FOURTH QUARTER 2018

ECON FOCUS

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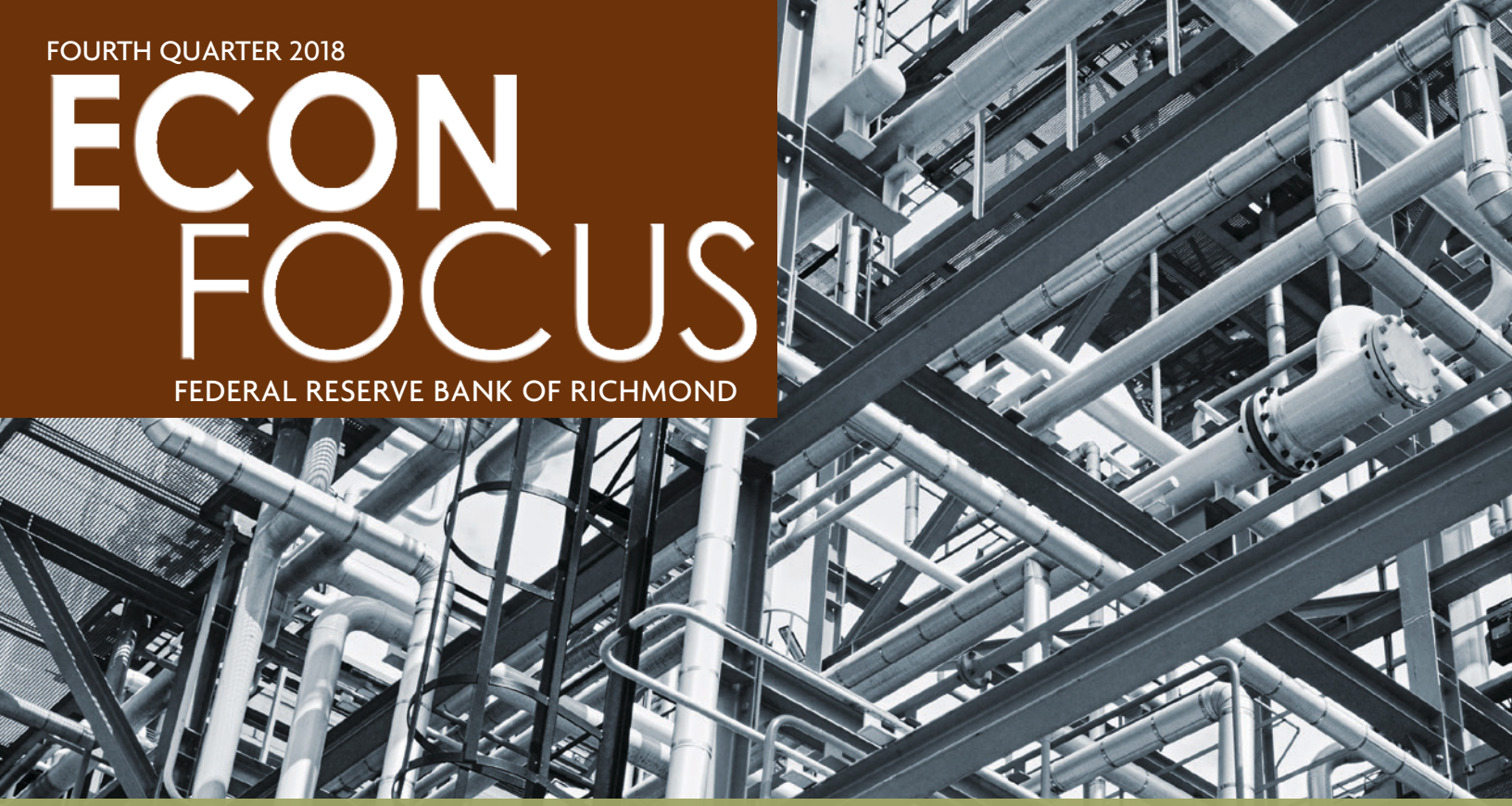

NAVIGATING ENERGY BOOMS AND BUSTS

How they affect job and educational choices

Are CEOs Overpaid?

The Fault in R-Star

Interview with Preston McAfee

ECON FOCUS

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What's Happening to Productivity Growth?

Over the past several years, monetary policymakers have been gradually raising the target federal funds rate to align with the "neutral" rate of interest. As Tim Sablik discusses in "The Fault in R-star" in this issue, our calculations of the neutral rate are imprecise; even the economist who helped develop one widely used estimate has described them as a "fuzzy blur."

Blurry as our estimates might be, they all point to the same general trend: a decline in the neutral rate. And if the neutral rate is the rate consistent with the economy performing at potential, then a lower rate implies lower potential as well. What's holding us back?

One major contributor appears to be a decline in productivity growth. Between 1985 and 2005, the United States had a productivity boom, with average annual growth of 2.3 percent. Over the past decade or so, however, productivity growth has slowed — with average annual growth of just 1.3 percent between 2006 and the present. I have to admit I find this very surprising from my perspective as a business consultant. I didn't observe any particular cliff around 2005. In fact, I saw management equally motivated to drive a focus on the bottom line. I saw new, powerful practices being implemented, such as artificial intelligence, voice recognition, digitization, and offshoring. I saw my individual clients get more productive.

One possibility is that the mix of businesses has shifted, for example, because of the growth in services or productive sectors moving to foreign locales. But the slowdown is widespread. Nearly every sector has experienced some decline in productivity growth since the mid-2000s (although the extent varies across sectors).

Another possibility is mismeasurement. Some surely exists; for example, the leisure value of free apps on a smartphone isn't measured, while toys are. (Of course, the economic statistics do include the ads that pay for many of those free apps.) But again, the widespread nature of the decline makes mismeasurement unlikely as an across-the-board explanation.

Productivity growth could also be hampered by regulatory costs and the expense of implementing cybersecurity: Costs have certainly been created that don't generate revenues. But back-of-the-envelope calculations suggest these costs aren't large enough to explain the slowdown.

So what do I think I know? I believe the productivity slowdown is real, and part of the explanation is nearly two decades of business underinvestment. Since 2000, investment has been low relative to measures of corporate profitability, driven by industry leaders not investing in growth the way they once did. Airlines have moderated capacity growth, banks aren't adding branches, and even successful retailers aren't adding stores. And in my view, it's easy to draw a line from lower investment to lower productivity growth.

Why has investment been low? My sense is that several things are going on. Short-termism has been increasing as CEO tenure has decreased and corporate activism has escalated. Share repurchases have become a compelling alternate use of capital. Cyclical industries have learned the lessons of overcapacity. And finally, companies are still feeling skittish after the Great Recession. For example, I've spoken with business leaders who, even if they see opportunities for investment, are reluctant to take them. They continually see the next recession as "just around the corner." That's certainly true today.

Another factor in slowing productivity growth is declining startup rates. Successful entrants drive innovation, which drives productivity. But the data show a massive reduction in entry rates in all states and all sectors. Startups accounted for 12 percent of all firms in the late 1980s. That fell to 10.6 percent in the mid-2000s and to 8 percent after 2008. As with investment, some of this decline might reflect lingering risk aversion after the Great Recession. Some might be the impact of regulation. Research also points to the slow growth of the working-age population as an explanation. In addition, I hear that there are tangible impediments — such as acquiring the necessary technology and talent — to building the scale and sophistication entrants require to be successful.

The good news is that change is possible. As the Great Recession fades further into memory, economic tailwinds may give both entrepreneurs and existing firms more confidence. Technological innovations such as AI aren't going away. And policymakers can promote a healthy environment for business investment. American businesses are practical and innovative. If the rules are clear and the environment is stable, they will find a way to become more productive. **EF**

TOM BARKIN
PRESIDENT
FEDERAL RESERVE BANK OF RICHMOND

Upfront

Regional News at a Glance

BY LISA KENNEY

MARYLAND — Maryland is ranked the third-best state for science and technology capabilities related to economic growth, according to the 2018 State Technology and Science Index from the Milken Institute. The index uses dozens of measurements in five categories to determine states' abilities to grow and sustain a tech sector. The report says Maryland earned its ranking due to its high concentration of computer science, engineering, and life science employment, its high level of research and development funding, and its creation of state programs that foster high-tech business growth.

NORTH CAROLINA — In late January, the North Carolina Department of Commerce announced it is investing more than $250,000 in Downtown Strong, a program that provides economic development and revitalization resources to local governments across the state. The program will be run by the department's Main Street and Rural Planning Center and will provide services such as staff training and technical assistance to towns that want to revitalize or preserve existing downtown commercial districts.

SOUTH CAROLINA — Greenville launched the seventh year of its Minority Business Accelerator program in January with 17 participants. The year-long program aims to encourage the development of minority-, women-, and veteran-owned businesses as well as ones operating in low-to-moderate income areas. Participants receive business development services, mentoring, technical assistance, and opportunities to partner with larger businesses. Since the program's 2013 launch, participating companies have created about 200 jobs and have gained more than $22 million in contract awards and revenue increases.

VIRGINIA — With Amazon headed to Northern Virginia, the University of Virginia announced in January that it will open a School of Data Science to help meet tech industry demand. Most of the funding will come from a $120 million donation by the Quantitative Foundation, a private foundation based in Charlottesville; it is the largest private gift in UVA's history. The new school will build on the university's existing Data Science Institute and is expected to offer undergraduate, doctoral, and certificate programs. Elsewhere in the state, Virginia Tech plans to build a $1 billion tech innovation campus near the Amazon site, and George Mason University plans to create a school of computing and almost triple its computer science enrollment over the next five years.

WASHINGTON, D.C. — College athletic programs at eight D.C. universities generated more than $122 million in sports revenue in 2016, according to a recent *Washington D.C. Business Daily* analysis of Department of Education data from colleges and universities that receive funding through federal financial aid programs. In D.C., George Washington University had the highest revenue per athlete, $74,153. Georgetown University had the highest total sports revenue, with more than $44 million.

WEST VIRGINIA — Out-of-work residents in the Upper Kanawha Valley will soon be able to apply for a new program that will provide up to $10,000 loans to help people start small businesses in their communities. UKAN, which was created in January, aims to assist those who may not be able to get a traditional business loan. Applicants will need to submit a business plan and agree to audits to ensure the loan is being spent on business purposes. If a business stays open continuously for two years, the loan will be forgiven.

The Fault in R-Star

Has the natural rate of interest lost its luster as a navigation aid for monetary policy?

BY TIM SABLIK

In a 2018 speech at the annual Economic Policy Symposium in Jackson Hole, Wyo., Fed Chairman Jerome Powell compared monetary policymakers to sailors. Like sailors before the advent of radio and satellite navigation, Powell said, policymakers should navigate by the stars when plotting a course for the economy. Powell wasn't referring to stars in the sky, however. He was talking about economic concepts such as the natural rate of unemployment and the natural real interest rate. In economic models, these variables are often denoted by an asterisk, or star.

The natural rate of interest in particular sounds like the perfect star to guide monetary policy. The real, adjusted-for-inflation interest rate is typically represented in economic models by a lowercase "r." The natural rate of interest, or the real interest rate that would prevail when the economy is operating at its potential and is in some form of an equilibrium, is known as r* (pronounced "r-star"). It is the rate consistent with the absence of any inflationary or deflationary pressures when the Fed is achieving its policy goals of maximum employment and stable prices. Since the financial crisis of 2007-2008, Fed officials have often invoked r-star to help describe the stance of monetary policy. But lately, r-star seems to have lost some of its luster.

"Navigating by the stars can sound straightforward," Powell said in his Jackson Hole address. "Guiding policy by the stars in practice, however, has been quite challenging of late because our best assessments of the location of the stars have been changing significantly."

Even New York Fed President John Williams, who helped pioneer estimating r-star, recently bemoaned the challenges of using the natural rate as a guide for policy. "As we have gotten closer to the range of estimates of neutral, what appeared to be a bright point of light is really a fuzzy blur," he said in September 2018.

Why did r-star become so prominent in monetary policy discussions following the Great Recession, and why have its fortunes seem to have waned?

A Star is Born

The concept of the natural rate of interest dates back more than 100 years. In an 1898 book titled *Interest and Prices: A Study of the Causes Regulating the Value of Money*, Swedish economist Knut Wicksell argued that one could not judge inflation by looking at interest rates alone. High market rates did not necessarily mean that inflation was speeding up, as was commonly believed at the time, nor did low rates mean that the economy was experiencing deflation. Rather, inflation depended on where interest rates stood relative to the natural rate.

Wicksell's natural rate seemed like an ideal benchmark for monetary policy. The central bank could slow down an economy in which inflation was accelerating by steering interest rates above the natural rate, while aiming below the natural rate could help stimulate an economy that had fallen below its potential. Indeed, Fed officials in the past made occasional reference to the natural rate of interest as a way to explain monetary policy. During testimony before Congress in 1993, then-Fed Chairman Alan Greenspan explained that "in assessing real rates, the central issue is their relationship to an equilibrium interest rate... Rates persisting above that level, history tells us, tend to be associated with slack, disinflation, and economic stagnation -- below that level with eventual resource bottlenecks and rising inflation, which ultimately engenders economic contraction."

Despite some passing references to the natural rate of interest, however, Wicksell's idea didn't truly rise to prominence until the early 2000s when Columbia University economist Michael Woodford incorporated it into a modern macroeconomic framework to describe how central banks should behave. In his book, titled *Interest and Prices: Foundations of a Theory of Monetary Policy* in a nod to Wicksell's work, Woodford argued that a central bank should seek to close the gaps between actual economic conditions and the economy's potential for output and employment (y-star and u-star, respectively) as well as the gap between actual real interest rates and the natural rate (r-star) all at the same time to obtain an optimal outcome. There was just one problem: No one knows exactly what r-star, or any of the stars, is equal to.

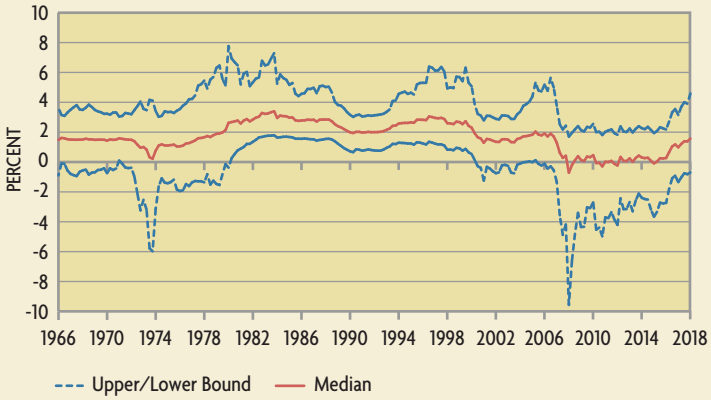
"R-star, just like potential GDP or the natural rate of unemployment, is fundamentally unobservable," says Thomas Lubik, a senior advisor in the research department at the Richmond Fed.

In 2003, New York Fed President Williams, then an economist at the San Francisco Fed, and Thomas Laubach, an economist with the Fed Board of Governors, published a paper in the *Review of Economics and Statistics* that attempted to estimate the natural rate of interest.

"The paper was highly cited, but it took some time before policymakers began to view r-star as a potential operational guide," says Lubik.

Finding R-Star

The Lubik-Matthes Estimate of the Natural Rate of Interest



SOURCE: Thomas A. Lubik and Christian Matthes, "Calculating the Natural Rate of Interest: A Comparison of Two Alternative Approaches," Federal Reserve Bank of Richmond *Economic Brief* No. 15-10, October 2015.

From the perspective of monetary policymakers, a key problem was that estimates of r-star are highly uncertain. This can be seen in the r-star measure developed by Lubik and fellow Richmond Fed economist Christian Matthes. Their median estimate represents the most likely value of r-star, which was 1.56 percent at the end of 2018, but that estimate exists in a range of potential values. (See chart.) The inability to measure the natural rate of interest precisely seemed to limit its usefulness as a benchmark for setting monetary policy. But after the Great Recession, policymakers began to take a closer look at r-star.

The New Normal

Given the severity of the financial crisis of 2007-2008 and the recession that followed, it was not entirely surprising when the Fed dramatically reduced the federal funds rate to nearly zero. But as the crisis subsided and the economy slowly started to recover after 2009, interest rates remained near zero year after year. In part, this was because the Fed held the federal funds rate low to keep monetary policy accommodative during the recovery, but it was also the case that low inflation and weak economic conditions left little room for rates to rise.

"I think most people expected that as the economy rebounded, interest rates would also rebound. But that didn't happen," says Andrea Tambalotti, a vice president in the research and statistics group at the New York Fed. "So the question became: Why?"

The answer, it turned out, could be found in r-star. In previous decades, many economists assumed the natural rate of interest was fairly constant over time. But in the wake of the Great Recession, new estimates by Laubach and Williams pointed to a dramatic collapse in the value of r-star, from 2.5 percent to less than 1 percent.

"It became pretty clear that r-star, at least in the short run and possibly even in the long run, may not be constant," says Marco Del Negro, also a vice president in the research and statistics group at the New York Fed.

Alongside Tambalotti and other New York Fed colleagues, Del Negro developed estimates for the natural rate of interest to complement the earlier work by Laubach and Williams. Around the same time, Lubik and Matthes in Richmond also developed their alternative methodology to estimate r-star. All of these estimates pointed to the same trend: The natural rate of interest had fallen dramatically since the financial crisis of 2007-2008, continuing a trend that had started in the 1990s.

Fed officials stipulated that some of this decline was likely transitory. On Dec. 2, 2015, then-Chair Janet Yellen remarked that "the *neutral* nominal federal funds rate ... is currently low by historical standards and is likely to rise only gradually over time." Two weeks later, when the Federal Open Market Committee (FOMC) voted to raise the federal funds rate for the first time since the Great Recession began, it noted that "the neutral short-term real interest rate was currently close to zero and was expected to rise only slowly as headwinds restraining the expansion receded," according to the minutes from the meeting. But estimates of r-star also pointed to a longer-run problem.

"The whole world was stuck at low interest rates long after the financial crisis had passed," says Tambalotti. "Researchers began looking at the work that John Williams and Thomas Laubach had done on r-star in the early 2000s. They realized that there was something unusual going on. It was not just the financial crisis. Something else was keeping interest rates low."

While monetary policy can influence short-term interest rates, economists believe that long-run interest rates are driven by forces outside the central bank's control. One such force is the demand for global savings. Before becoming chairman of the Fed, Ben Bernanke gave a speech in 2005 in which he talked about the "global saving glut." Increased global demand for safe assets, such as U.S. Treasuries, was bidding up their price and driving down interest rates, he said. As long-run interest rates remained low in the wake of the Great Recession, the global savings glut re-entered the policy discussion as a possible explanation. Economists also pointed to slowing productivity growth and aging populations in advanced economies as additional factors depressing r-star.

