joshua Aizenman of the University of Southern California and Nancy Marion of Dartmouth College estimated in a 2011 paper that inflation was responsible for

reducing the postwar debt-to-GDP ratio by more than a third over the course of a decade.

But Aizenman and Marion argued that it is unlikely such an intervention would work as well today. Average maturity for U.S. debt was more than twice as long in the late 1940s than it is today, making it more susceptible to surprise inflation. Today, rising inflation would be

met with creditor demands for higher interest rates or inflation-indexing on future debt securities, limiting the power of inflation to diminish the debt burden. Thus, inflation doesn’t necessarily help the debtor government get ahead.

“There is also some evidence that countries that run high inflation to escape debt end up destroying their financial markets, and it can take a long time to recover from that,” says Wright.

The Breaking Point

As history shows, attempting to escape sovereign debt through default or strategic inflation rarely pays off. But what happens when default becomes inevitable rather than a choice?

Predicting when a country will be unable to sustain its debts is fraught with difficulty. Although the debt-to-GDP ratio is an oft-reported metric of public indebtedness, it is not necessarily the best indicator of debt sustainability. For example, Greece’s debt-to-GDP ratio was 126 percent when its debt troubles began in late 2009. Meanwhile, Japan’s debt-to-GDP ratio surpassed 200 percent in the same year and has remained above that threshold for nearly a decade with no signs of impending default.

“One of the things that puzzles researchers is that some countries are able to borrow a lot without defaulting while others can only borrow very little,” says Wright.

The spread between the interest on a sovereign’s debt and a risk-free rate can be a sign of impending crisis. For example, as the Greek crisis intensified, the yield on Greek



bonds increased from 3 to 9 percentage points higher than the relatively riskless German bonds. But this spread typically only spikes when a default crisis is imminent, leaving little time to prepare.

The strength of a country's economic growth relative to the growth of its deficits can be another signal of future difficulties. While current economic growth in the United States is strong and is projected to remain so, government revenues remain too small to prevent public debt from increasing, says Gale. Still, that in itself may not necessarily be a concern.

"I don't see anyone pricing in a default premium into the U.S. debt for economic reasons anytime soon," says Gale. "We're a strong country, a safe place to invest, we

print our own currency, and our inflation rate is low."

But political standoffs over the debt ceiling could be a different story. After the 2011 political battle led to the S&P downgrade, Congress again fought over the debt limit in 2013. In a 2015 report studying the aftermath of the event, the Government Accountability Office found that interest rates on some Treasuries did increase, resulting in slightly higher federal borrowing costs.

Predicting the likelihood of sovereign default may be next to impossible, but history shows the costs of such episodes. Once lenders re-evaluate a borrowing nation's creditworthiness on the basis of new information, the adjustment can lead to swift and significant economic consequences. **EF**

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December 2018 Have Yield Curve Inversions Become More Likely?

Yield curve inversions have preceded each of the past seven recessions, so the recent flattening of the yield curve has fueled speculation that another recession might be imminent. But the latest *Economic Brief* shows how the low term premium (compensation for holding long-term rather than short-term bonds) could mean that yield curve inversions are more likely even if the risk of recession has not increased.

November 2018 The Differing Effects of the Business Cycle on Small and Large Banks

October 2018 Inequality in and across Cities

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What to Do When Large Firms Fail

BY RENEE HALTOM

Highlighted Research

“On the Measurement of Large Financial Firm Resolvability.” Arantxa Jarque, John R. Walter, and Jackson Evert. Working Paper No. 18-06R, February 2018 (revised July 2018).

The financial crisis of 2007-2008 confronted policymakers with the question of how to handle large firms that get into financial trouble. During the crisis, some failing firms went through bankruptcy, but others were rescued by emergency loans or other forms of support from the government.

There are costs to either choice: Bankruptcy may leave a substantial mess in terms of costs on other financial market participants or the overall economy. For example, there could be “fire sales,” when large quantities of assets are sold quickly to raise funds, causing asset prices to fall. Costs also could arise through “contagion,” when firms have a financial or operational relationship such that the failure of one disrupts others. Bailouts, on the other hand, minimize those spillovers, but they create potentially more costs in the future by providing an incentive to take risks in the first place.

It’s not an easy choice, and how policymakers make the decision has historically not been transparent. Two Richmond Fed economists, Arantxa Jarque and John Walter, aided by former research associate Jackson Evert, have proposed a tool that could help. Jarque and Walter created a framework for weighing the trade-offs using objective metrics.

“Many aspects of the potential costs of a firm’s failure are hard to measure, for example, the likely magnitude of fire sales,” explains Walter. “But it is reasonable to think those hard-to-measure costs are correlated with characteristics that we can objectively measure, such as a firm’s use of financing tools that may be most subject to fire sales.”

The researchers combined various firm characteristics — such as their connections to other firms and reliance on certain types of debt contracts — into an overall “impact score” that represents the costs of a firm’s failure. In principle, this allows a comparison between the impact score from bankruptcy and the impact score from bailouts. If the score under bankruptcy is lower, that firm is “resolvable” in the sense that a hypothetical policymaker would not choose bailouts. But if the bankruptcy score is higher, one implication could be that regulators and firms may want to consider changes to avoid bailouts.

Their score design accounts for the fact that policymakers may have different views on how the financial

system works. That may influence whether they prefer bankruptcy to bailout. Jarque and Walter illustrated how these differences of opinion may affect a policymaker’s decision by computing the score for different hypothetical policymakers — for example, one who believes firm size is the most important variable and one who doesn’t believe fire sales are important.

Overall, the framework provides a tool that could help policymakers choose between bankruptcy and bailout. Such a tool also could make the decision more transparent to the public and hold policymakers accountable, which were concerns many observers raised during the 2007-2008 crisis.

As they dove into the research, Walter says he was fascinated to learn in detail how large, globally systemic institutions differ from one another in their financial structure and activities. “It was challenging to very carefully think through which financial characteristic of a firm might produce which impacts on the financial system — for example, which items are related to fire sales and which to contagion. The academic literature is still working through these issues.”

There remains more they would like to do with the score. “Many of the measurable characteristics that we put in the score were not measured for these firms back when they got in trouble,” Jarque says. “This prevents us from using past failures to learn about the views of past policymakers and from validating our score by comparing firms that failed and those that didn’t. We would like to explore a simplified version of the score that would allow us to use historical data in this way.”

The work adds to a body of work at the Richmond Fed on the effects of large firm failures and the “too big to fail” problem. Walter helped create the “Bailout Barometer,” a measure of the share of the financial system that has benefited from bailouts — one gauge of future risk. And Jarque has studied living wills, the plans large financial firms have been required to make describing how they could be wound down without government support in the event of failure. Living wills are another tool for minimizing bankruptcy costs and avoiding bailouts.

All this work supports a better understanding of financial stability. “Our bank examiners, our analysts who work with banking data, and many other people around the Fed System and at the Federal Deposit Insurance Corporation do tremendous work in monitoring large systemic financial institutions,” Jarque says. “We learned a lot from talking to them and reading about the evolution of their approach to evaluating living wills, for example. It is inspiring for future research.” EF

Antoinette Schoar

Editor's Note: This is an abbreviated version of EF's conversation with Antoinette Schoar. For additional content, go to our website: www.richmondfed.org/publications

Antoinette Schoar, an economist at the Massachusetts Institute of Technology, is known for uncovering surprising trends in corporate finance, but her original economic interests lay elsewhere. “I grew up in Germany, but my father is originally from Iran,” she says. “Seeing the differences in income inequality and poverty between those countries, I felt this is something I want to understand.”

But upon arriving at the University of Chicago for her Ph.D., Schoar realized a wide range of economic decisions — affecting issues ranging from labor markets to development to economic growth — ultimately run through finance. Her academic adviser, Sherwin Rosen, suggested she talk to colleagues at the business school, and the rest is history.

Schoar's body of work is as wide-ranging as the field of corporate finance itself. A particular focus has been entrepreneurship: New firms have become an increasingly important source of growth and productivity, but data on them have historically been scarce. Schoar's work has shed light on the many ways new firms get funded and the managerial capital that investors bring to startups, as well as the role of management styles generally in a firm's success. She has documented that the so-called “subprime” housing crisis centered largely on middle- and upper-middle-class households. And Schoar's recent work has branched out to consumer credit, finding that credit card firms target more-shrouded offers to less-sophisticated consumers. She discusses all these topics and more in this interview.

Schoar co-chairs the National Bureau of Economic Research's program on corporate finance. She was previously a co-organizer of the NBER's Entrepreneurship Working Group. In 2009 she won the Kauffman Prize Medal for research in entrepreneurship. She also co-founded ideas42, a nonprofit that uses social sciences research to solve social problems.

Successful academics need to be excited by the research itself, Schoar says. “And with the freedom you have of designing what you do, the exciting people you can work with, the great students... I really feel very privileged.”

Renee Haltom interviewed Schoar in her office at MIT in September 2018.



EF: There has been a lot of talk recently about declining business dynamism in this country — that is, fewer businesses are being opened or closed. There's concern that this may be lowering productivity and economic growth. Do you see a problem here?

Schoar: There is lots of research showing that the number of people who are employed in small and young firms has gone down dramatically over the last two decades in the United States. Also, the number of small businesses that are being started is going down. It's very concerning for the United States, which has always prided itself on entrepreneurship. This trend is very strong in the data, but I also believe it's not the full story.

It's not that there are no startups in the United States, especially on the high-tech side. If anything, the United States is where startup financing like venture capital or angel finance is really the most vibrant.

A second trend that is very concerning is that the way small businesses exit has changed dramatically over the last 20 years. It used to be that the large fraction of them went IPO. Now, the vast majority are sold to companies and end up being small divisions of a much larger company. In the long run, we might be worried if it means the whole economy becomes more concentrated. That's a big debate. It's not so clear yet whether these firms have almost natural monopolies, in which case we should be worried about rent extraction, or whether it's

technological innovation giving some big firms an advantage.

EF: Is access to credit for new firms part of the problem?

Schoar: I would say credit is not the culprit here. One has to be very careful in differentiating between the startups that are new, disruptive technologies — think about Boston, Silicon Valley — and the kind of small businesses that are not necessarily disrupting existing firms.

Post-2008, credit to small businesses did initially plummet. Lots of small businesses went bankrupt, and the flow of new ones into the economy dropped. But the rate of startup creation recovered relatively quickly. Venture capital at the coasts, where there is a lot of entrepreneurship, recovered, and these areas have been very vibrant. If anything, the startup economy in the sense of disruptive financing is very deep in the United States. Some people have said there was even an oversupply of entrepreneurs.

Where I worry is growing firms beyond the startup level. That's why it's not a good trend that we're seeing fewer IPOs and many more acquisitions. It's not at the startup level where the pipeline is broken; where something seems to be changing is that these small firms don't become the next Google, the next disruptive big firm.

Some of it might be financing, but I feel a lot of it is that the structure of industries is changing. Venture capitalists call it "escape velocity"; many firms don't have the escape velocity to become standalone. It's much better for them to just be acquired and benefit from the fact that big existing firms have a big network of customers.

But what I worry about is that for entrepreneurs, it's not great if there are few exit options — say, being bought by Google, Facebook, and Amazon. If these three firms determine price, for entrepreneurs it may mean that their valuations will be depressed. Growing up in Germany, I have seen a market where there are few IPO opportunities, where entrepreneurs know that the only exit options are a few large firms like Siemens or Bosch that dictate the price at which you can sell out. In the long run, this reduces incentives for entrepreneurs. American venture capital firms came into Germany and really shook up the dynamism.

