FEDERAL RESERVE BANK OF RICHMOND

FIRST/SECOND QUARTER 2026

ECON FOCUS

Homegrown Health

Onshoring Pharma Production

AI Investment: Promises and Perils

The Rural Health and Employment Link

Interview with Ellen McGrattan

VOLUME 31 ■ NUMBER 1
FIRST/SECOND QUARTER 2026

ECON FOCUS

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

DIRECTOR OF RESEARCH
Anna Kovner

DIRECTOR OF PUBLICATIONS
Lisa Davis

EDITOR
Tim Sablik

STAFF WRITER
Matthew Wells

EDITORIAL ASSOCIATE
Katrina Mullen

CONTRIBUTORS
R. Andrew Bauer
Surekha Carpenter
Spencer Cooper-Ohm
Charles Gerena
Bethany Greene
Renee Haltom
Matthew Martin
Joseph Mengedoth
Stephanie Norris

DESIGN
Cynthia Cliff, LLC

PUBLISHED BY
the Federal Reserve Bank
of Richmond
P.O. Box 27622
Richmond, VA 23261
www.richmondfed.org
www.x.com/RichFedResearch

Subscriptions and additional copies: Available free of charge through our website at www.richmondfed.org/publications.

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

FEATURES

DEPARTMENTS

Cover: An employee at Merck's pharmaceutical facility in Elkton, Va. Credit: Merck & Co., Inc.

Scan here to subscribe to *Econ Focus*

Communities Light the Way

For much of 2025, businesses faced extraordinary uncertainty. Major policy changes — from tariffs to immigration to federal spending cuts — arrived alongside geopolitical shifts and rapid advancements in artificial intelligence (AI).

I likened running a business in such conditions to "driving through fog." With uncertainty high, business leaders didn't feel comfortable putting their foot on the gas nor slamming on the brakes. They didn't lean into investment, but they didn't necessarily cut back. They didn't hire, but they didn't fire either. They simply pulled over, turned on their hazards, and waited for clarity.

My job is to understand the economy, and I have a team to help me do it. But we too had to navigate with poor visibility. The official economic data, the headlights that often help illuminate our path, always have some drawbacks. They're backward-looking. They're revised multiple times. And they're aggregated, often missing underlying nuance.

Last year only brought more challenges. Response rates fell, and the recordlong government shutdown led to delayed data releases and, in some cases, skipped ones.

How did we proceed? We at the Richmond Fed relied on our low beams. We focused on what was directly in front of us: our communities.

The Richmond Fed has spent years building relationships with a wide network of business and community leaders in the Fifth District. Supplementing data with real-time intel from regional firms and individuals helps us fill gaps left by the data. You can read our most recent business insights from our outreach on page 3.

In 2025, we had nearly 4,000 touchpoints with contacts across the Fifth District. That included over 400 sit-down conversations with more than

300 unique firms, as well as dozens of roundtable discussions that brought in the public and nonprofit sector too.

Some of these conversations were regular updates to keep a general pulse on the economy. Others were specifically set up to better understand the implications of big changes in the most impacted industries.

Our surveys provided additional color. We received input from 233 manufacturing firms and 492 non-manufacturing firms over the course of the year via our monthly business surveys; all in all, that combined to provide us with a total of 3,200 responses. The CFO Survey, which we run quarterly with the Atlanta Fed and Duke University, received another 2,488 responses from 982 firms. Along with our regular survey questions, we wove in more topical questions throughout the year to gauge evolving conditions.

To illustrate, consider tariffs. After several years of elevated inflation, we wanted to quickly understand if the new rates would lead to a one-time price increase or enduring pressure on inflation. In the months following the bulk of the tariff announcements, we doubled outreach to manufacturing and retail firms. We leveraged research by one of our economists, Marina Azzimonti, on average effective tariffs rate by county to target our outreach geographically. We also embedded tariff-specific questions into our surveys.

It was clear early on that there would be a delay before tariff increases showed up in prices. That was thanks in part to a slew of strategies on the business side, including front-running tariffs, depleting pre-tariff inventory, and spreading out cost pass-through over time to make it less noticeable. This told us to be patient; the tariff impact was unlikely to show up immediately in prices, but that didn't mean it wasn't coming.

Most firms also told us they wanted to pass on all cost increases but did not feel they could. Consumers were pushing back on price increases, trading down to cheaper alternatives, or trading off between spending categories. This told us that consumers might help keep prices in line.

Tariffs had the potential to impact both sides of our dual mandate — not just price stability — but also maximum employment. If firms faced higher costs but were unable to raise prices in step, they could have turned to cutting labor. While firms repeatedly mentioned reducing headcount via attrition, few ever mentioned layoffs. This eased concerns about a coming spike in the unemployment rate.

Businesses highlighted rising productivity often; efficiency gains were helping them navigate tight margins. AI came up often as an area of exploration, but firms primarily credited process streamlining and non-AI automation for measurable improvement. In our December business surveys, firms told us employees were much more likely to test or use AI tools for specific tasks than to weave them into

wider operations. You can read more about AI investment on page 10.

The Washington, D.C., metro area took a disproportionate hit from federal spending and workforce cuts. Given they're a critical part of our Fifth District, we sought to understand the impact on the region. Along with one-on-one outreach to regional contacts, we organized roundtables with firms, federal contractors, and nonprofits to gauge the impact of changes. Doing so helped us understand where the pain points were. For example, professional services contractors in the Maryland portion of our district were hit much harder than defense-centric contractors in Virginia. In time, it also helped us differentiate between the feared policy impact and the realized one. There was real existential panic early on, but the local economy held up much better than initially feared. Even so, concern about growth and brain drain endured.

Early 2026 has already brought its fair share of developments. It looks like the fog may be here to stay. I'm grateful to be able to count on the generosity of our business and community partners, who I hope will continue to lend us their time and expertise. They continue to help light the way.

Tom Barkin
President and Chief Executive Officer

BY R. ANDREW BAUER, RENEE HALTOM, AND MATTHEW MARTIN

Tentative Momentum as Uncertainty Looms

Editor's Note: Business Insights highlights our outreach in the Richmond Fed's district. This on-the-ground sensing helps shape our understanding of the economy today and where it is headed.

After navigating 2025's challenges, firms entered 2026 with cautious optimism. They felt more confident in their own resilience and half joked that the new year could not possibly throw as many curve balls as the last one. Through mid-January, this optimism, however, had not translated into major hiring or investment decisions. While firms felt more upbeat, they were still hesitant. Of note, most of the outreach captured here occurred before the conflict with Iran began.

Firms sounded more positive last cycle than in the prior period, especially in Virginia and the Carolinas. This was true even for some sectors that had recently seen relatively weak sentiment, such as manufacturing. Amid the momentum, however, there was still an air of caution — a sense of testing the waters. For example, some manufacturing firms reported they were looking to hire, but more so for temp than full-time workers. Other firms noted they were finally restocking after drawing down pre-tariff inventory but doing so at conservative levels. A manufacturing executive expressed the cautious optimism sentiment well: "What I'm seeing in 2026 is encouraging, but I'm still going to be a bean counter." Firms that have faced stronger headwinds, such as those in the Washington, D.C., metro area, continued to report flat to slowing momentum. The conflict with Iran revived uncertainty as the full impact on energy, byproducts, shipping, and more remained to be seen.

Lower-income consumers continued to spend, but not with any ease. Luxury and high-end offerings still performed best, especially hotels. Middle- and lower-income individuals appeared stretched and highly price sensitive; they were still spending but trading down when possible or turning to alternative financing options, such as buy now, pay later. Should even higher gas prices materialize, they could stretch lower-income budgets further. One CEO shared a vivid image to illustrate the degree of strain already present: individuals at grocery stores with calculators.

An increasing number of firms expressed concern about losing customers. To defend market share, they were more conservative with price hikes. Some firms absorbed higher costs, while others skipped even regular price increases. More firms offered discounts and found ways to offer lower-cost options, such as removing features from a car or offering a cheaper pizza special with fewer toppings. Those that passed along costs did so with surgical precision, such as by targeting higher-end offerings only. They also closely tracked demand in response. If it were to fall, either due to the price hikes or an external factor such as climbing gas prices, those firms saw rolling back the price increases as an option.

Across the Fifth District, most firms were holding headcount flat or allowing it to drift down through attrition. Increasingly, however, turnover had fallen dramatically, making attrition a less useful lever for downsizing. Even so, layoffs remained rare. There were exceptions in the northern part of the Fifth District. A few firms in D.C., Maryland, and West Virginia felt layoffs were the only cost-cutting lever remaining; if margin pressure were to rise any further in the months to come, layoffs could be their only option.

Contrary to recent headlines, it was rare for Fifth District firms to say they had reduced staff due to artificial intelligence (AI). Some firms even noted that AI has proved most effective when combined with institutional knowledge, making retention key. On the other hand, AI use cases have been expanding rapidly, and the hopes of what it could do in the near future seemed to have helped many firms slow down hiring.

Many firms brought up productivity improvements to explain how they were navigating higher costs, weaker pricing power, and reduced headcount. Many efforts depended on technology, but not always AI, to speed up tasks or improve processes. Increasingly, firms have shared concrete outcomes, such as a quantified decrease of in-store labor hours resulting from a switch to digital price tags.

This cycle, we'll continue to monitor how conditions evolve on both sides of our mandate. Do firms retain their optimism despite renewed uncertainty? Are firms able to find additional ways to hike prices? Does any impetus emerge to tip firms out of the low-hire, low-fire place they've been in for the last year? And finally, to what extent does conflict abroad upend any of these answers? **EF**

This column was adapted from "What Businesses Are Saying: Tentative Momentum as Renewed Uncertainty Looms," Regional Matters, March 20, 2026.

The FUJIFILM Biotechnologies facility in Holly Springs, N.C.

IMAGE: FUJIFILM BIOTECHNOLOGIES

Pharmaceutical Onshoring in the Fifth District

As pharmaceutical manufacturers look to bring production back to the United States, the Fifth District is attracting billions of dollars in cutting-edge life sciences investments.

By Matthew Wells

Virginia's Shenandoah Valley is known for its bucolic landscape and proximity to some of the country's most scenic wilderness. Amid the farms and fields, adventurers on their way to Shenandoah National Park or the Blue Ridge Parkway might be unaware, however, of the valley's long history in producing some of the most innovative medicines and vaccines used to treat diseases and illnesses across the globe.

Last October, that reputation received a boost when pharmaceutical giant Merck announced plans to construct a $3 billion, 400,000-square-foot facility in Elkton, Va., in the heart of the valley. The facility will host the firm's Center of Excellence for Pharmaceutical Manufacturing, focusing on the testing and development of complex medicines and pharmaceutical ingredients, potentially creating over 500 full-time jobs and 8,000 construction jobs.

Merck has been producing medicines in the Shenandoah Valley for nearly 85 years, where it "has been a beacon of innovation in our proud legacy of delivering leading-edge science for patients," noted Sanat Chattopadhyay, executive vice president and president of Merck Manufacturing Division, in announcing the new facility. "We're proud to be part of the Elkton community, where generations have contributed to our important work with determination, accountability, teamwork and grit."

The project is part of a more than $70 billion multiyear expansion of Merck's U.S. manufacturing and research and development footprint, which reflects a broader effort by pharmaceutical firms and policymakers to bring production back to the United States after it shifted overseas in the late 2000s. In the last two decades, the growth of overseas production facilities has been substantial: Anaïs Galdin, an economist at Dartmouth College, noted in a recent working paper that in the early 2000s, only 15 percent of factories supplying the United States market were located overseas, but by 2020, that number had grown by more than 80 percent.

Problems with overseas supply chains have led to significant shortages, however, particularly for medicines needed in the wake of emergencies. Policymakers have also pointed to national security concerns that come with being reliant on China, a global competitor for these medicines, and reshoring efforts, which began prior to the COVID-19 pandemic, have since accelerated.

But the process of bringing pharmaceutical production back to the United States is not straightforward or risk-free. Onshore production is still subject to domestic supply shocks, which could translate into significant supply chain volatility. Labor dynamics, regulatory requirements, and firms' financial considerations are also complicating factors, even as federal and state governments take steps to ease the process and identify potential incentives.

Regions across the Fifth District, including the Shenandoah Valley and areas in and around Research Triangle Park in North Carolina, are responding to the onshoring push by creating or expanding the necessary infrastructure and building talent pipelines to position themselves as natural landing sites for these new investments.

Merck's Elkton expansion is just one of several such investments that pharmaceutical firms announced or started in 2025 alone. In March, Merck also opened a $1 billion vaccine production facility in Durham, N.C. That same month, Johnson & Johnson broke ground on a more than $2 billion plant in Wilson, N.C., where it will produce medicines for cancer, as well as immune and neurological diseases. In September, Eli Lilly and Company announced a $5 billion investment for a plant in Goochland County, Va., to develop ingredients to treat cancer and autoimmune diseases and for advanced therapies. Also in October, AstraZeneca announced a $4.5 billion project in Albemarle County, home to the University of Virginia, which will go toward the construction of two factories dedicated to medicines and therapies for cancer and chronic diseases. All told, pharmaceutical firms committed at least $23 billion in 2025 to solidify and expand their presence in the Fifth District.

THE DRIVE TO ONSHORE

Pharmaceutical supply chains have three phases. First is the production of raw materials, known as active pharmaceutical ingredients, or APIs. U.S. Pharmacopeia, a nonprofit that sets quality standards for pharmaceuticals and provides data and analysis on the supply of medicines, found in 2024 that over half of the APIs for prescription medicines in the United States came from India and the European Union (EU). APIs for generic drugs, which make up 90 percent of the United States' prescription drug volume, primarily came from India, while 43 percent of branded pharmaceutical APIs came from the EU. Only 12 percent of total API volume used in the United States was produced domestically.

The second phase is the manufacturing of the product in what is known as finished dosage form (FDF), which typically combines the APIs and any inactive ingredients into a deliverable form such as a pill or injectable. According to U.S. Pharmacopeia, the United States is the largest manufacturer of injectable FDFs, with 45 percent of global production volume, followed by the EU with 19 percent. For pills, India produces 60 percent of the global volume, with the United States second at 22 percent.

As with these two phases, the third phase, distribution, is spread all over the globe. This global supply chain reflects countries' different comparative advantages, as firms locate each step of the production process in countries or regions with plentiful labor and resources appropriate for that step. This abundance allows firms to reduce costs relative to regions where those inputs are not as plentiful. In the case of pharmaceuticals, firms realized that there was a large supply of workers abroad, particularly in places like India and China, and that APIs could be produced overseas more efficiently (that is, more cheaply) than in the United States. Similar to other industries, pharmaceutical firms also moved abroad to capitalize on lower land, energy, tax, and environmental and workplace safety compliance costs.

While firms benefitted from these reduced costs, there were trade-offs. Offshoring created unique supply chain vulnerabilities, sometimes leading to shortages of crucially needed medications in the United States. Global public health emergencies or natural disasters have caused surges in global demand, reducing availability in the United States for certain periods. Also, problems with overseas manufacturing quality have regularly constrained supply. The U.S. Food and Drug Administration (FDA), for example, found that 60 percent of all U.S. cases of supply interruption stemmed from quality control issues, which can range from errors in labeling to contaminated production processes. The COVID-19 pandemic also led countries like China to shutter manufacturing facilities, as well as the ports used to ship those products around the world. In 2016, an explosion in China at the only global production facility of APIs for a particular antibiotic led to worldwide shortages, and a 2007 shortage of an antibiotic made from pig intestines stemmed from an infectious disease that devastated China's pig herds.

In her research, Galdin found that drugs produced in Asia are 54 percent more likely to experience a shortage relative to those produced in the United States, and those shortages are an average of 130 days longer than those impacting medicines manufactured domestically.

These shortage problems are heightened when there are few sources of an API. Maria Nieradka, who studies life sciences supply chains at Gartner, a business research and advisory firm, notes that APIs are frequently the most expensive component of a drug, leading many manufacturers to rely on a single source to reduce costs.