If changes in the global economy had caused a longer-run decline in r-star, then returning monetary policy to neutral might look quite different from past economic recoveries. In December 2016, when the FOMC raised the federal funds rate for only the second time since the financial crisis of 2007-2008, it signaled that the factors holding down interest rates might be long-lasting and outside of its control.

According to the minutes from that meeting, "Many participants expressed a view that increases in the federal funds rate over the next few years would likely be gradual in light of a short-term neutral real interest rate that currently was low — a phenomenon that a number of participants attributed to the persistence of low productivity growth, continued strength of the dollar, a weak outlook

for economic growth abroad, strong demand for safe longer-term assets, or other factors."

Fading Light?

Despite the difficulties in estimating r-star, it helped monetary policymakers identify a decline in the natural rate of interest. It also proved to be both a useful guide for policy during the recovery from the Great Recession and a helpful communication device to explain to the public why interest rates had been so low for so long. Why, then, have policymakers recently downplayed r-star's utility? As Powell suggested in Jackson Hole, it has to do with the different context the Fed finds itself in today.

"When interest rates were close to zero, it was pretty safe to assume that we were far from the long-run natural rate, regardless of the uncertainty surrounding estimates of r-star," says Del Negro. "Now that nominal interest rates are above 2 percent, pinpointing the actual long-run level for the federal funds rate matters more, and the uncertainty around estimates of r-star plays a bigger role."

To be sure, Fed officials have always stressed the imprecision of r-star in their public communications. In a January 2017 speech, then-Chair Yellen remarked that "figuring out what the neutral interest rate is and setting the right path toward it is not like setting the thermostat in a house: You can't just set the temperature at 68 degrees and walk away. ... We must continually reassess and adjust our policies based on what we learn."

Failing to stay on top of changes to r-star and other unobservable economic indicators may result in the Fed drawing the wrong conclusions for monetary policy. During the Great Inflation of the 1970s, for example, loose monetary policy contributed to mounting inflation. Some economists have blamed this on incorrect estimates of the natural rate of unemployment at the time. On the other hand, the Fed has correctly interpreted hard-to-measure changes in the economy before. During the tech boom of the late 1990s, falling unemployment led many on the FOMC to call for raising interest rates to head off inflation. Then-Chairman Greenspan resisted, arguing that the data were pointing to rising productivity. He was vindicated when unemployment fell but inflation remained low and stable. During his 2018 Jackson Hole speech, Powell focused on a similar challenge now facing the Fed.

"The FOMC has been navigating between the shoals of overheating and premature tightening with only a hazy view of what seem to be shifting navigational guides," he said.

Even setting aside questions of measurement, some economists have questioned whether r-star should be used as a benchmark for monetary policy at all. While economists have traditionally assumed that long-run interest rates are driven by fundamental factors in the economy rather than monetary policy, Claudio Borio and Phurichai Rungcharoenkitkul of the Bank for International Settlements and Piti Disyatat of the Bank of Thailand argued in a 2018 paper that monetary policy decisions in the short run may in fact influence the long-run natural rate of interest. Easy policy in the short term may lead to "financial imbalances," which can generate losses in the long run when the economy goes bust. This boom and bust cycle may influence the natural rate of interest, according to the authors, compromising its ability to serve as an independent guide for policy.

One among Many

In a sense, the Fed's view on r-star hasn't changed. Early in the recovery, policymakers used it to help explain why interest rates were low and why they were likely to remain low for some time. But they were always careful to communicate the uncertainty surrounding r-star. As the federal funds rate has risen and that uncertainty has become more relevant, the Fed's communications have reflected that heightened concern. One thing has changed in the last decade, though. The renewed interest in r-star has spawned more efforts to better estimate and understand it.

"Multiple Reserve Banks are now contributing to the effort to measure r-star," says Lubik. "Some estimates are on the high end and some are on the low end, but together they provide a good assessment of the most likely value for r-star under a variety of assumptions and methodologies."

The Fed is making use of these and other data to gain a better picture of the economy while it shifts monetary policy into neutral. At the FOMC's September 2018 meeting following Powell's Jackson Hole speech, participants noted that "estimates of the level of the neutral federal funds rate would be only one among many factors that the Committee would consider in making its policy decisions," according to the meeting's minutes.

R-star has become an important tool in the Fed's kit following the Great Recession, but it should not come as a surprise to see its fortunes wax and wane as economic conditions change over time. It's a rare kind of navigational aid, one that becomes blurrier as it gets closer. **EF**

Readings

Borio, Claudio, Piti Disyatat, and Phurichai Rungcharoenkitkul. "What Anchors for the Natural Rate of Interest?" Paper prepared for the Federal Reserve Bank of Boston 62nd Annual Economic Conference, Sept. 7-8, 2018.

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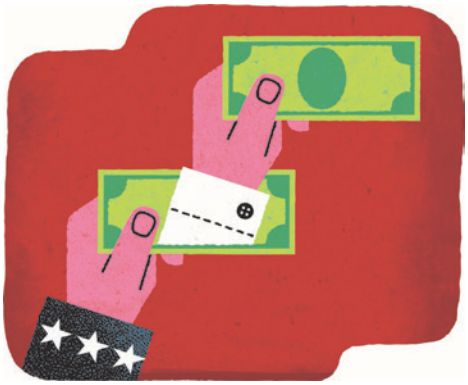
JARGON ALERT

Fiscal Multiplier

BY RENEE HALTOM

When the government spends money or cuts taxes, by how much does overall economic output change? The answer is called the "multiplier" on government spending. A multiplier of one, for example, means that an added dollar of government spending boosts economic output by a dollar.

The size of the multiplier matters because it indicates the potential effectiveness of the government's efforts to boost the economy. But it is exceedingly hard to estimate. The government tends to undertake stimulus precisely when the economy is weak — but because the economy is already behaving in a certain way, it is statistically hard to isolate the economy's response to fiscal policy. And if a spending package is announced far in advance, people may respond in anticipation, making it hard to identify the effect of the actual spending.



One popular way to overcome this problem is to look at instances where extra spending took place at the local level for reasons separate from local economic conditions — if economic activity responds in lockstep with the stimulus, it's more likely they're linked. Using this method, Richmond Fed economist Marios Karabarbounis and co-authors used regional variations in federal spending under the 2009 American Recovery and Reinvestment Act. The law's massive fiscal stimulus package of $840 billion included $228 billion in government contracts, grants, and loans, of which the researchers identified $46 billion spent locally based on factors like household characteristics rather than local economic conditions. Aggregating local multipliers to the national level, they estimated that a one-dollar increase in spending boosts consumer spending by about 64 cents — for a multiplier of 1.64. Other recent studies have provided a wide range of estimates of the multiplier, from 0.5 to 2.0.

Economic theory does provide some guidance on which fiscal policies are likely to produce bigger versus smaller multipliers. One important insight is that people generally "smooth" their consumption across time — rather than spending all of a one-time gain immediately, they'll spread it over months or years. For this reason, economists argue that temporary tax cuts or one-time rebates are likely to have a smaller multiplier than permanent tax changes. But one challenge for fiscal policymakers in a recession is that it might not be credible to announce a permanent tax change in response to a temporary recession — people might expect the policy to be undone once the need is gone, muting the multiplier. Another factor is that not all households respond the same to a tax cut or a tax increase — so who benefits and who bears the cost of a fiscal effort can affect the size of the multiplier.

Research has typically assumed that a multiplier is symmetric — that is, the effects of a fiscal change are the same size whether the spending is going up or down. But it's not hard to imagine why there might be different magnitudes for tightening versus loosening. Households might be constrained from borrowing when their incomes fall, or wages and prices may be less likely to fall in bad times than they are to adjust upward in good times. Research from Richmond Fed economist Christian Matthes and the San Francisco Fed's Regis Barnichon found that multipliers from spending contractions might be twice as big over the business cycle as they are for spending increases, peaking in recessions. Their results both weaken the case for fiscal stimulus and provide some caution against fiscal austerity.

The overall economic environment also matters. Standard economic models predict the government spending multiplier to be much larger when interest rates are very, very low. In fact, standard models predict lots of economic phenomena behave unexpectedly at the so-called "zero lower bound." The reason is that at low interest rates, the real interest rate — the nominal rate adjusted for inflation — is close to negative territory. If a fiscal boost produces inflation, the real interest rate could tip negative and penalize households for saving. That induces them to spend more today, adding to any boost in demand resulting from government purchases. A popular workhorse model suggests the government spending multiplier might be as large as 3.7 at the zero lower bound.

The overwhelming conclusion of research on fiscal multipliers is that they depend critically on the environment and design of the fiscal package. Moreover, economists are quick to caution that the multiplier is not the only success measure of fiscal policy: The taxes that fund fiscal stimulus can distort economic activity; the long-term budget impact may reduce future economic activity; and whether the dollars are spent on things that make the economy more productive over time can make the long-run multiplier much bigger. Suffice it to say, there is no "one" multiplier. **EF**

ILLUSTRATION: TIMOTHY COOK

Has AI Improved Productivity?

BY EMMA YEAGER

Economists interested in artificial intelligence (AI) have been puzzled by what some call a "productivity paradox." The paradox is the gap between the optimistic expectations about the economic effects of AI and the effects that appear in the data. On one hand, predictive technologies like image and speech recognition have experienced breakthroughs in recent years. The multitude of potential uses for such technologies are why AI has been called a "general purpose technology" like electricity and the steam engine, whose diverse and far-reaching applications changed the ways we work and live. On the other hand, contributions from AI are nonexistent in measures of aggregate productivity.

The productivity paradox isn't new. A similar phenomenon accompanied the advances of information technology in the 1970s and '80s when the Nobel Prize-winning economist Robert Solow famously remarked, "You can see the computer age everywhere but in the productivity statistics." As productivity in IT-intensive sectors eventually picked up around the turn of the millennium, researchers proposed that the paradox was simply an issue of timing. It seemed that IT implementation required the development of complementary innovations and the reshaping of production processes before its effects could be fully felt. The AI productivity story may prove to be much the same.

If slow implementation of AI is responsible for its absence from aggregate productivity numbers, then those sectors that can most readily adopt AI should be the first to experience its economic effects. A recent National Bureau of Economic Research paper by Erik Brynjolfsson of MIT and Xiang Hui and Meng Liu of Washington University in St. Louis considers whether this may be happening.

Brynjolfsson, Hui, and Liu looked at the effect of machine translation on international trade. Machine translation is an AI technology that has become increasingly capable of producing near-human-quality translations. The authors focused on the 2014 rollout of eBay's in-house translation tool, eBay Machine Translation (eMT). The eMT's implementation in Russia, Latin America, and the European Union represented only a moderate quality improvement over the platform's prior translation tool; even so, the authors found its introduction was associated with a sizable 17.5 to 20.9 percent increase in trade flows between Latin American consumers and U.S. sellers over eBay.

Machine translation makes sense for early AI adoption because it can be easily embedded into a digital platform's existing production process. The eMT translation is automatic and requires no change in behavior from buyers or sellers; in fact, they need not even be aware of the tool's existence to use it.

Brynjolfsson, Hui, and Liu quantified the effects of the eMT rollout using a natural experiment research design. Much like a scientific experiment performed in a laboratory setting, a natural experiment identifies the effect of a treatment — in this case, access to the eMT — through a comparison with a control group. The authors identify the effect of the eMT rollout using U.S. exports over eBay as the measurable outcome. If the eMT reduces barriers to international trade as the authors predict, then consumers in the eMT treatment group countries should buy more from U.S. exporters relative to the control group.

"Does Machine Translation Affect International Trade? Evidence from a Large Digital Platform." Erik Brynjolfsson, Xiang Hui, and Meng Liu. National Bureau of Economic Research Working Paper No. 24917, August 2018.

Determining who exactly this control group should include is imperative to producing meaningful results with a natural experiment. A natural experiment employs a "differences in differences" methodology to isolate the effects of a treatment while controlling for confounding effects. In this paper, the first difference is a comparison of an individual country's consumption of U.S. exports over eBay before and after the eMT rollout, regardless of whether the country is in the treatment group. This controls for differences in the magnitude of trade flows by country that had nothing to do with the eMT. The second difference is a comparison of the results of the first stage. It measures the change in trade flows among eMT countries versus the change in flows among non-eMT countries. This stage controls for changes occurring over time that are the same for all countries, like a global expansion or recession that affects trade flows in both eMT and non-eMT groups.

The authors interpreted the increase in trade flows due to eMT as an indication of the obstacle to international trade imposed by language barriers. The effect on trade flows was even larger for buyers and products with higher search costs, meaning inexperienced eBay users and consumers in the market for nonstandardized products responded most to the eMT implementation.

Similar effects in other sectors may become apparent as the development of AI technologies continues to make leaps. Of equal importance is the adjustment of firms to technological change. Optimism surrounding the productive capabilities of AI may prove true after all: Radical changes to production processes just take time. **EF**

What Happens When Bubbles Pop?

BY ERIC LAROSE

Highlighted Research
"Asset Bubbles and Global Imbalances." Toan Phan and Daisuke Ikeda. *American Economic Journal: Macroeconomics*, forthcoming.

For economist Toan Phan, who joined the Richmond Fed in 2017, traveling to Japan frequently and witnessing the economic stagnation of the country's "Lost Decade" sparked an interest in asset bubbles. During the 1980s, Japan experienced a massive rise in prices of stocks, housing, and other assets. In 1991, these prices began to fall sharply, coinciding with the start of a long period of low growth; annual per capita GDP growth averaged under 1 percent between 1992 and 2000, compared with nearly 4 percent in the preceding 10 years.

During an asset bubble — a sharp rise in the price of an asset that is unsupported by underlying fundamentals — the appreciation of the asset increases buyers' net worth, which can encourage investment and lead to an expansion of the economy. Eventually, however, the bubble bursts. As the price of the asset comes down, investment may decrease and the economy may contract. Most prior literature on the topic takes a relatively benign view of this trade-off between the expansion and subsequent contraction and, Phan says, "does not necessarily highlight the downside of a bubble collapse." That is, this literature predicts that when a bubble bursts, the economy will contract only to its pre-bubble trend, leaving the economy no worse off than before.

Historically, however, the bursting of asset bubbles has frequently been followed by deep recessions, such as the Great Recession and Japan's Lost Decade, that do leave the economy worse off. Many of these recessions share some common characteristics: low inflation (or deflation), low interest rates, and sharp increases in unemployment with little, if any, change in wages. Paying particular attention to these similarities, Phan says his research seeks to "provide theoretical mechanisms as to why collapses of bubbles tend to precede recessions."

Nominal wage rigidity — the historical tendency of wages not to fall, even in a recession — is one factor that can help explain this historical pattern. In a 2017 article with Andrew Hanson in *Economics Letters* and a 2018 working paper with Hanson and Siddhartha Biswas (both doctoral students at the University of North Carolina at Chapel Hill, where Phan was on the faculty prior to joining the Richmond Fed), Phan and his co-authors embedded wage rigidity into a model of asset bubbles. In the absence of such rigidity, they found that once a bubble collapses, contractions in investment and credit decrease wages while maintaining full employment, consistent with prior literature on asset bubbles. The presence of wage rigidity, however, leads to unemployment instead of wage decreases. Such unemployment reduces the returns to capital, creating a cycle in which investors' net worth declines, reducing investment and leading to additional unemployment. This cycle can produce what Phan calls "a long period of unemployment and low growth."

Low interest rates coinciding with a bubble bursting can also exacerbate the resulting economic downturn. Phan, Hanson, and Biswas showed that overinvestment in capital during a bubble's expansion can, once the bubble collapses, potentially push interest rates down. If rates go low enough, the economy may reach a liquidity trap in which there is little room for central banks to lower interest rates, greatly reducing the ability of expansionary monetary policy to stimulate the economy. Phan argues that the 2001 recession following the bursting of the dot-com bubble was relatively mild in part because "the Fed had a lot of room to lower interest rates" without entering a liquidity trap.

Additionally, when investment in a bubbly asset is financed through borrowing, as in the case of banks financing mortgage lending through mortgage-backed securities during the U.S. housing bubble preceding the Great Recession, the resulting bubble can reduce economic well-being. In a 2016 article in *Economic Theory*, Phan and Daisuke Ikeda at the Bank of Japan developed a model featuring such "leveraged" bubble investment. Leveraging shifts the risks associated with the bubble collapsing from borrowers to lenders, and the possibility of default can cause borrowers to focus only on the potential gains from investment and ignore possible losses. As the authors show, this risk shifting can make the bubble larger and more risky.

"Overall, it has been surprisingly hard to formalize the idea of a boom-bust trade-off, especially in the case of Japan," says Phan. "This has motivated me to keep thinking about the effects of bubbles bursting through future work." He is especially interested in further exploring asset bubbles in an open economy (one shaped by the economies of other countries). In a forthcoming paper with Ikeda in the *American Economic Journal: Macroeconomics*, the two build a framework in which flows of credit between a developing economy, such as China, and a developed one, such as the United States, can lead to a bubble in the developed economy by decreasing its interest rates. "There has been relatively little literature exploring asset bubbles from an open economy perspective," Phan observes. "But investigating the consequences of large capital flows into the U.S. from China, which occurred during the recent U.S. housing bubble, can further our understanding of how bubbles can form." **EF**

The Economist's Apprentice

BY DAVID A. PRICE

This summer, a new class of a half-dozen or so recent college grads will enter a two-year boot camp in economics research, joining the Richmond Fed's Research Department as research associates, or RAs. Bearing degrees in economics, math, or statistics, they will work with Richmond Fed economists studying a variety of fields, including monetary policy, labor markets, and payments systems. Other recent grads will start as RAs at the 11 other regional Reserve Banks, at the Fed's Board of Governors in Washington, and at nonprofits such as the Brookings Institution and the American Enterprise Institute. (At some institutions, RAs have the title "research assistant," not to be confused with student research assistants.)

According to Arantxa Jarque, a microeconomist who also manages the Richmond Fed's RA program, most of them come for a couple of reasons. Some are interested in economics research as a career, but they aren't sure enough to make the five- or six-year commitment to pursue a Ph.D. "They come to figure out whether they really like it," she said. And both they and the ones who are already sure come "to beef up their applications to have more of a chance of getting into a top school."