To me, the real sticking point in the United States is that access to data is becoming more difficult for small startups that want to disrupt a market. In the modern digital world, the quality of the machine learning algorithms that you can set up depends on how much data you have and how good they are. This network effect story means that it becomes tougher in those industries for newcomers to disrupt incumbents.

I feel policy should be more mindful about this in the United States. Right now, if you talk to people who think about cartel enforcement, they look at whether

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pricing is still competitive. But for Amazon and other large firms, it really is not about how to price one widget versus another but rather having more and more data about how consumers shop, how their preferences manifest. For the consumer, it's great — it keeps prices down and gives free access to all the search functions. Disrupters would make that industry less efficient.

EF: Do angel investors have a special role in facilitating these coveted high-growth startups? Your work with Josh Lerner of Harvard Business School on angel investors has been some of the first on the topic.

Schoar: In the United States over the last decade, we've seen many new online models of angel financing. In research with Josh, we show that the impact of angels is very positive on the firms where they invest. We test this by looking at firms that were just on the cusp of being accepted versus rejected by angels, the idea being that these firms are probably quite similar, and we compare their ultimate outcomes.

Getting financing from angels has a very positive impact on your survival, growth rate, and revenues three to five years out. What we were very surprised about is that it doesn't seem that it is the funding that the angels facilitate; the two sets of firms were equal in the amount of funding they received over the next five years, so it's not the case that without an angel you don't get more capital. We think it's the advice, connections, and help the angels are giving that really makes the difference — giving you a sense of when to grow the business, who to hire at each stage, course correction, all that. It's actually much more the human or "managerial" capital that comes with the angel.

We did another paper using similar data with angels around the world, in Europe and South America. Again, we found angels have a very big and positive impact, but there a lot of it was because of financing. There we found that if you didn't get angel financing, it was much less likely for you to get follow-on funding. On top of that, we found in most countries outside the United States, the firms that get angel funding are much older and already mature; they are already cash-flow-positive compared to the United States.

EF: As informational frictions decrease, do you think angels will become even more important as a source of financing for new businesses? In terms of freer access to information raising the marginal value of angels' unique expertise identifying the highest-potential startups?

Schoar: Some informational frictions have reduced because of technology, but a lot of the judgment about the

quality of an entrepreneur, the subtle differences in the quality of the business, are still very difficult to decide for investors.

I think the rise of angels comes from the fact that we have more and more people in the United States who were successful entrepreneurs and made some money and now have a combination of skills required to understand what an entrepreneur needs. They are often still very young, so they have the energy to want to do more than just sit at home. After firms like Google and Facebook went public, you had a wave of people leaving these firms who were maybe 35, who made a lot of money, and who turned themselves into angels.

It spurs entrepreneurship — in certain pockets of the country, this activity feeds on itself. These successful early entrepreneurs become angels, and they support the ecosystem of entrepreneurship. In emerging markets like India and China, it looks very similar — in places where you have a lot of entrepreneurship, the process has a positive loop.

Our research looked at some of the most successful angel groups in the country, and it would be interesting to have an even wider lens on all the different angels who are active in the United States and in other countries and see how much heterogeneity there is.

In particular, in the United States, if the benefit of angels really comes from the managerial capital they're bringing, there's probably a lot of differences between people, and so it would be good to see the distribution of the angel quality, the matching between entrepreneurs and angels, and whether that can be better facilitated. There are online networks like AngelList that are trying to improve the introduction between investors and entrepreneurs, but I think we are still in the process of figuring out if this is even possible to do on a digital platform and how scalable that is.

EF: One of your most famous papers documented persistence among private equity firms: that the best-performing funds tend to continue being the best performers. Can you explain why this was such a surprising result?

Schoar: That paper, from 2005 with Steve Kaplan at the University of Chicago, was the first to have large-scale

Antoinette Schoar

► Present Position

Michael M. Koerner (1949) Professor of Entrepreneurship, Massachusetts Institute of Technology; Co-Director, Corporate Finance Program, National Bureau of Economic Research

► Education

Ph.D. (2000), University of Chicago; Diploma in Economics (1995), University of Cologne

► Selected Publications

"Managing with Style: The Effect of Managers on Firm Policies," *Quarterly Journal of Economics*, 2003 (with Marianne Bertrand); "Private Equity Performance: Returns, Persistence and Capital Flows," *Journal of Finance*, 2005 (with Steven N. Kaplan); "The Market for Financial Advice: An Audit Study," NBER Working Paper, 2012 (with Sendhil Mullainathan and Markus Noeth); "Loan Originations and Defaults in the Mortgage Crisis: The Role of the Middle Class," *Review of Financial Studies*, 2016 (with Manuel Adelino and Felipe Severino); "House Prices, Collateral, and Self-Employment," *Journal of Financial Economics*, 2015 (with Manuel Adelino and Felipe Severino); "Do Credit Card Companies Screen for Behavioral Biases?" NBER Working Paper, 2016 (with Hong Ru)

data on private equity returns. The paper got a bit of notoriety because we found three things that were very stunning and counterintuitive in finance.

First, as you said, we found that there was persistence in returns even over quite long time periods, on both the good end and the bad end. Partnerships that had good performance tended to have good performance from one fund to the next, and funds that were in the top 25 percent persistently stayed there. But partnerships that were in the bottom had several funds in the bottom. Persistence basically means predictability, and that's obviously very different from public asset classes where you have no predictability. That's bizarre.

On top of that, we found that in venture capital and private equity, the relationship between performance and fund flow is concave when everywhere else it's convex; in other words, the best funds in venture capital and private equity don't grow as quickly as the medium-good funds. If you look at the mutual fund industry, it's exactly the opposite. There's a ton of research over more than two decades finding that mutual funds that perform slightly better get

massive increases in fund flows, and the ones that are in the middle might see outflows.

Why this was particularly puzzling at the time is that the top venture capital firms are what people call "oversubscribed," meaning lots of investors would love to invest with them. But in that time period, the 1990s and early 2000s, they seemed to voluntarily stay smaller. What we concluded is that this seems to be an industry where the quality of the manager, the general partner, matters a lot. At the beginning, the high-performing managers didn't say, "Let's take all the money we can," which might dilute the marginal performance. We saw in our data that funds that grow very quickly see a reduction in performance. It seems that manager quality is an asset, a type, an area where it's tougher to scale up.

For a mutual fund, once I identify one great investment strategy, given how big the public market is, it's more scalable. If you invest in Google, say, it is possible to scale your investment — to invest \$5 million, \$50 million, or maybe even \$500 million. But with venture capital, even if I identify a few really good startups, I can't invest \$500 million. Maybe I can invest \$10 million, but then I

have to go and find another firm; it's less scalable.

So that's what we found. Lots of people found it very surprising because it shows how different this industry is from other financial industries.

What then happened was a misinterpretation of our findings. A lot of investors in venture capital and private equity said, "Because Kaplan and Schoar find there is persistence, all you need to do is identify good firms and then keep on investing no matter what." But it's not as easy as that. Venture capital funds, in particular, might go through cycles. They were really good and had fantastic past performance, but that might change if they lose one of their top managers.

EF: You also found that persistence has declined recently. What changed, and why does it matter?

Schoar: Here we are 20 years later. In a paper we just finished with co-authors, Josh Lerner and I look at this same question using data from State Street, which is one of the biggest custodians for investors in private equity and venture capital. We found that this industry has really transformed, and some of the puzzles we identified in the 1980s and the 1990s have changed.

First, we showed there are big differences between limited partners — that is, the investors in a private equity or venture capital fund. Some investors seem to be very smart about identifying top funds but also about predicting when they will turn south. Other investors don't have that skill. We found that foundations, endowments, and some of the experienced public pension funds are good at making those decisions, but sovereign wealth funds and banks that invest money on behalf of their clients are much worse at it. They stay in a partnership even when performance goes down.

Also, the way firms set themselves up has changed. Before, most partnerships would raise money from lots of limited partners and invest it, and all the investors would get the same terms. Once you made it into a top fund, your chances of getting great returns were quite high. And if you went into a bad fund, everybody got the same returns — in that case, bad returns.

The puzzle Steve and I originally identified was why partnerships were willing to give different investors the same terms. It's like leaving money on the table, right? If I'm a fund trying to raise money from one of the top limited partners, I will be willing to give better terms to a prestigious limited partner than when I'm trying to raise money from a no-name investor who doesn't bring as much to the table in terms of liquidity or accreditation.

The industry is not stupid. If we as academics could see and test this, they surely can see it too. So in the paper with Josh Lerner, we show that firms have started to offer different deals and different investment vehicles to different investors according to the bargaining power of the investor. Even the very top funds give top limited partners access to

their best deals, but for less high-powered investors, they provide investment vehicles that have lower returns.

It matters because as the industry is becoming more competitive, it leaves much less rent on the table. It also means the general partners are capturing more of that rent.

I think the shift was caused by a combination of competition and the fact that some firms have really manifested their reputation. In the 1980s and 1990s, this was still a very young industry. Once you have that reputation, you monetize it. Now everybody is bidding like crazy to get into the top funds, and they can now dictate the prices to different limited partners.

EF: Switching to consumer finance: How are technology, big data, and fintech changing consumer financial services?

Schoar: Fintech and big data and machine learning have really changed the face of many financial services, away from brick and mortar provision to online, on your cell phone; it's much more personalized than in the past.

The credit card industry was really early in this. In the early 1990s, that was the closest to a machine-learning, big-data approach one could get, mailing something to your personal mailbox that's very much targeted at you. If I know that you are an educated young woman who is interested in a certain type of leisure activity, I might send you a credit card mailer that shows international travel or going to a museum, things that might appeal to you.

EF: How granular are they getting? At this juncture, are they profiling someone like you, or are they actually exploiting individual data for you?

Schoar: It's a bit of both, actually. Machine-learning algorithms are using information about what you just did and what people who look like you then did after they made a similar choice. Once you buy a house, what are the other financial services you might now need? Maybe you will start renovating your house and therefore might want certain financial products.

On top of that, many financial subfirms are starting to find that looking at your past financial behavior is very predictive of your future behavior. If you are somebody who always pays on time and is mindful of your bills, it's a very good predictor of whether you will fall late or default in the future. That's very valuable information to financial service companies. To be honest, it's very valuable information to you too, because if you are a well-organized, mindful person, it means a lower cost of financial services.

So there's definitely a good side to the fact that firms can target your type better — it reduces the cost of capital for everyone. I don't want to lose sight of that. If you think about the story of American personal finance over the last 30 years, it's really that personal finance was able to expand so much because the banks were becoming better

at predicting who is a good payer and who is a bad payer.

We also lose track of the fact that when you look at emerging market countries, like India or Cambodia, people have very little access to personal finance. The financial service industry is not at the same level yet, some of

it because the banks themselves are not as sophisticated, some of it because the infrastructure, such as credit scores, isn't there. That's a bad thing; it means a mother whose child is sick might not be able to get a loan for the treatment even though she would have the ability to pay it back in the future. Or a small business that has a great idea that might be relatively safe can't get the credit.

But what my research with a former student, Hong Ru, shows is that there is also a darker side to that personalization. Now that they can predict whether you're less financially literate, in the credit card industry they target you with offers that are deliberately more complicated and more shrouded. Not only are they more complicated in the deal terms, there are more hidden and back-loaded fees. We even see that the offer itself is more complicated — there is more distracting material on the first page and more enticing material that shows you the great shopping experience you can have. The cost of credit is buried on the last page, and, we show linguistically, using more complicated language when the consumer is less educated.