Onshoring could mitigate some of these supply chain issues. The federal government has long expressed concerns over the role pharmaceutical access could play in contentious politics with other countries, especially China. Domestic manufacturing of those medicines would eliminate the possibility that other countries could use access to crucial treatments as leverage against the United States. Further, manufacturing entirely in the United States could make regulatory compliance within that jurisdiction easier, although that might mean new compliance issues in other countries should firms export domestically produced medicines abroad.

POLICY SUPPORT

Moving production back to the United States does not automatically alleviate the shortage problem, as it could even reduce supply diversification. John Murphy III, president and CEO of the Association for Accessible Medicines, a generic manufacturing advocacy group, argues the economics of

generic medicines (which, again, make up 90 percent of the U.S. market) are driven by efficiency, not redundancy.

This suggests domestic production could still be exposed to supply shocks. Murphy cites Hurricane Helene, which hit western North Carolina in 2024, as an example of how onshoring by itself might not solve supply chain issues. "Ninety percent of the U.S. supply of sterile saline produced domestically comes from one plant in western North Carolina. When it was knocked offline, we were stuck with no alternatives in the United States, and we had to import saline from China during that period," he recalls. "Onshoring without a plan to imbue resiliency and redundancy doesn't help us in the context of natural disasters or outbreaks." Domestic onshoring coupled with expanded production in countries that have good trade relations with the United States would be one potential way to increase redundancy.

Also, firms originally moved their manufacturing abroad to reduce costs, and those higher domestic costs still exist. Murphy notes that for generic manufacturers, those costs can be a strong deterrent to bringing production back onshore. Generics are priced low and produced in high volume, meaning thin profit margins with little left for new capital investments in the United States. "If I'm a generic manufacturer and I have a facility in Canada and a facility in India, and I'm producing at 100 percent capacity for the demand that I'm seeing in the global market, how do I justify a $1 billion facility in the United States to my board of directors or to a bank?" he says.

"Onshoring without a plan to imbue resiliency and redundancy doesn't help us in the context of natural disasters or outbreaks," says Murphy.

In Congressional testimony last June, Murphy called for the government to play a more active role in assisting firms to relocate onshore, drawing a parallel with the $280 billion CHIPS and Science Act of 2022, which boosted domestic semiconductor manufacturing by smoothing the permitting process, providing manufacturing incentives, and granting a tax credit for necessary capital expenses. (See "Semiconductor Industrial Policy and the Fifth District," *Econ Focus*, Third Quarter 2023.)

In response to a May 2025 executive order to encourage firms to onshore, the FDA developed the PreCheck Program, which would streamline the application process for the construction of new facilities. It would first institute more frequent communication with manufacturers at different stages of the process, including facility design, construction, and preproduction; and streamline development of approvals for the chemistry and development portions of the application.

Nieradka sees these moves as a step in the right direction, noting that they could make the process more predictable and improve the timing for bringing manufacturing back to the United States. "I think it's a big opportunity, and I think life science companies are going to be really attracted by it," she says.

The FDA also created a new pilot process, the Abbreviated New Drug Application, to expedite applications for drugs made with APIs sourced entirely in the United States. For this to work as intended, however, API suppliers would also have to move back to the United States. Because they operate on thin margins like pharmaceutical firms, convincing them to bring production onshore might also require additional government investments and incentives.

Tariff dynamics further complicate the effort to bring pharmaceutical production back to the United States. Despite early indications it intended to apply tariffs to both generic and brand name medicines made abroad, the Trump administration ultimately exempted generics. On the other hand, President Donald Trump announced a 100 percent tariff on brand name pharmaceutical imports unless the manufacturer was actively building capacity in the United States. The administration also carved out an exception for brand name medicines produced in the EU, setting that rate at 15 percent.

While many of the larger companies have been able to move quickly by expanding existing facilities, John Crowley, CEO of the Biotechnology Innovation Organization said that a 100 percent tariff "for any company without 'shovels in the ground' would devastate our nation's small and mid-sized biotechnology companies." Alex Schriver, senior vice president at the Pharmaceutical Research and Manufacturers of America also expressed concern, arguing "every dollar spent on tariffs is a dollar that cannot be invested in American manufacturing or the development of future treatments and cures." The pharmaceutical firms themselves have been vague about how tariffs influenced their plans, but they committed over $351 billion in new investments in the United States in 2025.

THE DRAW OF THE FIFTH DISTRICT

As firms return to the United States, they likely will look for locations where they can minimize costs, particularly those costs that led them to move much of their production abroad previously. This means finding sites with preexisting infrastructure and a talent pool suitable for pharmaceutical research and production. If firms do not have to start operations from scratch and can leverage plentiful training and education programs already in place, the move onshore may be more attractive.

Research Triangle Park (RTP) in North Carolina is one such location. In the 1940s, Duke University, the University of North Carolina, and North Carolina State University began engaging in collaborative research with private industries with a goal of keeping talent in the state. After a failed bid to attract Merck, leaders of the project adopted the RTP name in the 1950s and began with a technology-heavy focus that gradually expanded to include health and biological science firms.

That effort paid off, as RTP now has around 24,000 employees across more than 675 life science companies. This clustering increases efficiency by allowing firms to share infrastructure, and they are also able to share innovations and technology with lower transaction costs than if they were geographically dispersed.

Just as important, these firms can draw on a common

talent pool through initiatives they developed in partnership with the state's postsecondary education systems. Laura Rowley is the vice president for life sciences economic development with the North Carolina Biotechnology Center, a state-funded nonprofit company founded in 1984 to strengthen the research capacity of the state's universities and companies and encourage development of the biotech industry in North Carolina. "If companies have access to an established system for recruiting from community colleges and universities, it can be a lot easier than starting at zero in a new market," she says of firms looking to set up operations in the RTP. "Having more of that system structure, where you're able to benefit from shared services rather than isolated activities at each institution, can increase efficiencies."

NCBioImpact is another public-private partnership providing connectivity across biomanufacturing training programs throughout the University of North Carolina and the North Carolina Community College system. Its member institutions provide many of these hands-on programs, which are specifically tailored to companies' needs, from those that are well-established global brands to smaller firms that are just getting started.

These collaborative programs include a biomechatronics apprenticeship program recently launched at three NC Life Sciences Apprenticeship Consortium member companies — Eli Lilly, FUJIFILM Biotechnologies, and CSL Seqirus — to train students for industrial maintenance positions at these firms. Rowley explains that these positions, which are responsible for keeping the advanced equipment running at these facilities, don't require a degree, but do require a knowledge of biomanufacturing and skilled trades. This knowledge, which is gained through coursework at local community colleges, is then paired with on-the-job training at these facilities.

Virginia's Shenandoah Valley pharmaceutical footprint is not on the same scale as North Carolina's, but it shares some common traits that Merck has found attractive. Jay Langston is the executive director of the Shenandoah Valley Partnership, the region's economic development and marketing organization. He suggests that when Merck first established operations in the valley in 1941 to produce vitamins for soldiers, it was drawn to the location by its proximity to Washington, D.C. It also had existing transportation assets, such as rail lines and waterways, which were used to ship medicines needed for the war effort. It was also close to the University of Virginia. "It was a classic sort of economic development story in many ways," says Langston. "It was the right place, at the right time, with the right assets."

Those assets have only grown in the years since. Food and beverage manufacturing has also been a huge driver of the valley's economy, and Langston notes that the technology and skills necessary to produce food and pharmaceuticals are similar. In particular, the technology that drives both automation and sanitation are the same, and both industries rely on the same subcontractors to build their manufacturing infrastructure. "There's a lot of synonymous activities between those two industries, and I think that is what has helped Merck over time."

Merck has expanded its Elkton operations several times over the years. Its decision to commit to its 2019 expansion was made easier after it secured an agreement with nearby James Madison University and Blue Ridge Community College to develop programs geared toward ensuring a pipeline of local talent to meet its short- and long-term workforce needs. The programs include STEM opportunities for middle schoolers, high school and college internships, apprenticeships, associate and bachelor's degree courses and technical certificates, and professional development programs for current Merck employees. At the same time, however, Langston acknowledges these programs are not the whole story when it comes to creating that workforce; those workers also need somewhere to live. "We need to consider housing development as a foundational part of economic development," he says, noting that two local manufacturers recently could not hire key talent because of lack of housing. (See "What's Driving Rural Population Growth?" *Econ Focus*, Third Quarter 2025.)

MAKING THE MATH WORK

As these firms and others look to bring production back to the United States with the goal of a resilient and secure supply chain, they will be relying heavily on technological innovations allowing them to develop and manufacture medicines, vaccines, and other complex therapies more efficiently. Artificial intelligence could help determine which costly clinical trials are more likely to succeed, and in the context of manufacturing, identify potential issues before they occur, which can reduce a drug's time to market. Process innovations will also be key, such as the move to continuous manufacturing from traditional batch production, which will allow firms to check quality and consistency in real time rather than waiting for a batch to be completed.

For onshoring to make sense, manufacturers need to address ongoing cost concerns, particularly for much-needed generic medicines and API production. But if those costs can be overcome, states like North Carolina and Virginia, with their existing manufacturing and workforce pipelines dedicated to producing lifesaving medicines, may offer a launchpad for further domestic pharmaceutical production. **EF**

READINGS

Galdin, Anaïs. "Resilience of Global Supply Chains and Generic Drug Shortages." Working Paper, January 2026.

Mitchell, Andrew. "The Geography of Health: Onshoring Pharmaceutical Manufacturing to Address Supply Chain Challenges." *World Trade Review*, Sept. 27, 2024, vol. 23, no. 4, pp. 519-531.

Wosińska, Marta. "Will Pharmaceutical Tariffs Achieve Their Goals?" The Brookings Institution, March 27, 2025.

BY SPENCER COOPER-OHM

Responding to a Spouse's Lost Income

Yongsung Chang, Elin Halvorsen, and Marios Karabarbounis. "Spousal Labor Response to Primary Income: Identification and Heterogeneity." Federal Reserve Bank of Richmond Working Paper No. 25-13, November 2025.

Does a spouse increase the amount they work when their spouse loses income? Finding proof of what economists call the "added worker effect" has historically been difficult. It seems intuitive that people would be incentivized to balance out their spouse's wage loss to prevent large drops in household income, but economic work to date has found little evidence that this is the case.

There are several statistical challenges to estimating the added worker effect. Productivity changes are frequently correlated between spouses, which can bias results. For example, a recession where both spouses' wages decreased would falsely suggest a negative added worker effect if spousal correlation wasn't accounted for. Additionally, it is difficult to differentiate in the data between unexpected and long-term earnings losses that impact household consumption and anticipated short-term losses that do not, such as a primary earner resigning before starting a new job in a month. For these reasons, directly measuring the effect of job displacements on spousal income will likely lead to biased estimates.

A recent working paper by Marios Karabarbounis of the Richmond Fed and co-authors Yongsung Chang of Seoul National University and the Bank of Korea and Elin Halvorsen of Statistics Norway addressed these statistical issues using Norwegian data that matched households to the balance sheets of their employers. Instead of using a variable like job displacements, the authors used firm revenue as measured by sales data from workers' employers as an instrument. Changes to firm-specific sales that do not originate from a broad labor market recession affect worker income but are unrelated to job opportunities the spouse has if the couple does not share an employer, and the income loss caused by a firm's revenue change cannot be predicted in advance. Thus, measuring firm revenue let the researchers exclusively measure shocks to income that were unpredictable and uncorrelated between spouses, avoiding the identification challenges faced by past studies.

Karabarbounis, Chang, and Halvorsen determined that a company's ratio of sale revenue to assets is highly correlated with primary income earnings, indicating that the sales-to-revenue ratio is an effective instrument. Using that instrument, they found that a 10 percent decline in a family's primary income increased the spousal employment rate by 1.5 percentage points and spousal earnings by 4.2 percent.

The comprehensive nature of the dataset, which documents a household's total worldwide assets and demographic information, let the authors examine the added worker effect among specific groups. Among poor households, which are less equipped to weather income losses, a 10 percent primary income decline increased spousal earnings by 8.8 percent — more than twice the average. There were also substantial differences based on household age: A 10 percent primary income decline caused a 2.7 percentage point increase (80 percent larger than the average) in spousal employment in households between ages 25 and 39, while the same decline had no effect on households close to retirement.

The authors next constructed a model of households that work, consume, save, accumulate skills, and face spells of unemployment and lower wages that vary in time and intensity. They also added a government that provides welfare and social security funded by taxes. The model predicted an added worker effect that is extremely similar to the one found using variations in employer sales data: A 10 percent decline in the primary worker's earnings increased the spousal employment rate by 1.3 percentage points and spousal earnings by 2.7 percent.

Finally, the authors used this model to demonstrate the welfare effects of a temporary income reduction shock on a small percentage of the population. In this scenario, a welfare transfer (e.g., a temporary government relief program) would support the consumption of households but reduce spousal employment. The authors formulated an alternative fiscal assistance program with the goal of supporting consumption and employment at minimal cost. For those impacted by income reduction, receiving a transfer is contingent on being employed, and the transfer is doubled if both members of the household are employed. This policy, they found, would provide almost the same average welfare benefits as an unconditional transfer but require less government funding.

The finding of a small but substantial added worker effect that is compounded in poor and young households contrasts with most past studies. This is an especially notable result given that Norway has a relatively high spousal employment rate and generous welfare system — the effect could be even more pronounced in a country without these features. Taking this added worker effect into account could improve temporary relief programs, maintaining the welfare benefits they provide while lowering their cost. **EF**

BY CHARLES GERENA

Charting Career and Education Pathways

Every high school senior faces the same fateful question: "What am I going to do after graduation?" More questions may follow such as, "What do I want to do for a living? How do I get started in that career? Can I afford any more school?"

Asking the right questions and finding the answers is important not just for that student. A growing, productive economy needs people who are willing and able to invest in their career development and whose skills line up with the needs of the job market.

The Federal Reserve Bank of Richmond has a long history of researching human capital investment and the matching process in labor markets as part of the Federal Reserve's mandate to promote maximum sustainable employment. In the early 2010s, the Richmond Fed saw an opportunity to help support both components of a healthy job market by developing an online course that helps middle and high school students explore pathways for future work and education.

Students at Clover Hill High School in Chesterfield, Va., using Invest in What's Next.

Economic education and online learning experts at the Richmond Fed, the San Francisco Fed, and the St. Louis Fed developed "Invest in What's Next: Life After High School," rolling it out in phases between 2014 and 2018. In 2019, they added complementary classroom activities and a comprehensive guide for parents and other caregivers of children taking the course.

Students use Invest in What's Next to create a personalized career and education plan. Interactive exercises guide them through identifying jobs that match their interests and skills, estimating the income they will need to support their future lifestyle choices, and researching postsecondary school options and costs. The goal is to give students access to the information they need to make the best decisions for themselves, rather than to suggest a one-size-fits-all path.

Richmond Fed staff spread the word about Invest in What's Next through one-on-one interactions with teachers at conferences and professional development sessions. For example, the Richmond Fed partnered with the North Carolina Council on Economic Education in 2022 to show more than 200 teachers how the online course and supplementary materials could be used in their classrooms. In addition, the course is available on the Federal Reserve Education website, and the Reserve Banks of Atlanta, Cleveland, Dallas, San Francisco, and St. Louis leverage the course in their economic education programming.

This marketing has paid off: More than 82,000 students across the United States registered to take Invest in What's Next between 2015 and 2024. As a growing number of states require high school students to learn about personal finance, as well as to create a career plan for after high school, demand continues to grow for educational material like Invest in What's Next that meets such standards of learning.

When Invest in What's Next recently underwent some behind-the-scenes technical upgrades, it provided an opportunity to redevelop the content to better reflect the variety of education pathways available to students, according to Sarah Gunn, district outreach manager for community development at the Richmond Fed. "There was an opportunity to achieve that goal, as well as to add characters who are modeling the decision-making process as part of the course to help students who may not have access to those role models in their everyday lives."