An RA stint is a popular path to economics grad school — and from there, to jobs in academia, public policy, and finance. The prevalence of the RA path has been documented by, appropriately enough, economists' research: According to a 2005 article in the *Journal of Economic Perspectives* by Middlebury College economist David Colander, a "slight majority" of students at highly selective graduate programs in economics worked after college and before grad school, most of them as RAs. In later research, Colander and co-authors found that students at those programs are more likely to have worked as RAs than students in middle-tier programs.

The institutions, for their part, get top-flight junior staff members whose labors help the economists to be more productive.

As usual, the transition from college to full-time work involves some adjustments. "When RAs arrive, they're good at getting good grades," Jarque says. "But they're unused to the lack of structure in their time. They may have to learn to balance their time among multiple significant projects."

At the Richmond Fed, RAs commonly assist economists by writing code to analyze data with statistical software packages such as Stata. On other projects, they may work on code for constructing model economies that are used in frontier macro research. While RAs at some institutions are hired to work with one economist or just a few of them, those at others, including the Richmond Fed, potentially may work with economists in multiple subject areas based on the RA's interests and the institution's needs.

Sara Ho, an RA nearing the end of her second year, says that in her first year and a half, she did mostly empirical work. "I worked with the National Establishment Time Series dataset for Nico Trachter and Pierre Sarte's paper [with Esteban Rossi-Hansberg at Princeton] 'Diverging Trends in National and Local Concentration.' I also contributed to Nico and Bruno Sultanum's paper [with Zachary Bethune at the University of Virginia] on financial intermediation by analyzing big data on credit default swap trades." More recently, she says, she has been focused on banking-related research.

When an RA makes an exceptional contribution to a project, he or she may be named a co-author on the resulting paper or journal article. Since 2010, nineteen RAs have been named co-authors on articles in the Richmond Fed's economics research journal, *Economic Quarterly*. A co-author credit on an article submitted to an outside peer-reviewed journal is uncommon but does occur every so often.

During an RA's second summer and fall, the question of grad school becomes more concrete as winter application deadlines draw closer. "They come to the one-year mark and they have to decide in a couple of months whether they should apply to grad school," Jarque says. "Suddenly, the other shoe drops and they know what they want. That's one thing that changes in them: They're a lot more informed about what they like and what they aspire to do in the future."

A little more than half do go on to doctoral study. From 2010 to 2018, some 55 percent of Richmond Fed RAs went to Ph.D. programs and another 31 percent went directly into employment. The rest went into master's programs, law school, or, in one case, full-time motherhood.

But the experience may change more than their career outlook. "I've gotten more confident over the two years since being here," Ho says. "I really learned how to up my technical standards and anticipate other people's questions and be able to think those through in advance."

By the end of the two-year cycle, Jarque says, an RA typically has honed his or her skills to the point that the economists rue them departing. "When they're ready to leave, we're thinking, 'No, please, don't leave!' But at the same time, they need to keep growing and move on with their lives." **EF**

NAVIGATING ENERGY BOOMS AND BUSTS

The fracking revolution has created new job opportunities, but are workers prepared for the fluctuations of the energy economy?

By Tim Sablik

In 1956, Shell Oil Co. researcher M. King Hubbert predicted that U.S. oil and gas production would begin to decline after 1970. This theory of "peak oil" caught on quickly when it seemed that Hubbert was spot on. According to the U.S. Energy Information Administration, crude oil production grew to just shy of 10 million barrels per day in 1970 and then declined to roughly half that over the next three decades. Natural gas production kept growing a bit longer, until 1973, before declining as well.

Recently, however, oil and gas drilling have been making a comeback. Oil production is nearly back to its previous peak, and natural gas production has surpassed its 1973 high point. In 2017 and 2018, the United States extracted so much oil and gas that it became a net exporter for the first time in over half a century. The twin developments of hydraulic fracturing ("fracking") and horizontal drilling are responsible for this boom. They have allowed firms to tap into previously difficult to reach deposits of oil and natural gas in shale rock formations throughout the country. (See "The Once and Future Fuel," *Region Focus*, Second/Third Quarter 2012.)

For states sitting on top of rich shale oil and gas reserves, such as North Dakota, Texas, Pennsylvania, Ohio, and West Virginia, the fracking boom has brought huge job opportunities. From 2007 through 2014, the oil and gas industry added roughly 60,000 jobs on net during a period when many industries were still reeling from the Great Recession.

Much of the boom in natural gas extraction has been driven by activity along the Marcellus shale formation underlying where Pennsylvania, Ohio, and West Virginia meet. From the beginning of 2007 to the end of 2018, the Marcellus shale region went from producing a million cubic feet of gas per day to over 21 billion cubic feet per day, a 21,000-fold increase. (See chart.) The shale revolution has resulted in huge economic opportunities in energy extraction, construction,

and related fields. But are some workers giving up their education, and future opportunities, to get in on the boom?

Energy Boom, Empty Classrooms?

To fuel the boom in the Marcellus region, firms have been willing to pay a premium for drillers and construction crews to build wells and lay pipelines. A 2017 study by the RAND Corporation found that in 2010-2014, wages for construction and extraction in the Ohio, Pennsylvania, and West Virginia counties affected by the shale boom were about $10,000 higher on average than for the rest of the country. While this represents a good opportunity for workers in those areas, one concern is that this premium might draw students away from school, potentially harming their long-term employment prospects as well as the overall human capital of the region.

"In southwestern Pennsylvania, there was a surge in low-skill employment over a very short period when the fracking pads were being constructed," says Jim Denova, vice president of the Claude Worthington Benedum Foundation, a nonprofit that promotes education in West Virginia and southwestern Pennsylvania. "I think those jobs tended to draw students out of community colleges."

It's a problem the region is all too familiar with. Coal mined in the Appalachians helped fuel the Industrial Revolution in America in the 18th and 19th centuries and production across two world wars, but since then, the industry has mostly been in decline. About nine out of 10 West Virginia coal mining jobs disappeared between 1940 and 2000. (See "The Future of Coal," *Econ Focus*, Fourth Quarter 2013.) Coal did enjoy a bit of a comeback in the 1970s as oil and natural gas declined. This led to a sudden increase in demand for coal miners in West Virginia, Pennsylvania, Kentucky, and Ohio that lasted about a decade.

Dan Black of the University of Chicago, Terra McKinnish of the University of Colorado Boulder, and Seth Sanders of Duke University found that during this coal boom, the wage gap between high school graduates and non-graduates shrank. In economics, the potential loss associated with choosing one investment over another is known as the opportunity cost. In this case, the opportunity cost of staying in school went up as wages for miners increased. As this happened, Black, McKinnish, and Sanders found that high school enrollment rates declined.

A similar dynamic played out in Alberta, Canada, during the same period. There, rising oil prices driven by the OPEC embargoes increased oil production and demand for workers. J.C. Herbert Emery of the University of New Brunswick, Ana Ferrer of the University of Waterloo, and David Green of the University of British Columbia found that enrollment in postsecondary education fell in Alberta during the 1973-1981 oil boom.

Early evidence suggests that the shale boom may be having a similar effect on students' decisions about staying in school. Elizabeth Cascio of Dartmouth College and Ayushi Narayan, a Ph.D. candidate in economics at Harvard University, found that fracking increased high school dropout rates, particularly for young men. And another study by Dan Rickman and Hongbo Wang of Oklahoma State University and John Winters of Iowa State University found that the shale boom reduced high school and college attainment among residents of Montana, North Dakota, and West Virginia. And declining student attendance isn't the only way energy booms could hurt education outcomes. Even students who remain in school may be affected.

"In the case of Texas, we saw no effect on completion rates and some small decline in student attendance," says Jeremy Weber, an economist at the University of Pittsburgh. "But changes in the labor market brought about by the shale boom influenced whether teachers stayed in the classroom."

In a recent paper with Joseph Marchand of the University of Alberta, Weber found that the average experience of teachers fell during the boom as teacher turnover went up. Some teachers may have been drawn to other private sector opportunities made more attractive by the boom, while others may have been able to retire thanks to royalties on property connected to drilling. Indeed, in another paper with Jason Brown of the Kansas City Fed and Timothy Fitzgerald of Texas Tech University, Weber found that the largest shale oil and gas regions generated $39 billion in private royalties in 2014. Whatever the cause, as the turnover of experienced teachers went up, standardized test performance at Texas schools went down.

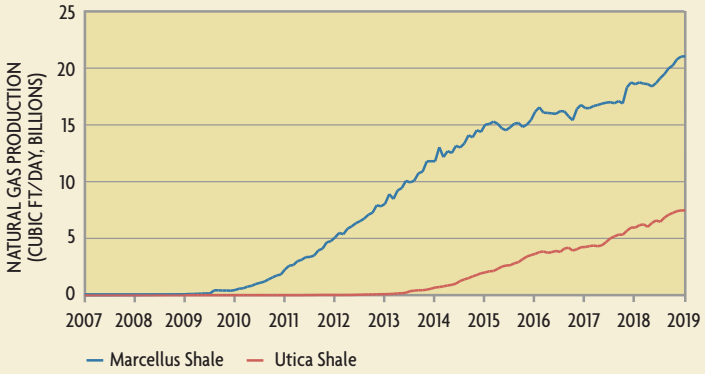
This evidence seems to suggest that energy booms reduce educational attainment, at least in the short run. But in the case of the shale revolution, there may also be other factors pushing in the opposite direction.

A Different Kind of Boom

Early on, fracking companies needed a lot of labor to transport materials and build the wells and pipelines. But Denova says that in Pennsylvania those jobs were short lived. Dropping out of school to work may be less

Shale Gas Production Takes Off in Appalachia

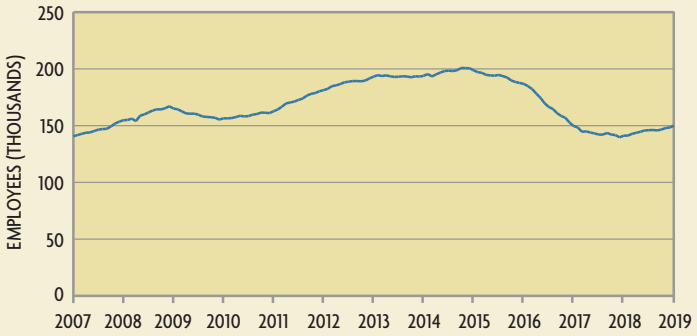
The Marcellus and Utica Shale Formations Lie Under PA, OH, and WV



SOURCE: U.S. Energy Information Administration, "Natural Gas Weekly Update"

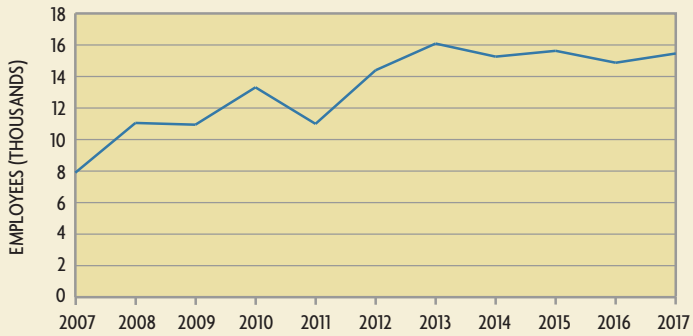
Boom and Bust

National employment in oil and gas extraction



SOURCE: Bureau of Labor Statistics

West Virginia employment in oil and gas extraction



SOURCE: Bureau of Economic Analysis

attractive if the job is expected to only last about a year rather than a decade, as in the case of the coal and oil booms of the 1970s.

Additionally, many of the shale well construction jobs don't always go to locals, says Jen Giovannitti, president of the Benedum Foundation and a former community development manager at the Richmond Fed. "The companies doing the initial drilling and exploration are often out-of-town companies that have the ability to move their workforce from site to site."

A study by Riley Wilson of Brigham Young University confirmed that the surge in demand for fracking workers generated a "sizable migration response" across shale regions. These effects may have muted some of the incentives for local students to drop out and work. Once the wells were constructed, shale firms needed workers to operate them, but those positions are not low skill.

"The technicians who run the wells all need at least two years of training to operate the complex systems," says Paul Schreffler. From 2011 to 2016, he served as dean of the School of Workforce Education at Pierpont Community and Technical College in Fairmont, W. Va. "Companies couldn't find enough of those workers, no matter how much they were willing to pay."

Firms began turning to local community colleges and technical schools, like Pierpont, to train workers for those jobs. Pierpont was an early participant in ShaleNET, an effort to develop those training and certification programs across shale oil and gas regions. The program received initial federal funding from the U.S. Department of Labor in 2010. Energy companies helped to develop curricula and also provided funding, instructors, and apprenticeship opportunities for students. Although Schreffler says firms were committed to student development, some students were still lured away from their studies by the opportunities in the industry.

"The companies right now are so eager for workers that they are hiring students right out of programs," says Elizabeth McIntyre, director of the Tristate Energy and Advanced Manufacturing (TEAM) Consortium that connects schools and employers across western Pennsylvania, eastern Ohio, and northern West Virginia.

In the case of both technicians and lower-skilled positions, though, students who left school to work in the shale industry may not be out for good. The study by Emery, Ferrer, and Green that looked at the oil boom in Alberta during the 1970s found that while postsecondary education attainment fell initially, it later recovered after the boom ended. The authors hypothesized that individuals who went to work in the oil fields instead of going to school were able to save enough money to make it easier to go back to school once the boom ended. In contrast, they found that the cohorts of students who came of age after the oil boom had gone bust were less likely to go to college, perhaps because they did not have the same opportunity to earn the premium wages in the energy sector that would have helped them cover the costs of higher education.

"Are people worse off for having not pursued college because of an energy boom?" asks University of Pittsburgh's Weber. "Suppose I graduate from high school and instead of going to college, I go to work in a shale-related industry. When the boom goes bust, maybe I get a two-year degree in a field I'm interested in and see a demand for, or maybe I go to college with a clearer focus and more money so I don't need to borrow as much. It's not clear to me that that scenario is so problematic."

Of course, that partly depends on the drive and circumstances of each individual and may also depend on his or her age when the boom ends. Kerwin Charles and Erik Hurst of the University of Chicago and Matthew Notowidigdo of Northwestern University studied the educational effects of the U.S. housing boom and bust that lasted from the late 1990s to the late 2000s. They found that the boom in housing demand drew many young people into related sectors, including construction and real estate. But unlike the case of the Alberta oil workers, after the housing market collapsed, educational attainment for

individuals who had deferred school remained low, suggesting that many did not return to their studies.

"Once you start working and start a family, it can become very difficult to go back to college," says Weber. "So I could see different scenarios playing out."

Preparing for the Future

Fulfilling the boom demand for workers is important but so is having a plan for the bust.

"I think everyone knows that the energy sector is very volatile when it comes to employment," says Gabriella Gonzalez, a researcher at the RAND Corporation who studies the energy sector in Pennsylvania, Ohio, and West Virginia. She has also been involved in promoting education and industry partnerships in that region.

At the national level, signs of a slowdown are already here. Employment in shale oil and gas extraction peaked in 2014 and has now declined to pre-boom levels. In places like West Virginia, where the shale boom started a bit later, employment has held steady so far, but growth has largely plateaued. (See charts.) Both signs point to one truth that experienced workers in the energy sector know well: Booms don't last forever.

The Appalachian region has been through slumps before. Past declines in coal mining and manufacturing displaced workers who came from long lines of coal miners or steel workers and strongly identified with that work. Despite efforts to retrain those workers for new advanced manufacturing or shale-related energy jobs, some reports suggest that the take-up rate of those programs has been low.

"Many people are still looking to find that one company where they can get hired and work until retirement," says John Goberish, the dean of workforce and continuing education at the Community College of Beaver County (CCBC) in Pennsylvania, where TEAM is headquartered. "But that's just not as likely as it was 30 or 40 years ago."

To that end, programs developed under ShaleNET and TEAM aim to give students a foundation of basic skills such as problem solving and teamwork while also teaching them the technical skills to meet a variety of industry needs. For example, a degree in mechatronics combines skills from mechanical and electrical engineering that apply to jobs in advanced manufacturing as well as natural gas extraction and processing.

"Those basic skills are critical across industries," says Schreffler. "I would tell my students all the time that once they understand the basic properties of mechanical or electronic systems, it's very easy to jump from one sector to another."

And to encourage students to stick with their training until they graduate, schools like CCBC and Pierpont offer flexible programs that allow students to take classes piecemeal and build toward certifications and a degree over time.

"We are trying to give students a lot of options, including an 'earn and learn' approach that includes internships, apprenticeships, and other on-the-job training where they don't have to choose between going to school and going to work. They can do both," says TEAM's McIntyre.

Companies have also expressed their support. "Firms want our students to have that associate's degree," says Goberish. "Many of our instructors are from industry and they know it will be beneficial to everyone if students finish their training."

Firms and schools are also looking ahead to the jobs to come and finding ways to ensure that the activity surrounding the shale boom doesn't just disappear once the wells are in place and the gas is flowing. Shell is building an ethane cracker plant in Beaver County to turn the ethane gas extracted from the shale there into plastics that can be used in a variety of products. Construction of the plant has employed thousands of workers, and once the plant is in place, it will represent hundreds of advanced manufacturing jobs for graduates of CCBC's programs. There have been discussions about building additional cracker plants along the Ohio River Valley, including in West Virginia.

By collaborating with industry, educators are trying to provide relevant and flexible programs to prepare workers for the next jobs. That constant change requires both students and teachers to be nimble.

"No one really knows what's coming down the pipeline next," says Gonzalez. "There's continuous innovation in technology, and it makes it hard for educators to keep pace with those changes. Likewise, employers may not know how many people they will need next year because the economy or the price of oil and gas could change. So everyone is just trying to do the best they can." **EF**

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ARE CEOS OVERPAID?

Incentives for chief executives have important economic implications

By Jessie Romero

The 2019 proxy season will mark the second year firms have to disclose how their CEOs' compensation compares to the pay of their median employee. The ratios are likely to generate quite a few headlines, as they did last year, and perhaps some outrage, especially in light of relatively stagnant wage increase for most workers in recent years. (See "Will America Get a Raise?" *Econ Focus*, First Quarter 2016.) But do CEOs actually earn hundreds, or even thousands, of times more money than their employees? And does that necessarily mean they're paid too much?

Calculating CEO Pay

It should be easy to determine how much CEOs earn. The Securities and Exchange Commission (SEC) requires publicly traded companies to disclose in detail how they compensate their chief executives, including base salaries, bonuses, stock options, stock grants, lump-sum payments such as signing bonuses, and retirement benefits. Firms are also required to report any perks worth more than $10,000, such as use of the corporate jet or club memberships, that aren't directly related to the executive's job duties.