We believe it's deliberate. More financially sophisticated people know that somewhere you have to tell me what is the cost of credit — so please don't hide it from me because maybe then I will be upset with the offerer. Whereas somebody who is not as financially attuned might just think, wow, you are offering me a card with a zero APR! They don't think about the fact that the bank also has a cost, so it must be hidden somewhere.

In our data, we only see the offer side. There is research by Sumit Agarwal, John Driscoll, Xavier Gabaix, and David Laibson showing that customers who make mistakes in the financial contracts they take up indeed pay much more for credit and would be better off taking a contract with fewer hidden fees. That seems to get worse as consumers age. Right now we are working to match the offer data with the user data, and then we will see basically the entire universe.

EF: The implications for consumers are important in their own right, but at this year's annual Jackson Hole central banking conference you also touched on potential monetary policy implications. Could you talk about that?

Schoar: If you look at how monetary policy passes through to the consumer, typically what we look at is when the fed fund rate changes, how the interest rate offered on credit

[The housing crisis] wasn't just a story of banks all making a mistake by lending to subprime borrowers. The mistake, really, was not caring enough about what would happen if collateral values went down.

cards or small business loans changes.

But what we found is that for the cards that have all these shrouded features, when the interest rate goes up, the APR doesn't immediately go up with it. Instead, some of the back-loaded costs go up — late fees, over-limit fees, penalty APR, all the things that are hidden from less-sophisticated customers. Those customers may not even understand that the cost just went up; they just look at the low APR and keep on borrowing.

But this can have a delayed effect on monetary policy. Instead of immediately changing people's demand for credit, it might only change people's demand for credit once the fees really hit. But then once the fees hit, it might also mean that now people are really shocked because the costs are much higher than they thought they were. It might even create some credit risk for the banks and for the people themselves.

What I wanted to highlight in Jackson Hole is that right now there is only a subset of consumer financial products that uses these strategies intensively. But given how much data are becoming available, this will become a bigger channel. It might be something that actually affects how the Fed should think about the asymmetric effect that monetary policy can have on people who are financially savvy and those who are not.

EF: Innovations in credit also played a role in housing. The housing boom and bust was initially interpreted as primarily a phenomenon centered on subprime borrowers. To what extent has that view held up?

Schoar: Research I did with Manuel Adelino at Duke and Felipe Severino at Dartmouth suggests it's unfair to blame it on subprime. It was a broad phenomenon across most income classes.

In dollar value terms, mortgage credit to households from 2000 to 2007 grew in particular for middle-class and upper-middle-class people. They buy the big houses, and therefore take the big mortgages. It's stunning: If you look at the top 1 percent, you see a drop in leverage, the only group for which we don't see an increase. It's almost like houses were not getting big enough, their income was growing so quickly over that time period.

Why we think it's so important is that we also find that the largest growth in the dollar value of defaults post-2008 happened in the middle class and upper middle class.

This is really where the big dollars defaulted and also where the banks were most caught off guard. I did some research just after the financial crisis where we found that in many cases the banks couldn't even reach the prime customers who defaulted. They hadn't even bothered to take a phone number, they were so sure the customer would

never need to be reached again. This is the same bank that is phenomenal at barraging you when you're even just one day late on your credit card payment. It was a mindset that middle-class American customers never default on their mortgages, so if the collateral is good enough, we don't have to worry about the quality or personality of the borrower.

So it wasn't just a story of banks all making a mistake by lending to subprime borrowers. The mistake, really, was not caring enough about what would happen if collateral values went down. This is important for Fed policy because regulating misaligned incentives is much easier than regulating stupidity. The economics profession is reasonably good at understanding agency problems, but we are still grappling with what the Fed should do to deflate a bubble. First, you have to understand what a bubble truly is, the thing we are worst at as economists. Even if you could, it's politically very difficult for a central bank to pull the brake when everything is going well.

EF: Have policymakers responded adequately to correcting misaligned incentives in housing finance, or is there more that should be done?

Schoar: I feel many good things were put in place, and I do strongly believe that incentives for banks improved.

The place where I've been disappointed is around mortgage loans. Fannie Mae and Freddie Mac were nationalized, and the taxpayer absorbed the losses from these institutions. But we didn't make any progress on their regulation and their incentives. We are almost back to a point where mortgage leverage is very similar to what it was pre-crisis. The private securitization market has shut down, which means the banks would not be as caught in the fire if house prices were to go down, but there might be losses on Fannie and Freddie and ultimately the taxpayer.

The other thing that really worries me is the mortgage origination sector. The big banks have significantly reduced their origination activity, so now you have many fintech lenders that are doing origination and securitizing these loans via Fannie and Freddie. And while they have very nice data because of the other services they provide, we don't know how good they are at being originators. They all have one thing in common, which is that they are extremely thinly capitalized, so they are bearing no true mortgage risk; it all immediately gets passed on to Fannie and Freddie.

To me that is worrisome, because Fannie and Freddie, by the nature of being government institutions, may not price credit risks correctly and therefore might indeed feed a bubble again in the housing market. That could feed a different form of downturn — in this case maybe not a disruption in the banking industry, but tax money

being used to bail out the housing market and being made unavailable for other services.

EF: Corporate finance is a subfield of economics that is not particularly known for its diversity. Have your experiences there led you to believe the economics profession should do more to improve diversity — and if so, what?

Schoar: Obviously diversity is a big topic, and I think it's a subtle topic. There are some areas in economics I feel have made bigger progress, in particular labor, public finance, and development. And then there are areas like finance, corporate and asset pricing, economic theory, and macroeconomics that really have made very little progress.

Part of it might be that women have interest in some areas versus not. But finance especially is very broad. Many of the questions are very close to labor and to public finance, and so there is no reason why a woman shouldn't be interested in corporate finance if she is interested in labor.

I have never experienced outright sexism in my field. But in all of us, including women, there are implicit biases, and I do think that matters. Even well-meaning people might not be fully aware of the fact that when they listen to a woman they somehow don't take everything she says as seriously, or they are more willing to believe that somebody else made that comment first and therefore attribute it more to a man than a woman. What I see a lot is when a man gets hired that somebody doesn't like, it's attributed to a hiring mistake. But if there's a woman hired whom they feel didn't fit in or deserve it, then it goes, "She was hired because she's a woman." I think it's not very helpful, and it's detrimental.

There is some interesting work by Anusha Chari and Paul Goldsmith-Pinkham that has looked at participation of economists in large, important industry institutions like the National Bureau of Economic Research. They find that the fraction of women who present, especially in corporate finance and asset pricing, is low relative to the fraction of women in the field. But they also find that the average woman who presents at those meetings has a much more illustrious CV than the average man. So it's by far not the case that women are so subsidized that less-qualified women get to present anywhere, even though that narrative sometimes exists.

There are lots of efforts now to be aware of the biases and to support women in the hiring process. But seeing female role models, especially in finance, is still very rare. I feel what really has to happen is that more women have to study economics. If the pipeline is rich and is strong, that will make a difference. But that can't be the only thing, because it would take many years before something changes. **EF**

Founding America's First Research University

Johns Hopkins put American higher education on the path to world domination

BY KARL RHODES

In 1872, Daniel Gilman, president of the University of California, Berkeley, articulated his vision of what a university should be. During his inaugural address, he argued that the mission of a university should be “to advance the arts and sciences of every sort and to train young men as scholars for all the intellectual callings of life.”

Gilman further stated that universities should elevate scientific research to the same level as the study of language, history, literature, and art. “Give us more and not less science,” he demanded. “Encourage the most thorough and prolonged search for the truth which is to be found in the rocks, the sea, the soil, the air, the sun, and the stars; in light and heat, and magnetic forces; in plants and animals, and in the human frame.”

Such ideas were radical in 1872, a time when most American colleges still focused on teaching Latin, Greek, and mathematics to undergraduates. The advancement of knowledge — especially scientific research — was rarely encouraged.

Near the end of his speech, Gilman imagined what Berkeley would be like 100 years in the future. “I see a flourishing University,” he prophesized. “Students are flocking from east, west, and south, from South America, and Australia, and India, from Egypt and Asia Minor, with the ease and rapidity of a locomotion not yet discovered.”

Gilman's address was eloquent enough but not sufficiently persuasive. He struggled to sell his plan to state legislators who had their own agendas. He also encountered an aggressive farm lobby that wanted the fledgling land-grant university to focus primarily on agricultural and mechanical arts. After two years of slow progress and growing frustration, he resigned to become the first president of Johns Hopkins University — transplanting his dream from Berkeley to Baltimore.

Back on the East Coast, funded by the unfettered bequests of Johns Hopkins — a recently deceased business owner and investor — Gilman and the university's trustees established the first research university in the United States. It was a hybrid of the German model that emphasized graduate research and the British model that focused on undergraduate education. The founding faculty members added the uniquely American features of greater academic freedom and closer collaboration between professors and students. They made the laboratory and the seminar the primary centers of learning. They conducted research and published the results in academic journals, including several they started themselves.

The founding of Johns Hopkins was “perhaps the single, most decisive event in the history of learning in the Western Hemisphere,” according to the late Edward Shils, a University of Chicago sociologist. Shils' assessment may go a bit too far, responds Jonathan Cole, former provost of Columbia University and author of *The Great American University*. “Nevertheless,” Cole adds, “Gilman's molding of Hopkins' mission represented the beginning of the great transformation in American higher learning.”

The Economic Impact of Higher Ed

Before the 20th century, American colleges and “universities” were small, and their economic impact was negligible. Today, American research universities contribute to the economy in at least three primary ways. First, they have a direct impact by employing people and purchasing goods and services. Second, they help students acquire human capital — knowledge and skills that are useful to employers. And third, they increase productivity by conducting research that creates new knowledge or applies existing knowledge in innovative ways.

Johns Hopkins is a good example of the first and second of these channels. In the university's 2014 fiscal year, it paid \$3.9 billion in wages and spent \$1.5 billion on goods and services, including construction. During the spring of that year, more than 20,000 students were enrolled in for-credit programs at Hopkins. But the third channel — creating and applying knowledge — is more complicated. Nationally, Hopkins has ranked first in research spending for 38 consecutive years. In 2016, the university spent more than \$2.4 billion on research and development, according to the latest survey by the National Science Foundation. No other university came close to that figure. Globally, basic research advances knowledge, a public good. Anyone anywhere might then apply that knowledge in ways that add to economic growth. Locally, however, Hopkins' high volume of basic research has not produced a regional concentration of high-tech spinoffs in Maryland, such as those in California's Silicon Valley or North Carolina's Research Triangle.

For a university to have that level of economic impact on its home region, a high number of its graduates must find jobs that keep them there, according to research conducted by Jaison Abel and Richard Deitz, regional economists at the New York Fed. One way to make that happen is to promote university research that creates spillovers into the local economy that create more jobs requiring high levels of human capital.

In recent years, Hopkins has done more to facilitate such spillovers, but progress has been slow, according to Stuart Leslie, a professor in the History of Science and Technology Department who is writing a history of the university. “Our work to build a biotech industry and a pharmaceutical industry using faculty research is very difficult because it runs against a really long-standing prejudice against application,” he says. Traditionally, Hopkins professors have created knowledge for the sake of creating knowledge — not for commercial applications. It’s an ethos that harkens back to Gilman and the founding faculty.