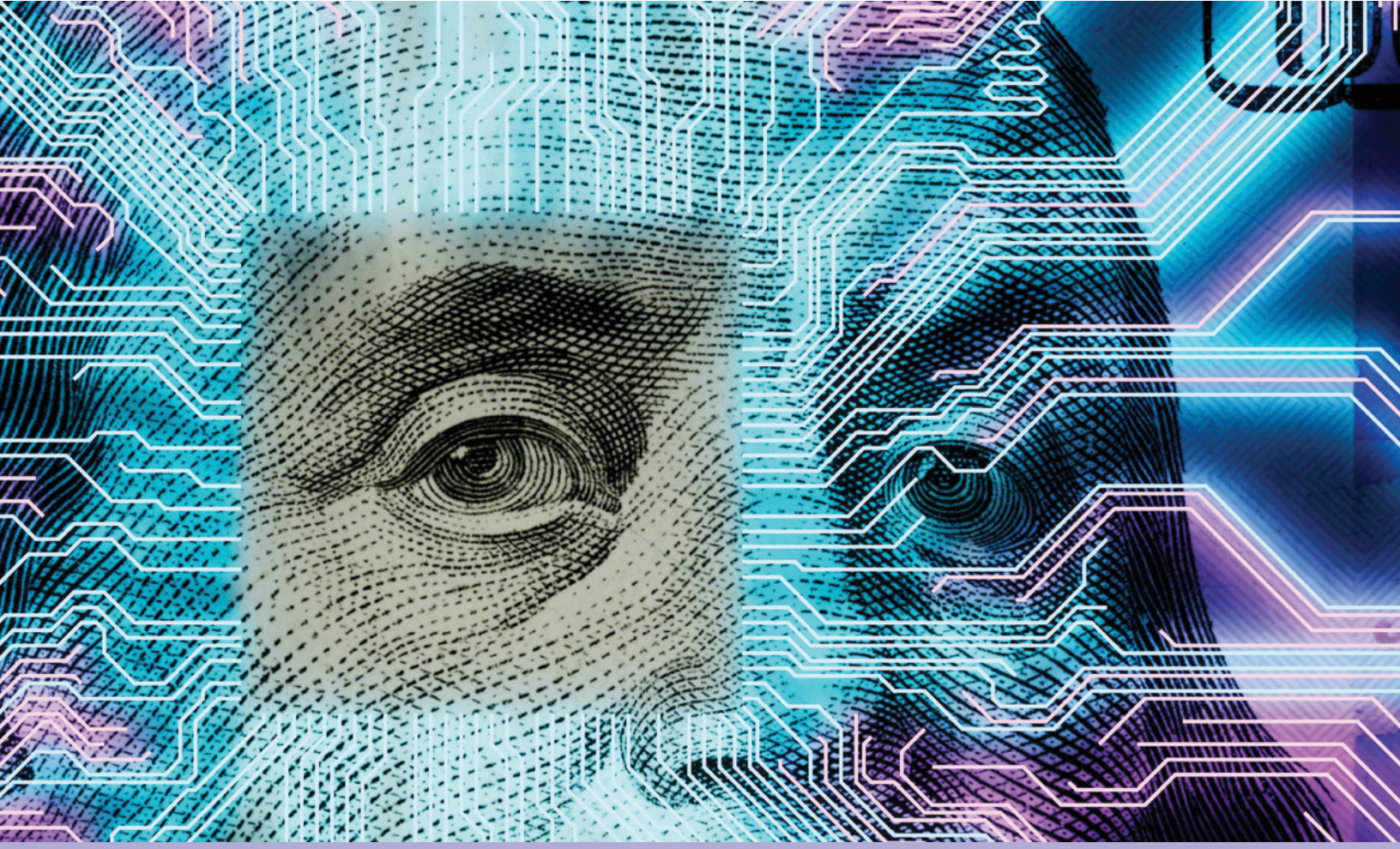
In addition to content revisions, the underlying platform changed in 2025 to make it easier for teachers to incorporate Invest in What's Next into their cirricula. Instead of existing on its own website, the course is now a module that can be imported into several types of learning management systems, including Blackboard, Brightspace, Canvas, D2L, Google Classroom, and Schoology.

"Teachers won't have to get permissions for students to use a different website because it's already part of the approved software package for their schools," explains Gunn. "The assessments can be automatically embedded into their gradebooks, so they are not having to pull information separately."

The Richmond Fed will continue to evolve Invest in What's Next and "the variety of ways that it can be leveraged to meet someone's needs," says Gunn, marketing the online course directly to teachers and school counselors as well as to school district leaders. It will also use Invest in What's Next as a part of a broader effort to work with business and education leaders in the Fifth District to improve awareness of the education and career pathways in their communities.

"We recognize that teachers and parents might have biases about what the correct path is," says Gunn. "By giving them access to information, we can really help them look at options they may not have considered before." **EF**

IMAGE: FEDERAL RESERVE BANK OF RICHMOND



Will AI Investments Pay Off?

Artificial intelligence is taking root in the workplace and beyond. How will it impact labor productivity and the wider economy?

By Matthew Wells

Artificial intelligence (AI) is having a moment. In its Real-Time Population Survey, the St. Louis Fed found that 55 percent of people in the United States reported using AI as of August 2025. Stanford University reported that businesses adopted AI at a 78 percent clip in 2024, up from 55 percent the year before. This adoption rate exceeds those of personal computers and the internet at comparable stages.

In response to this interest, companies are spending billions on the equipment, research and development, and infrastructure required to accommodate the demand from businesses seeking to capitalize on AI's anticipated advantages. In fact, AI investments are now a larger contributor to overall economic activity than consumer spending, accounting for nearly 92 percent of GDP growth in the first half of 2025, the most recent period for which data is available. AI investments have also surpassed GDP growth attributable to the dot-com boom more than 25 years ago, both in terms of levels and share of GDP.

The eventual role of AI in the economy is still unknown, however, as ultimate adoption and productivity patterns are still developing. In a February speech, Federal Reserve Gov. Michael Barr identified three possible outcomes: widespread adoption that is integrated into the broader economy with minimal displacement of human workers; rapid integration with widespread labor losses; and minimal adoption where returns on investments are unrealized, leading to painful economic hardship.

Economists are divided on which one of these scenarios — or others — will emerge. Massachusetts Institute of Technology (MIT) economist and Nobel laureate Daron Acemoglu suggested in a 2024 *Economic Policy* article that after considering the kinds of tasks current AI models are intended to perform, "it is difficult to arrive at very large macroeconomic gains" from AI. Conversely, Stanford University economist Erik Brynjolfsson, who studies the impact of new technology on labor markets and productivity, says, "We're creating the potential to have massive productivity gains and a lot more wealth."

THE INVESTMENT BOOM

Researchers from the St. Louis Fed break AI's contributions to GDP growth into four categories: information processing equipment, software, research and development, and data center construction. The Deutsche Bank Research Institute reported in December 2025 that capital expenditures on data centers alone may reach $4 trillion by 2030. A significant chunk of that investment is coming from well-established "big tech" firms, which are expected to collectively spend at least $650 billion on AI this year. These companies — for example, Amazon Web Services, Microsoft, Meta, Apple, and Alibaba (the online Chinese retailer) — are hyperscalers, building large-scale data centers allowing other businesses to access ever-increasing computing power and storage.

One focus of software investment is large language models, or LLMs. These models develop their capability by training on vast amounts of existing text, which are broken down into basic units called tokens. After exposure to everything from Shakespeare to computer code, they can use that knowledge to perform any number of tasks. AI champions note that frontier models are consistently outperforming earlier ones in reasoning and performance testing, and they are making major strides in visual reasoning, as well.

There are several factors that account for any improvement in the models' performance over time, and one of the primary ones is increasing computing scale. For example, Open AI's GPT-3 model included 175 billion parameters and was trained on 300 billion tokens at a cost of more than $4.6 million in June 2020. GPT-4, which was developed in 2023, had around 1.8 trillion parameters and was trained on about 13 trillion tokens at an estimated cost of $63 million. (OpenAI has not publicly released the size and architecture of current GPT-5 level models.)

THE MATTER OF FUNDING

For most of AI's growth, firms funded investments in data centers and chip and hardware production via cash flows from their operations. This meant they could afford to invest in further infrastructure development without the need for debt financing. But according to a January bulletin from the Bank for International Settlements, that pattern no longer holds, as capital expenditures fueled by the rush to build are now outpacing cash inflows.

To bridge that gap, AI firms are beginning to issue bonds: Oracle, Meta, Alphabet (Google's parent company), and Amazon issued nearly $90 billion worth of bonds in the last quarter of 2025 alone. Relative to cash transactions, bonds provide investors with additional flexibility, allowing them to structure financing plans to better align with the lifespan of AI infrastructure such as data centers and computing clusters.

Private equity is also emerging as a major AI investor. Morgan Stanley anticipates such firms will make about $800 billion in data center-focused investments by 2028. One of the earliest high-profile commitments of this kind materialized last summer, when Meta negotiated a $29 billion data center expansion, with $26 billion raised from debt and the remaining $3 billion in equity. Last October, xAI, Elon Musk's AI firm, also announced it was financing a $20 billion purchase of Nvidia chips through a combination of $7.5 billion in equity and up to $12.5 billion in debt.

If AI ends up delivering on its potential, the returns could justify any risk that might be involved with these deals. But if demand slows or technological advancements hit a wall, there's potential for firms to hold a lot of liabilities and assets that aren't worth the investment.

All this investment into a single sector is also creating spillover effects that impact the rest of the economy. While "crowding out" is a term that generally refers to situations where increased government spending or borrowing reduces private sector investments and limits overall economic growth, there is some evidence that spending on AI is having a similar effect.

In a 2025 paper, researchers from the Aalborg University Business School in Denmark and the Université de Strasbourg in France found that over the past decade, young AI researchers at top-tier academic institutions are migrating to corporate laboratories, leading to concerns about a "brain drain" in basic scientific research. Once at these private firms, the paper's authors found that these leading researchers produced less novel and impactful exploratory science.

The concerns extend beyond human capital investment to resources such as energy. Data center hotspots are experiencing unprecedented demand for energy and water, straining supply and disrupting utility markets. According to the Electric Power Research Institute, northern Virginia is the largest data center market in the world, with 13 percent of all global operational capacity and a quarter of capacity in the Americas. These data centers consumed over a quarter of Virginia's total electrical supply in 2023, with an annual consumption of 24 terawatts. (One terawatt-hour provides a year of electricity to around 93,000 homes.)

Finally, a range of consumer goods including computers, smart appliances, phones, cars, and televisions all use RAM (random-access memory) chips, and the demand for them from AI developers has skyrocketed. Consumer RAM prices recently spiked at over 170 percent year over year, as AI firms are outbidding all other customers. Some consumer electronics vendors have started pricing chips like fresh seafood at "market price" because prices change so frequently. Also, Micron Technology, one of the leading manufacturers of commercial RAM, recently announced it would be leaving the business entirely to focus on supplying its "larger, strategic customers in faster-growing segments."

IS PRODUCTIVITY INCREASING?

Because of AI's ability to perform certain tasks such as summarizing large amounts of information that previously had to be read by humans, writing thousands of lines of code in minutes, or automating complex workflows, proponents argue that an AI-fueled increase in business productivity has already begun. According to the Bureau of Labor Statistics, nonfarm business labor productivity measured in output per hour has increased since the beginning of AI adoption around 2023.

Economists are trying to get a handle on the question of how productivity is changing as AI begins to filter through the economy. In a National Bureau of Economic Research working paper from earlier this year, economists at eight institutions including Stanford University, the Atlanta Fed, the Bank of England, and the Deutsche Bundesbank surveyed nearly 6,000 CEOs, CFOs, and executives from firms of varying sizes and sectors across the United States, United Kingdom, Germany, and Australia. They found that while just under 70 percent of respondent firms reported using AI, over 90 percent indicated that it had no impact on employment, and 89 percent reported no effect on productivity.

The CFO Survey, which the Richmond Fed conducts in partnership with the Atlanta Fed and Duke University's Fuqua School of Business, found similar results at the end of 2025. Generally, surveyed firms reported no change or only minimal increases in productivity in the previous 12 months, and between 65 percent and 70 percent expected either no change or only modest increases in efficiency and productivity in the coming year.

Companies are already moving to do more with less. Goldman Sachs, for example, estimated that last year, firms collectively laid off 5,000 to 10,000 workers per month due to AI.

These data support the views of economists who expect AI to generate muted gains in productivity and growth. Acemoglu, in his 2024 paper, suggested that total factor productivity gains over the next 10 years will be less than 0.55 percent, even when accounting for exposure to AI and associated productivity improvements.

Late last year, a study by Alexander Arnon at the Wharton School of the University of Pennsylvania exhibited a bit more optimism than Acemoglu's prediction of half a percentage point increase in productivity over the next decade. That analysis estimated that AI will boost productivity and GDP by 1.5 percent by 2035, nearly 3 percent by 2055, and 3.7 percent by 2075.

Brynjolfsson, the Stanford University economist, is more optimistic still. He argues that based on historical patterns, for every $1 of investment in tangible technology — data center infrastructure, software — firms are likely to make $9 or $10 in intangible investments. During this period, workers are learning how to use new technology, and businesses are learning how it can help redesign organizational structures and processes. Most of these investments, however, do not show up as output; instead, measured productivity can be lower as resources are diverted to those investments, a phenomenon he calls the productivity J-curve. This finding may explain why The CFO Survey, as well as the larger cross-national firm study, did not show significant productivity gains: Many firms are still figuring out how AI can best benefit them, if at all. (For more on the role of intangible investments, see "Interview with Ellen McGrattan" on pp. 14-18.)

Brynjolfsson believes the economy may be at the point where these investments are beginning to pay off. In an article in the *Financial Times* from February, he estimated that U.S. productivity increased by about 2.7 percent, nearly double the 1.4 percent observed over the past decade and well ahead of Arnon's predicted pace. He pointed to the fact that total payroll growth for 2025 was recently revised downward by 403,000 jobs, while output growth remained strong. This high output with significantly lower input — only 181,000 total nonfarm jobs were added last year — signals strong productivity growth. (When the Bureau of Labor Statistics announced productivity growth in early March of this year, it was 2.8 percent in the fourth quarter and 2.2 percent for the full year.)

Additional research has shown that any returns to productivity from AI are likely to be heavily context-dependent: They depend on the work being done and who is using AI. For example, in a 2023 *Science* article, MIT economists Shakked Noy and Whitney Zhang conducted an online experiment, assigning occupation-specific tasks to 453 college-educated individuals and randomly giving half of them access to ChatGPT. Workers who had ChatGPT showed a substantial increase in productivity over the control group: Average time to complete tasks dropped by 40 percent and output quality increased by 18 percent. Those individuals were also twice as likely to report using ChatGPT in their actual job two weeks later, and still 1.6 times as likely after two months.

WINNERS AND LOSERS

In his February speech, Gov. Barr noted that history is full of innovations, from steam engines to personal computers, that eventually led to increases in productivity and living standards and lasting growth in both the labor market and the wider economy. But along the way, these new technologies led to significant dislocations for some workers, while others found themselves newly indispensable, creating both winners and losers.

Labor economists, policymakers, and, perhaps most acutely, workers are concerned about the winners and losers that will come from AI adoption. Companies are already moving to do more with less. Goldman Sachs, for example, estimated that last year, firms collectively laid off 5,000 to 10,000 workers per month due to AI. In February, Block, a financial technology company, laid off 4,000 workers with Jack Dorsey, the company's CEO and co-founder and former CEO of Twitter, suggesting in a letter to shareholders the move was because of gains from AI: "A significantly smaller team, using the tools we're building, can do more and do it better."