The challenge for researchers is that some forms of compensation, such as stock options, can't be turned into cash until some later date. That means there's a difference between expected pay — the value of compensation on the day it's granted, which depends on the current market value of the stock and expected value of stock options — and realized pay, or what a CEO actually receives as a result of selling stock or exercising options.

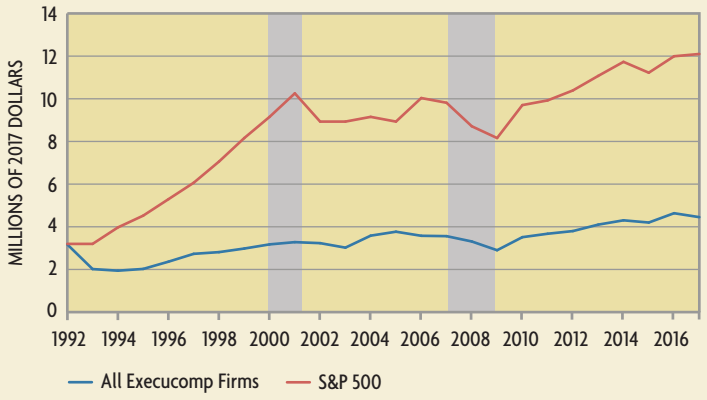
One widely used measure of expected pay comes from the Execucomp database, which is published by a division of Standard and Poor's. The database includes about 3,000 firms, including current and former members of the S&P 1500, and contains information gleaned from firms' proxy statements. Between 1993 and 2017, according to Execucomp, median CEO pay increased more than 120 percent in inflation-adjusted terms. (The Execucomp data begin in 1992, the year before Congress passed a law limiting the tax deductibility of CEO compensation.) The increase was greater for bigger firms: Median CEO pay in the S&P 500 increased 275 percent, from $3.2 million to $12.1 million, in 2017 dollars. (See chart.) Over the same time period, median wages for workers overall increased just 10 percent.

Calculating realized pay is tricky, since data about the specific vesting schedules for stock grants or the exercise dates of options can be difficult to obtain. One approach is to approximate realized pay using the information in Execucomp about the value of a CEO's stock and options holdings at the end of a year, as Richmond Fed economist Arantxa Jarque and former research associate John Muth did in a 2013 article. They found that between 1993 and 2012, median realized pay followed the same general upward trend as expected pay, although it was usually a little bit lower.

Both measures are valuable for researchers to study. "Expected pay is based on the history of returns of the firm's stock," says Jarque. "But the insiders — the board of directors setting the pay, and the CEO — have private information about how those future outcomes may change. That is, they calculate expected pay using a private distribution that we researchers cannot observe. Because of this difficulty, complementing a measure of expected pay with a measure of realized pay can be informative."

Bigger is Better

Compensation for CEOs at large firms has increased faster than for CEOs more broadly.



NOTE: Figure displays median direct compensation as reported on firms' proxy statements. Shaded areas denote recessions.

SOURCE: For all firms, Execucomp and *Econ Focus* calculations. For the S&P 500, Murphy (2013)/Execucomp; *Wall Street Journal*/MyLogic IQ; The Conference Board/Arthur J. Gallagher & Co; Associated Press/Equilar

The CEO Multiplier

How much do CEOs earn relative to their employees? According to the AFL-CIO, the average CEO of a company in the S&P 500 earned $13.94 million in 2017 — 361 times more than the average worker's salary of $38,613. (To calculate the average worker's salary, the AFL-CIO uses Bureau of Labor Statistics data on the wages of production and nonsupervisory workers, who make up about four-fifths of the workforce.) But this ratio may be overstated for several reasons. One is that the AFL-CIO uses average CEO pay, which is typically much higher than median pay because of outliers. Another is that the data used for CEO compensation include nonsalary benefits, while the data for average workers include only salary. In addition, workers' salaries aren't adjusted for firm size, industry, or hours worked, so a CEO who works 60-hour weeks at a company employing 50,000 people is compared to, say, a part-time bookkeeper at a firm employing 10 people. Still, even adjusting for hours worked and fringe benefits, CEOs earn between 104 and 177 times more than the average worker, according to Mark Perry of the University of Michigan-Flint and the American Enterprise Institute, a conservative think tank.

The pay ratio required by the Dodd-Frank Act does take into account firm size and industry, since it compares CEOs to the median workers at their own companies. According to the corporate governance consultancy Equilar, the median pay ratio in 2017 was 166 to 1 for the 500 largest publicly traded companies by revenue. Among a broader group of 3,000 publicly traded firms, the median pay ratio was 70 to 1. But this comparison can be skewed in one direction if a CEO receives a large one-time payment, or in the other direction if a CEO declines all compensation, as do the chief executives at Twitter, fashion company Fossil, and several other firms. (Twitter's and Fossil's CEOs both have significant stock holdings in the firms.) In addition, pay ratios might appear especially high at companies with a large number of part-time or overseas employees, who tend to earn lower annual wages.

Power and Stealth

Until the turn of the 20th century, most firms were small and run by their owners. But between 1895 and 1904, nearly 2,000 small manufacturing firms merged into 157 large corporations, which needed executives with specialized management skills. These executives didn't have equity stakes in the companies, which created a "separation of ownership and control," as lawyer Adolf Berle and economist Gardiner Means described in their seminal 1932 book, *The Modern Corporation and Private Property*.

In modern economics terms, this creates what is known as a "principal-agent" problem. A manager, or agent, has wide discretion operating a firm but doesn't necessarily have the same incentives as the owners, or principals, and monitoring is unfeasible or too costly. For example, a CEO might try to avoid a takeover even if that takeover is in the shareholders' best interest. Certainly, managers are motivated by career concerns, that is, proving their value to the labor market to influence their future wages. But the primary approach to aligning managers' and shareholders' interests has been to make the executive's pay vary with the results of the firm, for example via stock ownership or performance bonuses. (Of course, this can go awry, as it famously did when executives at the energy company Enron engaged in fraudulent accounting to boost short-term results.)

At the same time, a talented CEO is unlikely to want to work for a company without some guarantee of compensation in the event of circumstances beyond his or her control, such as regulatory changes or swings in the business

cycle. So firms also have to provide some insurance, such as a base salary or guaranteed pension.

In theory, a company's board of directors acts in the best interest of shareholders and dispassionately negotiates a contract that efficiently balances incentives and insurance, which economists refer to as "arm's-length bargaining." But as Lucian Bebchuk and Jesse Fried of Harvard Law School described in their 2004 book *Pay Without Performance*, there may be circumstances when CEOs are able to exert significant influence over their pay packages. This might happen because the CEO and the directors are friends, or because the chief executive has a say in setting board compensation and perks, or because the directors simply don't have enough information about the firm's operations. And if the shareholders' power is relatively weak, they are unlikely to check the directors. Bebchuk and Fried cited research finding that CEO pay is lower when investors have larger stakes, and thus more control, and when there are more institutional investors, who are likely to spend more time on oversight.

Even when CEOs have a lot of power, they and their boards might still be constrained by what Bebchuk and Fried called "outrage costs," or the potential for obviously inefficient pay packages to damage the firm's reputation. That can lead to "stealth compensation," or compensation that is difficult for investors or other outsiders to discern. In the 1990s, for example, it was common for firms to give their CEOs below-market-rate loans or even to forgive those loans. (These practices were outlawed by the Sarbanes-Oxley Act in 2002.) And until the SEC tightened pension disclosure rules in 2006, firms could give CEOs generous retirement benefits without reporting their value. CEOs might also receive stealth compensation in the form of dividends paid on unvested shares.

Stealth compensation does face some constraints, as Camelia Kuhnen of the University of North Carolina at Chapel Hill and Jeffrey Zwiebel of Stanford University found in a 2009 article. For example, hidden compensation could be sufficiently large and inefficient to weaken a firm's performance and lead the shareholders to fire the CEO. Kuhnen and Zwiebel concluded that CEOs are more likely to earn stealth compensation when a firm's production process is "noisy," meaning it's difficult to determine the factors that contribute to the firm's performance.

Talent and Value

While some research suggests that CEOs' pay reflects their power over their boards, other research suggests they're worth it. (The two explanations aren't necessarily mutually exclusive — a CEO could significantly increase shareholder value while still influencing a board to pay more than the market rate.) In a 2016 article, Alex Edmans of London Business School and Xavier Gabaix of Harvard University summarize the research on the latter perspective as the "shareholder value" view. In short, from this perspective, CEOs' contracts reflect their significant influence on a company relative to rank-and-file employees and the fact that it may be necessary to pay a premium to attract talent in a competitive market.

In this view, one explanation for high and rising CEO pay might be technological change. In a 2006 article, Luis Garicano of the London School of Economics and Political Science and Esteban Rossi-Hansberg of Princeton University described firms as "knowledge hierarchies," in which workers specialize in either production or problem solving. The hardest problems eventually filter up to the workers with the most knowledge, and new tools that make it cheaper to communicate means that firms rely more on problem-solvers, which decreases the knowledge necessary for production work. The end result is higher pay for those at the top of the hierarchy.

It's also well-documented that CEO pay increases with firm size, which could be the result of a CEO's ability. For example, more-talented CEOs might be able to hire more people and purchase more capital equipment, enlarging their firms. In addition, the dollar value of a more-talented CEO is higher at a larger firm. So when firms get bigger on average, the competition for talented CEOs increases. In a 2008 article, Gabaix and Augustin Landier of HEC Paris and the Toulouse School of Economics concluded that the increase in CEO pay in the United States between 1980 and 2003 was fully attributable to large companies' increase in market capitalization over the same time period. In addition, in a market where both CEO positions and talented CEOs are rare, even very small differences in talent can lead to large differences in pay, according to research by Marko Terviö of Aalto University in Finland — although Terviö also notes this does not necessarily mean that CEOs aren't "overpaid."

Unintended Consequences

The composition and level of CEO pay might reflect not only power and talent, but also the consequences — often unintended — of government intervention. Between 1993 and 2001, median CEO pay more than tripled, driven almost entirely by increases in stock options, according to research by Kevin J. Murphy of the University of Southern California. The increase in stock options, in turn, was fueled by several tax and accounting changes that made options more valuable to the executive and less costly to the firm. In 1991, for example, the SEC made a rule change that allowed CEOs to immediately sell shares acquired from exercising options. Previously, CEOs were required to hold the shares for six months and could owe taxes on the gain from exercising the option even if the shares themselves had fallen in value. And in 1993, Congress capped the amount of executive compensation publicly held firms could deduct from their tax liability at $1 million unless it was performance based, with the goal of reducing

"excessive" compensation. (The cap applied to the five highest-paid executives.) But stock options were considered performance based and thus were deductible. The cap also induced some companies to raise CEO salaries from less than $1 million to exactly $1 million.

Regulators took steps that curbed the use of option grants in 2002, when the Sarbanes-Oxley Act tightened the reporting standards, and again in 2006, when the Financial Accounting Standards Board mandated that they be expensed. Both of these changes decreased the attractiveness of stock options relative to stock grants, which led some firms to stop awarding options and others to start granting stock in addition to options, according to research by Jarque with former Richmond Fed research associate Brian Gaines.

Regulation might also have increased the use of perquisites in the 1980s. In the late 1970s, the SEC started requiring more disclosure of perks such as entertainment and first-class air travel; one SEC official said the "excesses just got to the point where it became a scandal." But as Murphy and others have documented, the disclosure rules actually increased the use of perquisites (although they remained a fairly small portion of total compensation), as executives learned what their peers at other firms were receiving.

Since 2011, large publicly traded firms have been required to allow their shareholders a nonbinding vote on executive pay packages. The goal of "Say on Pay," which was part of the Dodd-Frank Act after the financial crisis, was to rein in executive compensation and enable shareholders to tie pay more closely to performance. (See "Checking the Paychecks," *Region Focus*, Fourth Quarter 2011.) But research by Jill Fisch of the University of Pennsylvania Law School, Darius Palia of Rutgers Business School, and Steven Davidoff Solomon of Berkeley Law suggests shareholders are highly influenced by the company's performance; that is, they tend to approve pay packages when the stock is doing well. That could encourage executives to focus on the short-term stock price rather than the firm's long-term value. Other research has found that Say on Pay has made firms more reliant on outside compensation experts, who tend to design homogenous pay packages geared toward shareholder approval rather than what's most effective for the firm.

Does CEO Pay Matter?

"CEO pay can have substantial effects, which spill over into wider society," says Edmans. "Incentives can backfire with severe societal consequences. In contrast, well-designed incentives can encourage CEOs to create value — and hold accountable those who do not."

In the 1970s, for example, CEOs were largely rewarded for making their companies bigger — at the expense of their firms' value, according to Murphy. "The implicit incentives to increase company revenue help explain the unproductive diversification, expansion, and investment programs in the 1970s, which in turn further depressed company share prices," he wrote in a 2013 article.

More recently, many observers and researchers believe that compensation practices played a role in the financial crisis. As Scott Alvarez, former general counsel of the Fed, observed in 2009 testimony before the U.S. House Committee on Financial Services, "Recent events have highlighted that improper compensation practices can contribute to safety and soundness problems at financial institutions and to financial instability." Many of these practices also applied to lower-level executives and employees, but CEOs might have been incentivized to ignore the risks their employees were taking.

There is also the question of fairness. To the extent high pay is the result of managerial power or efforts to take advantage of tax laws, rather than the result of higher output or performance, workers might not be getting their share of the fruits of economic growth. This is an opinion that's been voiced since at least the early 1930s, when the public first started to learn what executives were paid as the result of a series of lawsuits. Recently, some research attributes the rise in income inequality at least in part to executive compensation, although, as Edmans notes, the top 1 percent comprises many professions, including lawyers, bankers, athletes, authors, pop stars, and actors, to name a few. In Edmans' view, fairness isn't necessarily the right reason to be concerned about CEO pay. "Often people care about CEO pay because there's a pie-splitting mentality — the idea that there's a fixed pie and anything given to the CEO is at the expense of others," he says. "But if we have a pie-growing mentality, we should care because the correct incentives affect the extent to which the CEO creates value for society." **EF**

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INTERVIEW

R. Preston McAfee

Just about every economist, of course, is excited about economics. And many economists are excited about technology. Few, however, have mashed those two interests together as thoroughly as Preston McAfee. Following a quarter-century career in academia at the California Institute of Technology, the University of Texas, and other universities, McAfee was among the first economists to move from academia to a major technology firm when he joined Yahoo in 2007 as chief economist. Many of the younger economists he recruited to Yahoo are now prominent in the technology sector. He moved to Google in 2012 as director of strategic technologies; in 2014, he joined Microsoft, where he served as chief economist until last year.

McAfee combined his leadership roles in the industry with continued research, including on the economics of pricing, auctions, antitrust, and digital advertising. He is also an inventor or co-inventor on 11 patents in such wide-ranging areas as search engine advertising, automatically organizing collections of digital photographs, and adding user-defined gestures to mobile devices. While McAfee was still a professor in the 1990s, he and two Stanford University economists, Paul Milgrom and Robert Wilson, designed the first Federal Communications Commission auctions of spectrum.

Among his current activities, McAfee advises the FCC on repurposing satellite communications spectrum and advises early-stage companies. The latter include Telescent, a network switching company; Prysm Group, a blockchain governance company; Merlin, an online employment market; CG, a digital security company in stealth mode; OpenX, a digital advertising exchange; and the Luohan Academy, a not-for-profit research institute created by Alibaba. He also serves on the visiting committee of the MIT Institute for Data, Systems, and Society and on the boards of the Pardee RAND Graduate School and the Mathematical Sciences Research Institute.

McAfee served as editor of *Economic Inquiry* for six years and co-editor of the *American Economic Review* for nine years and is a founding co-editor of the economics and computer science journal *ACM* [Association for Computing Machinery] *Transactions on Economics and Computation*.

He is also a confirmed iconoclast. In the pages of the *Journal of Economic Literature*, he opined that "the most important reason for China's success" was that "China ignored the advice of Harvard economists."

David A. Price interviewed McAfee in Washington, D.C., in November 2018.

PHOTOGRAPHY: LISA HELFERT

EF: How did you become interested in economics?

McAfee: When I was a high school student, I read *The Worldly Philosophers* by Robert Heilbroner. It's a highly readable history of economic thought. I didn't know anything about economics — I didn't even know who Adam Smith was — and I found it fascinating. I was pretty familiar with the science of atoms and electrons and planets and stars, but the idea of a science of people was not something I had encountered.

EF: You were one of the first academic economists to move to a major technology company when you joined Yahoo as chief economist. You've since spent more than a decade as an economist at major technology companies. What has changed in the way that economic research is used in these firms?

McAfee: The major change is the relevance of microeconomics — the study of individual markets.

Economists have had a big role in companies doing macroeconomics for forever, worrying about inflation, GDP, and how those broad aggregates influenced demand for the firm's products. Microeconomists bring a very different skill set and answer very different questions.

That's a major change in roles. Amazon, for instance, has more than 150 microeconomists. A really big thing there, and at Microsoft and at Google, is the problem of causality.

Microeconomists have been studying how to get at causality — what caused something as opposed to what's just correlated with it — for 40 or 50 years, and we have the best toolset.

Let me give an example: Like most computer firms, Microsoft runs sales on its Surface computers during back-to-school and the December holidays, which are also the periods when demand is highest. As a result, it is challenging to disentangle the effects of the price change from the seasonal change since the two are so closely correlated. My team at Microsoft developed and continues to use a technology to do exactly that and it works well. This technology is called "double ML," double machine learning, meaning it uses machine learning not once but twice.

> From an economic perspective, the frequently encountered goal of recreating a market, entrepreneurial or otherwise, inside a firm involves a misunderstanding of the reason for a firm to exist. If a market can work inside a firm, there shouldn't be a firm in the first place!

This technique was originally created by some academic economists. Of course, as with everything that's created by academic economists, including me, when you go to apply it, it doesn't quite work. It almost works, but it doesn't quite work, so you have to change it to suit the circumstances.

What we do is first we build a model of ourselves, of how we set our prices. So our first model is going to not predict demand; it's just going to predict what decision-makers were doing in the past. It incorporates everything we know: prices of competing products, news stories, and lots of other data. That's the first ML. We're not predicting what demand or sales will look like, we're just modeling how we behaved in the past. Then we look at deviations between what happened in the market and what the model says we would have done. For instance, if it predicted we would charge $1,110, but we actually charged $1,000, that $110 difference is an experiment. Those instances are like controlled experiments, and we use them in the second process of machine learning to predict the actual demand. In practice, this has worked astoundingly well.

The pace at which other companies like Amazon have been expanding their microeconomics teams suggests that they're also answering questions that the companies weren't getting answered in any other way. So what's snowballing at the moment is the acceptance of the perspective of economists. When I joined Yahoo, that was still fairly fragile.