But regardless of Hopkins’ regional impact, it has made a singular contribution to the national economy. The university created a model of graduate study and research that has flourished in the United States. This model has helped develop dozens of top research universities that have become global leaders in the advancement and dissemination of knowledge in many academic fields of study, including disciplines that have proved invaluable to economic development both globally and regionally.

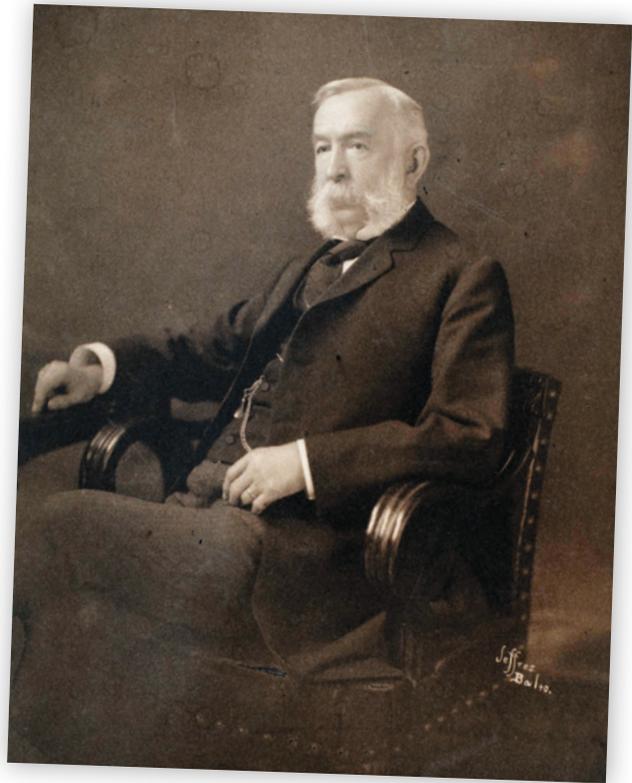
“If you are purist on causality, it’s tough to say that universities generate innovation and economic growth,” cautions Adam Jaffe, an economist at Brandeis University who studies the process of technological change and innovation. “But if you are willing to say, ‘It’s only a correlation, but the correlation is quite robust — it has developed in a lot of places in a lot of different ways,’ then I think the story is compelling.”

Promoting Science

Early American colleges, such as Harvard and Yale, followed the British model of Oxford and Cambridge. Undergraduate students mostly pursued a classical course of study.

The University of Virginia, which started classes in 1825, experimented with a more varied and flexible curriculum that stirred debate over the value of the classical course. At Yale, for example, a trustee resolution suggested that the study of “the dead languages” should be eliminated. This proposal prompted what is now known as the “Yale Reports of 1828,” which reaffirmed the conventional wisdom of sticking to the classical course. American colleges mostly adhered to Yale’s advice for three more generations — partly because the market demanded it — but some universities experimented with various electives and, in some cases, separate schools for scientific studies. Yale formed such a school in 1847, but its resources were severely limited.

Gilman graduated from Yale in 1852 and traveled to Europe, where he visited Noah Porter, a Yale professor who was studying philosophy at the University of Berlin. This trip likely was Gilman’s first exposure to the German model of higher education, and he was impressed by its emphasis on research and graduate studies. He detailed his many observations of Berlin and other universities in letters that he sent back to the United States.



Daniel Gilman, founding president of Johns Hopkins University

Gilman “accumulated meticulously large stores of knowledge regarding education, the history of learning and science, the achievements of great scholars and scientists, the development of educational institutions at every level,” noted Abraham Flexner, an expert on higher education who graduated from Hopkins in 1886 and published a biography of Gilman in 1946. “His ideas were not original; he sought them here, there, and everywhere, combining and adapting them to American needs and conditions.”

Gilman returned to Yale to help raise money for its scientific school. “His task was, in essence, to win adherents to the teaching of science,” Flexner wrote, but “the classicists fought hard to maintain their monopoly.” In 1856, Gilman published a pamphlet calling for greater opportunities for Americans to study basic and applied science. Because these opportunities were lacking, he lamented, the United States was “far behind European nations in many important branches of industry.”

In 1866, Gilman became essentially the chief operating officer of the scientific school, which was making good progress with increased funding and a new corporate structure that further separated it from Yale. “While Yale College continued to operate on traditional lines, the Scientific School embraced modern subjects,” Flexner wrote. Forward-looking “Yale men,” he noted, started to hope that Gilman might become the university’s next president, but when the job went to Porter, Gilman went to Berkeley.

Founding Johns Hopkins

While Gilman was accumulating ideas in Europe and experience at Yale, Johns Hopkins (the man) was amassing a fortune in Baltimore as a wholesaler of groceries, a financier of various enterprises, and a major shareholder in the Baltimore and Ohio Railroad. Hopkins died in 1873, leaving \$3.5 million to start a university and \$3.5 million to establish an affiliated hospital. There were few strings attached to these gifts, but he advised the trustees to never sell the B&O stock, a recommendation they followed and would later regret.

After Hopkins' death, the trustees began researching various models of American higher education. They asked the presidents of three universities — Charles Eliot of Harvard, Andrew White of Cornell, and James Angell of Michigan — to advise them. “White made encouraging suggestions from his experience at Cornell, Angell was skeptical, and Eliot could not imagine more than a fledgling regional college in Baltimore,” wrote Roger Geiger, a Penn State education professor who in 2015 published *The History of American Higher Education*. “But all agreed that the best person to lead such a venture was Gilman.”

Reverdy Johnson Jr., chairman of the trustees' executive committee, offered the job to Gilman in an 1874 letter. “The Institution which I represent,” Johnson began, “is the recipient of a fund of some three and a half millions of dollars — with no shackles of state or political influence, and with no restriction but the wisdom and sound judgment of the Board of Trustees.” The institution, he added, would be “entirely plastic in the hands of those to whom its founder has entrusted its organization and management.” In short, Hopkins would not suffer from any of the impediments that Gilman was struggling against at Berkeley.

“The trustees of the university believed in Gilman from the start: He had no opposition to overcome, no vested interest to combat, no tradition to defy,” Flexner wrote. Gilman took the job and opened the university in 1876 with 54 graduate students, 12 matriculates, and 23 special students.

In Hopkins' third annual report, Gilman cannily attributed the university's emphasis on graduate education not to himself but to the trustees. He said the trustees found strong demand “for opportunities to study beyond the ordinary courses of a college or scientific school.” The best evidence of this demand was “the increasing attendance of American students upon the lectures of the German Universities.”

To attract such students, Gilman sought professors who were devoted to specific disciplines and eminent in their fields with “power to pursue independent and original investigation, and to inspire the young with enthusiasm for study and research.” He hired three professors immersed in science: Henry Rowland (physics), Ira Remsen (chemistry), and H. Newell Martin (biology). He also hired three professors steeped in classical instruction: J.J. Sylvester (mathematics), Basil Gildersleeve (Greek),

and Charles Morris (Latin and Greek).

“Sylvester and Gildersleeve were the elder statesmen. The rest of the faculty members were about 30, which is astonishing when assembling what was supposed to be a world-class faculty,” Leslie says. “How do you get a great university without a great faculty? And how do you get a great faculty without a great university? You have to think about it differently. You have to think about assembling a *future* great faculty.”

Many young professors from the early years at Hopkins never became outstanding scholars, but they trained hundreds of Ph.D.s who spread Hopkins' research-centric model of learning to many other American universities.

“The numbers are staggering by today's standards,” Leslie says. Rowland died at 52 after training more than 100 Ph.D.s, including more than 30 who went on to chair departments at other universities. “Remsen was not a great scholar at all, but as a trainer of people who would train other graduate students at other universities, he was unmatched,” Leslie says. “This was also true of William Welch in medicine. He set up an environment in which great medical researchers flourished and went on to do tremendous things all over the world.”

In economics, Hopkins awarded its first Ph.D. in 1878 to Henry Adams, who later became a co-founder of the American Economic Association along with Richard Ely, who was among Hopkins' first professors of political economy.

Imitation and Acclaim

Gilman corresponded frequently with Eliot, the president of Harvard. Eliot understood the importance of science. He was familiar with the German model of graduate education, but he also was bound by the ancient traditions of America's oldest college. He famously stated that the German approach would suit Harvard freshmen “about as well as a barnyard would suit a whale.”

Harvard was not alone in its complacency. “By 1890, the German ideal of advanced scholarship, professors as experts, doctoral programs with graduate students, and a hierarchy of study had few adherents in the United States outside of Johns Hopkins,” wrote University of Kentucky professor John Thelin in his 2004 book, *A History of American Higher Education*.

Hopkins took full advantage of this head start. It graduated its first Ph.D.s in 1878, and by 1889, it had produced a total of 151 — more than Harvard and Yale combined, according to Geiger. “Hopkins' Ph.D.s were soon sought by ambitious universities throughout the country.”

The university's first obvious imitator was Clark University, which opened in Worcester, Mass., in 1889 with G. Stanley Hall (a former Hopkins professor of psychology) as its founding president. Clark was the first all-graduate studies institution in the United States. It focused on mathematics, physics, chemistry, biology, and most importantly, psychology.

The University of Chicago was not a Hopkins imitator, according to Cole, but its first president, William Harper, came from the same school of thought as Gilman. Beginning in 1890, and 14 years after the founding of Hopkins, Harper created “a small undergraduate body and a much more elaborate and important research enterprise,” Cole says. “He recruited extraordinarily able faculty members by raiding a lot of the prestigious eastern universities. He essentially killed Clark University by stealing almost all of their very good psychologists.”

Hopkins’ emphasis on research also attracted talented professors. “Harvard was forced to adopt the model because Hopkins began to raid some of Harvard’s faculty who were interested in doing research,” Cole says. “They revered the German universities and the opportunity to produce new knowledge rather than simply to transmit existing knowledge.”

Harvard’s Eliot was not an early adopter of the Hopkins model, Cole says, “but when he got into it, he got into it in a big way. He not only adopted it, he quintessentially adopted it.”

As Harvard surged ahead, Hopkins lost momentum. The university struggled financially after its endowment — almost all of it still in B&O Railroad stock — stopped generating cash in 1887. Also, the university started to lose some of its most distinguished faculty to retirement, death, and academic free agency. By the time Gilman retired from Hopkins in 1901, Eliot and Harper were beating him at his own game. But at the university’s 25th anniversary celebration, they gave him credit for much of their success.

“We are celebrating the close of the first period of University Education in these United States,” Harper said. “During this first period, the Johns Hopkins University has been the most conspicuous figure in the American University world, and, to its achievements we are largely indebted for the fact that we may now enter upon a higher mission.”

Eliot’s tribute went even further. Eating crow from his infamous barnyard quote, he said, “I want to testify that the graduate school of Harvard University, started feebly in 1870 and 1871, did not thrive, until the example of Johns Hopkins forced our Faculty to put their strength into the development of our instruction for graduates. And what was true of Harvard was true of every other university in the land which aspired to create an advanced school of arts and sciences.”

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American Dominance

In 1910, Johns Hopkins still was struggling financially, but its reputation was intact. It appeared in Edwin Slosson’s book of 14 *Great American Universities*. “Slosson chose universities with the largest instructional budgets,” Geiger noted. “Johns Hopkins, with a slightly smaller budget, was grandfathered in” at the expense of MIT. In another 1910 tome, written by Flexner under the auspices of the Carnegie Foundation, Hopkins’ medical school was deemed the best in the nation, an excellent model for others to emulate.