Researchers have tried to understand who is likely to be impacted by these moves by looking at the effects on junior and senior workers. In a recent working paper, Brynjolfsson, along with other Stanford University researchers Bharat Chandar and Ruyu Chen, found dislocation fell primarily on younger workers: They used payroll data from ADP to estimate that early career workers from ages 22 to 25 in

occupations that are highly exposed to AI experienced a 16 percent decline in employment relative to experienced workers, whose employment rates remained stable.

In another 2025 working paper, Harvard University researchers Seyed Hosseini and Guy Lichtinger looked at U.S. resume data for 62 million workers across 285,000 firms and found a sharp drop in junior-level employment after firms adopted AI technology, while senior-level employment remained mostly unchanged. Interestingly, the decline in junior workers came not through layoffs, but rather through slower hiring.

Despite these findings, junior and middle-aged workers still potentially have a significant role to play in driving productivity gains, according to Richmond Fed senior advisor Pierre-Daniel Sarte and research associate Jack Taylor. In a 2024 Economic Brief, they, along with former research associate Erin Henry, argued that productivity is driven more by the age composition of the workforce rather than technological innovation. They noted that while young workers may be the most adept at using new technologies, it takes time and experience to understand how to apply them in the workplace, meaning that productivity growth may pick up as those younger workers reach ages 35 to 44.

"The effects of AI on productivity are only as good as the knowledge and experience of the workers using it," say Sarte and Taylor. "The current composition of the workforce suggests higher productivity gains ahead as younger workers exposed to AI early continue to gain experience in the workplace."

Anthropic, one of the largest AI firms, released a study in March that provided additional insight into how AI might shape employment patterns. It identified some occupations most exposed to AI displacement, which included computer programmers, customer service representatives, data entry operators, and financial analysts. The report estimated that 75 percent of computer programmer tasks currently can be replaced by AI, and the technology can complete 67 percent of a data entry worker's tasks. In terms of the demographics of those most exposed to AI displacement, the study found they are more likely to be female, white, and more educated.

The report also claimed that as AI improves, it will be able to do many more tasks currently done by humans. For example, in occupations that require knowledge of computers and mathematics, Anthropic estimates that Claude, its LLM, can currently accomplish 33 percent of relevant tasks, but it anticipates that it could ultimately complete 94 percent.

If these numbers are true, it could be a good thing for growth, as firms achieve more productivity with lower costs. This would allow them to offer additional services and attract new customers. But as the case of Block suggests, it could also mean significant labor dislocation. The question then becomes one of how to best manage that.

This is an unsettling question, even for those who are enthusiastic about AI's revolutionary potential. "I think we should worry a lot, and we have a track record of blowing it in the past with globalization and other things, where we didn't handle some of these disruptions as well as we could have," says Brynjolfsson. "We're going to have to work hard with the right institutions, the right policies at the company level, and the right worker training."

HOW WILL IT ALL SHAKE OUT?

At the same time, it may not be a sure thing that widespread adoption will occur. In addition to the potential technical limitations described earlier, AI companies may encounter financial headwinds, governments may decide to erect regulatory or legal hurdles, and workers and possibly even consumers may resist in ways that make implementation more difficult.

If the massive investments currently being made ultimately do not pay off for these or any other reasons, the economic effects could be widespread. Investors might have to liquidate their assets, which could create a cycle that spreads to pension funds, mutual funds, insurance companies, and everyday investors. As capital flees the AI market, firms outside of the tech sector could also lose value, and if private equity firms which fund the data centers and other infrastructure were to also fail, the wider economy could also suffer significant losses.

How long AI's moment will last and what the world will look like as a result are open questions. For now, AI firms are betting on a bright future for the technology and working to lock in customers for the long haul through extensive marketing efforts. Anthropic spent at least $10 million for a pair of ads before and during this year's Super Bowl touting its product, and it is also partnering with colleges and students to establish brand ambassadors for Claude. Perplexity, another AI firm, recently gave a year of free access to students at colleges where at least 500 students signed up to use their AI platform. These investments pale in comparison to what it takes to build the AI infrastructure, but if those students become lifelong users when they enter the workforce, they may be the best dollars these firms will have spent. **EF**

READINGS

Brynjolfsson, Erik, Bharat Chandar, and Ruyu Chen. "Canaries in the Coal Mine? Six Facts about the Recent Employment Effects of Artificial Intelligence." Stanford Digital Economy Lab Working Paper, Nov. 13, 2025.

Hosseini, Seyed, and Guy Lichtinger. "Generative AI as Seniority-Biased Technological Change: Evidence from U.S. Résumé and Job Posting Data," Working Paper, Nov. 5, 2025.

Jurowetzki, Roman, Daniel Hain, Kevin Wirtz, and Stefano Bianchini. "The Private Sector Is Hoarding AI Researchers: What Implications for Science?" *AI & Society*, Feb. 1, 2025, vol. 40, pp. 4145-4152.

Noy, Shakked and Whitney Zhang. "Experimental Evidence on the Productivity Effects of Generative Artificial Intelligence." *Science*, July 13, 2023, vol. 381, no. 6654, pp. 187-192.

Ellen McGrattan

On measuring what businesses do, developing effective tax policy, and searching for answers beyond the lamppost.

Like many academic economists, Ellen McGrattan's gateway to the field was math.

"I was a math major in undergrad at Boston College, but I didn't see myself pursuing math as a profession," she says. "I tried an economics class, and I was instantly hooked."

The course opened her eyes to how the Greek letters in the equations she was familiar with could be used to shed light on real-world questions. She wanted to learn more about what life as a professional economist might be like, so she asked one of her professors to help her find a job as a research assistant during the summer after her junior year. He connected her with future Nobel-prize-winning economist William Nordhaus of Yale University. At the time, Nordhaus was surveying professional macroeconomic forecasters to learn more about their methods and how they modeled the economy. In addition to learning how to ask survey questions to get good responses, McGrattan learned about a relatively new economic theory that piqued her interest: rational expectations.

When she returned to Boston College for her senior year, she was determined to learn all she could about it. One of her professors gave her a copy of *Macroeconomic Theory* by Thomas Sargent and she read it cover to cover — twice. But despite her interest in Sargent's work, she was dissuaded from going to the University of Minnesota where he taught and instead elected to go to Stanford University for graduate school. As fate would have it, however, Sargent joined Stanford's Hoover Institution during her second year.

"Somehow the stars were aligned, and I was able to work with him after all," says McGrattan.

After graduation, she taught briefly at Duke University before beginning a long career as an economist at the Federal Reserve Bank of Minneapolis, where she remains a research consultant today. Around the same time, she also began teaching at the University of Minnesota, bringing her full circle with the theorists of rational expectations who had captured her attention as an undergraduate. She remains a professor there today, and since 2018, she has been a visiting fellow at the Hoover Institution.

Tim Sablik interviewed McGrattan in February.

IMAGE: COURTESY OF UNIVERSITY OF MINNESOTA

EF: What led you to your early research focus on trying to understand business cycles?

McGrattan: In grad school, I stumbled upon a paper by Finn Kydland and Ed Prescott that was game changing for me. Their revolutionary idea, which might sound obvious today, was that you should write down a theoretical model, simulate the data from it, and then match it up head to head with actual economic data. That wasn't what economists were doing at the time. They would write down a theoretical model, understand its inner workings, and then put up a big wall between the model and the empirical work. Kydland and Prescott decided to take all the warts and pimples of an economic model, make predictions based on it, and go head to head with the data. That was the first time I had ever seen that done. I think it is the right approach.

It just so happens that what they were analyzing in that paper was business cycles. They were trying to understand why we see very large movements in investments, employment, and GDP over the cycle. The standard answer at the time was that the source of fluctuations was monetary in nature. But when you put the Fed in any of the models being analyzed at the time, monetary shocks — or more generally financial disruptions — have little impact on the business cycle. So, Kydland and Prescott realized that adding the Fed wasn't the answer, and they pointed to something else: Total factor productivity (TFP).

Some might say that TFP is just a measure of our ignorance — it's what we don't understand. In some sense, I've been struggling with trying to look inside the black box of TFP all my career. My interest in business cycles partly stems from trying to measure what goes into TFP. That can be hard outside of big business cycle events like the Great Depression, the 2008 downturn, or the tech boom in the 1990s. If you just

have ups and downs of 3 percent to 5 percent, you can't get much precision from the data.

EF: How did the recession of 2008-2009 affect the way economists think about business cycles? Did it help you shine any light in the black box of TFP?

McGrattan: I think we're still pretty ignorant about it. I co-authored a paper at the time called "Business Cycle Accounting" with Varadarajan Chari and Patrick Kehoe mainly to critique Bernanke and Gertler, who studied the Great Depression. They argued that financial market disruptions amplify economic downturns. But when you build a prototype model, like the Bernanke and Gertler models, to explore this hypothesis, it has predictions that are grossly at odds with the data.

In the work with Chari and Kehoe, we developed a method that could point researchers to more promising theories. The main idea behind the method is to work with a prototype model and actual data and determine where exactly the model is off. We add "wedges" to get a perfect fit between model and data and then determine which of the wedges are quantitatively important — that helps us think about the factors our theories are missing.

For example, suppose you abstract from the fact that companies make certain kinds of investments in intellectual property. You only put physical capital in your model, and you just ignore R&D, customer bases, branding, and other intangible assets. Then TFP in your model would be picking up these investments. When you go to do tax policy analysis or monetary policy analysis, you would wrongly treat TFP as something that's exogenous when, in fact, it's investments that you don't measure. So, you need some theory for what the black box is.

EF: Is that what sparked your research interest in intangible investments?

McGrattan: Yeah, it goes back to Kydland and Prescott. What is TFP? It's what we don't know, it's the part that we need to fill in. It's not just some magic dust that's in the air. People are making investments and doing things better. If you were to travel back in time five decades, economic activity would look a lot different than it does today. But how do you model that? How do you think about that? Little by little, that's what we're trying to fill in. What is different about the economy now, and how does it need to be modeled?

"There are 40 million active businesses in the United States, and most have assets that we can't see."

EF: Why are intangible investments so difficult to measure? And has our ability to measure them improved?

McGrattan: If you buy, say, a computer, it has to be put on your balance sheet. But if you're a dentist and you spend time building your patient list, that's not put on any balance sheet. That patient list is the thing you sell when you retire or relocate, and that asset contributes to the value in the business, but we never see it until it gets sold or transferred somehow.

There are 40 million active businesses in the United States, and most have assets that we can't see. Assets like customer bases or trademarks — until there's a transaction, we can't see them. You might have a good accounting system that you developed within your business, or you're a chef and you have recipes, and we can only see those things if you trade them. But most ongoing businesses don't list these assets on a balance sheet, so we never get to see them. And that's why we need a theory to infer it.

I was just talking to a colleague who was trying to use Chinese data to measure TFP, and he was confused about what he was seeing. Some new firms had TFP that was negative, others had TFP that was really high, and it just didn't seem to make sense. I said, it doesn't make sense because measured TFP does not help you see what the businesses are actually doing. He said, no, I can, I've got all the balance sheets and the financial statements. Unfortunately, a lot of activity is not on balance sheets or financial statements.

It all ties back to work I was doing to measure movements in the economy over the business cycle, but now I would say the bigger issue is how to measure all activity in the U.S. economy.

EF: Have these types of intangible assets become more important as the U.S. economy has become less concentrated in manufacturing and more service-based over the last century?

McGrattan: The fact that the U.S. economy is now service-based presents a new measurement challenge. We do not have prices and quantities for many service activities. What's the price of a surgery? Did the surgeon sell a patient one heart surgery for a certain dollar amount? No, they only report how much they get paid for their job overall, and that's all we know.

So, with services, you're really kind of stuck. You can pretend you see prices, but it's getting murkier because we're moving away from buying just bundles of wheat or other physical goods. And even bundles of wheat are not so easy to price because there are different qualities of wheat.

I'm working on a book based on a lecture I gave in honor of Zvi Griliches. He was a Harvard economist famous for studying productivity by looking at the development of hybrid seeds. He was trying to understand the returns from investing in new technologies, and the numbers he came up with were very high — something like 700 percent returns to investments. You would think that if there were 700

percent returns to investing in hybrid seeds, everybody would be working on it. Why do anything else? So that seems implausible, and he persisted in trying to better understand the impact of technological change and R&D and how we measure it. He gave a presidential address to the American Economic Association in 1994, and that's what I used as the basis for my lecture and now the book I'm writing.

He thought that we just needed better data to measure these things. We have much better data today. We can look at IRS data, we can gather prices from the web, but a lot of activity remains hard to measure. There's never going to be a perfect administrative dataset where the government records every activity. So, you've got to use theoretical models, the observations you can get (which are imperfect), and do what Kydland and Prescott did years ago, which is to compare predictions of the model with what you can observe. That will reveal the underlying latent activities.

The mission is to use the data we can get to understand how people react to policy changes. You're never going to be able to write to everyone and ask, 'What did you do?' Some people try with surveys, but response rates are low, and respondents oftentimes do not know what is being asked.

EF: How is tax analysis influenced by intangible investments?

McGrattan: An important consideration is tax evasion because it is hard to know if losses are due to owners investing in their businesses or underreporting income and overreporting expenses. That's why my co-authors and I have been working with the IRS and using their data to help them think about tax evasion and policies that could be more effective at identifying the likelihood of tax evasion.

When a dentist goes to a conference in Hawaii, it might not be to build their patient list; it might be that they are attributing a personal expense to their business. We're trying to figure out the difference between consumption on the job and legitimate investments in the business. How do you distinguish those? How do you capitalize things that don't have a price? If you build something and you didn't pay anybody to do it, how do you give it a value? We can do that with something like a house. You can count the number of bedrooms, compare it to other houses in the neighborhood, and use hedonic pricing to infer valuations. But how do you do that with a dentist's patient list?

Ellen McGrattan

PRESENT POSITIONS

Professor, Department of Economics, University of Minnesota; Consultant, Federal Reserve Bank of Minneapolis; Visiting Fellow, Hoover Institution, Stanford University

SELECTED ADDITIONAL AFFILIATIONS

Member, Econometric Society Council, North America; President, Society for Economic Dynamics; Research Associate, National Bureau of Economic Research

EDUCATION

Ph.D. (1989), Stanford University; B.S. (1984), Boston College

EF: A recent paper where you used IRS data to shed new light on business activity was "On the Nature of Entrepreneurship," which you wrote with Anmol Bhandari, Tobey Kass, Thomas May, and Evan Schulz. What inspired you to look at that topic, and what did you find?

McGrattan: We wrote a proposal to the IRS on the topic of tax administration with businesses that are hard to observe because there's no third-party reporting for them. They claim investments on their taxes, but it's hard to see whether those are legitimate. We wanted to develop a theory, but our first step was to clear up some misconceptions in the economics literature based on surveys of entrepreneurs.

When we say entrepreneur, sometimes people may think about venture capitalists in Silicon Valley, but really, it's any business owner. They could be running a sole proprietorship or a corporation, but whatever the business is, they're not monitored by anyone.

Economists have made bold claims about entrepreneurs. For example, a common view based on survey data is that business owners choose to run a business even with low earnings because they want to be their own boss. But is it the case that they don't make money, or are they evading taxes? It could be that they just don't write down all the income they earn.

Researchers also have different ideas about how risky it is to start your own business. If the risks are high and the rewards are low, why would anybody run a business? Well, there are 40 million businesses in the United States. Why are they doing it?

Economists have written down models of business owners who are financially constrained, make less than they would if they were in paid employment, and face huge risks forcing them to keep their business small. They can never scale up, because if they tried, they would go under. They have no spouses — nobody else making income in the house. We wanted to see what the universe of businesses in the United States actually looks like. Then we can build theories about the income process and match those to what we see in the data. That doesn't get us all the way because we'd really like to know more, but it's a more accurate picture. Once you have that, you can think about how you might redesign tax administration and tax policy to either get better enforcement or remove loopholes.

EF: As you mentioned, many of the existing theories about entrepreneurs come from survey data. Surveys have been a staple source of data on the economy for a long time, but they have a lot of shortcomings. Do you have any thoughts on ways that surveys could be improved?