EF: In both your academic work and in your published work as a corporate economist, you've done a lot of research on market design, including auction design. And of course, you collaborated on the design of the FCC wireless spectrum auctions. What are some of the main things you've learned about designing markets?

McAfee: First, let's talk about just what market design is. It's a set of techniques for improving the functioning of markets. Specifically, it uses game theory, economic theory, experimental research, behavioral economics, and psychology, all of those disciplines, to make markets work better.

In politics, you have people who don't want to use markets, and then you have people who say just let the market do it — as if that didn't have any choices attached to it. But in fact, often how you make a market work determines whether it works well or poorly. Setting the rules of the game to make markets more efficient is what market design is all about. Thus, whether to hold an auction, whether to sell or lease, who bears responsibility for problems, and what information is communicated to whom are all questions answered by market design. At least four Nobel Prizes have gone for developments in this area.

One thing we learned is to design for mistakes by participants. People will make mistakes, and to encourage participation and efficient outcomes, it is desirable that those mistakes not be catastrophic.

Moreover, there is a trade-off between the potential efficiency of a market and the generation of mistakes. Give people the ability to express complex demands, for example, and the potential efficiency rises, because people can express exactly what they want. But the number of mistakes will rise as well, and the actual performance can decline. I often find myself supporting a simpler design for this reason; I push back on complexity unless that complexity buys a lot of efficiency.

When we designed the PCS [personal communications services] auctions, the spectrum auctions, we were aware that if you made them complicated, people weren't likely to function that well. We had empirical evidence of that.

Take a situation where you have seven properties up for auction. One regime is that I bid independently on each of the properties, and if I am the winning bidder on all seven, I get the seven. Another is to allow the bidder to submit a contingent bid — to say I only want all seven. That's called package bidding or combinatorial bidding. We were aware that in practice those don't work so well, because it winds up taking a long time to figure out who should win what.

But there is some potential loss from not having a package. Because if, let's say, I'm selling shoes, most people don't have much use for a single shoe. So you would not want to sell the shoes individually, even though there are a few people who want only the left shoe or the right shoe. And in fact, I am a person who would like to get different sizes in a left shoe and a right shoe. So there's this trade-off between simplicity, which makes it easier for most, and expressiveness. There is value in that simplicity not only in terms of getting to an answer more quickly, but also in helping bidders avoid mistakes.

Another example is a second-price auction, where you don't pay what you bid; if you're the highest bidder, you pay the second-highest bid, as opposed to paying your

own bid. It has a certain resilience to it. There was a guy who actually submitted a bid that was 1,000 times higher than he intended. Just added three zeroes by accident. But in that auction, if you're paying not your bid but the next highest bid, it takes two to make the mistake in order for that to actually cause him to go broke. He wouldn't have gone broke under the second-price auction, whereas he would under the first-price auction. In that specific instance, we had put in a withdrawal rule that allowed him, at some penalty but not a ruinous penalty, to withdraw.

EF: Much of the economic research that has been publicly discussed by technology companies has focused on outward-facing decisions such as pricing and, as we discussed, market design. Are tech companies also using research to structure the incentives of their employees, and is there more they can be doing?

McAfee: I've hired a lot of people over the years, more than 50 anyway, probably more than 60. And among those have been several people, some quite distinguished economists, who decided that the first thing they wanted to do was get involved in compensation.

Your leverage regarding compensation is greatest in the sales force. If you've got a salaried engineer, let's say, there's not as much you can do. But in sales, the financial incentives are large and strong. I try to prevent economists on my teams from ever messing with sales force compensation, because there's no quicker way to be fired. The sales force is very persuasive. That's their job; they're supposed to be persuasive.

There was a case where we had an executive vice president come to us and say, "We really want to run some experiments and learn about the sales force." As I said, I did my best to keep my team out of such matters, but when management comes to me and asks for help, I feel I have to oblige. Not only that, I had people chomping at the bit wanting to get involved. We designed some incentives and then what happened next was fully predictable, which is that the EVP got fired. Fortunately, my team was safe because it hadn't come from them.

My teams have worked with HR on other issues. There's always some ongoing work with HR. It can be on promotion, recruiting, collaborating — anything but compensation.

EF: Based on the literature and on your own experiences at Google and Microsoft especially, what is the role of entrepreneurship within large tech companies and has it been evolving?

McAfee: Most tech companies have been extremely skewed toward trying to encourage entrepreneurship, as well as giving a lot of lip service to tolerating failure, so as to recreate entrepreneurial activity inside the firm. The "maximize entrepreneurship" approach works pretty well for certain kinds of projects, in particular the kind where a small team can build a functioning product. But there are other products where it is a terrible idea — do you really want to fly in an airplane where each piece was designed and built by separate entrepreneurial teams aiming to maximize their own success?

Indeed, the economic theory of the firm suggests that firms arise when markets don't work well. We know markets work well when complementarities are weak and tend to fail when complementarities are strong. The term "complementarity" is economics jargon for synergy. As a result, the economic theory of the firm suggests that when complementarities are strong, we should see firms arise to internalize these complementarities and use nonmarket control — dictators, hierarchies, committees, and so on — to direct activities. Thus, from an economic perspective, the frequently encountered goal of recreating a market, entrepreneurial or otherwise, inside a firm involves a misunderstanding of the reason for a firm to exist. If a market can work inside a firm, there shouldn't be a firm in the first place!

Four firms — General Motors, Standard Oil, DuPont, maybe Sears — developed the multidivisional firm. These were firms where pieces of the firm operated as separate firms. And they were doing that just because they had gotten to the stage where they were was too large for any one person to operate. It's unsurprising that Silicon Valley's version of the multidivisional firm is to say we're going to run a venture capital firm inside.

I'm generally a voice, not all that successful a voice, against this trend. And the reason is, first, Silicon Valley's

R. Preston McAfee

➤ Selected Positions

Chief Economist and Vice President, Microsoft, 2014-2018; Director, Google Strategic Technologies, 2012-2014; Chief Economist, Vice President, and Research Fellow, Yahoo Research, 2007-2012; J. Stanley Johnson Professor of Business, Economics, and Management, California Institute of Technology, 2004-2009; chaired professor, University of Texas at Austin, 1990-2003

➤ Education

Ph.D. (1980), Purdue University; B.A. (1976), University of Florida

➤ Selected Publications

"Machine Learning in an Auction Environment," *Journal of Machine Learning Research*, 2016 (with Patrick Hummel); "Evaluating the 'Big Deal' Journal Bundles," *Proceedings of the National Academy of Sciences*, 2014 (with Ted Bergstrom, Paul Courant, and Michael Williams); "The Cost of Annoying Ads," *Proceedings of the 22nd International Conference on the World Wide Web*, 2013 (with Dan Goldstein and Sidharth Suri); "Capacity Choice Counters the Coase Conjecture," *Review of Economic Studies*, 2008 (with Thomas Wiseman); "Signaling Character in Electoral Competition," *American Economic Review*, 2007 (with Navin Kartik); "Coarse Matching," *Econometrica*, 2002; "Bidding Rings," *American Economic Review*, 1992 (with John McMillan); "Correlated Information and Mechanism Design," *Econometrica*, 1992 (with Philip Reny)

venture capital is an extremely finely tuned machine. It works extraordinarily well. And if you think about business strategy 101, one of the first rules is that if you've got a competitive market doing something, buy it from them, don't do it yourself.

There are a few exceptions. You might want to do it yourself if the market won't produce the quality you need. Also, we've had actually a long-running challenge where American companies like Cisco will subcontract to Chinese manufacturers that eventually go into business against them — so you might not want buy it where you're going to create future competitors.

But otherwise, in general, no. Venture capital does a great job, and it's a competitive market. So the idea of trying to replicate venture capital inside the company is usually misguided.

EF: How do you expect the exploitation of big data and machine learning to affect market structure and competition?

McAfee: AI is going to create lots of opportunities for firms in every industry. By AI, I mean machine learning, usually machine learning that has access to large volumes of data, which enables it to be very clever.

We're going to see changes everywhere: from L'Oréal giving teenagers advice about what makeup works best for them to airplane design to logistics, everywhere you look within the economy.

Take agriculture. With AI, you can start spot-treating farms for insect infestation if you can detect insect infestations, rather than what we do today, which is spread the treatment broadly. With that ability to finely target, you may be able to reduce pesticides to 1 percent of what you're currently using, yet still make them more effective than they are today and have them not deteriorate so rapidly in terms of the bugs evolving around them.

If you look back at the history of big firms, what you see is that when there are these big innovations — electricity and the automobile are good examples — these innovations fundamentally change the way things are done. So what we see and will continue to see is that companies in the face of AI technology have to change their way of doing things. We expect to see a lot of entry into these spaces from firms that have mastered an adjacent technology and can use AI to push themselves into a business. Meanwhile, the existing firms of course are going to fight back, and in some cases they'll push into other areas. This will likely be very disruptive. You'll also get the creation of completely new markets.

Some of those markets are likely to be ones in which a single firm becomes dominant. Digital commerce was an example of this; there was a period when there were lots of companies in digital commerce, but Amazon has clearly stepped out as the leader.

We will also see a lot of mergers and acquisitions. If you look at the history of merger waves, they tend to follow disruptive technologies. Indeed, all of them followed extensive technological change except the 1980s merger wave, which came about from deregulation. Such merger waves arise as firms struggle to change their business model, due to the changing environment the technological change brought about, and purchase new capabilities via merger. I expect to see a large merger wave from AI, lasting a decade or more, that could change competition in many or even most sectors.

The provision of AI technology is itself quite competitive. Google, Microsoft, Amazon, and IBM offer general AI technologies that, while somewhat differentiated, are competitive with each other, and a plethora of small firms offer more specialized technologies. When electricity disrupted industry, typically there was only one local provider. When business machines disrupted industry, there was one dominant vendor, IBM. But with AI, there are three or four strong vendors. That is positive both for advancing the technology and for maintaining competition. Competition among AI vendors will limit the antitrust problems in other verticals as they adapt to AI. Indeed, the shortage today is in humans: ML experts to implement and operate AI and data scientists to clean the data, prepare pipelines, and structure the output.

EF: What are the implications of machine learning, if any, for regulators?

McAfee: It is likely to get a lot harder to say why a firm made a particular decision when that decision was driven by machine learning. As companies come more and more to be run by what amount to black box mechanisms, the government needs more capability to deconstruct what those black box mechanisms are doing. Are they illegally colluding? Are they engaging in predatory pricing? Are they committing illegal discrimination and redlining?

So the government's going to have to develop the capability to take some of those black box mechanisms and simulate them. This, by the way, is a nontrivial thing. It's not like a flight recorder; it's distributed among potentially thousands of machines, it could be hundreds of interacting algorithms, and there might be hidden places where thumbs can be put on the scale.

I think another interesting issue now is that price-fixing historically has been the making of an agreement. In fact, what's specifically illegal is the agreement. You don't have to actually succeed in rigging the prices, you just have to agree to rig the prices.

The courts have recognized that a wink and a nod is an agreement. That is, we can agree without writing out a contract. So what's the wink and a nod equivalent for machines? I think this is going somewhat into uncharted territory.

EF: Is part of the difficulty that's emerging the result of machine learning in particular? As opposed to a

company making decisions based on an algorithm that's in code or using an econometric model?

McAfee: Yes. If you're using a deep neural net, which is a way of simulating how brains might work, it's really hard to say what the factor was, and actually you're seeing a bunch of interesting examples of this.

Deep neural nets are what have gotten people excited about artificial intelligence now. AI is a field that came and went repeatedly. People were excited in 1980. They get excited and then it never delivers. But this time was different, and what was different was the deep neural net and its capabilities.

Let me give the example of classifying photos. With deep neural nets, both Google and Microsoft can classify photos better than humans. The way we measure this is that we first have humans classify the photos — this the Golden Gate Bridge, that's a dog running in a field. We have humans do it and then we have machines do it. Then we show a human the photo and the two answers, and we ask which one is better. And the machines win. That is, the human picks the machine's interpretation over the human interpretation.

So they use a deep neural net, which is a kind of statistical process that's just wildly complicated because it has multiple layers — 150, 170, 200 of these layers that each have numerical weights attached, so there may be thousands of parameters in each layer and hundreds of layers. It's a wildly complicated system. It doesn't look like a regression where I can say, "Oh yeah, the coefficient on income in a loan is 0.2."

EF: What should antitrust policy be doing more generally, if anything, to respond to the dominance of some online firms in terms of market share?

McAfee: I disagree with those who find the antitrust laws inadequate. With few exceptions, I find our laws adequate for preventing monopolistic mergers, sanctioning anticompetitive behavior, and potentially offering the powerful ability to break up a firm that abuses its dominance.

I do sometimes question the application of the laws. There have been many tech acquisitions where the target might have grown into a serious competitor for the acquirer. Facebook, Instagram, and WhatsApp all offer competing services. Perhaps more of a recognition that tech firms in adjacent markets grow into challengers is warranted, though even the merger guidelines recognize the potential for entry.

We can address monopoly power, even when legally acquired, with regulation. I realize this is incredibly unpopular at the moment, but regulation is a pendulum that swings back and forth. When electricity generation, with its sizeable scale economies, was subject to monopolization, we responded both by regulating private provision and by creating municipal utilities. We should do the same with Internet provision and for exactly the same reasons.

Of course, a lot of the discussion today is focused on FAANG — Facebook, Apple, Amazon, Netflix, and Google. I see the issues somewhat differently. First, let's be clear about what Facebook and Google monopolize: digital advertising. The accurate phrase is "exercise market power," rather than monopolize, but life is short. Both companies give away their consumer product; the product they sell is advertising. While digital advertising is probably a market for antitrust purposes, it is not in the top 10 social issues we face and possibly not in the top thousand. Indeed, insofar as advertising is bad for consumers, monopolization, by increasing the price of advertising, does a social good.

Amazon is in several businesses. In retail, Walmart's revenue is still twice Amazon's. In cloud services, Amazon invented the market and faces stiff competition from Microsoft and Google and some competition from others. In streaming video, they face competition from Netflix, Hulu, and the verticals like Disney and CBS. Moreover, there is a lot of great content being created; I conclude that Netflix's and Amazon's entry into content creation has been fantastic for the consumer. Who would have thought that tech geeks could actually teach Hollywood, with a century of experience, a thing or two?

That leaves Apple, and the two places where I think we have a serious tech antitrust problem. We have become dependent on our phones, and Apple does a lot of things to lock in its users. The iMessage program and FaceTime are designed to force people into the Apple ecosystem. Also, Apple's app store is wielded strategically to lock in users (apps aren't portable), to prevent competition with Apple services, and to prevent apps that would facilitate a move to Android. My concern is that phones, on which we are incredibly dependent, are dominated by two firms that don't compete very strongly. While Android is clearly much more open than Apple, and has competing handset suppliers, consumers face switching costs that render them effectively monopolized.

So there are issues as to how the antitrust laws should be applied, but by and large, the framework of antitrust is fine. We shouldn't want competition for competition's sake; we want competition because it delivers innovation and good and cheap products. That's how the antitrust laws have been interpreted, and so I'm happy with that.

Going back to Facebook and Google, the reason people are worried is along the lines that our ability to communicate with Grandma is through only this one company. That's what we're worried about. It's not actually an antitrust issue, though. The same with fake news: We want companies to be more responsible, but I don't think the antitrust laws are a solution to that. That's a place where we should, as a society, look at what regulations are appropriate.

A good way to arrive at what those regulations should look like is by doing experiments. The fact that Europe

and California have adopted forms of data protection is a good idea. It's good for us to see some experiments.

The second place I'm worried about significant monopolization is Internet service. In many places, broadband service is effectively monopolized. For instance, I have only one company that can deliver what anyone would reasonably describe as broadband to my house. The FCC says I have two, but one of these companies does not actually come to my street.

I'm worried about that because I think broadband is a utility. You can't be an informed voter, you can't shop online, and you probably can't get through high school without decent Internet service today. So that's become a utility in the same way that electricity was in the 1950s. Our response to electricity was we either did municipal electricity or we did regulation of private provision. Either one of those works. That's what we need to do for broadband.

EF: The notion of regulation or public provision makes sense from your perspective in the broadband market. Does it also make sense in the provision of, let's say, social media?

McAfee: I'd be pretty leery about government provision of social media. Partly because it's a scale play — you need to run a pretty large network. With electricity and with broadband, you can actually run a municipal-level service and you can have local control and you can meet the needs of the local community, but that doesn't really work for a phone system or a social media system. So I would tend to look more toward regulation for that reason, to make sure it serves the national interest.

EF: What was the most surprising part of your transition from being an academic economist to being an economist in a high-tech corporate setting?

McAfee: There's a school of thought that government is inefficient because it can be, while firms, subject to markets, are forced to be efficient. The thing that shocked me the most was how inefficient large firms can be. Sure, there is government waste, but it is commensurate with size and clarity of mission. In one sense, I already knew that large firms could be inefficient — the failure of Kodak and Blockbuster are examples — but it is another thing to live through it.

I have a much deeper appreciation that slow optimization is a better model of human behavior than full optimization, and indeed, I've often used evolutionary models rather than optimization models in my work. People do respond to incentives, and they respond faster to stronger incentives, but along the way there are lots of mistakes and bad choices and hysteresis.

EF: What are the best and worst things about working in a place like Microsoft or Google?

McAfee: The thing I liked best was access to real problems. As a professor, I would dream up problems and solve them. I tried to pick problems whose solutions were likely to be valuable, and I had reasonable success at doing that. But it is another thing entirely when a multibillion-dollar business is measurably improved by a change your research suggested.

Indeed, one way of framing the answer is that, 300 years ago, scientists wrote each other letters of their findings, and these letters came to be reprinted in volumes for others to see. Eventually, these volumes become journals, and universities start to hire people who wrote lots of these letters. At that point, the writing of letters, as opposed to the making of discoveries, becomes a way of advancing in a scientific career, and you start to see "literature-driven" contributions, which are often uninteresting or not useful or both. As a corporate economist, in contrast, I and my team would typically be handed an existing problem, and if we made substantial progress in resolving it, we would write something up for a journal. In that way, I felt much more grounded in reality and actual success rather than academic success.

The worst aspect was firing people. Universities fire a lot of assistant professors, but the process is structured so that committees make decisions and there is no individual responsibility. Firing people is awful, even when it turns out they needed the change and are ultimately better off for it.

EF: Who have been your main influences?