In the early 20th century, European research universities were still considered better than American research universities on average. Nobel prizes, for example, mostly went to professors in Germany, France, and Great Britain. But American research universities were improving rapidly under the Hopkins model. By then, they had developed strong ties to their European colleagues — including those in Germany.

When Hitler came to power in 1933, American universities were well-positioned to garner the lion’s share of academic talent flowing out of Germany. The United States welcomed these refugees “with open arms as well as with university appointments, research fellowships, and a level of academic freedom they quickly learned to cherish,” Cole says. “It’s hard to say what might have happened if our system had not been receptive to the German researchers.”

Following World War II, the United States continued to invest heavily in higher education, producing armies of Ph.D.s. who facilitated the rapid expansion of American higher education. Gilman’s international vision for Berkeley came true at Johns Hopkins, at Berkeley, and at dozens more American universities that have become magnets for the brightest scholars from all over the world. Hopkins currently serves more than 4,000 of the 1 million international students who are enrolled in American universities. The United States hosts almost twice as many international students as any other country, according to the U.S. Department of Commerce. America also has the largest number of colleges and universities — even more than China, whose population is four times larger.

Economists may debate the degree to which American higher education has driven U.S. innovation and economic growth, but there’s no question that America’s top research universities are the envy of the world — thanks in part to the intellectual entrepreneurship of Daniel Gilman at a new university in Baltimore. **EF**

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Tailoring Bank Regulations

BY TIM SABLİK

On Oct. 2, 2018, Fed Governor and Vice Chairman for Supervision Randal Quarles appeared before the Senate Committee on Banking, Housing, and Urban Affairs to discuss the Fed's progress in implementing new reforms to bank regulation.

The reforms are a result of the Economic Growth, Regulatory Relief, and Consumer Protection Act, or EGRRCPA, signed into law in May 2018. In addition to introducing protections for consumers and relaxing mortgage lending rules, EGRRCPA amended several banking regulations put in place by the Dodd-Frank Act of 2010.

Dodd-Frank introduced new rules for financial firms, such as stronger capital and liquidity requirements and stress tests to assess institutions' resiliency to future crises. While Dodd-Frank set easier requirements for smaller entities than for large institutions whose failure could create spillover effects for the overall economy, leaders of community banks argued that the law's new requirements were nevertheless disproportionately burdensome for their smaller staff.

There is some evidence that the cost of regulatory compliance can be significant for smaller financial institutions. A 2013 Minneapolis Fed study found that for a third of community banks, hiring just two additional employees to manage regulatory compliance would be enough to make them unprofitable. Some have suggested this burden may have contributed to the dearth of new community banks formed in recent years. (See "Who Wants to Start a Bank?" *Econ Focus*, First Quarter 2016.)

To address these concerns, EGRRCPA makes a number of changes to how Dodd-Frank applies to community banks. Existing rules require all banks to maintain capital at no less than 4 percent of total assets. Banks are also subject to additional risk-weighted capital requirements. Under EGRRCPA, banks with less than \$10 billion in assets have the option to instead meet a new Community Bank Leverage Ratio, which requires them to maintain capital at between 8 percent and 10 percent of total assets unweighted by risk. While this new leverage ratio is higher than the old one, banks that meet this requirement will be exempt from any additional capital requirements. In his October testimony, Quarles noted that the Fed and other banking regulators plan to issue a proposal for implementing the Community Bank Leverage Ratio "in the very near future."

Under EGRRCPA, banks with less than \$10 billion in assets are also exempt from the so-called "Volcker Rule," which prohibits proprietary trading by banks. (See "Rolling Out the Volcker Rule," *Econ Focus*, First Quarter 2014.) Finally, EGRRCPA seeks to ease some of the reporting costs for smaller banks. Banks must file quarterly "call

reports" collecting a variety of information on their operations for regulators. Under the new law, banks with less than \$5 billion in assets can file more simplified reports for the first and third quarters of the year. Additionally, EGRRCPA allows banks with less than \$3 billion in assets to reduce the frequency of bank examinations from yearly to once every 18 months. Under Dodd-Frank, this was only available to banks with less than \$1 billion in assets.

EGRRCPA makes a number of changes to regulations for larger banks as well. Under Dodd-Frank, all banks with more than \$50 billion in assets were subject to additional requirements and regulatory scrutiny. They were subject to periodic stress tests, asked to provide living wills detailing how regulators could unwind them in the event of failure, and required to maintain a certain threshold of assets that could easily be liquidated in a crisis, among other measures. EGRRCPA raised the asset threshold for applying these requirements to \$100 billion and gave the Fed greater discretion to tailor requirements for banks with more than \$100 billion in assets. In an Aug. 17 letter, a group of senators urged the Fed to use that discretion to reduce regulations for large banks that do not pose a systemic risk to the economy.

On Oct. 31, the Fed's Board of Governors released a draft framework for implementing these changes. The proposal creates four categories for large banks based on asset size and risk profile. The first category applies to globally systemically important banks and their subsidiaries. Regulators have determined that these institutions pose the greatest risk for the financial system, and under the new framework they would remain subject to the most stringent requirements introduced by Dodd-Frank and the international Basel Committee on Banking Supervision.

The second category of regulations would apply to banks with \$700 billion or more in assets as well as those firms engaged in significant international activity. These firms would be subject to many of the same enhanced requirements as the firms in the first category. Firms with \$250 billion or more in assets that do not meet the criteria for the first two categories would also face similar rules but less demanding liquidity requirements.

The biggest changes under the proposed framework would be for firms with between \$100 billion and \$250 billion in assets. Those firms would no longer be subject to certain liquidity requirements and would need to submit to stress tests only every other year rather than annually.

In a statement accompanying the new framework, Quarles said that he was "hopeful that firms will see reduced regulatory complexity and easier compliance with no decline in the resiliency of the U.S. banking system." EF

Updating the Schoolhouse

**INFORMATION, INCENTIVES, AND
EDUCATION POLICY**

BY DEREK A. NEAL, CAMBRIDGE,
MASS.: HARVARD UNIVERSITY PRESS,
2018, 224 PAGES

REVIEWED BY AARON STEELMAN

Human capital — the collection of traits that improve people’s productive capacities, such as health, skills, knowledge, and habits — is a primary driver of economic growth at the aggregate level and earnings potential at an individual level. But how do people acquire human capital — and what can policymakers do to facilitate that acquisition? One of the most significant ways is formal education.

In *Information, Incentives, and Education Policy*, Derek Neal, an economist at the University of Chicago, explores how K-12 education might be provided most efficiently. To address that issue, Neal first examines the performance of existing public schools, which he often finds wanting due to inefficient personnel policies and waste, and then assesses three widely proposed reforms.

He first discusses assessment-based incentive (ABI) systems, which reward or penalize educators based on how their students perform on standardized tests. He notes that the “teacher effects” literature has identified three facts about the determinants of test scores. First, among a population of students with similar records of past achievement who attend schools with comparable resources, expected test scores differ systematically across classrooms. Second, much of those differences can be predicted by the performance of students taught previously by the teachers assigned to each classroom. Third, researchers have not been able to identify the characteristics of new teachers that will foster higher achievement among their students.

Neal argues that ABI systems, in principle, show promise but can fail to deliver for several reasons. There have been numerous cases of corruption, in which students’ test scores have been manipulated by teachers and principals. Also, ABI systems can encourage instructors to teach to the test rather than devote class time to more productive uses. In addition, teachers may neglect students who they perceive as having little chance of passing the test in favor of other students. Neal and Gadi Barlevy of the Chicago Fed have proposed an ABI scheme called Pay for Percentile (PFP), which defies succinct explanation, but which they argue would avoid those pitfalls. Even if PFP were adopted, though, it still would not necessarily foster other important skills and character traits, such as

acting more maturely and responsibly. Some have argued that school choice proposals, including charter schools and voucher programs, would allow parents to choose schools that seem to perform well along those dimensions.

Charter schools, the second reform he considers, are schools that the government authorizes and pays for but does not operate. There are a large number of charter schools across the country, which have been the subject of much research. Neal argues that performance among charter schools can be quite variable and what has been described as the “No Excuses” model has often yielded significant returns, particularly in urban schools with significant minority populations. He cites work by Roland Fryer Jr., an economist at Harvard University, who has written that the No Excuses approach follows five broad tenets: (1) an increase in instructional time, including longer school days, longer school years, and classes on Saturdays; (2) changes in the human capital in schools, including rigorous screening of school principals, resources dedicated to teacher training, and frequent feedback given to teachers on the quality of their instruction; (3) significant time devoted to tutoring; (4) regular assessments of students’ progress and updated performance goals based on those assessments; and (5) a culture of high expectations, including clearly stated objectives, with both school administrators and students’ parents signing agreements to honor the policies designed to ensure that students succeed.

The third reform is voucher programs that provide parents with funds they could use to send their children to any school they choose, public or private, and perhaps would allow parents to provide additional personal funds to meet any shortfall between the amount of the voucher and the tuition rate. Neal has less to say about voucher programs than he does about ABI systems or charter schools, in part because there is less evidence to draw on. He is generally favorable toward them, though he worries about the inequality of educational outcomes they may produce and argues that their adoption faces large political barriers.

In the end, Neal argues that optimal education policies might draw from all three reforms discussed, producing a “system of regulated competition among sets of education providers that education authorities deem eligible to receive public funds.” He sees a parallel with the Medicare system, which allows beneficiaries to receive care at public or private hospitals, but the providers are licensed and treatments deemed wasteful are not covered. It may seem like a less than satisfying proposal to some — including both those who see such reforms as undermining a system they believe works reasonably well now and those who would like to see schooling separated from the state altogether — but solutions to issues this complex often are. **EF**

Definitions Matter: The Rural-Urban Dichotomy

BY JOSEPH MENGEDOTH

Economic disparities between urban and rural areas have been discussed widely in recent years, with larger metro areas seeing remarkably stronger growth, on average, than their smaller or more rural counterparts. The Richmond Fed’s district, the Fifth Federal Reserve District, encompasses many points along this spectrum, from the Appalachian region of West Virginia to the Lowcountry of South Carolina, and from large metro areas such as Washington, D.C., and Charlotte to the sparsely populated Highland County in the western mountain region of Virginia.

What is the nature of the disparities across those regions? Do we see what is commonly called an urban-rural divide? And how is it influenced by the definition of urban or rural? This article will take a look at some commonly used ways to define urban and rural areas from agencies such as the U.S. Department of Agriculture (USDA), the National Center for Health Statistics (NCHS), and the Census Bureau to see what the current data tell us about disparities across measures of demography, education, employment, and poverty.