McGrattan: When we started working on that paper, we were originally using the Fed's Survey of Consumer Finances to think about modeling businesses and entrepreneurs, but we found that the public data and the aggregated survey data didn't match when comparing samples of private businesses. The original survey design is fine if respondents reference their tax returns when they answered questions, but in practice, that isn't always the case. When I worked for Bill Nordhaus, I learned that you have to ask people things they know the answer to because they're not going to go to their closet and dig out their tax return before taking the survey.

More importantly for us, survey questions can be unclear or misinterpreted by respondents. For example, the survey might ask if your business made income. If it didn't, the respondent might think they should put a zero for income earned, even if they in fact had a loss and therefore earned *negative* income. When you look at the survey data, it looks like there are no businesses with losses, but when you look at the IRS data, there are tons of people making losses. We found that the Survey of Consumer Finance was missing both the highest-earning and the largest-losing business owners.

When it comes to improving surveys that have been going on for a long time, there's a tension between making changes and maintaining consistency with past results.

EF: Can missing data not only skew policy prescriptions, but the direction of research as well?

McGrattan: Economists call this lamppost economics. You stand under the lamppost to look for your lost keys because that's where the light is, but the keys are in the dark. You can write models about things happening under the lamppost, but what we really want are the keys. I understand the incentives to write lamppost papers, especially for young economists just starting out. But there are a bunch of questions we need answers to, and we're only going to find those answers by leaving the lamppost.

You have to be disruptive. People like Ed Prescott, Tom Sargent, and Bob Lucas were disruptive. They were very disruptive. A lot of people at the time thought the new rational expectations wave was just mathy people who want to play with mathematical models. That wasn't it at all. They had to be disruptive and say, if we're going to learn anything, we have to challenge conventional wisdom.

"Don't start with data and try to identify a question; start with a question and identify what you need to reliably answer that question."

EF: Would that be your main advice to young economists: Be disruptive?

McGrattan: I always tell my students, ask a question first. Don't read what other people have done. Decide on your own, especially when you're writing your first paper. It doesn't matter if you reinvent the wheel. If you're thinking about things without having somebody else in your head, you're going to come to a new creative idea. It's fine after you've done something to compare yourself, because then you can really sharpen your results and make clear distinctions between what has been done in the past and what you did.

I really don't like it when students are told to replicate findings from papers because that makes them too comfortable working with models that have already been analyzed to death. They learn an existing model and just make a small tweak to it. Before they do anything, I would rather they think of a good and, as yet, unanswered question and how they would go about answering it.

Often when I ask my students what they're working on, they tell me they have some interesting data. That's putting the cart before the horse. Start with an idea and then go down the path that may lead you to that data but may not. Don't start with data and try to identify a question; start with a question and identify what you need to reliably answer that question.

EF: In the late 1990s and early 2000s, you wrote some papers with Ed Prescott examining the tech stock boom. Do you see any parallels between that period and AI investments today?

McGrattan: Ed and I had been working with a model that wasn't too different from Kydland and Prescott, but we realized that things were just way off. For instance, the Kydland-Prescott model is terrible at predicting movements in the stock market because it assumes that the value of the stock market will be equal to the value of capital used by corporations. But you can take data from the stock market and data from the Bureau of Economic Analysis, plot the two together, and they don't look anything alike. And during the tech boom, they started deviating a lot.

It led us to start thinking about what we were missing in our models, sort of like business cycle accounting. We eventually realized that the Bureau of Economic Analysis didn't include certain things like R&D and branding, which gets back to the missing intangible investments we talked about earlier.

If I were investigating AI investments today, which I think is a fascinating thing, I would look at the actual expenditures companies are making on data centers. There are only so many data centers you need, so what does our stock look like now, and is it continuing to grow? If there is overbuilding, are those data centers going to be used for other things?

There's also a fight over energy use, so I would be looking at energy prices. During the tech boom and bust, there was also a regulatory component. There were legal questions about who owned the fiber optic lines and who was going to get the cash flow from them.

My guess is that we're going to have a little bit of a shakeout with AI, but as we've been discussing, the big challenge is that we can't really see inside these companies.

EF: What are you working on now?

McGrattan: I am finally going to start looking at some of the IRS data related to the National Research Program. Under this program, the IRS randomly selects tax filers to undergo a thorough audit. It's very valuable to researchers because there is no selection bias, it is truly random. The entrepreneurship paper set us up well for this new project. We were able to develop models and match them up to the IRS data on business owners. Now, we're going to finally think about their behavior when it comes to tax administration. What happens after a business owner gets audited? Do they change anything? Do they close their business? Does it create any long-term deterrence? There's disagreement on that among economists.

In the past, researchers who studied these questions looked at household filings, so they only saw some aspects of the business. We're going to be looking directly at people who are running a business and filing taxes for a business. This will hopefully be informative about the models we wrote down. Do we have all the critical factors? How do we think about tax compliance in general?

What we know from past studies is that there's a lot of non-compliance, but it's very concentrated. I compare it to people who drive on the highway: Nobody goes under the speed limit, but there are some people who go 100 miles an hour. How can we predict ahead of time who's going to be going 100 miles an hour and who's going to be going a little over the speed limit?

There's a big debate between those who say tax non-compliance is concentrated at the top of the income distribution, and those who say it's present throughout the income distribution. It could be throughout the income distribution for business owners, who might make up a large share of the top income distribution overall. How much of that tax non-compliance is someone putting their trust funds in Bermuda versus a dentist writing down his trip to Hawaii as a business expense? It matters for policy.

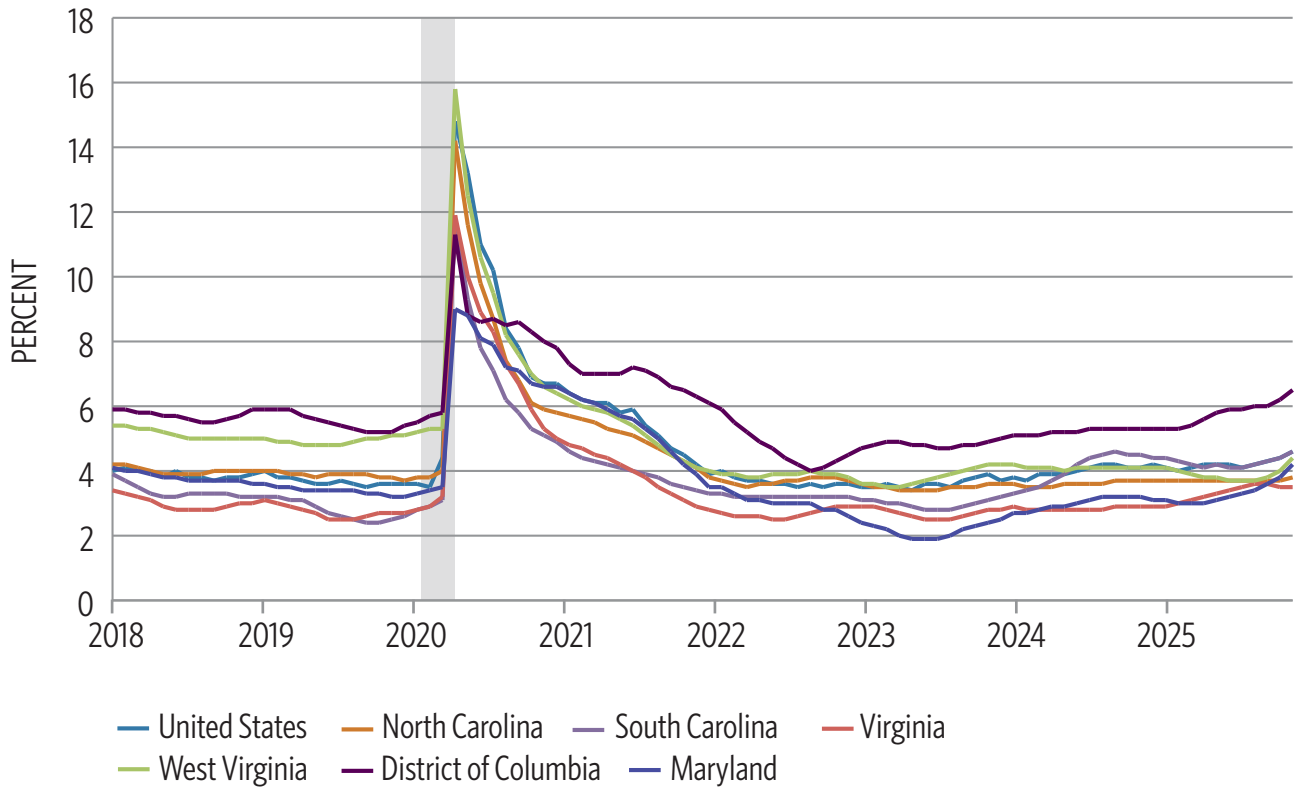
I think economists sometimes forget that the reason we develop new theory is to use it for policy. It's not to have something to talk about at cocktail parties. It's to help us do counterfactuals, welfare analysis, and assess changes in policy. **EF**

Labor Market Indicators

BY BETHANY GREENE AND JOSEPH MENGEDOTH

The Fifth District labor market weakened in December. Total payroll employment declined by 8,000, primarily due to job losses in trade, transportation, and utilities (-15,500 jobs). Only one state and the District of Columbia experienced net job gains during the month: North Carolina (3,300 jobs) and Washington, D.C. (500 jobs). Job losses were partially offset by gains in some industries. The largest monthly employment increases were in leisure and hospitality (5,000 jobs), financial activities (2,900 jobs), and government (2,900 jobs). Year over year, employment increased by 55,500 (0.3 percent), mostly due to gains in education and health services (55,200 jobs). Conversely, there were significant losses in government employment (-46,000 jobs). The Fifth District unemployment rate is currently 4.1 percent, having increased slightly by 0.1 percentage point during December.

Unemployment Rate, Seasonally Adjusted



NOTE: Shaded region indicates recession.
SOURCE: Bureau of Labor Statistics, Haver Analytics

The charts in this Regional Economic Snapshot display data through December 2025.
Scan the QR code or visit Regional Economic Snapshot on RichmondFed.org for the most recent data.

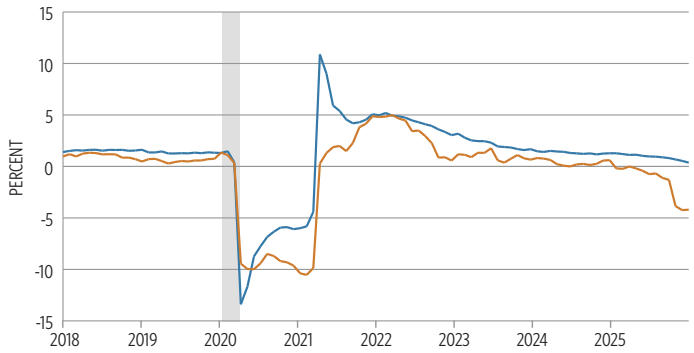
Fifth District Employment Growth

Total Nonfarm Employment Growth

Seasonally Adjusted, Year-over-Year Percent Change

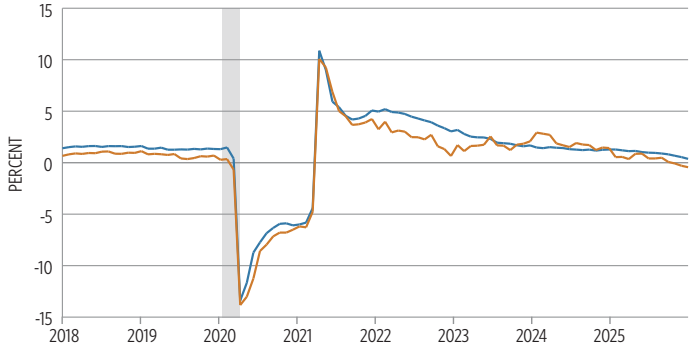
United States DC/State Indicates Recession

District of Columbia



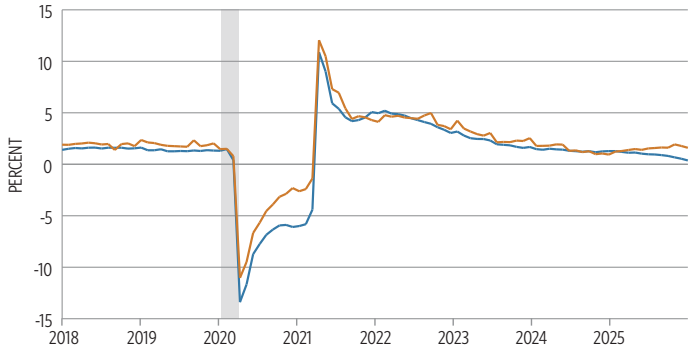
Reports on the District of Columbia's labor market were mixed in December. Payroll employment increased slightly and the labor force expanded, but the unemployment rate increased 0.2 percentage point to 6.7 percent. On a year-over-year basis, payroll employment in the District of Columbia declined by 32,400 jobs (4.2 percent), on net. Compared to last year, the most jobs were lost in government (24,900 jobs) and professional and business services (5,400 jobs).

Maryland



Maryland's labor market softened in December as payroll employment fell slightly, the labor force contracted, and the unemployment rate was unchanged at 4.2 percent. On a year-over-year basis, payroll employment in Maryland declined by 12,400 jobs (0.4 percent), on net. The most jobs were lost over the year in trade, transportation, and utilities (14,600 jobs), government (13,700 jobs), and professional and business services (2,100 jobs).

North Carolina



Significant job losses in North Carolina's trade, transportation, and utilities sector offset otherwise solid job growth in December. On an annual basis, payroll employment increased by 80,700 jobs (1.6 percent). Yearly job growth was led by education and health services (19,400 jobs), professional and business services (18,200 jobs), and construction (14,400 jobs). However, manufacturing employment declined by 7,200, and the information sector lost 700 jobs on a yearly basis.

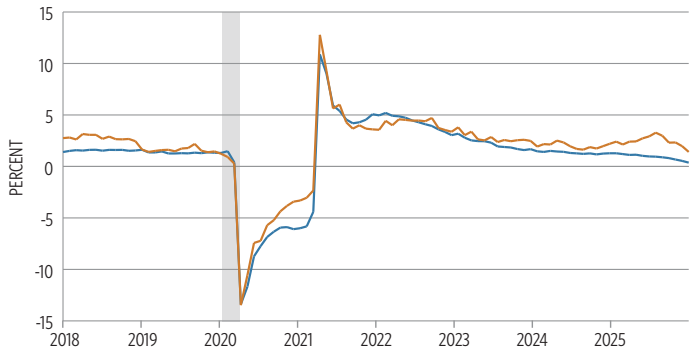
SOURCE: Bureau of Labor Statistics, Haver Analytics

Total Nonfarm Employment Growth

Seasonally Adjusted, Year-over-Year Percent Change

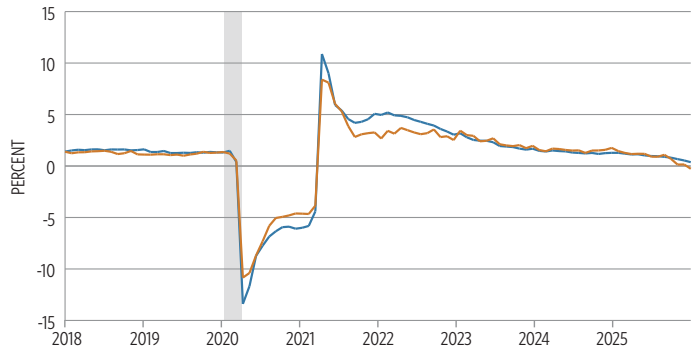
United States · State · Indicates Recession

South Carolina



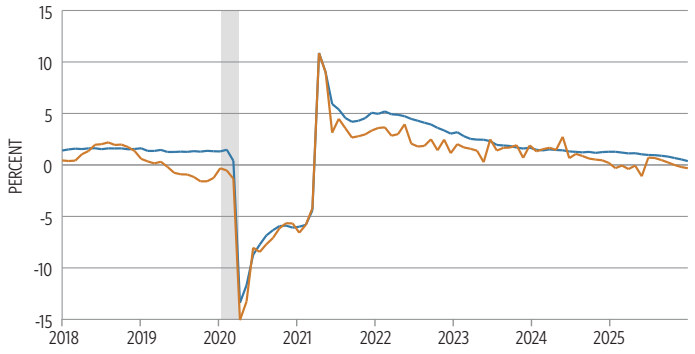
South Carolina's labor market conditions deteriorated in December due to sizable job losses in trade, transportation, and utilities, and professional and business services. The unemployment rate also increased to 4.8 percent. On a yearly basis, payroll employment grew by 33,600 jobs (1.4 percent). Annual job growth was led by leisure and hospitality (17,900 jobs) and education and health services (7,300 jobs). Manufacturing employment declined by 2,200 jobs on an annual basis.