McAfee: I learned to be a modern economist from John McMillan, my long-term co-author and author of *Reinventing the Bazaar*, which I think is the best book on market design. John made ideas operational and was a fabulous expositor. I now spend a full third of my research time on exposition -- ideas will never persuade if not articulated well.

Paul Milgrom's perspective on economic theory — his relentless focus on high-value insights, his often uncanny ability to simplify and get at the root cause, and his mastery of statistics underlying economic analysis and its role in economics — continues to be a crucial influence. I would be happy to produce even 1 percent of his theoretical insights.

And I learned a great deal from my boss at Yahoo, who I followed to Google, Prabhakar Raghavan. Prabhakar now leads advertising engineering at Google. Let me describe an outstanding thing he taught me. A manager's job is to make his or her team successful. Full stop. It isn't even to get a job done, though the team's success may require getting some job done. By defining your job as making the team succeed, you focus on what is blocking the team and how to remove those blocks. You acknowledge and advertise the team's contributions within the company. You are no longer the leader but the cheerleader. Upper management loves managers whose teams are successful, and I was well-rewarded for the success of my teams. **EF**

When a South Carolina City Tried to Become Motor City

The Fifth District's automotive entrepreneurs eventually lost out to the forces of agglomeration

BY JESSIE ROMERO

In the early 1900s, hundreds of entrepreneurs across the United States tried to get into the car-making business. Most of them produced only a few cars at best — but buggy maker John Gary Anderson of Rock Hill, S.C., thought he had a real shot at giving Henry Ford a run for his money. "These [Detroit] factories are turning out five thousand cars per annum," he wrote in an appeal to potential shareholders. "Why can't this be done in the South — even in Rock Hill? It can and we believe it will."

The Anderson Automobile Co. did achieve national distribution and produced more than 6,000 cars between 1916 and 1926, far more than any other Southern auto manufacturer. It eventually failed due to faulty engines, not to mention price competition from the Ford Motor Co. But Anderson's dream to turn Rock Hill into the car capital of America — and the aspirations of many other manufacturers — may have been doomed from the start, as the forces that contributed to the concentration of the auto industry in Detroit were well underway by the time he entered the race.


ANDERSON 6

A Quality Car of Distinctive Individuality

The New Series of Anderson Six Models

DIGNITY, grace, power and comfort developed to an unexpected degree.

ANDERSON MOTOR COMPANY

Rock Hill, South Carolina U. S. A.

A PARTIAL LIST OF ANDERSON DISTRIBUTORS AND THEIR TERRITORIES:

John Gary Anderson was a big proponent of advertising and designed his own ad campaigns. He manufactured a wide range of cars (including the 1919 Allen convertible Roadster pictured here) and painted them any color a customer wanted.

IMAGE: COURTESY OF DR. J. EDWARD LEE

Made in Dixie!

Anderson was born in 1861 in Lawsonville, N.C., and raised by his grandparents after both his mother and father died of tuberculosis. In his teens, Anderson relocated to Rock Hill, then a town of fewer than 1,000 people just south of the North Carolina state line. (Today, Rock Hill is considered part of the Charlotte metro area.) Anderson was intent on climbing the economic ladder, and in 1881, with only a few months of formal schooling, he managed to purchase an interest in a grocery store. Three years later, he married Alice Holler, the daughter of a prominent local businessman, and started a successful buggy company with his new father-in-law.

As historian J. Edward Lee describes in his 2007 book *John Gary Anderson and His Maverick Motor Company,* Anderson was an enthusiastic booster of his adopted city. He formed its first chamber of commerce and played a major role in persuading the Winthrop Normal and Industrial College, today Winthrop University, to relocate there from Columbia in 1895. He also advocated diversifying the South's economy away from cotton — in no small part because farmers dependent on the crop couldn't afford to buy buggies when crop prices fell. Transforming Rock Hill would require "leaders of vision, courage and enterprise that are rarely found in small towns," Anderson wrote in his autobiography. Not lacking in self-esteem, he believed he was up to the task.

In 1910, two years after Ford launched the Model T, Anderson and his sons started tinkering with gasoline engines. At the turn of the century, many cars had electric engines, but within a few years the internal combustion engine dominated the market. (See "Car Wars," *Econ Focus*, Fourth Quarter 2014.) Six years later, they introduced the Anderson Motor Co. to the world with a week-long open house for prospective dealers and customers. The cars received favorable reviews; *Automobile* magazine described the "Anderson Six" as a "new car manufactured in a new territory... a good unit assembled in a neat chassis with extra lavish equipment." It sold for $1,250.

Anderson emphasized that lavishness, hoping customers would choose quality over cost. A brochure proclaimed, "You will find the upholstery deep and wide, stuffed with real curled hair and carefully tailored in real leather. You will find the finish of lasting luster, hand applied and hand rubbed, involving twenty-one distinct operations in all." Anderson also appealed to regional pride, adopting the slogan, "A little higher in price, but made in Dixie!"

For several years, the strategy appeared to be working; investors were eager, and 200 workers produced as many as 22 cars per day. The company wasn't a match for Ford, however, which had introduced the assembly line in late 1913 and by 1915 could produce between 50 and 250 cars per day in a single plant. Across more than two dozen facilities (including one that opened in 1914 in Charlotte), Ford was manufacturing more than 45,000 cars per month.

The U.S. economy entered a severe recession at the beginning of 1920. Many automakers had invested heavily in new equipment, anticipating a postwar surge in demand, but found themselves with excess capacity and debts they couldn't pay when that demand dried up. General Motors survived courtesy of an investment by the du Pont family; Ford survived by cutting prices even further (and by forcing dealers to accept — and pay cash for — shipments they hadn't ordered).

Anderson didn't have that kind of leverage, and he "seemed perplexed about the problems facing the industry," according to Lee. He didn't start lowering prices until 1921, and even then, his cars cost two to four times more than a Ford. It turned out most customers cared more about price than quality. "To be sure, [the Model T] didn't have many of the extras one got with the local product, such as silver fittings, satin-covered rope and twin vanity sets, but [it] usually got passengers to their destinations," Lee wrote.

Anderson persevered for several more years, urging local consumers to "buy at home" and warning "what a hole would be left in Rock Hill should the Motor Company be taken away." In 1922, he launched a cheaper touring car called the "Light Aluminum Six," which cost $1,195. But a basic Ford touring car cost just $298, and the new Anderson model turned out to have a major defect in its engine. The company had to shut down production to fix the problem and never recovered. Anderson appealed to the city for help, but in 1926 the Anderson Motor Co. and its assets were sold at auction for $53,000, just enough to pay the back taxes. The *Rock Hill Record* reported the news on Sept. 9, 1926: "And thus comes to an end the most ambitious enterprise ever launched in Rock Hill."

Why Not Richmond?

Anderson wasn't the only automotive entrepreneur hoping to get in on the burgeoning car craze. By 1909, there were around 270 automobile manufacturing companies across the United States — and hundreds of other enthusiasts experimenting who never managed to actually produce anything. Nor was Anderson the only person optimistic about the South's prospects. In 1910, a writer for the *Richmond Times-Dispatch* gushed about the "vigorous and far-seeing young men" at the Richmond Iron Works, a cooperative of several small foundries, who were starting to manufacture cars in the city. "Why should not Richmond make automobiles just as good as any that ever came from the factories in Detroit or any other town?" he wrote. He added a prediction: "The automobile industry is going to be a big thing for Greater Richmond."

The Richmond Iron Works ceased car production in 1912.

But it wasn't the end for Virginia auto manufacturing. Around the same time, a group of businessmen persuaded James Kline to move his company from Pennsylvania to Richmond. He set up on a plant on the Boulevard — today the site of a Greyhound bus station — where he assembled around 3,700 cars between 1912 and 1923. A little over 100 miles west, in Lynchburg, the Piedmont Motor Co. started producing cars in 1917. It manufactured between 2,500 and 3,000 cars, most of which were purchased by other companies and sold under other names, before going bankrupt in the early 1920s.

Many automotive entrepreneurs were, like Anderson, former buggy makers. In Baltimore, Charles and Jacob Spoerer, the sons of carriage and wagon builder Carl Spoerer, started making cars in 1907. Until deciding in 1914 to focus instead on tire and auto accessory sales, they manufactured, among others, a roadster, a touring car, and a landaulet, essentially a limousine with a convertible top. Richard Corbitt of Henderson, N.C., also was a carriage builder; his company, Corbitt Automobile Co., was the only North Carolina firm that managed to build a production model, although he sold at most 100 vehicles between 1907 and 1912. Corbitt continued building trucks and farm equipment until the company was liquidated in 1952.

Other manufacturers' connection to the auto industry was less clear. Baltimore's Sinclair-Scott was known for apple peelers and food-canning machines before it started producing a roadster called the "Maryland" in 1907. (The Maryland was originally manufactured in Boston under the name Ariel; Sinclair-Scott acquired the rights when Ariel went bankrupt.) Sinclair-Scott built close to 900 cars before going back to food canning in 1910.

One source of publicity for these early manufacturers was multiday driving tours, in which cars had to reach checkpoints within specific timeframes and were penalized for repairs. In these, the "Washington" automobile, manufactured in Hyattsville, Md., by the Washington, D.C.-based Carter Motor Car Corp., performed quite well. In the 1910 Munsey Historic Tour, a 12-day, 1,500-mile race, two Washingtons finished with perfect scores. An advertisement later that year proclaimed the Washington the "Victor of Victors." But Carter couldn't scale up and went bankrupt in 1912.

Automotive Agglomeration

Despite the flurry of activity in the Fifth District and across the country, the American automotive industry was highly concentrated nearly from the beginning. By most accounts, the industry got its start in New England in 1895. Within 10 years, 68 percent of auto manufacturing firms were located in just six cities: Detroit, New York, Chicago, Indianapolis, Rochester, N.Y., and St. Louis.

Detroit had the highest share, with 25 percent, followed by New York with 15 percent and Chicago with 10 percent. Indianapolis, Rochester, and St. Louis each had between 2 percent and 8 percent of firms. Concentration increased dramatically over the next four decades. Between the mid-1910s and the mid-1920s, the number of firms fell from around 200 to just 40, and Detroit's share increased substantially. By the 1940s, only eight auto manufacturers remained and nearly all of them were in Detroit.

Broadly speaking, there are four factors that could contribute to such geographic clustering, or what economists call "agglomeration." The first is intra-industry spillovers, which occur when firms located near other firms in the same industry share knowledge and inputs. There may also be inter-industry spillovers, when knowledge is shared across firms in related industries. Agglomeration might also occur when employees leave an incumbent firm and start another firm in the same industry, known as "family network" or "spinout" effects. Finally, a cluster might be the result of a location's unique attributes, such as natural resources or a favorable regulatory environment.

What explains the agglomeration of the U.S. auto industry? That question was explored by Richmond Fed economist Zhu Wang, Luís Cabral of New York University, and Daniel Yi Xu of Duke University in a 2018 article in the *Review of Economic Dynamics*. The researchers ran a "horse race" between the potential contributing factors and concluded that in the short run, the most significant were spinouts and inter-industry spillovers from local carriage and wagon manufacturers. Local inputs, such as iron and lumber, played a smaller role. "This finding highlights how human capital, accumulated at a location by working in the same or a related industry, contributes to industry agglomeration," says Wang.

From a long-run perspective, however, the location of the carriage and wagon industry in the first place was determined by the availability of local inputs. In addition, spinouts are influenced by the local regulatory environment; one reason there were so many spinouts in Detroit was that Michigan had passed a law banning noncompete clauses in 1905. In this sense, Wang says, "It is fair to say that location-specific effects accounted for the lion's share of the auto industry's agglomeration."

Wang and his co-authors distinguished two different phenomena: the agglomeration of the auto industry in a few cities, particularly Detroit, which had already occurred by the early 1900s, and the industry shakeout that led to the marked decline in the number of firms by the 1940s. "Before the assembly line, you needed a lot of producers to meet the demand," says Wang. "But the scale economies created by the assembly line meant you only needed a few firms. Detroit had already built up an advantage that enabled it to capitalize on the new technology — and that agglomeration occurred before the industry consolidated."

Full Circle

After his company failed, Anderson spent most of his time in Lakeland, Fla., with his wife until his death in 1937. He never forgave Rock Hill for "abandoning" his company; he devoted nearly 100 pages of his 900-page biography to criticizing the leaders who hadn't returned his loyalty.

After the bankruptcy, Manhattan-based M. Lowenstein and Sons Co. purchased the vacant car factory and built a textile processing facility. Known locally as "the Bleachery," the Rock Hill Printing and Finishing Co. opened in 1930. Residents viewed the opening as "proof that the 'Good Town' [as Rock Hill was popularly known] was Getting Better," according to a 1953 history of Rock Hill by the late historian Douglas Summers Brown. The facility eventually expanded to 31 buildings over more than 30 acres and helped foster the economic growth Anderson had hoped to provide. In 1952 and 1960, Rock Hill residents had the highest per-capita income of any South Carolinians. At the peak in the mid-1960s, nearly 5,000 people — 70 percent of Rock Hill's workforce — worked there. With another 33 textile factories in Rock Hill, the Bleachery was at the center of an agglomeration of its own.

During the 1980s and 1990s, many textile manufacturers moved overseas. M. Lowenstein and Sons sold the Rock Hill Printing and Finishing Co. in 1985, and the new owners closed the facility in 1998. The building sat vacant for more than a decade, subject to fires and vandalism. The city purchased most of the site in 2011 and has partnered with developers to create a new complex called University Center, part of a broader revitalization effort known as Knowledge Park. Scheduled to be completely open by 2020, the mixed-use center will feature restaurants, apartments, office space, a hotel, an indoor sports complex, and housing for students at Winthrop University, the school John Gary Anderson worked so hard to bring to the city.

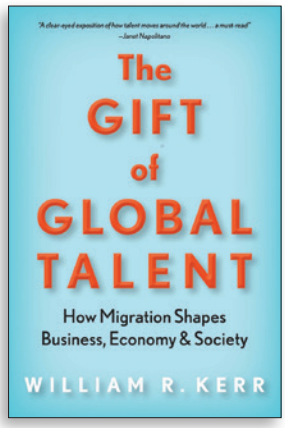
Detroit's "Big Three" auto manufacturers began to face serious foreign competition themselves in the 1980s. Today, eight of the top 10 automakers by U.S. market share are based overseas (including Chrysler, which merged with Italy's Fiat in 2014). And car and truck manufacturers, including BMW, Mercedes, Toyota, and the Japanese company Hino, operate plants in the Fifth District. BMW's plant is in Spartanburg, S.C., a little more than an hour's drive from Rock Hill. **EF**

Readings

Cabral, Luís, Zhu Wang, and Daniel Yi Xu. "Competitors, Complementors, Parents, and Places: Explaining Regional Agglomeration in the U.S. Auto Industry." *Review of Economic Dynamics*, October 2018, vol. 30, pp. 1-29.

Lee, J. Edward. *John Gary Anderson and His Maverick Motor Company*. Charleston, S.C.: The History Press, 2007.

A Welcome for the Talented



THE GIFT OF GLOBAL TALENT: HOW MIGRATION SHAPES BUSINESS, ECONOMY & SOCIETY
BY WILLIAM R. KERR, STANFORD, CALIF.: STANFORD UNIVERSITY PRESS, 2019, 237 PAGES

REVIEWED BY AARON STEELMAN

Immigration skeptics argue that newcomers are taking jobs Americans would otherwise fill and that immigration is having a divisive effect on the country's culture. Proponents argue that the net economic effects of immigration are overwhelmingly positive and that it's not plain that immigrants are assimilating at a lesser rate than in the past.

In *The Gift of Global Talent*, William Kerr, an economist at Harvard Business School, addresses these issues — although exclusively through the lens of "high-skilled" immigration. He doesn't attempt to analyze effects of "lower-skilled" immigration, which drives many, though certainly not all, of the concerns of immigration skeptics.

Kerr favors more high-skilled immigration to the United States. "Some may cheer at the prospect of reduced inflows of talented immigrants, but they should not," he writes in the book's preface. "Ceding U.S. talent leadership would hurt Middle America as much as it would harm Manhattan or Silicon Valley, as a result of lost tax revenues, weakened colleges, and more. It would diminish America, not make it whole again."

The book builds on three propositions. First, talent is the world's most important resource. Second, talent is a resource that is quite movable, unlike, say, a harbor or coal mine. Third, talent is significantly shaped by the environment around it. Some might quarrel with the first proposition, and in some parts of the world this may not yet be true, but as a general statement it seems quite sensible. The second proposition seems inarguable. It's the third proposition that may seem most dubious to some.

The notion that proximity is important to the development of talent in a world in which many people work remotely and see their colleagues relatively infrequently may seem outdated. But Kerr argues quite convincingly that being close to those with complementary ideas remains very important. Ideas tend to build on each other, whether in a university setting or a commercial one – and often those overlap. Think of tech clusters in Northern California and Boston, for instance. But such clusters can sprout up in less predictable areas as well. For instance, Olathe, Kan., has become home to a thriving tech community. (It also was the site of a 2017 shooting of two Indian-born engineers, one fatal, who were targeted because they were immigrants, demonstrating, tragically, the anger that immigration can stir among some people, especially those already disgruntled or prone to violence.)

Such clusters benefit greatly from high-skilled immigrant labor, particularly that from India and China. And these clusters improve the well-being of not only the immigrants themselves and the companies they help to thrive but of Americans as a whole. There are some people who are made worse off, though, and Kerr argues for finding ways to help buffer them from those shocks. Perhaps paradoxically, immigrant-fueled tech clusters also can benefit the talent-sending countries themselves. Those countries reap gains from the inventions and innovations produced by such talent clusters, in the same way as Americans. But the overseas workers also often "provide their home countries with special insights and business linkages," Kerr writes. For instance, India has launched programs to bring Indians working abroad (and who often received their higher education abroad) back to India's research and development institutions for months at a time.

Kerr maintains that the United States will continue to remain the destination of choice for the world's most talented workers, but as countries such as India and China further develop, fewer people likely will opt to leave them. Also, in order to continue to attract the type of skills that have benefited the U.S. economy, policymakers will need to consider changes to the H-1B visa program, the primary entryway for high-skilled foreign workers. First, he argues, the United States should raise its annual cap on H-1B visas from its present level of 85,000 and then index future increases to population growth or to the national employment growth for skilled workers. But it should also consider reforms such as replacing the current lottery system for selection with a wage ranking system: Applicants earning the highest salaries from their sponsoring employers, and therefore arguably demonstrating the greatest economic value, would move up the queue. In addition, to "complement wage ranking and to preserve scarce visas for the best uses," he favors raising the H-1B minimum wage from $60,000 to $100,000. This would leave some important but lesser-paying professions, such as social work, at a disadvantage, and exceptions should be considered in those instances.