Defining Rural and Urban Areas

The first step is deciding how to define urban and rural. One crude approach is to rely on the Office of Management and Budget’s (OMB) categorization of economically integrated

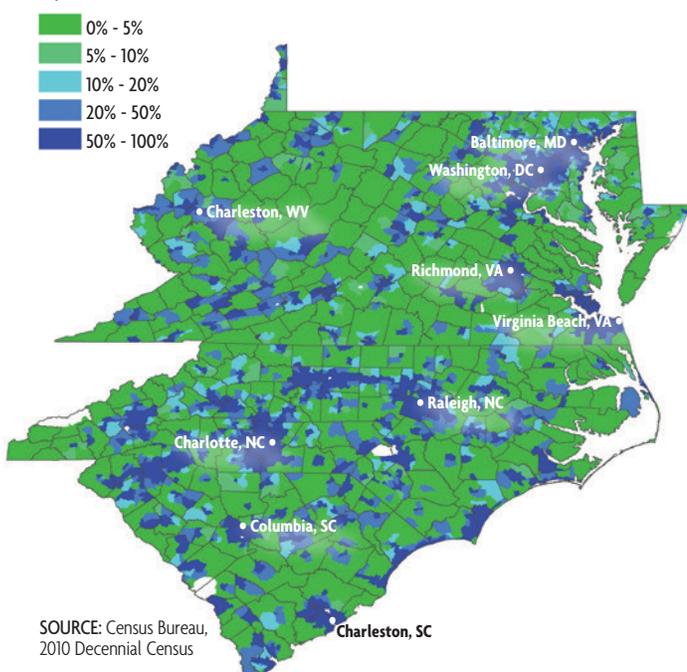
areas: Any county that is within a metropolitan or micropolitan statistical area (metropolitans have at least one urbanized area with more than 50,000 inhabitants while micropolitans have at least one with a population between 10,000 and 49,999) could be treated as “urban” and the rest could be treated as “rural.” However, this method would classify many counties as urban that, to most people, would seem less urban than some counties classified as rural. For example, Goochland County, Va., which is part of the Richmond MSA, has a population density of about 77 people per square mile, which is more similar to the density of Accomack County on Virginia’s Eastern Shore (which is not in a metro area) than to Richmond City’s approximately 3,400 people per square mile. Thus, it may be helpful to have ways of categorizing areas as urban or rural beyond the basic metro and nonmetro definitions.

Census Bureau data are a commonly used alternative. The Census Bureau designates rural and urban areas at the Census tract or block level with each decennial Census. A block is considered urban if the density is greater than 1,000 people per square mile or if it has a density of 500 to 1,000 people per square mile plus a mix of residential and certain nonresidential land uses. The latter may include such uses as parks, schools, office buildings, or retail. Rural areas are simply those that do not meet the criteria to be considered urban. Using this definition, 81.2 percent of the U.S. population and 72.3 percent of the Fifth District population lived in urban areas in 2010. Of course, urban areas are denser, accounting for only 3.1 percent of land area in the United States in 2010 and 8.1 percent of land area in the Fifth District. (See map.)

The USDA has another method of categorizing areas as urban or rural. The USDA uses the OMB determinations of core-based statistical areas as a starting point to create a county-level classification system that it calls the Rural-Urban Continuum. This system divides counties into nine classifications. The first three include all counties within an OMB-defined metropolitan statistical area, which are then separated by size of the metro area population. For the remaining six classifications, the USDA ignores the OMB’s designations of a micropolitan statistical area and instead separates counties based on the size of the total population that live in urban areas of each county (based on data from the decennial census) and then by their adjacency to a metro area. The USDA system assigns a code that ranges from one (counties in metro areas with 1 million or more in population) to nine (counties with less than 2,500 urban population that are nonadjacent to metro areas).

The largest number of counties in the Fifth District

Share of Population Living in Urban Areas by Census Tract



SOURCE: Census Bureau, 2010 Decennial Census

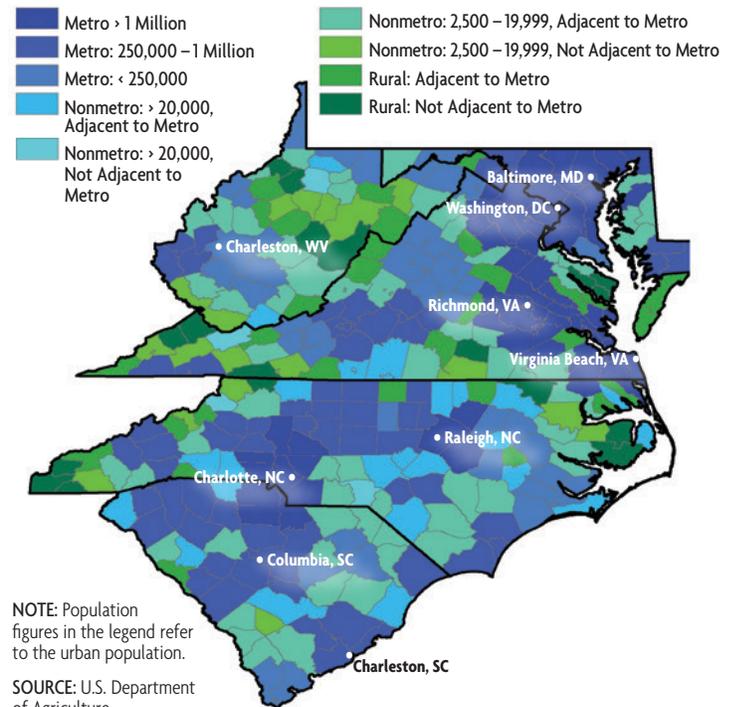
fall into the first category, large metro areas, and include those that are a part of the Washington, D.C., Virginia Beach, Richmond, Baltimore, or Charlotte MSAs. (See map.) These counties contained almost half of the 2016 population of the Fifth District. Nationally, this category contained 55 percent of the total population. The second-largest number of counties fall in the sixth category — counties not part of but adjacent to an MSA that have between 2,500 and 19,999 people living in urban areas of the county. This includes counties such as Logan and Wyoming in West Virginia that are near but not part of the Charleston and Beckley MSAs. Although a large number of counties fit in this category, they contained only 5.8 percent of the District’s population in 2016, slightly less than the national share of 8.4 percent.

Another useful scheme for categorizing counties as more rural or less rural is that of the NCHS, which, similar to the USDA, uses the core-based statistical areas developed by the OMB as a basis. This system has six categories. The first four include counties in metropolitan statistical areas, and the last two include counties in micropolitan statistical areas and counties that are neither in a metro or micro area, which are labeled “noncore.” (See table.)

One of the major benefits of using the NCHS system is that it separates the counties in large metro areas into one central county and fringe counties. As a result, the 78 Fifth District counties that were in the most urban category of the USDA rural-urban continuum are separated into two NCHS categories. Nine of these counties are in the most urban category of the NCHS system, while 69 are in what the NCHS deems “fringe” counties. It is easy to see why separating metropolitan counties might be important; in many metro areas, it is the suburbs of the cities that tend to be in the strongest economic position.

Meanwhile, on the rural end of the spectrum, the NCHS system groups all counties that are not part of any MSA or micropolitan statistical area into one “rural” category. In the Fifth District, then, 112 counties are considered to be rural, or “noncore,” and there is no distinction by proximity to metro areas. (See map on next page.) And

Fifth District Counties by Rural-Urban Continuum Area



counties that are adjacent to metro areas might see different economic outcomes than those that are more distant from an urban core.

Demographics of the Fifth District’s Rural Areas

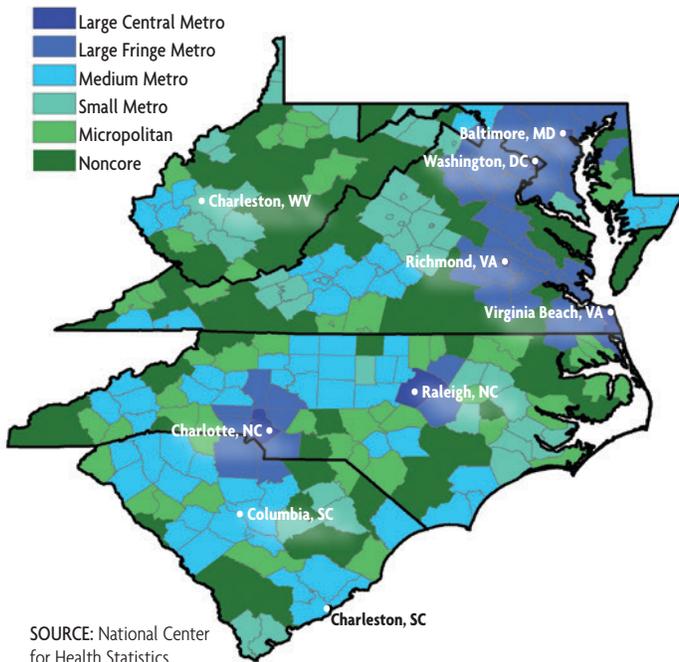
So what do the data tell us about differences between urban and rural areas? For one thing, no matter which definition of urban and rural we use — Census, USDA, or NCHS — rural populations are older. Using the Census definition, about 17.5 percent of the 2016 U.S. population in rural areas was over the age of 65 compared to only about 14 percent of the urban population. Most of the states in the Fifth District had similar shares and similar discrepancies between urban and rural areas. Virginia had the largest urban/rural divide with respect to the older

NCHS 2013 Rural-Urban Classifications

Code	Name	Description
Metropolitan		
1	Large central metro	NCHS-defined “central” counties of MSAs of 1 million or more population
2	Large fringe metro	NCHS-defined “fringe” counties of MSAs of 1 million or more population
3	Medium metro	Counties within MSAs of 250,000 – 999,999 population
4	Small metro	Counties within MSAs of 50,000 – 249,999 population
Nonmetropolitan		
5	Micropolitan	Counties in micropolitan statistical areas (urban core population 10,000 – 49,999)
6	Noncore	Counties not within micropolitan statistical areas

SOURCE: National Center for Health Statistics, U.S. Dept. of Health and Human Services

Fifth District Counties by NCHS Rural-Urban Classification



population with just under 13 percent of the urban population over 65 compared to around 20 percent of the population in rural areas. Moreover, while the rural population in West Virginia is older than its urban population, West Virginia's population is also just generally older. In fact, the share of the population over 65 in urban areas of West Virginia was higher than that in rural areas of the nation.

Applying the USDA and NCHS definitions to county-level data corroborates this pattern in age demographics, with the lowest shares of the over-65 population occurring in the most urban categories and the highest shares in the most rural. In particular, applying the USDA definitions to the Fifth District and aggregating counties within each category gave a range from about 18 percent of the population over age 65 in large MSAs to almost 31 percent in the most rural counties. And under the NCHS system's separation of large MSAs into central and fringe counties, the central counties had an even lower share, about 16 percent.

Rural areas also tend to be less educated. According to the Census, each state in the Fifth District had a smaller share with a bachelor's degree (or higher) in rural areas than in urban areas. The District of Columbia, which is completely urban, had the highest share of those with at least a bachelor's degree, almost 57 percent; on the other hand, among the rural population of West Virginia, only about 16 percent of the population had a college degree. (West Virginia's urban population also had a relatively low share at about 26 percent.) Of course, this is only one measure of human capital accumulation — if one is interested in economic divides between rural and urban areas, it is important to also understand high school graduation rates and access to vocational or technical

schools, among other human capital measures.

As with the Census definitions, statistics based on the USDA definitions show that college attainment was highest in the most urban areas and lowest in the most rural. But the data also show, perhaps unsurprisingly, that the counties that were adjacent to metro areas generally had higher shares of college graduates than those that were nonadjacent. In the Fifth District, this was particularly the case for Virginia. Further, the NCHS categories showed a substantial difference in college attainment between central and fringe counties of large urban areas, with about 45 percent of the population in central counties having a bachelor's degree or higher compared to 39 percent in the fringe counties. But as always, or almost always, there are exceptions; for example, fringe counties of Baltimore City had a higher share of the college educated than the central county of Baltimore City.