Virginia



Virginia's labor market deteriorated slightly in December as payroll employment fell, the labor force contracted, and the unemployment rate ticked up to 3.6 percent. On a year-over-year basis, payroll employment in Virginia fell by 11,700 jobs (0.3 percent), on net. Since last December, the most jobs were lost in leisure and hospitality (12,400 jobs), government (9,700 jobs), and professional and business services (9,100 jobs).

West Virginia



West Virginia's labor market continued to contract in December as payroll employment declined and the unemployment rate moved higher. On a year-over-year basis, payroll employment in West Virginia declined by 2,300 jobs (0.3 percent), on net. Since last December, the most jobs were lost in leisure and hospitality (1,900 jobs), government (1,600 jobs), and trade, transportation, and utilities (1,500 jobs).

SOURCE: Bureau of Labor Statistics, Haver Analytics

BY TIM SABLIK AND MATTHEW WELLS

Remembering Bob Black and Al Broaddus

The Richmond Fed recently lost two of its former presidents: Robert (Bob) P. Black and John Alfred (Al) Broaddus. Their combined tenure at the Bank spanned 50 years, from 1954 when Black first arrived as a newly minted economist to Broaddus's retirement in 2004. Both leaders guided the Bank through turbulent economic times, from the Great Inflation of the 1970s and 1980s to the Great Moderation and dot-com boom and bust of the 1990s and early 2000s. Before serving as Bank presidents, both men were economists in the Bank's research department and helped shape its model of informing monetary policy through rigorous research and debate that continues today. As presidents, Black and Broaddus were both ardent supporters of monetary policies that prioritized stable prices and low inflation — positions that were tested and refined through their engagement with Richmond Fed economists.

Bob Black (left) and Al Broaddus (right). Credit: Federal Reserve Bank of Richmond

"Where Al and Bob were similar is that they both brought curiosity and real presence to every human interaction," says Jeffrey Lacker, who joined the Richmond Fed as an economist in 1989 and served as Bank president from 2004 to 2017 after Broaddus retired. "They treated every soul in the Bank with dignity and genuine interest. I think that played no small part in the strong culture in the Bank during the years they were in charge."

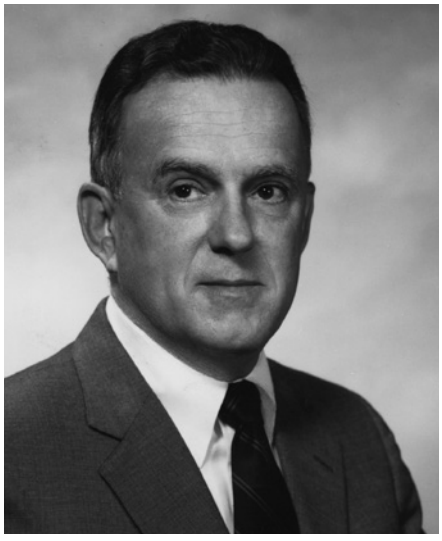
Black died on Dec. 5, 2024, and Broaddus died on Oct. 26, 2025.

BOB BLACK

Black was born in 1927 in Hickman, Ky., a small town of about 2,500 people and a single traffic light. He first moved to Virginia in 1945 to study at the University of Virginia. After one year at school, he was drafted into the U.S. Army and served in the infantry. After serving in the army for 18 months, he returned to the University of Virginia to earn his bachelor's degree, master's degree, and doctorate in economics. He completed his dissertation while he worked at the Richmond Fed in 1954. Black then taught for a year at the University of Tennessee before he returned to the Richmond Fed in 1956 as an economist.

"In my first year of graduate school, I planned to become a college professor," Black said in a 1992 Richmond Fed interview. "I was offered a job at the time by the Bank, but I felt obligated to teach. When I returned to the Bank a year later, I came with the idea of staying." He went on to become assistant vice president, vice president, and first vice president. In 1973, he became president of the Richmond Fed, the first economist to serve in that position.

Black's tenure as president began during a challenging time for the Fed. The United States had gone off the gold standard two years earlier, and inflation was on the rise. A proponent of the monetarist school of economic thought, which emphasizes the role of the supply of money in determining the price level, Black advocated for the Fed to do more to restore price stability and developed a reputation as an



"Bob was an inflation hawk's inflation hawk. He understood the great damage high inflation could do to our economy and society," said Broaddus.

"inflation hawk." In 1990, he testified in support of House Joint Resolution 409, which would have required the Fed to achieve an inflation rate of zero within five years of passage.

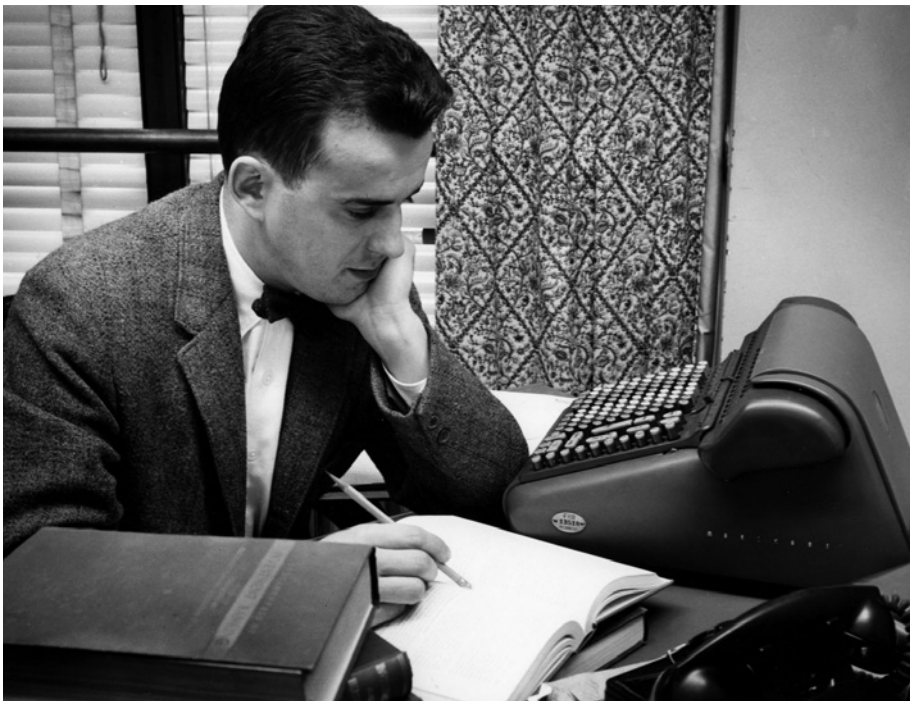
"Bob was an inflation hawk's inflation hawk," said Broaddus in a 2024 interview. "He understood the great damage high inflation could do to our economy and society by undermining the broader public's confidence in the Fed's commitment to protecting the purchasing power of everyday people's wages and savings."

At a time when it was still uncommon for Reserve Bank leaders to be economists, Black worked closely with the Richmond Fed's research department to develop his policy positions.

"Richmond was the first of the regional Banks to formulate its recommendations for monetary policy through open debate between the Bank president and all the economists in the research department," says Robert Hetzel, an economist at the Richmond Fed from 1975 to 2018.

In 1978, Black presided over the Richmond Fed's move to its current headquarters overlooking the James River. Upon his retirement in 1992, he was remembered as a kind and respectful leader who took great interest in the well-being of all Bank employees.

"He was committed to a personal touch in the Bank," says Lacker. "I recall how excited he was on my job interview visit to find out I was a fellow Kentuckian. That was just like him — taking delight in his humble country roots and finding a way to connect with a new acquaintance. I miss his eternal optimism and good cheer."



Black as a Richmond Fed economist in 1958, pictured here at his desk and in a meeting with other research department staff. (Black is third from the left.) Credit: Federal Reserve Bank of Richmond

AL BROADDUS

A Richmond, Va., native, Broaddus was born in 1939 and attended Thomas Jefferson High School before he earned a bachelor's degree in political science from Washington and Lee University in 1961. As a Fulbright Scholar in France the following year, he received a graduate degree from the Center for Advanced European Studies at the University of Strasbourg. Like Black, he served in the U.S. Army from 1962 to 1964 and then spent two years at the Defense Threat Reduction Agency before he completed his doctoral studies in economics at Indiana University in 1970. Broaddus returned to Richmond and began his career at the Richmond Fed that same year.

"I didn't really anticipate that I would come back [to Richmond]," Broaddus said in a 2004 *Econ Focus* (then called *Region Focus*) interview. As Broaddus prepared to graduate and enter the job market, one of his professors at Indiana, Elmus Wicker, connected him with James Parthemos, then the research director at the Richmond Fed. "Jim interviewed me and offered me a job. I had a lot of trouble getting comfortable with the idea of coming back home but, ultimately, this seemed to be the place where I would be happiest professionally."

Broaddus succeeded Parthemos as research director in 1985, a position he held until he succeeded Black as Bank president in 1993. During his tenure as research director, Broaddus and his team of economists, led by Marvin Goodfriend, advocated increased transparency by the Fed at a time when its deliberations and decisions were largely kept behind closed doors. They argued that clear signals from monetary policymakers regarding their goals and intentions would enhance credibility, showing the public their decisions were based on sound macroeconomic arguments free from political influence.

As president, he forcefully, but always respectfully, brought those calls for reform before the Federal Open Market Committee (FOMC), the body responsible for setting interest rates. Chief among those changes was the establishment of an explicit inflation target, which he argued would anchor expectations about the Federal Reserve's commitment to long-term price stability.

"Famously, two FOMC meetings in the mid-1990s featured organized debates on the subject of inflation targeting, with Al advocating in favor and then-Gov. Janet Yellen taking the skeptical view," recalls John Weinberg, former research director and policy

Broaddus judges student teams in the third annual Fed Challenge in 1997 in between Vice Chair of the Federal Reserve Alice Rivlin (left) and Director of the Division of Monetary Affairs and Secretary of the FOMC Donald Kohn (right). Credit: Federal Reserve Bank of Richmond

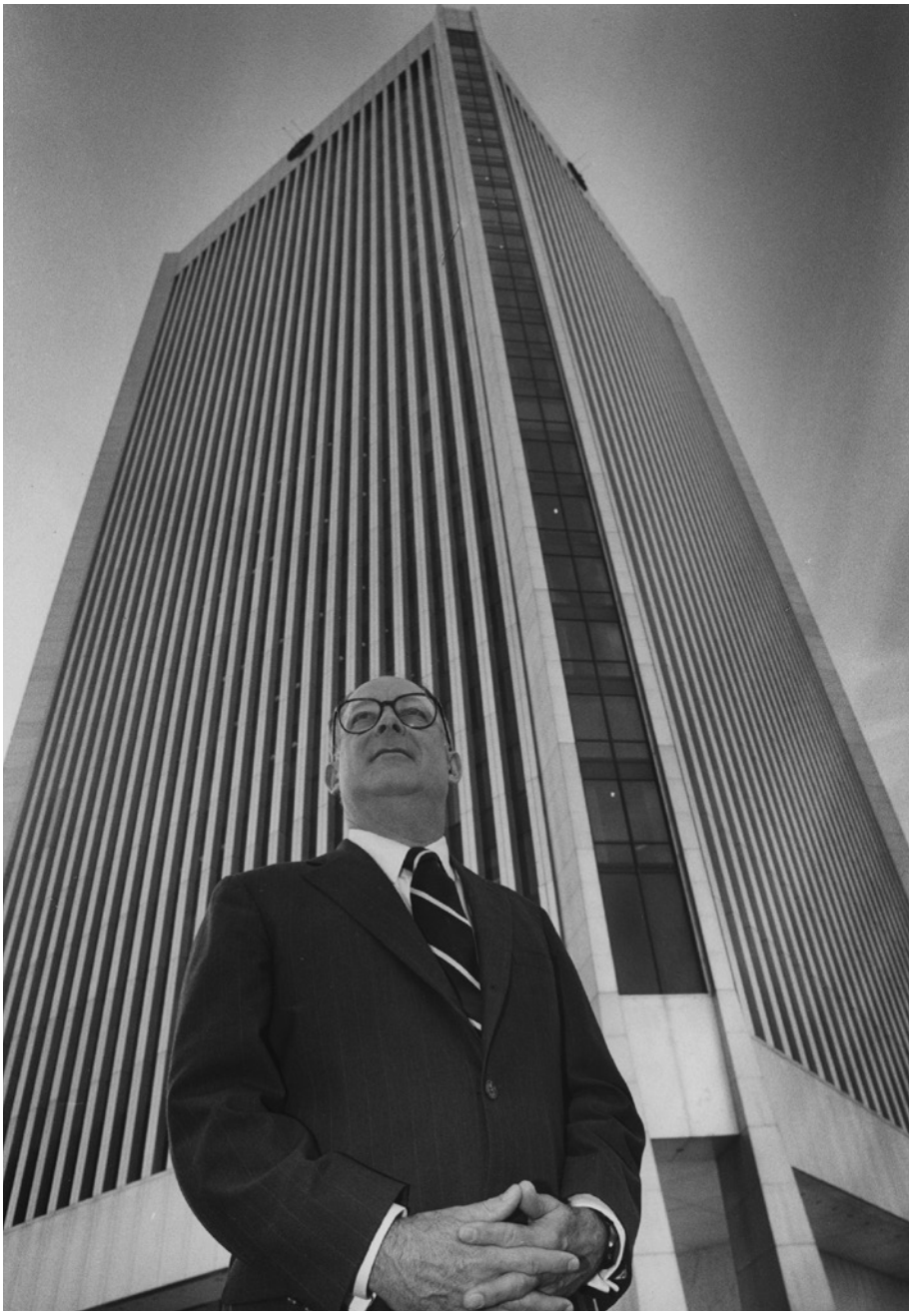
"Al was a prince: always positive, always gracious, determined to give credit to others, and relentlessly focused on the Bank's people and their personal success," says Barkin.

advisor at the Richmond Fed. "These debates were an important first step in the building of the consensus for the committee's eventual adoption of its 2 percent target."

Broaddus's principled argument gradually gained the support of his FOMC colleagues, and inflation targeting is now a fundamental principle of U.S. monetary policy. Broaddus also furthered Black's work in elevating the intellectual profile of the Richmond Fed's research department. He recruited high-caliber economists committed to cutting-edge research that shaped monetary policy debates, and he hired influential monetary and banking economists as consultants who helped create a rich environment that strengthened the Bank's reputation as a thought leader across the Federal Reserve System.

"I drafted a number of speeches for him over the years and found out what a stickler he was for good grammar and clear prose, which he attributed to the influence of his mother who taught high school English," says Lacker. "He took pains to sit down and explain to me what he changed in my drafts and why, which impressed me a great deal. I would have been content to get a copy back by interoffice mail with red marks all over it."

Broaddus was actively engaged in the civic life of Richmond, where he served on numerous boards, including the board of trustees of Virginia Commonwealth University, the American Civil War Center at Historic Tredegar, the Richmond Society for the Prevention of Cruelty to Animals, the Virginia Council on Economic Education, and the United Way of Greater Richmond & Petersburg.