Kerr's book is readable and his arguments are generally reasonable, but they are not as fully developed as one might hope, a sacrifice often made to ensure accessibility. It also would have benefited from more than just glancing attention to lower-skilled immigration, the benefits of which often are not clearly seen while the costs often are widely lamented. Bringing insight to such cases is something economists are particularly well-positioned to do. **EF**

Understanding Recent Trends in Labor Market Participation

BY R. ANDREW BAUER

By many metrics, the labor market is very tight. The national unemployment rate ended 2018 at a level not seen since the 1960s, while the unemployment rate for the Fifth District reached its lowest level since the first half of 2000. The number of job openings in the United Sates exceeds the number of workers looking for jobs, and the level of initial claims for unemployment insurance is near a 50-year low. Businesses indicate that finding and retraining workers is difficult. Yet the percentage of working-age adults in the country who are active in the labor market — the labor force participation rate — is below where it was prior to the Great Recession. A similarly broad metric of the labor market that compares the number of employed persons in the country to the working-age population, the employment-to-population ratio, also remains well below prerecession levels. Do these metrics imply that the labor metric is not as tight as thought — that there is additional slack? Are there workers who left the labor market and are available to return should the right opportunity arise?

Some point to the fact that wages have increased only moderately and wage growth remains below rates during other expansion periods as an indication that there is some additional slack in the labor market. The lack of wage growth has been unexpected — particularly given the drop in the unemployment rate from 10 percent to under 4 percent. When something becomes scarce or less abundant, all other things being equal, the price would be expected to rise. Perhaps what is muting the price increase is the availability of labor that is currently out of the labor force.

Another unexpected fact of the labor market in recent years has been the strength of the monthly job gains. Given population and labor force growth, the number of monthly job gains necessary to incorporate new entrants into the labor market is estimated to be between 50,000 and 110,000 jobs. Actual job growth in 2018 far surpassed this level at close to 225,000. In a tight labor market, with a low unemployment rate and labor scarcity, one would have expected to see greater moderation in the monthly job gains — but that has not happened. Perhaps the explanation, once again, is hidden slack: workers not in the labor market who are entering as opportunities arise.

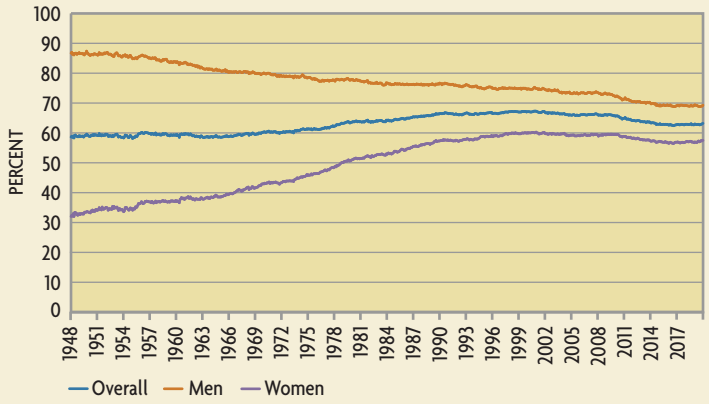
In response to these questions, there has been a lot of research devoted to understanding movements in the labor force participation rate. It has been in decline since the late 1990s and that decline accelerated during the Great Recession and afterward. Is the accelerated decline due to transitory factors associated with the business cycle, changing trends in the demand for labor, changes in the demographic composition of the labor force, or some combination thereof? This article will review some of the research that examines the decline in these metrics and then look to see if this research helps explain the trends in the Fifth District.

A Look at the Trends

In the latter half of the 20th century, the percentage of workers engaged in the labor force rose considerably. The labor force participation rate increased by roughly 8 percentage points from the 1960s to 2000 — from just under 59 percent to just over 67 percent. The employment-to-population ratio experienced a similar increase over the same period. Underlying the increase in employment and the labor force were several factors: (1) a large demographic group entering the labor force — the baby boomers, (2) an increase in educational attainment, and (3) women entering the workforce in greater numbers. After peaking at 67.3 percent in early 2000, the labor force participation rate declined in two stages: gradually during the first half of the 2000s before leveling off just prior to the Great Recession and then more sharply during and after the Great Recession until reaching a 40-year low of 62.5 in 2015. It is notable that in 2017, the U.S. labor force participation rate for prime-age workers (aged 25 to 54) ranked 40th out of 50 among countries in the Organization for Economic Co-operation and Development — a fact that would perhaps surprise some as American culture

Labor Force Participation Rates by Gender

16 years+



NOTE: Seasonally adjusted

SOURCE: Bureau of Labor Statistics

is sometimes associated with a stronger emphasis on work and less on leisure than other cultures.

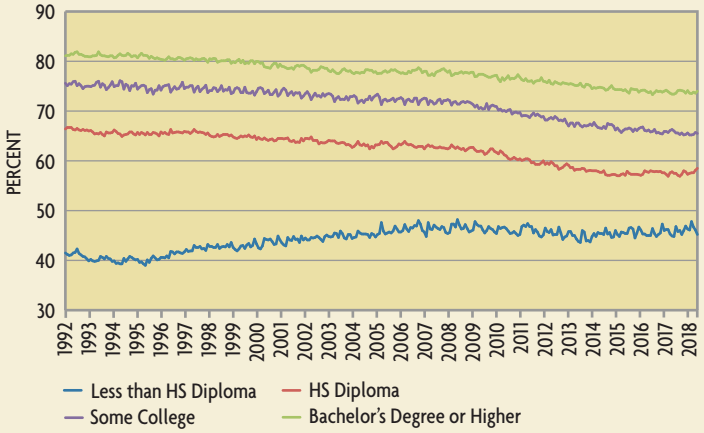
Underlying the overall decline are movements by various subgroups within the labor market. There are notable difference in trends by age group, gender, and educational achievement. The labor force participation rate for men has been in decline for many decades, while the rate for women rose consistently from 1960 to 1980 before slowing during the 1990s. (See chart.) The participation rate for women peaked at 60.3 in early 2000 before declining to 56.4 in 2015 and has edged slowly higher in recent years.

The more educated a worker, the more likely he or she will be participating in the labor market. The labor force participation rate for workers with less than a high school diploma was 46.1 percent at the end of 2018, while the participation rate for workers with a bachelor's degree or higher was 73.6 percent. (See chart.) Note that for workers with a high school diploma or higher, the participation rate has been steadily declining in recent decades. In contrast, the participation rate for workers who have not finished high school rose from 39 percent in 1995 to just over 48 percent in 2008. It then declined until 2014 and has moved higher in recent years but has not regained its previous high.

With respect to age, while there was a fairly steady decline for prime-age workers from 2000 to 2015 (with the exception of 2005 to 2008), there was a much larger decline for younger workers — particularly workers aged 16-19. (See chart.) In contrast, the participation of older workers (55 and older) increased from 1990 to 2010 and has held steady since.

Labor Force Participation Rates by Education

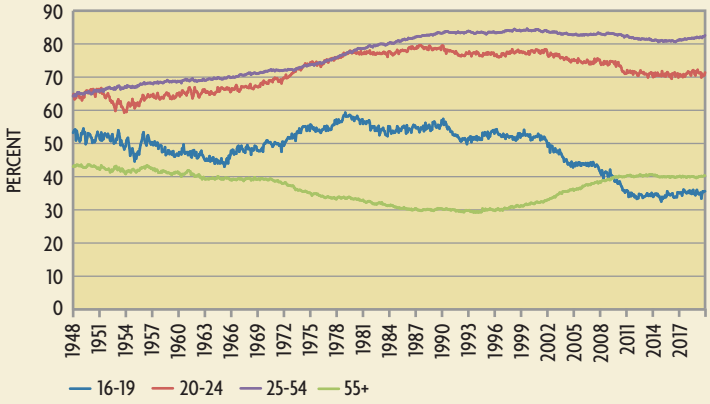
25 years+



NOTE: Seasonally adjusted

SOURCE: Bureau of Labor Statistics

Labor Force Participation Rates by Age Group



NOTE: Seasonally adjusted

SOURCE: Bureau of Labor Statistics

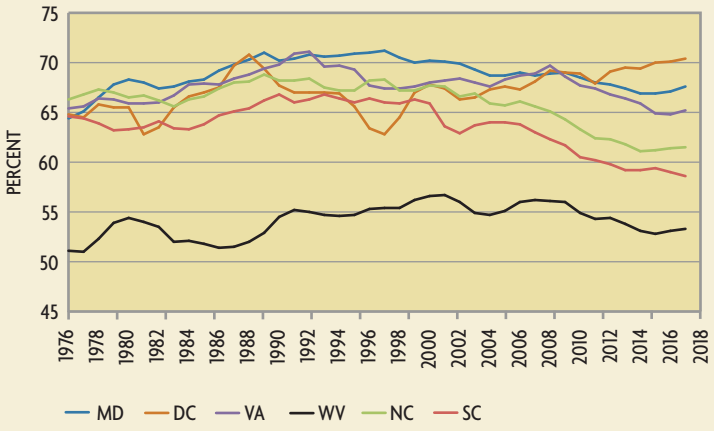
Explaining the Changes in Labor Force Participation

There has been a considerable amount of research looking at these trends. Much of the work concludes that longer-term secular trends are responsible for the decline as opposed to temporary cyclical factors. One of the key drivers in the decline in the U.S. labor force participation rate is demographics. As mentioned above, a key trend in recent decades has been in the increase in the share of older workers (55 and older). Not surprisingly, this is due to the population getting older — specifically, the aging of the baby boomer generation. Given that the labor force participation rate of older workers is considerably lower, the increase lowers the overall participation rate. Researchers who have looked at this have found that this accounts for a sizeable portion of the overall decline.

Andreas Hornstein of the Richmond Fed, Marianna Kudlyak of the San Francisco Fed, and Annemarie Schweinert, formerly of the San Francisco Fed, constructed a hypothetical labor force participation rate by fixing the educational composition of the population and the participation rate of each group at their 2000 levels and using the actual age-gender population shares as weights. In a 2018 San Francisco Fed *Economic Letter*, they found that changes in age-gender composition of the population caused about three-fourths of the decline in the overall rate. Similarly, in a 2017 article in the *Brookings Papers on Economic Activity*, Alan Krueger of Princeton analyzed the participation rate using a similar methodology and found that the shift in population shares accounted for 65 percent of the decline in the participation rate between 1997 and 2017. Moreover, because the aging of the population is expected to continue, its downward effect on labor participation will most likely continue. In a 2017 article in *Economic Insights*, Michael Dotsey, Shigeru Fujita, and Leena Rudanko of the Philadelphia Fed projected that rising retirements will continue through the late 2020s, which would imply a roughly 4 percentage point decline in the participation rate over that period.

Fifth District Labor Force Participation Rates

16 years+



NOTE: Seasonally adjusted

SOURCE: Bureau of Labor Statistics

Other factors besides demographics are at work, however. The decline in the labor force participation rate among prime-age workers over the past two decades has been particularly pronounced for prime-age males, whose participation rate declined by 2.6 percentage points from 2000 to 2018. There have been a number of explanations put forth to explain this decline.

John Coglianese, a Ph.D. candidate at Harvard University, argued that a change in how men are attached to the labor market is a factor. In his paper "The Rise of In-and-Outs: Declining Labor Force Participation of Prime Age Men," he found that one-third of the decline in the labor force participation rate of prime-age males is due to an increase in occasional short breaks between jobs. He argued that despite these breaks, these individuals are highly attached to the labor force and work typical jobs but are notable in that they take brief breaks outs of the labor force. He found that married or cohabitating men are taking more breaks and account for about half of the increase in "in-and-outs." He attributed this rise to a wealth effect from their partners' growing incomes. Young men increasingly living with their parents accounted for much of the rest of the increase.

An article by an economist at the Kansas City Fed, Diden Tuzemen, argued that a decline in the demand for middle-skill workers due to job polarization along with increased international trade and weakened unions accounted for most of the decline in participation among prime-age men. He looked at the increase in the nonparticipation rate (out of the labor force) for prime-age males by education level and noted while there is an increase across all education levels, the increase was largest for males with a high school degree and those with an associate's degree or some college (middle-skill workers). He also pointed out that at the same time that more middle-skill workers were not participating in the labor force, the share of employment by occupations with middle skills declined considerably over the past two decades, while the share of low-skilled and high-skilled occupations increased.

Research has looked at the impact of trade on employment and found that dislocations due to increased imports may have pushed down labor participation rates. In a 2016 article in the *Journal of Labor Economics*, "Import Competition and the Great U.S. Employment Sag of the 2000s," Daron Acemoglu and David Autor of MIT, Brendan Price of the University of California, Davis, David Dorn of the University of Zurich, and Gordon Hanson of the University of California, San Diego argued that slow employment growth between 2000 and 2007 was due to greater import competition from China. They estimated the direct and indirect impact of Chinese imports on U.S. manufacturing and found sizeable negative effects on employment — for industries directly exposed to import competition as well as indirectly for upstream industries. In theory, the employment lost to import competition would be expected to be reallocated to other industries, but they found no evidence that this occurred. They argued that the reallocation into nonexposed industries is overwhelmed by a negative adverse demand effect. Prime-age males comprise the majority of manufacturing employment, so as a result, the negative impact of trade could be a factor explaining the decline in participation by prime-age males.

Two other factors cited by research are the rise in disability and the opioid crisis. Dotsey, Fujita, and Rudanko noted that the decrease in the overall participation rate since 2000 has been due to roughly equal increases in the number of nonparticipants citing "in school," "retired," or "disabled." Krueger analyzed the effect of the opioid crisis by looking at survey data and opioid prescription rates to see if the sharp rise in prescription rates had an impact on labor markets. His results suggest a link between the opioid crisis and depressed labor force participation. Still, the effects of the opioid crisis remain difficult to isolate; it could be that poor labor market outcomes result in opioid usage in some instances, while opioid use drives poor labor market outcomes in others. Or it could be that some other factor is related to both. (See "The Opioid Epidemic, the Fifth District, and the Labor Force," *Econ Focus*, Second Quarter 2018.)

Fifth District Trends

We see similar trends within Fifth District labor markets. As in the national data, the labor force participation rate declined in each of the district jurisdictions from 1997 to 2017 — with the exception of the District of Columbia, where the rate increased sharply. The largest declines were in the Carolinas, where the participation rate dropped close to 7 percentage points; declines in other states were much less severe — 3.6 percentage points in Maryland, and

2.2 percentage points in Virginia and West Virginia. (See chart.) The participation rate itself also varies considerably, from West Virginia's 53.3 percent to the District of Columbia's 70.4 percent.

What is driving the differences among jurisdictions? Not surprisingly, many of the same demographic factors as on the national level are at work. One is education. As noted earlier, workers with higher levels of education are more likely to be in the labor force and employed. In terms of education, West Virginia stands out in that the percentage of the population aged 25 or older with less than a high school education is the highest in the district, although South Carolina is not far behind, and that the percentage with only a high school degree is the highest — and by a considerable margin (41 percent versus an average of 25 percent for the other five jurisdictions). At the same time, the percentage of workers with college or advanced degrees is the lowest. Still, other factors must be at work as well. Even when looking at participation rates by education level, West Virginia is still lower than the rest of the district, and this is true across all education levels. Most notably, only 36 percent of West Virginians with less than a high school diploma were in the labor force versus an average of 60 percent for the rest of the district. In contrast, the District of Columba has the highest participation rate and the highest percentage of people with college and advanced degrees -- as well as the lowest percentage of the population with high school diplomas or less.

Much like the national picture, changes in participation rates by age and gender as well as the aging population help to account for recent Fifth District trends. The aging of the baby boomer generation is at work within district jurisdictions with one notable exception, the District of Columbia, which has been getting younger. From 2005 to 2017, the percentage of the population 55 or older increased between 5.6 percent in Virginia to nearly 7 percent in South Carolina. Moreover, within the 55 and older age group, the larger increase has been for the population above the age of 64 — whose participation rate is considerably lower. At the same time, in contrast, the median age in the District of Columbia fell by almost two years.

With regard to gender, too, the Fifth District's economies largely parallel the nation's. In the district, the participation rate for males aged 20 to 64 declined by 2.7 percentage points from 2005 to 2017. This was partially offset by an increase in the participation rate of females by 2.2 percentage points. The male participation rate remained considerably higher than the female participation rate, though the gap has declined — the average difference across district jurisdictions was 7.3 percentage points in 2017, down from 12.2 percent in 2005.

In addition to demographics, what other factors may be influencing labor market outcomes in the Fifth District? Job polarization within the district appears to be a factor behind the decline in the participation rate of males. Richmond Fed research has found that with the exception of the District of Columbia, the middle-salary occupation group has grown more slowly than higher- and lower-salary occupations — consistent with the notion that increases in technology were displacing middle-skill employment. (See "Post-Recession Labor Market Trends in the Fifth District," *Econ Focus*, Third Quarter 2015.)

Another factor cited earlier is the opioid crisis. The hardest-hit jurisdiction in the Fifth District, West Virginia, has seen improvements. The usage rate there was exceedingly high in the late 2000s, peaking at 146.9 prescriptions per 100 people in 2009 — 1.8 times greater than the national average. It has since dropped sharply to 81.3 in 2017, which is still significantly greater than the U.S. average, but the gap has shrunk.

Did opioid usage contribute to a decline in the participation rate in the Fifth District? The high usage rates along with anecdotal information from businesses, nonprofits, and hospitals within the district suggest opioid usage did hurt the supply of labor. As noted earlier, however, the scale of this effect is difficult to assess.