Labor Market Outcomes and Poverty in the Rural Fifth District

There are many measures of labor market outcomes; here, we explore labor force participation, unemployment, and wages to get some sense of labor market activity across areas. In general, labor force participation rates were higher in urban areas than rural areas. This is true at the state level according to the Census data, but the county-level systems offer further insight. Although generally the highest participation rates were in central counties of large urban areas (using the NCHS system), this was not always the case. For example, in Maryland, fringe counties had the highest participation rates.

Again, the USDA system offers insight for rural counties by considering adjacency to metro areas. For example, some of the lowest participation rates in the Fifth District of 35.1 percent and 36.5 percent occurred in Virginia's neighboring counties of Buchanan and Dickenson, respectively. Both counties are in the southwest region of the commonwealth and are designated as rural, not adjacent to a metro area by the USDA. Meanwhile, in the nearby county of Wythe, Va., which is also rural but adjacent to the Blacksburg MSA, the participation rate was more than 20 percentage points higher at 57.1 percent.

Such differences in the data may lead a policymaker to ask: What drives the lower participation rates in more rural counties? Is it the fact that those areas tend to be older, or are there potential workers on the sidelines in rural areas who can be brought into the fold, especially in this period of very low unemployment?

Using data from 2016, one can aggregate the number of unemployed and the labor force for all the counties in each rural-urban continuum group and calculate an unemployment rate. Doing so reveals that unemployment was lowest in large metro areas and generally increased with rurality, with a notable exception of counties considered rural but adjacent to a metro area. Fifth District rural, metro-adjacent counties had a combined unemployment rate of 5.2

percent. That was lower than nonadjacent rural areas, which had a rate of 6.7 percent.

Meanwhile, under the NCHS scheme, unemployment was lowest in fringe counties of large MSAs in the Fifth District, which had an aggregate rate of 4.1 percent compared to central counties and medium-sized cities with 4.8 percent each. And the highest aggregate rate of 6.1 percent occurred in the category for micropolitan areas. Some of the highest county-level unemployment rates were in rural counties, but this category is large and included many counties with very low unemployment rates.

Wage data aggregated across the USDA's urban-rural continuum likewise show that wages were higher the more urban the area. In fact, in 2016, wages were almost 40 percent higher in large metro areas than in mid-sized and smaller MSAs. But unlike with educational attainment and labor force participation, there was very little difference between adjacent and nonadjacent rural areas. Using the NCHS classification further showed the wage premium earned in large cities. The average employee working in a central county of one of the Fifth District's large MSAs earned a wage about 20 percent higher than the average employee working in a fringe county. Wage data are reported by place of work, so a person earning those higher wages might live in the fringe county and commute to the central county.

Although the data above show generally lower unemployment, higher wages, and higher labor force participation in urban areas (with some key exceptions), those areas also tend to have higher levels of poverty. Using Census definitions, a higher share of the urban population lived below the poverty line than the rural population in the United States and in most Fifth District jurisdictions (the exceptions being Virginia and South Carolina). This, however, is where the classification system matters. Using the USDA classification and creating an aggregate measure of the share of the population living below the poverty line for each urban-rural category, we observe that counties in large metro areas actually tended to have the lowest poverty rate at around 11 percent, followed by mid-sized and small MSAs. Among the nonmetro categories, poverty rates were between 20 percent and 22 percent, with the exception of rural areas that are adjacent to a metro area, where the aggregate measure was about 18 percent.

There is also a considerable amount of variation within categories. For example, poverty rates among large metro areas ranged from 2.7 percent in Falls Church City, Va. (part of the Washington, D.C., MSA) to 29.4 percent in Petersburg City, Va. (part of the Richmond MSA). In fact, the poverty rate in Petersburg is higher than that of any completely rural county, adjacent to a metro area or not. Similarly, there was a large variation in poverty rates in nonmetro counties with urban populations between 2,500 and 19,999, which ranged from 5.6 percent to 33.0 percent.

Meanwhile, using the NCHS system showed that fringe counties of large MSAs had the lowest poverty rate

(9 percent), while central counties of large MSAs actually had similar poverty rates to medium and small sized MSAs. The category with the highest poverty rate was micropolitan areas, at just over 20 percent. Although this classification system showed that central counties had higher poverty rates than fringe counties, it is important to remember that aggregating to the county level might mask large differences within counties, such as the difference between poverty inside the city and outside of the city.

For example, the central county of the Richmond, Va., metro area is the independent city of Richmond, where the poverty rate was 25.4 percent in 2016. Meanwhile, the more suburban neighboring counties of Henrico and Chesterfield had poverty rates of just 10.6 percent and 7.4 percent, respectively. Comparatively, in Mecklenburg County, N.C. (the central county of the Charlotte MSA), the poverty rate was 14.2 percent. But although Mecklenburg's 524 square miles contain the center city of Charlotte, the county also contains a large portion of the city's suburban areas. This could mask differences in economic outcomes between the city of Charlotte and its suburbs.

Definitions Matter, but so Does Geography

No matter the classification system, the data indicate that more rural areas tend to be both older and less educated. It is no coincidence, then, that measures such as labor force participation and wages tend to be lower. Nonetheless, analyzing the classification systems for urban and rural areas shows the importance of close attention to how data are aggregated.

The USDA and NCHS county-based systems enable distinctions among urban areas by population size and between central and fringe counties of large MSAs, which can highlight important differences. Likewise, separating rural areas by adjacency to metro areas shows the potential importance of proximity to a city.

With each method comes costs and benefits. The Census' block-level definition, while the most comprehensive, is also the most difficult to use with other data, since data at the block or tract level are usually collected at best every few years and at worst every decade. What is more, since counties are a common geographic category, classification schemes like those of the USDA or the NCHS enable a researcher to use much more data to characterize an area that most people can relate to. On the other hand, the USDA classification system, with its nine categories, allows for a richer comparison across the rural and urban continuum but obfuscates some differences between central and fringe counties of large MSAs. The NCHS system's fewer categories do distinguish between central and fringe counties, but it groups a larger set of rural areas together, making it difficult to understand how adjacency to metro areas might influence outcomes. Recognizing and understanding these limitations is important for researchers and policymakers when trying to understand geographic disparities broadly and the urban-rural divide more specifically. EF

STATE DATA, Q1:18

	DC	MD	NC	SC	VA	WV
Nonfarm Employment (000s)	794.1	2,731.5	4,466.5	2,117.4	3,979.0	751.0
Q/Q Percent Change	0.0	0.3	0.6	0.6	0.6	0.5
Y/Y Percent Change	0.7	0.3	1.6	1.5	0.8	0.7
Manufacturing Employment (000s)	1.3	108.2	469.8	243.5	238.3	47.3
Q/Q Percent Change	0.0	0.9	0.5	0.7	1.5	0.5
Y/Y Percent Change	8.3	1.6	0.8	1.9	2.0	1.1
Professional/Business Services Employment (000s)	166.9	447.1	632.5	274.5	736.6	66.1
Q/Q Percent Change	0.0	0.8	0.7	-2.3	0.6	0.1
Y/Y Percent Change	0.5	0.6	2.9	0.7	1.8	-0.3
Government Employment (000s)	238.4	503.5	735.8	367.5	715.9	154.1
Q/Q Percent Change	-0.2	0.0	0.2	0.2	0.0	0.3
Y/Y Percent Change	-1.4	-0.3	0.9	0.8	-0.1	-1.0
Civilian Labor Force (000s)	402.7	3,224.7	4,974.0	2,324.5	4,321.1	784.4
Q/Q Percent Change	0.3	0.1	0.1	0.2	0.0	0.3
Y/Y Percent Change	0.8	0.4	1.3	0.8	0.7	0.9
Unemployment Rate (%)	5.7	4.2	4.5	4.4	3.5	5.4
Q4:17	5.9	4.1	4.5	4.2	3.6	5.4
Q1:17	6.1	4.3	4.8	4.4	4.0	5.1
Real Personal Income (\$Bil)	52.8	350.1	434.9	199.5	445.4	66.4
Q/Q Percent Change	0.5	0.3	0.7	0.8	0.6	0.5
Y/Y Percent Change	1.4	1.6	2.4	1.7	2.0	1.1
New Housing Units	721	4,405	18,075	8,756	8,399	619
Q/Q Percent Change	-69.3	56.4	10.4	11.6	7.8	2.7
Y/Y Percent Change	6.5	16.3	14.1	5.6	15.9	-8.3
House Price Index (1980=100)	878.2	473.0	371.3	381.6	458.0	235.0
Q/Q Percent Change	1.8	0.9	1.6	2.0	1.0	-0.3
Y/Y Percent Change	7.4	5.0	7.2	7.6	4.9	3.3

NOTES:

- 1) FRB-Richmond survey indexes are diffusion indexes representing the percentage of responding firms reporting increase minus the percentage reporting decrease.
The manufacturing composite index is a weighted average of the shipments, new orders, and employment indexes.
- 2) Building permits and house prices are not seasonally adjusted; all other series are seasonally adjusted.
- 3) Manufacturing employment for DC is not seasonally adjusted

SOURCES:

Real Personal Income: Bureau of Economic Analysis/Haver Analytics.
Unemployment Rate: LAUS Program, Bureau of Labor Statistics, U.S. Department of Labor/Haver Analytics
Employment: CES Survey, Bureau of Labor Statistics, U.S. Department of Labor/Haver Analytics
Building Permits: U.S. Census Bureau/Haver Analytics
House Prices: Federal Housing Finance Agency/Haver Analytics

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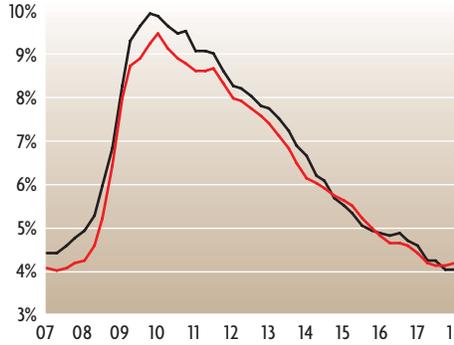
Nonfarm Employment

Change From Prior Year
First Quarter 2007 – First Quarter 2018



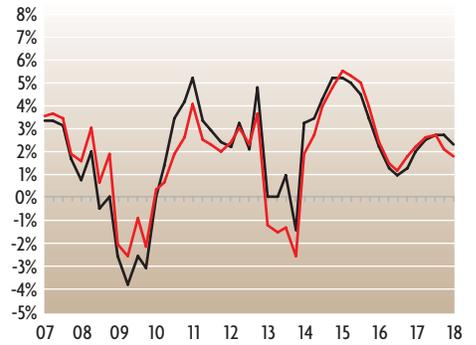
Unemployment Rate

First Quarter 2007 – First Quarter 2018



Real Personal Income

Change From Prior Year
First Quarter 2007 – First Quarter 2018

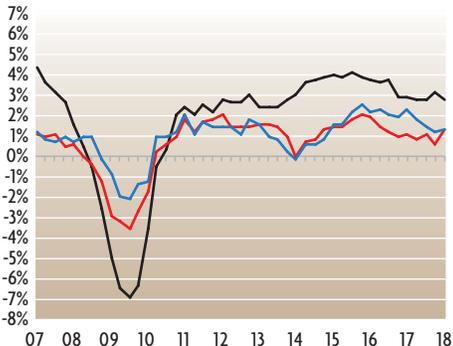


— Fifth District

— United States

Nonfarm Employment Major Metro Areas

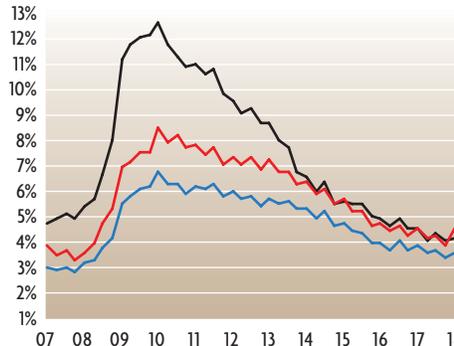
Change From Prior Year
First Quarter 2007 – First Quarter 2018