Broaddus in front of the Richmond Fed's third and current headquarters, which opened in 1978.
Credit: Federal Reserve Bank of Richmond

"Al was a prince: always positive, always gracious, determined to give credit to others, and relentlessly focused on the Bank's people and their personal success," says current Richmond Fed President Tom Barkin. "I know longtime employees recall his steadfast leadership the morning of 9/11, as well as his affection for and service to his native Richmond. Many of us also enjoyed seeing Al here at the Bank after his retirement and around town. We will miss him, and Richmond will miss him." **EF**

BY SUREKHA CARPENTER, BETHANY GREENE, AND STEPHANIE NORRIS

Working on Wellness: The Rural Health and Employment Link

The relationship between health and employment is bidirectional and intensified by structural and geographic factors unique to rural communities.

Adverse health events can be disruptive to employment. A health shock, such as suffering an injury or developing a chronic condition, can limit an individual's ability to perform the physical and mental demands of work, potentially leading to lower productivity, fewer hours, and even a labor force exit. But the relationship between health and employment doesn't end there — employment outcomes also influence health outcomes. Employment is a key social determinant of health, supporting well-being through financial stability and access to employer-provided health insurance. For some, workplace conditions can increase individual exposure to health risks.

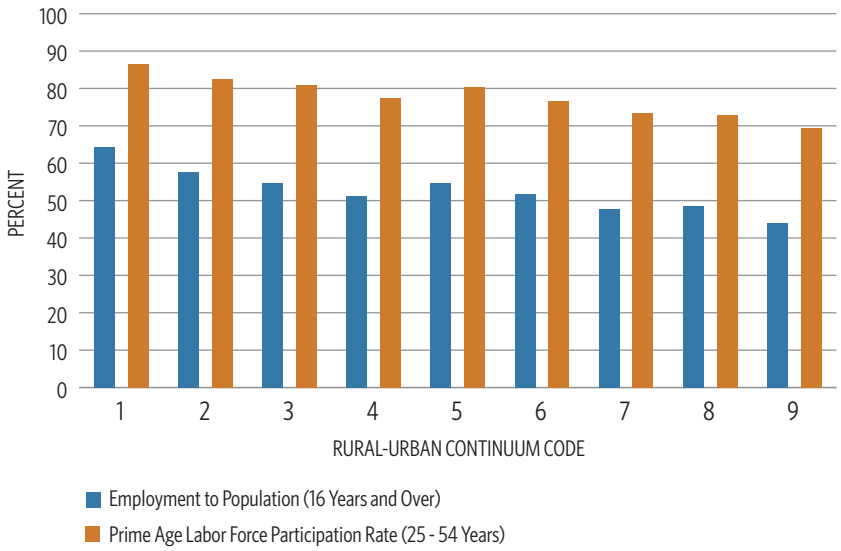
In the Fifth District, the disparity in employment outcomes along the rural-urban continuum may be in part due to variation in health outcomes. Rural counties in the Fifth District on average have lower employment-to-population ratios compared to their urban counterparts. Rural counties also have poorer health outcomes compared to urban areas, including higher incidence of some chronic conditions, lower scores on self-reported measures of health, and lower life expectancy. The relationship between poor health and employment outcomes is consistent across geographies. However, features of rural places in particular — like greater distances between residents and amenities, lower population density, and industry and occupation characteristics — may exacerbate the incidence and severity of adverse health events and compound the negative relationship between poor health and employment. Recognizing the inherent challenges rural areas might face, communities across the Fifth District are looking for ways to ensure that high-quality health care, including preventative care, is available to all residents.

RURAL-URBAN DISPARITIES IN EMPLOYMENT OUTCOMES

Differences in employment-to-population ratios and labor force participation rates along the rural-urban continuum suggest an underutilization of labor in some rural areas in the Fifth District. (See chart.) In 2023, the aggregated employment-to-population ratio was 64 percent in the most urban counties compared to 44 percent in the most rural counties in the District. The age composition of the population partially explains this difference, as rural areas tend to have a higher share of older adults who are more likely to be retired. But prime age (aged 25-54) labor force participation rates are also lower on average in rural counties. The prime age labor force participation rate varies from 87 percent for the most urban counties, to 69 percent for the most rural counties.

Labor Force Participation Declines With Rurality

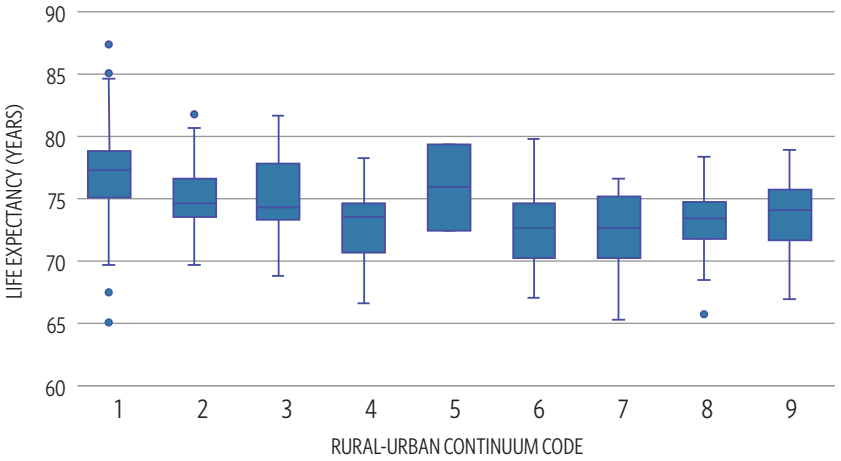
Labor statistics for Fifth District counties, 2023



NOTES: The Rural-Urban Continuum Codes denote how rural or urban a location is, with 1 being the most urban and 9 being the most rural. The Richmond Fed defines RUCCs 1-2 as urban and 3-9 as small towns or rural.
SOURCES: 2023 American Community Survey 5-Year Estimates, U.S. Department of Agriculture 2023 Rural-Urban Continuum Codes.

Life Expectancy Declines With Rurality

Life expectancy for Fifth District counties, 2025



NOTES: Boxes indicate first through the third quartiles. Whiskers show minimum and maximum values. Dots outside of the box-whisker indicate outliers. The Rural-Urban Continuum Codes denote how rural or urban a location is, with 1 being the most urban and 9 being the most rural. The Richmond Fed defines RUCCs 1-2 as urban and 3-9 as small towns or rural. There are only two counties in the Fifth District that are classified as a RUCC 5.

SOURCES: University of Wisconsin Population Health Institute, County Health Rankings & Roadmaps 2025 and U.S. Department of Agriculture 2023 Rural-Urban Continuum Codes.

Poorer health outcomes in rural areas may partially explain this difference. According to a 2024 article in *Systematic Reviews* of the impact of health shocks on labor supply by Ken Chamuva Shawa of the International Labour Organization, Bruce Hollingsworth of Lancaster University, and Eugenio Zucchelli of AESARA, there is overwhelming evidence that poor health has a negative impact on labor supply. A 2019 report from the Urban Institute showed that workers who experienced a health shock were nearly 22 percentage points more likely to exit the labor force compared with all workers. Additionally, worse employment outcomes in rural areas may reinforce poor health outcomes and create a negative feedback loop. A 2021 *American Journal of Industrial Medicine* article by Sharon Silver and Jia Li of the Centers for Disease Control and Prevention and Brian Quay of the National Institutes of Health suggested that negative health outcomes increase as unemployment duration increases.

RURAL-URBAN DISPARITIES IN HEALTH OUTCOMES

Health outcomes across several domains are worse in rural areas compared to their urban counterparts. One of the broadest measures of aggregate health at the regional level is life expectancy at birth, which measures the average lifespan of a newborn under current mortality conditions. In Fifth District states, median life expectancy is roughly three to four years higher in urban counties compared to the most rural counties. (See chart.) However, there is a wide distribution of outcomes within urban and rural spaces. Petersburg, Va., Hopewell, Va., and Chester County, S.C., severely underperform relative to the urban median, while some rural counties outperform their urban counterparts. Another indicator that provides a baseline measure of health from birth is low birth weight — a health metric associated with a variety of negative outcomes, including lower educational attainment, lower employment, and decreased earnings. The percentage of babies born with low birth weight is higher in rural Fifth District counties on average.

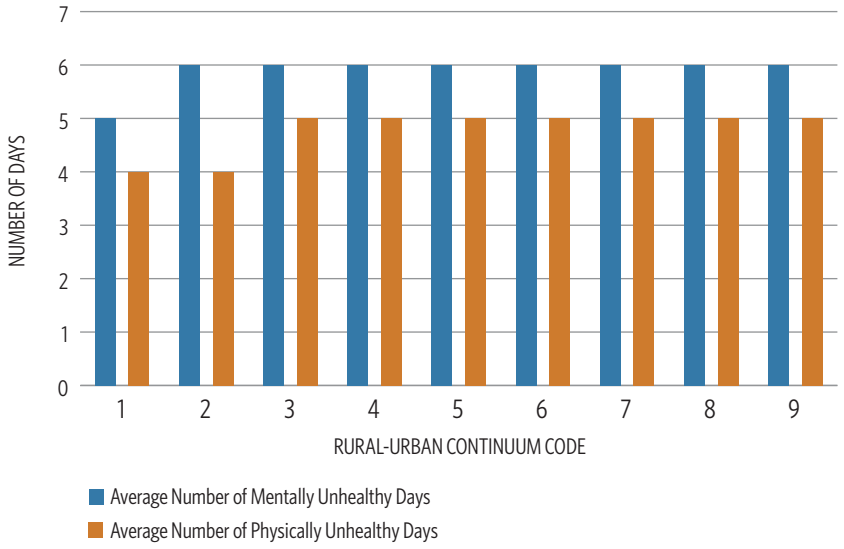
Self-reported healthy (or unhealthy) days are another health metric that reveal rural-urban health differences. This indicator measures the number of days that an individual reports feeling physically or mentally unwell during a 30-day period. Although self-reporting can be subjective, it is still a valuable tool for understanding how individuals view their health and ability to work. Indeed, the measure is connected to work: A 2004 article in the *American Journal of Epidemiology and Community Health* showed that counties with higher average unhealthy days also tend to have higher levels of unemployment, lower educational attainment, and higher prevalence of disability. In general, rural counties show slightly higher average unhealthy days compared to urban areas.

Why might rural counties have lower life expectancy or more unhealthy days? For one thing, chronic diseases like arthritis, hypertension, and diabetes are more prevalent in rural places, as are risk factors for long-term health problems, such as smoking and obesity. According to a 2017 report from the Centers for Disease Control and Prevention, accidental deaths from injuries, traffic accidents, and drug overdoses were 50 percent higher in rural areas. The opioid epidemic has been especially damaging to rural areas. A 2020 *Rural Sociology* article by David Peters and Andrew Hochstetler of Iowa State University, Shannon Monnat of Syracuse University, and Mark Berg of the University of Iowa found that most U.S. counties facing a prescription opioid epidemic are rural or nonmetropolitan. Rates of death due to opioid overdose are highest in the Appalachian region of the United States, and West Virginia consistently has the highest rate of opioid overdoses in the country.

Also, rates of self-reported disability are higher in many rural areas relative to urban areas. The Census Bureau's disability assessment covers a range of illnesses and conditions including vision, hearing, cognitive, independent living, ambulatory, and self-care limitations. In the Fifth District, self-reported rates of

Unhealthy Days Elevated in Rural Places

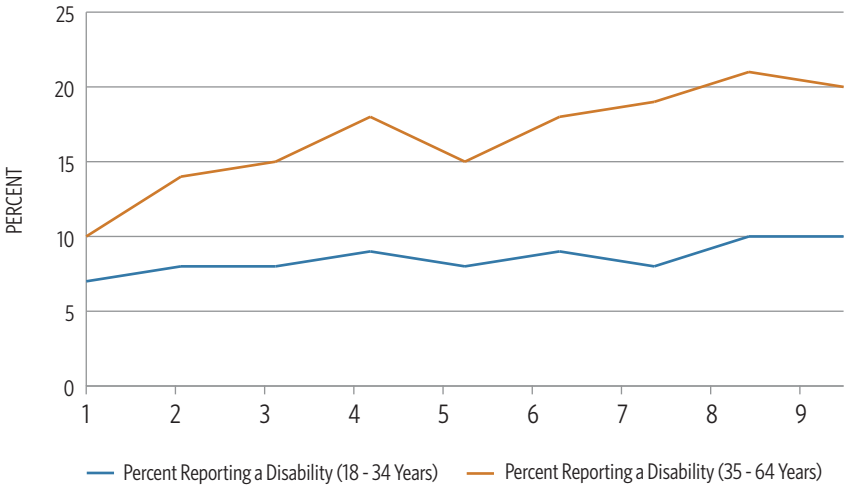
Average unhealthy days in a 30-day period for Fifth District counties, 2025



NOTES: The Rural-Urban Continuum Codes denote how rural or urban a location is, with 1 being the most urban and 9 being the most rural. The Richmond Fed defines RUCCs 1-2 as urban and 3-9 as small towns or rural.
SOURCES: University of Wisconsin Population Health Institute, County Health Rankings & Roadmaps 2025 and U.S. Department of Agriculture 2023 Rural-Urban Continuum Codes.

Disability Rates Increase With Age and Rurality

Self-reported disability rate by age group for Fifth District counties, 2023



NOTES: The Rural-Urban Continuum Codes denote how rural or urban a location is, with 1 being the most urban and 9 being the most rural. The Richmond Fed defines RUCCs 1-2 as urban and 3-9 as small towns or rural.
SOURCES: 2023 American Community Survey 5-Year Estimates, U.S. Department of Agriculture 2023 Rural-Urban Continuum Codes.

disability generally increase as rurality increases, though the largest disparity exists for older adults. (See charts.)

The link between a health shock and labor force exit often operates through the disability channel. Workers who suffer a health shock that creates work limitations can receive Social Security Disability Insurance (SSDI), which is typically available to workers with sufficient and recent work history. Some SSDI recipients also receive Supplemental Security Income (SSI), which is available to disabled persons of any age who either have no income or have limited financial resources. While some recipients of SSDI still work, there is evidence that the receipt of disability benefits provides a disincentive to work and tends to reduce labor supply. However, not all workers who exit the labor force due to a self-reported disability will pursue or qualify for federal benefits.

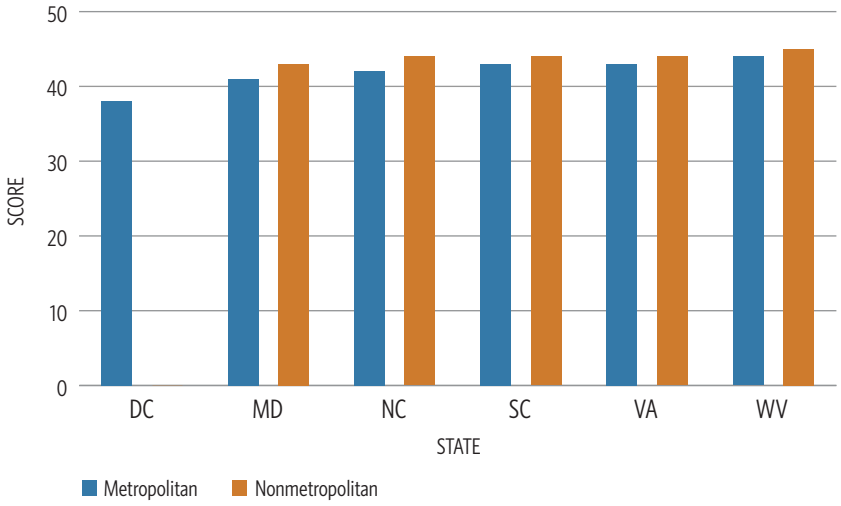
RURAL-SPECIFIC CHALLENGES AFFECTING HEALTH

There are rural-specific challenges that can increase the occurrence of adverse health events, hinder their effective treatment, and negatively impact employment outcomes.