Conclusion

The labor force participation rate peaked in the late 1990s and had been in decline until the last few years. The labor market continues to tighten, with strong job growth and an unemployment rate nearing lows not seen since the late 2000s and 1960s. Much of the explanation for the changes in participation lies in long-term secular trends, demographics in particular. An aging population has had an enormous impact, but the participation rates of young workers and older workers have had a noticeable impact as well. The long-term decline in the participation rate of men is less well understood. Job polarization, the impact of trade on manufacturing, the rise in disability, and the opioid crisis have been looked at as possible explanations. There is some suggestive evidence that job polarization and opioid usage are factors affecting the district's labor market. The changing age profile of the Fifth District, changes in participation rates by age and gender, and differences in educational attainment are large factors underlying participation rates across the district. **EF**

State Data, Q2:18

	DC	MD	NC	SC	VA	WV
Nonfarm Employment (000s)	**794.9**	**2,735.1**	**4,501.4**	**2,123.1**	**4,000.1**	**753.3**
Q/Q Percent Change	0.1	0.1	0.8	0.3	0.5	0.3
Y/Y Percent Change	0.6	0.5	2.2	1.8	1.2	1.3
Manufacturing Employment (000s)	**1.4**	**107.8**	**474.9**	**243.7**	**239.1**	**47.0**
Q/Q Percent Change	5.1	-0.4	1.1	0.1	0.3	-0.6
Y/Y Percent Change	5.1	1.0	1.6	1.4	2.1	0.6
Professional/Business Services Employment (000s)	**167.1**	**451.7**	**637.5**	**280.5**	**739.4**	**66.6**
Q/Q Percent Change	0.1	1.0	0.8	2.2	0.4	0.7
Y/Y Percent Change	0.4	1.6	3.6	1.3	1.4	-0.1
Government Employment (000s)	**237.9**	**501.6**	**737.4**	**367.9**	**714.2**	**156.6**
Q/Q Percent Change	-0.2	-0.4	0.2	0.1	-0.2	1.6
Y/Y Percent Change	-1.3	-0.8	0.8	0.9	-0.4	1.8
Civilian Labor Force (000s)	**406.9**	**3,231.5**	**4,988.9**	**2,318.2**	**4,339.4**	**785.4**
Q/Q Percent Change	1.1	0.2	0.3	-0.3	0.4	0.1
Y/Y Percent Change	1.4	0.3	1.2	0.4	0.8	1.2
Unemployment Rate (%)	**5.6**	**4.3**	**4.3**	**4.0**	**3.2**	**5.4**
Q1:18	5.7	4.2	4.5	4.4	3.5	5.4
Q2:17	6.2	4.1	4.5	4.2	3.8	5.0
Real Personal Income ($Bil)	**53.1**	**351.7**	**437.2**	**200.3**	**448.1**	**66.7**
Q/Q Percent Change	0.5	0.4	0.5	0.4	0.6	0.4
Y/Y Percent Change	1.8	1.4	2.3	1.7	2.2	1.8
New Housing Units	**974**	**4,280**	**18,536**	**9,729**	**8,227**	**900**
Q/Q Percent Change	35.1	-2.8	2.6	11.1	-2.0	45.4
Y/Y Percent Change	-9.9	-10.9	26.9	12.2	-1.8	17.8
House Price Index (1980=100)	**899.7**	**479.7**	**383.6**	**388.4**	**466.5**	**240.9**
Q/Q Percent Change	2.5	1.2	3.1	1.6	1.8	2.0
Y/Y Percent Change	7.4	4.2	6.8	6.8	3.9	4.3

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

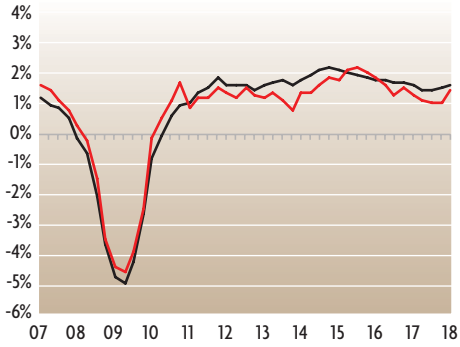
SOURCES:
Real Personal Income: Bureau of Economic Analysis/Haver Analytics.
Unemployment Rate: LAUS Program, Bureau of Labor Statistics, U.S. Department of Labor/Haver Analytics
Employment: CES Survey, Bureau of Labor Statistics, U.S. Department of Labor/Haver Analytics
Building Permits: U.S. Census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

For more information, contact Akbar Naqvi at (804) 697-8437 or e-mail Akbar.Naqvi@rich.frb.org

Nonfarm Employment

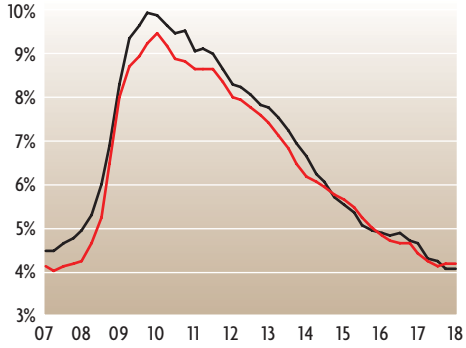
Change From Prior Year

Second Quarter 2007 – Second Quarter 2018



Unemployment Rate

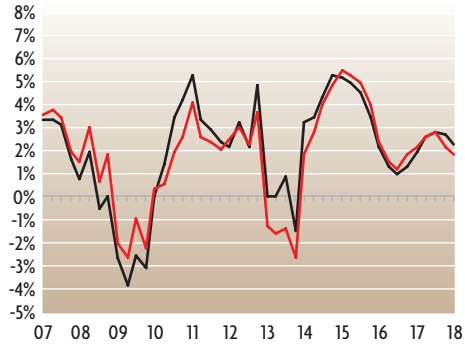
Second Quarter 2007 – Second Quarter 2018



Real Personal Income

Change From Prior Year

Second Quarter 2007 – Second Quarter 2018

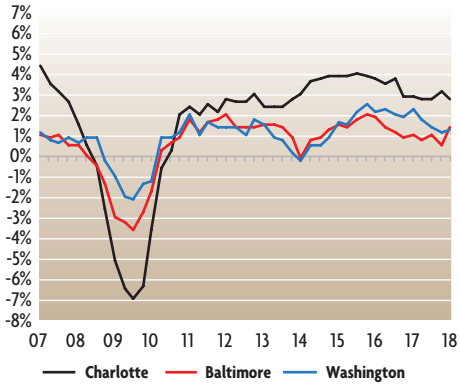


Fifth District — United States

Nonfarm Employment Major Metro Areas

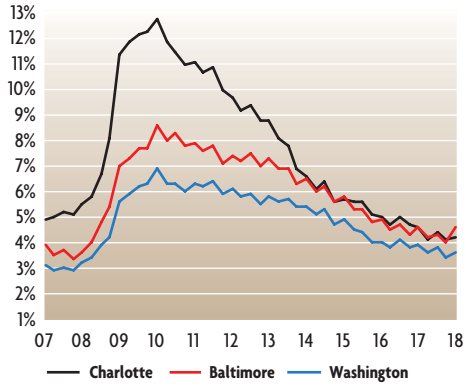
Change From Prior Year

Second Quarter 2007 – Second Quarter 2018



Unemployment Rate Major Metro Areas

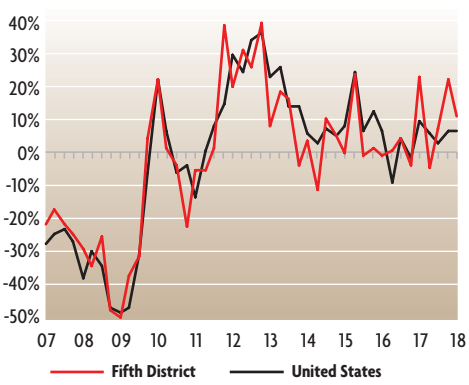
Second Quarter 2007 – Second Quarter 2018



New Housing Units

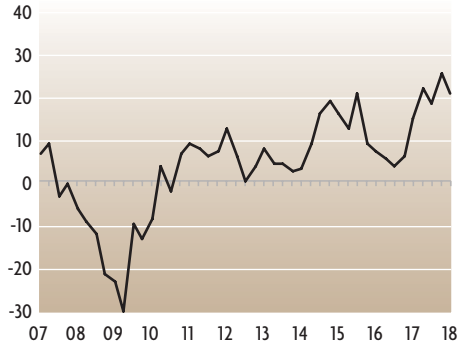
Change From Prior Year

Second Quarter 2007 – Second Quarter 2018



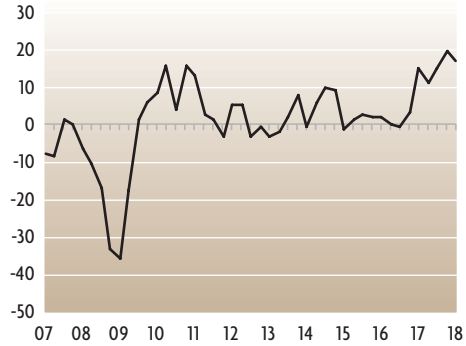
FRB—Richmond Services Revenues Index

Second Quarter 2007 – Second Quarter 2018



FRB—Richmond Manufacturing Composite Index

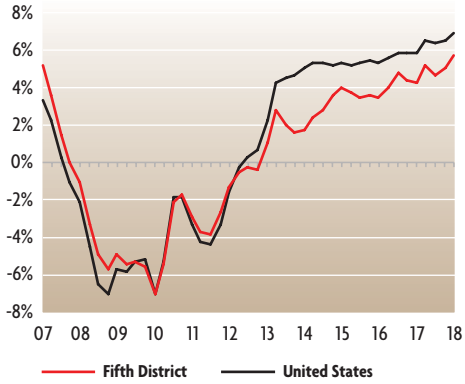
Second Quarter 2007 – Second Quarter 2018



House Prices

Change From Prior Year

Second Quarter 2007 – Second Quarter 2018



Metropolitan Area Data, Q2:18

	Washington, DC	Baltimore, MD	Hagerstown-Martinsburg, MD-WV
Nonfarm Employment (000s)	**2,726.9**	**1,426.2**	**106.0**
Q/Q Percent Change	1.6	2.5	2.1
Y/Y Percent Change	1.4	1.8	0.8
Unemployment Rate (%)	**3.4**	**4.2**	**4.4**
Q1:18	3.6	4.4	4.4
Q2:17	3.7	4.3	4.1
New Housing Units	**5,838**	**1,966**	**413**
Q/Q Percent Change	-9.4	-8.3	60.7
Y/Y Percent Change	-12.6	8.5	35.0

	Asheville, NC	Charlotte, NC	Durham, NC
Nonfarm Employment (000s)	**194.5**	**1,212.7**	**316.4**
Q/Q Percent Change	1.8	1.7	1.9
Y/Y Percent Change	2.0	2.8	1.5
Unemployment Rate (%)	**3.3**	**3.8**	**3.6**
Q1:18	3.4	4.2	3.9
Q2:17	3.6	4.2	3.9
New Housing Units	**814**	**5,988**	**2,023**
Q/Q Percent Change	2.3	-15.7	78.6
Y/Y Percent Change	4.4	41.9	69.9

	Greensboro-High Point, NC	Raleigh, NC	Wilmington, NC
Nonfarm Employment (000s)	**364.1**	**633.8**	**128.1**
Q/Q Percent Change	1.5	2.1	3.1
Y/Y Percent Change	1.1	3.1	1.0
Unemployment Rate (%)	**4.3**	**3.5**	**3.9**
Q1:18	4.6	3.9	4.1
Q2:17	4.7	3.9	4.2
New Housing Units	**656**	**4,421**	**556**
Q/Q Percent Change	15.3	1.3	5.7
Y/Y Percent Change	-19.2	20.5	8.6

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)	**268.1**	**360.0**	**399.3**
Q/Q Percent Change	1.5	2.1	1.3
Y/Y Percent Change	1.8	1.4	0.1
Unemployment Rate (%)	**3.9**	**2.8**	**3.2**
Q1:18	4.2	3.8	4.4
Q2:17	4.3	3.5	3.9
New Housing Units	**626**	**2,072**	**1,301**
Q/Q Percent Change	5.6	38.0	6.8
Y/Y Percent Change	2.5	25.0	-13.0

	Greenville, SC	Richmond, VA	Roanoke, VA
Nonfarm Employment (000s)	**424.2**	**680.3**	**161.8**
Q/Q Percent Change	1.3	2.0	2.0
Y/Y Percent Change	2.2	1.0	0.8
Unemployment Rate (%)	**2.9**	**3.2**	**3.1**
Q1:18	4.0	3.4	3.3
Q2:17	3.7	3.9	3.8
New Housing Units	**1,748**	**1,404**	**N/A**
Q/Q Percent Change	21.9	-15.8	N/A
Y/Y Percent Change	32.3	-9.2	N/A

	Virginia Beach-Norfolk, VA	Charleston, WV	Huntington, WV
Nonfarm Employment (000s)	**788.6**	**117.6**	**138.0**
Q/Q Percent Change	2.7	1.9	1.9
Y/Y Percent Change	0.4	0.3	-0.6
Unemployment Rate (%)	**3.3**	**5.2**	**5.5**
Q1:18	3.5	5.4	5.4
Q2:17	4.2	5.0	5.7
New Housing Units	**1,563**	**22**	**67**
Q/Q Percent Change	8.5	0.0	0.0
Y/Y Percent Change	-6.1	0.0	0.0

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OPINION

Does the Fed Need Room to Cut?

BY JOHN A. WEINBERG

The U.S. economy has been growing steadily since the end of the Great Recession, and during most of that period, the target rate set by the Federal Open Market Committee (FOMC) remained exceptionally low. It has only been in the past few years that the FOMC has gradually raised the target rate to its current range of 2.25 to 2.5 percent, which is still low by historical standards.

Some have criticized those increases, arguing that despite the unemployment rate falling to unusually low levels, signs of incipient inflation are hard to find. Why risk potentially dampening the recovery in the face of a nonexistent threat, they have asked.

Recently, however, a different argument has been made by some other critics of FOMC policy actions. The target rate is too low, they claim. But not for the reason you might initially expect — namely, that they *do* see inflation on the horizon and believe the FOMC should act more aggressively than it has. Rather, they say the FOMC effectively needs to put more ammunition into its toolkit than it currently has to fight the next recession.

The argument goes something like this. When the economy has contracted in the past, the target rate has been substantially higher than it currently stands. As a result, the FOMC had room to cut to help foster a recovery. Writing in the *Wall Street Journal*, Harvard economist Martin Feldstein noted that the United States has experienced 11 recessions since 1945. With the exception of the Great Recession, most of those have been short and shallow. The reason, according to Feldstein? "[B]ecause the Federal Reserve historically has responded to downturns by sharply reducing the fed-funds rate."

Feldstein is correct that the Fed has in the past cut the target rate substantially during recessions. For instance, in response to the slowdown of the early 2000s, the Fed cut the target rate from 6.5 percent in December 2000 to 1.75 percent by December 2001. The magnitude of this reduction, about 5 percentage points, is roughly on par with the Fed's response to previous post-World War II recessions. Such historical comparisons suggest that the Fed is at risk of not being able to cut enough should a recession occur in coming years.

But in the standard models used for assessing interest rate policy, it is the level of the real rate that matters, not the change in the rate per se. With inflation expectations anchored around 2 percent and an effective zero lower bound for the nominal rate, the lowest you can bring down the real rate to is about -2 percent — no matter how high the nominal rate is when the Fed begins to cut.

It's not plain that increasing the nominal rate would be meaningful in the way that Feldstein and others have suggested, because it's not plain that a real rate of -2 percent wouldn't bolster the macroeconomy in the case of a typical downturn. Furthermore, it's true that rates are low by historical standards for an economy that has been expanding for nearly a decade. But relatively low rates are consistent with relatively modest growth, and annual real economic growth has been about 2 percent since the end of the Great Recession, roughly 1 percentage point lower than the rest of the post-World War II period. In a lower growth environment, it seems reasonable to believe that the Fed would not have to lower rates as sharply as it has in the past to achieve a real rate that would help bring the economy out of recession.

In addition, research done by my Richmond Fed colleague Christian Matthes, in conjunction with Regis Barnichon of the San Francisco Fed, tells me that we should not underestimate the costs of raising the target rate. Their research suggests that contractionary monetary policy shocks raise unemployment more strongly than expansionary monetary policy shocks lower it. That means, if anything, the cost of pushing rates in an expansion a little higher than would otherwise be expected could be greater than any benefit of being able to take rates down a little bit more in a recession.

One objection proponents of the "room to cut" argument might raise is that the rate increases they advocate would not be shocks, what Matthes and Barnichon discuss, at least not in the way that term is generally used. That is, those increases would be following an expected path. But raising rates higher than you otherwise would based on current economic conditions and the near-term outlook in order to create room to cut could act as a shock.

All that said, we never really know with high precision what the "correct" target rate is for any given set of economic conditions, and small differences in rates appear to make relatively little difference most of the time. Also, the efficacy of monetary policy is strongly affected by whether it instills confidence. So it's possible that if the public believes that having room to cut will be important in a future downturn, there might be some benefit to a slightly higher rate in the present at relatively little cost. But I suspect that any such benefit wouldn't be significant. And, importantly, the types of increases that current room-to-cut advocates favor are far from small and could bring with them considerable costs. **EF**

John A. Weinberg is a policy advisor at the Federal Reserve Bank of Richmond.

Next Issue

Opportunity Zones

"Opportunity Zones," which were created by the 2017 Tax Cuts and Jobs Act, are intended to draw long-term investment to distressed areas. More than 800 have been designated in the Fifth District. Many policymakers and community leaders are excited about their potential, but others are worried about unintended consequences.

Initial Coin Offerings

In recent years, firms have raised billions of dollars in capital by selling digital tokens or coins. These initial coin offerings, or ICOs, may have some advantages over traditional corporate fundraising, but they also raise new questions for regulators.

Rural Hospitals

Hospitals in rural areas across the country, especially in more distressed rural areas, are closing at an increasing rate. What challenges do rural hospitals face that are different from those of hospitals elsewhere? And what do the closures mean for access to health care, economic activity, and upward mobility in the affected communities?

Federal Reserve

The Fed has a mandate to meet domestic economic goals of maximum employment and stable prices. But changes in U.S. monetary policy can have effects on other countries too. As financial markets become increasingly global, should central banks worry about monetary policy spillovers?

Economic History

The U.S. capital was originally Philadelphia, but Congress fled when angry Continental Army soldiers marched on Independence Hall in 1783 to demand back pay. Eventually, the capital was relocated to a special district carved from Virginia and Maryland. The move had massive long-run implications for the economic development of those two states.

Interview

Enrico Moretti of the University of California, Berkeley on why rich cities are becoming richer, the role of universities in a region's development, Amazon's HQ2 decision, and word-of-mouth about movies as a case study in information sharing.

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March 2019

The Persistence of Financial Distress

Household financial distress is pervasive. Is this pattern driven by a small share of individuals experiencing persistent distress, by the majority facing more occasional distress, or something in between? Recent research indicates that over a lifetime, financial distress is unlikely for most but very persistent for some. Models that account for the uncertain evolution of consumers' earnings over time and the availability of formal consumer bankruptcy cannot explain this pattern by themselves, but a model that also allows for informal default and variation in consumers' willingness to sacrifice future wealth for current spending can.

February 2019

Large Excess Reserves and the Relationship Between Money and Prices

January 2019

It's a Wonderful Loan: A Short History of Building and Loan Associations

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