— Charlotte — Baltimore — Washington

Unemployment Rate Major Metro Areas

First Quarter 2007 – First Quarter 2018



— Charlotte — Baltimore — Washington

New Housing Units

Change From Prior Year
First Quarter 2007 – First Quarter 2018



— Fifth District — United States

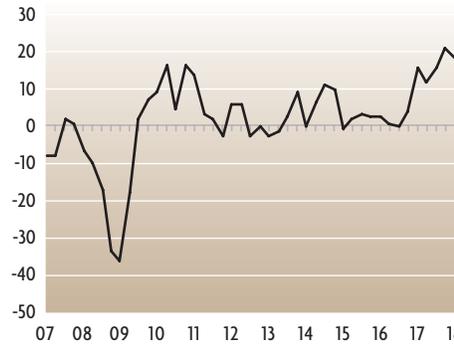
FRB—Richmond Services Revenues Index

First Quarter 2007 – First Quarter 2018



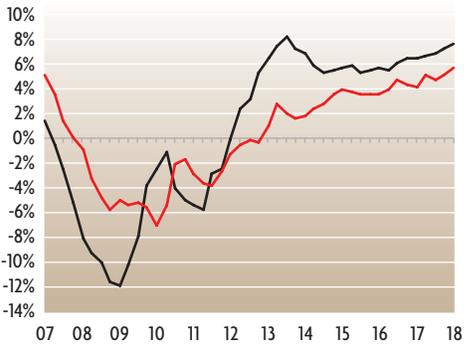
FRB—Richmond Manufacturing Composite Index

First Quarter 2007 – First Quarter 2018



House Prices

Change From Prior Year
First Quarter 2007 – First Quarter 2018



— Fifth District — United States

METROPOLITAN AREA DATA, Q1:18

	Washington, DC	Baltimore, MD	Hagerstown-Martinsburg, MD-WV
Nonfarm Employment (000s)	2,683.8	1,392.0	103.9
Q/Q Percent Change	-0.9	-1.4	-3.4
Y/Y Percent Change	1.3	1.4	0.2
Unemployment Rate (%)	3.6	4.4	4.4
Q4:17	3.6	4.2	4.3
Q1:17	3.8	4.4	4.2
New Housing Units	6,443	2,144	257
Q/Q Percent Change	-5.2	86.6	-13.8
Y/Y Percent Change	27.1	48.2	-1.5

	Asheville, NC	Charlotte, NC	Durham, NC
Nonfarm Employment (000s)	191.0	1,192.4	310.5
Q/Q Percent Change	-1.7	-1.2	-1.1
Y/Y Percent Change	1.7	2.8	1.2
Unemployment Rate (%)	3.4	4.2	3.9
Q4:17	3.7	4.2	4.0
Q1:17	3.8	4.5	4.3
New Housing Units	796	7,107	1,133
Q/Q Percent Change	15.5	25.6	0.8
Y/Y Percent Change	68.3	42.8	3.1

	Greensboro-High Point, NC	Raleigh, NC	Wilmington, NC
Nonfarm Employment (000s)	358.6	620.7	124.2
Q/Q Percent Change	-1.2	-0.9	-1.9
Y/Y Percent Change	0.6	2.7	1.0
Unemployment Rate (%)	4.6	3.9	4.1
Q4:17	4.8	4.0	4.3
Q1:17	5.0	4.2	4.4
New Housing Units	569	4,363	526
Q/Q Percent Change	-3.7	26.2	-23.9
Y/Y Percent Change	-34.6	12.7	21.8

NOTE: Nonfarm employment and new housing units are not seasonally adjusted. Unemployment rates are seasonally adjusted.

	Winston-Salem, NC	Charleston, SC	Columbia, SC
Nonfarm Employment (000s)	264.0	352.7	394.4
Q/Q Percent Change	-0.9	-1.0	-0.8
Y/Y Percent Change	1.0	1.4	-0.3
Unemployment Rate (%)	4.2	3.8	4.4
Q4:17	4.3	3.6	4.3
Q1:17	4.6	3.9	4.2
New Housing Units	593	1,501	1,218
Q/Q Percent Change	-6.6	-6.8	18.7
Y/Y Percent Change	30.0	-13.0	2.4
	Greenville, SC	Richmond, VA	Roanoke, VA
Nonfarm Employment (000s)	418.6	666.9	158.6
Q/Q Percent Change	-0.7	-1.3	-1.4
Y/Y Percent Change	1.9	0.7	-0.3
Unemployment Rate (%)	4.0	3.4	3.3
Q4:17	3.8	3.8	3.7
Q1:17	3.9	4.1	3.9
New Housing Units	1,434	1,667	N/A
Q/Q Percent Change	20.3	17.7	N/A
Y/Y Percent Change	20.5	-0.2	N/A
	Virginia Beach-Norfolk, VA	Charleston, WV	Huntington, WV
Nonfarm Employment (000s)	768.1	115.5	135.4
Q/Q Percent Change	-1.7	-1.7	-3.5
Y/Y Percent Change	0.1	-0.5	-1.2
Unemployment Rate (%)	3.5	5.4	5.4
Q4:17	4.0	5.5	5.6
Q1:17	4.4	5.1	5.8
New Housing Units	1,441	54	38
Q/Q Percent Change	5.9	0.0	0.0
Y/Y Percent Change	-11.5	0.0	0.0

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What Have We Learned since the Financial Crisis?

BY KARTIK ATHREYA

The financial crisis of 2007-2008 and the ensuing recession raised important questions for policymakers and researchers alike. In the 10 years since, research by economists has helped improve our understanding of financial markets, labor markets, economic shocks, and policy responses and the interactions among them. (Many of these developments are nicely summarized in the Summer 2018 issue of the *Journal of Economic Perspectives*.) I'd like to share with you some of the ways that researchers at the Richmond Fed and elsewhere in the Federal Reserve System are contributing to this work.

One feature of the financial crisis was the sudden large-scale withdrawal of funds from large financial institutions, most famously Lehman Brothers. Some observers have likened these withdrawals to the classic bank runs of the 19th and early 20th century. Research on how to prevent such rapid liquidations can help make both the financial system and the real economy more stable.

To that end, Bruno Sultana of the Richmond Fed, David Andolfatto of the St. Louis Fed, and Ed Nosal of the Atlanta Fed have proposed creating a new type of financial instrument to help detect runs. This instrument creates an incentive for investors to signal to financial institutions when they believe a run is imminent. In theory, this new instrument would give institutions the necessary information to take actions such as temporarily suspending payments and, ideally, prevent runs from happening.

Understanding the labor market — the market most important to most of us — was also a focus for policymakers and economists in the immediate aftermath of the crisis. Millions of workers who lost their jobs during the recession sought new positions, but the labor market recovery took a long time compared to past downturns. Research by Andreas Hornstein of the Richmond Fed, Marianna Kudlyak of the San Francisco Fed, and Fabian Lange of McGill University provides an account of this fact: Not all job seekers transition from unemployment to employment at the same rate. Depending on their circumstances, job seekers face different probabilities of returning to work. Using this information, Hornstein, Kudlyak, and Lange constructed an alternative measure of unemployment called the Non-Employment Index. Tools like this help policymakers better understand phenomena observed during the Great Recession, such as the elevated long-term unemployment rates and slow labor market recovery.

Another key aspect of the Great Recession was the apparent transmission of shocks in some sectors of the economy (mortgage finance and housing) to the economy as a whole. To understand how such transmission occurs, Pierre-Daniel Sarte of the Richmond Fed along

with Lorenzo Caliendo of Yale University, Esteban Rossi-Hansberg of Princeton University, and Fernando Parro of Johns Hopkins University modeled these types of linkages across the United States. Sectors tend to be located across different regions; Sarte, Caliendo, Rossi-Hansberg, and Parro showed that understanding the regional and sectoral characteristics of the economy is essential to understanding how shocks affect the overall economy.

Fed researchers have also improved the tools available to policymakers and have advanced our understanding of the effects of policy. This work is crucial because the fiscal and monetary policy responses to the financial crisis and subsequent recession were large but neither their costs nor their benefits are fully understood. Richmond Fed economist Christian Matthes and Fabio Canova of the BI Norwegian Business School have presented new solutions to problems arising in macroeconomic models used to formulate advice for policymakers. This helps to ensure that researchers and policymakers alike are working with the best available model of the economy.

As for understanding the effect of policy, in work with Regis Barnichon of the San Francisco Fed, Matthes found that monetary policy has a larger effect on unemployment when it is contractionary than when it is expansionary, and the same is true for fiscal policy. Policymakers aware of these potential asymmetries can make more informed decisions about how best to respond to downturns such as the Great Recession.

A final strand of work I want to mention is also aimed at improving policy evaluation, this time by allowing for much greater differences across households in economic models, especially in their income and wealth. These new models are known as Heterogeneous Agent New Keynesian, or "HANK." Along with other leading macroeconomists, Richmond Fed economists Felipe Schwartzman and Marios Karabarbounis and their co-authors have analyzed and used HANK models to help us better understand how both fiscal and monetary policy work by allowing us to selectively incorporate real-world features such as credit constraints, illiquid wealth, and uninsurable risks.

These are just a few examples of how work by Richmond Fed economists has helped improve our understanding of the economy over the last decade. As we get further away from the financial crisis of 2007-2008, it is important to continue to push the research frontier using existing tools and also improve our toolkit if we want to be prepared to face the next crisis — or, ideally, avoid it altogether. **EF**

Kartik Athreya is executive vice president and director of research at the Federal Reserve Bank of Richmond.

NEXT ISSUE

Energy Booms and Busts

Fracking has led to a boom in natural gas exporting in West Virginia and other states, but the energy sector is also prone to busts due to the variability of energy prices. How do these booms and busts affect how local workers manage their labor market risks?

Executive Pay

How do you compensate CEOs so they have the right incentives to maximize value to shareholders? It's a question that economists (and boards of directors) have long tried to answer. Some research suggests the average CEO is overpaid, while other research argues that the value of high-performing CEOs has increased — justifying bigger pay plans.

Federal Reserve

The Fed's long-term policy goal is to steer interest rates toward their "neutral" level, where the economy is stable and inflation is neither rising nor falling. The trouble is there is no way to directly observe this variable, referred to as R-star by economists and policymakers. Is R-star a useful tool for monetary policy, despite its elusive nature?

Interview

Preston McAfee, former chief economist of Microsoft, director of Google strategic technologies, and professor at the California Institute of Technology, on designing markets, entrepreneurship within large tech companies, and what machine learning means for competition and antitrust.

Economic History

Motor City... Maryland? In the early 1900s, there were around 200 auto manufacturers in the United States, including in Maryland, Virginia, and North Carolina. By the 1940s, there were only eight — and nearly all of them were located in Detroit. Why didn't the auto industry take hold in the Fifth District?

At the Richmond Fed

For Richmond Fed economist Toan Phan, seeing the effects of Japan's housing bubble in the 1990s sparked an interest in why asset bubbles form, what the economic trade-offs of a bubble are, and how the bursting of a bubble affects the economy.

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