In the Fifth District, rural counties have higher poverty rates compared to urban counties. According to 2020 American Community Survey data, 47 percent of Fifth District rural counties had poverty rates above 17 percent, compared to 15 percent in urban counties. Fewer financial resources limit access to medical care — including preventative and routine visits, access to medication and treatment for minor or chronic health conditions, and access to healthy food. Educational attainment is also lower in rural areas. Higher levels of education are correlated with increased likelihood of employment, higher income, and better health outcomes. Additionally, more educated workers may have an advantage after an adverse health event: In a 2016 article in *Labour Economics*, Matthew Hill of the University of Southern California, Nicole Maestas of Harvard University, and Kathleen Mullen of the RAND Corporation found that workers who have at least some college education

Workers in Nonmetropolitan Areas Perform More Physical Activities

Performing general physical activities average score



SOURCES: O*NET, OES, Authors' calculations.

are 8 percentage points to 12 percentage points more likely than those with less than a high school education to receive employer accommodations that allow them to remain on the job following the onset of a new disability.

Lower population densities in rural areas often mean that residents must travel longer distances to access care, especially for specialized services that are not offered at nearby rural hospitals. According to a 2021 policy brief from the Southwest Rural Health Research Center of Texas A&M University, rural residents traveled over twice the distance of urban residents to receive medical or dental care. Lack of transportation can result in delays in the diagnoses of serious medical conditions and inconsistent treatment for chronic conditions. Transportation barriers can also hinder behaviors that support a healthy lifestyle, such as healthy eating and physical activity. Research suggests that rural residents have less access to healthy food due to higher costs and greater distances to supermarkets. Also, environmental and infrastructure limitations of rural areas, including less walkability and fewer parks and recreational spaces, can limit opportunities for physical activity.

Some rural communities lack critical medical services, creating an environment where residents are medically underserved and may face higher rates of untreated chronic conditions and mortality. Also, rural hospitals face a unique set of financial challenges that impact their provision of services and increase their vulnerability to closure or consolidation. Low patient volumes compress margins, making it increasingly difficult to cover fixed costs. Additionally, due to higher levels of poverty and lower levels of employment in rural areas, a higher share of rural patients is either uninsured or using government health insurance programs like Medicaid and Medicare, resulting in lower reimbursement rates and higher instances of uncompensated care. According to a report from KFF, a nonprofit health policy organization, 44 percent of rural hospitals operated on negative margins in 2023, compared to 35 percent of urban hospitals.

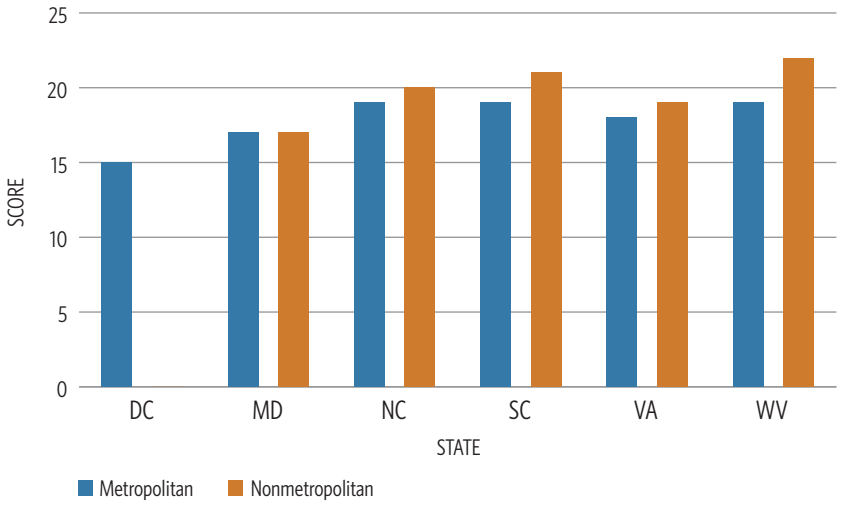
With these financial challenges, some rural hospitals face difficult choices regarding the continuation of critical services that are less profitable, such as maternal health. According to a 2024 JAMA article, the share of rural hospitals that had obstetrics services declined from 57 percent to 48 percent between 2010 and 2022. And for other hospitals, financial challenges led to closure. According to the UNC Chapel Hill Rural Health Research Program, 22 rural hospitals in the Fifth District closed over the last two decades. Also, a 2026 report from The Commonwealth Fund, a foundation that promote health care improvements, shows that more than 20 percent of rural hospitals are currently at risk of closure.

Difficulty recruiting and retaining health care workers in rural areas presents another major challenge for rural residents accessing medical care. Nearly all rural counties in the Fifth District are classified as full or partial Health Professional Shortage Areas for mental health care, primary care, or dental care. The shortage of primary care professionals is particularly concerning as they serve as an entry point to health care and are essential for administering preventative care. There is also evidence that health systems that prioritize primary care have healthier populations. According to the Rural Health Information Hub, there are 5.1 primary care physicians per 10,000 people in rural areas compared to 7.9 in urban areas. In addition to primary care physicians, rural areas also lack other vital health care professionals such as nurses, mental health professionals, and specialists.

Structural issues that are unique to rural areas such as fewer housing options than in cities, limited job opportunities for spouses, lack of child care facilities, and lower salaries create barriers to the recruitment and retention of health care professionals. Additionally, there is evidence that the COVID-19 pandemic exacerbated rural workforce challenges. A 2022 National Rural Health Association policy brief reported that during the pandemic, many health care workers left rural settings for higher-paying opportunities. Rural hospitals, which have fewer financial resources, were unable to counter these incentives and retain staff who were in high demand.

Workers in Nonmetropolitan Areas Have a Higher Exposure to Hazardous Work Conditions

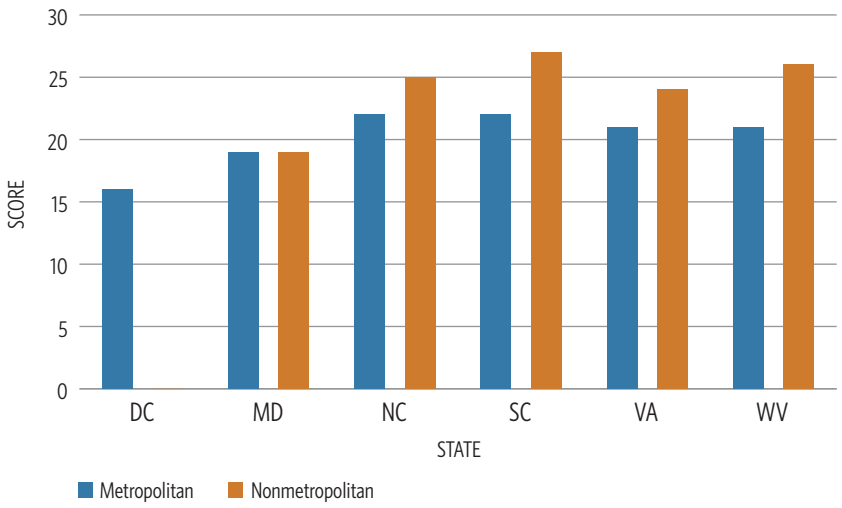
Exposure to hazardous conditions average score



SOURCES: O*NET, OES, Authors' calculations.

Workers in Nonmetropolitan Areas Have a Higher Exposure to Hazardous Equipment

Exposure to hazardous equipment average score



SOURCES: O*NET, OES, Authors' calculations.

RURAL LABOR MARKET CHARACTERISTICS

The industry and occupational composition of many rural areas may also create work barriers for individuals with certain health conditions. For example, jobs with significant physical requirements may not accommodate an individual who develops mobility issues associated with a chronic health condition or injury. In fact, data on work activities from the U.S. Department of Labor's Occupational Information Network (O*NET) reveal that workers in nonmetro areas are more likely to be employed in roles that require performing general physical activities. O*NET defines such jobs as those involving "activities that require considerable use of your arms and legs and moving your whole body, such as climbing, lifting, balancing, walking, stooping and handling materials." The O*NET database assigns each occupation a score out of 100 that reflects the degree to which physical or manual work activities are performed. For example, electrical power line installers have a score of 90, indicating a high degree of job-related physical activities, while web developers have a score of 6. Using the occupational composition of an area's employment, it is possible to calculate a weighted average score for general physical job activity by region.

In all Fifth District states, nonmetro regions had higher general physical activity scores, which reveals that there is a larger share of employment opportunities that require a high level of physical activity. (See chart on previous page.) Additionally, workers in rural areas have more exposure to hazardous conditions that can impact health outcomes. O*NET provides data that measure an occupation's level of exposure to hazardous equipment and hazardous conditions, which can be used to construct a weighted average score based on an area's occupational composition. The results show that workers in nonmetro areas are more exposed to hazardous work conditions and equipment, which may lead to a higher risk of injuries and other health conditions. (See charts.)

As previously mentioned, self-reported levels of disability are higher in rural areas compared to urban areas. There is a lack of data to show rural-urban differences in SSDI participation rates, but self-reported disability is associated with increased uptake of SSDI. While higher rates of self-reported

disability and potentially higher rates of SSDI reflect disparities in access to health care, they may also reflect disparities in accommodative job opportunities and higher occupational risk. A 2016 *Journal of Labor Economics* article by Andreas Mueller of the University of Zurich, Jesse Rothstein of the University of California, Berkeley, and Till von Wachter of the University of California Los Angeles showed that SSDI awards increase during recessions, an indication that uptake in disability insurance may also be tied to local labor market conditions. Rural workers may have an increased likelihood of receiving disability because their ability to find gainful employment or make an occupational shift may be more limited than urban workers. As such, SSDI may play a unique role as a source of income stability in rural labor markets where employment is more concentrated in physically demanding and hazardous roles and alternative job opportunities are more limited.

ADDRESSING RURAL HEALTH AND EMPLOYMENT CHALLENGES

Rural areas have concentrations of employment that are more likely to result in injury, and it can be difficult to access health care. So, what are rural communities doing to address those challenges? Many have focused on increasing access to health care and addressing the underlying determinants of health. To overcome shortages of health care facilities and the distances between residents and health amenities, many places have turned to improving telehealth services. While telehealth removes the physical distance between individuals and health care providers, it is dependent on the availability of reliable internet services. As such, broadband expansion and adoption, which many rural places have also struggled with, is a critical component to this solution. These improvements in technology infrastructure also serve to expand remote work access to rural residents, which can be accommodative for those with physically limiting health conditions.

Another way rural areas have addressed distance and transportation challenges is by offering flexible health care that meets people where they are. Marshall University's Marco Mobile Medicine, for example, aims to bring advanced health care, like early disease detection and chronic condition management, to rural West Virginians. Universities and community colleges often offer discounted or free services — achieving both workforce training for students and bridging the gap in health care access for low-income or uninsured residents.

Other solutions target the health and employment link explicitly. Employer-based initiatives, like on-site medical services for employees, can be especially valuable for hourly employees who otherwise would have to leave work and travel long distances to receive medical care.

Addressing the underlying determinants of health goes beyond just access. Some rural communities are now emphasizing multifaceted development aimed at improving the overall quality of a place, rather than addressing health in a vacuum. For example, Paola Gutiérrez of the South Carolina Office of Rural Health highlights initiatives that stress the importance of strengthening rural identity and promoting community engagement. Whether it be the creation of a new trail or a Main Street revitalization project, these initiatives help to retain residents by strengthening the physical and social environments that people live in. One example is the Purpose Built Communities model, which focuses on developing community vibrancy alongside economic vitality (including improving housing and education-to-career pathways).

The determinants of better health and employment outcomes are wide ranging and interconnected. Alongside immediate improvements to health care access, longer-term investments in quality of life can strengthen community morale, improve living environments, and make rural places attractive for residents and employers. **EF**

BY ANNA KOVNER

Resisting the Siren Song of Easy Money

In Homer's "The Odyssey," Odysseus has his crew tie him to the ship's mast to resist the deadly temptation of the sirens' song. A modern equivalent of this might be the screen time limits you set on your phone to help yourself limit any time wasting from scrolling in the face of algorithms designed to hold your attention. These are both examples of what economists call a commitment device — a mechanism by which you commit now to protect your future self from temptation. When the Federal Reserve was founded, the debate around its design took into account the siren song of easy money and enshrined central bank independence in its organization.

The economic theory of central bank autonomy is grounded in theories of time inconsistency. Politicians facing reelection may favor policies to boost short-term growth at the expense of long-term outcomes. Without a credible commitment to resist the temptation to stimulate the economy for short-term macroeconomic gains, the result is higher inflation. Even worse, the public understands what politicians want to do, and this expectation can lead to even higher inflation without sustainable real gains.

Knowing that they cannot commit to constraining their own behavior, politicians can create an institution that can take a long-term view, delegating monetary policy to an independent central bank insulated from short-term political pressures. The ability to commit to future behavior makes it possible to achieve outcomes that the elected government could not achieve on its own.

Theories supporting the independence of central banks are grounded in the real-world outcomes achieved by countries with these structures. Academic economists studied this topic in the 1990s by categorizing the independence of different central banks. They found that measures of independence are linked to lower inflation without worsening outcomes in the real economy (i.e., output and employment). It is true that the most spectacular cases of runaway inflation are found in developing countries with weak institutions, but evidence of this empirical relationship can also be found looking only within a sample of OECD nations. Greater independence, both legal and operational, delivers both lower inflation and reduced price volatility, on average.

Far from being undemocratic, U.S. central bank independence rests on deliberate choices made through the democratic process. In drafting the Federal Reserve Act of 1913, rather than concerns about elected politicians, Congress was perhaps equally or more concerned with ensuring regional independence and limiting the influence of the federal government, Wall Street investors, and banks. When the Federal Reserve System's governance was redesigned in the Banking Act of 1935, then-Fed Chair Marriner Eccles actually argued for the Fed and monetary policy to be controlled by the president. However, as the Act made its way through Congress, many experts and stakeholders who testified in Senate hearings argued for independence from the president, with then-Treasury Secretary Henry Morgenthau going so far as to argue that the Fed should be like the Supreme Court. This de jure (in law) setting for independent monetary policymaking also requires a de facto (in practice) exercise, which evolved over the next decades, notably with the Treasury-Fed Accord of 1951. Indeed, debates around central bank independence are hardly new. Evidence of this is the fact that there are over 100 references to the topic each decade since the 1990s in the hearings, speeches, and economics articles collected on the Federal Reserve Archival System for Economic Research (FRASER).

Independent monetary policy serves the American people by creating the conditions that support economic growth and stable prices.

Independence, of course, comes with commensurate responsibilities. The Federal Reserve Act directs the Fed to promote "maximum employment, stable prices, and moderate long-term interest rates." One of the advantages of independence is that a credible central bank has an easier time at balancing these goals, which may be in conflict if stimulating demand when seeking to increase employment leads to excess aggregate demand that pushes prices up. A credible central bank can convince businesses and consumers to expect stable prices, and those inflation expectations will anchor the responses in the economy to temporary shocks that lead to one-time price pressures or employment changes.

The Fed cannot rest on the democratic principles of its founding and goals set by politicians to act without accountability and transparency. The Fed serves the public by pursuing its assigned monetary policy goals transparently through regular reports to Congress, sharing its economic analysis and ideas with the public, and clear communication. Ultimately, independent monetary policy serves the American people by creating the conditions that support economic growth and stable prices. The best way to resist the siren song of easy money is to find ways to commit. **EF**

Anna Kovner is executive vice president and director of research at the Federal Reserve Bank of Richmond.

Federal Reserve Bank
of Richmond
P.O. Box 27622
Richmond, VA 23261
Change Service Requested

To subscribe or make subscription changes, please email us at research.publications@rich.frb.org.

Monthly Business Surveys and Business Attitudes on Pricing and Inflation

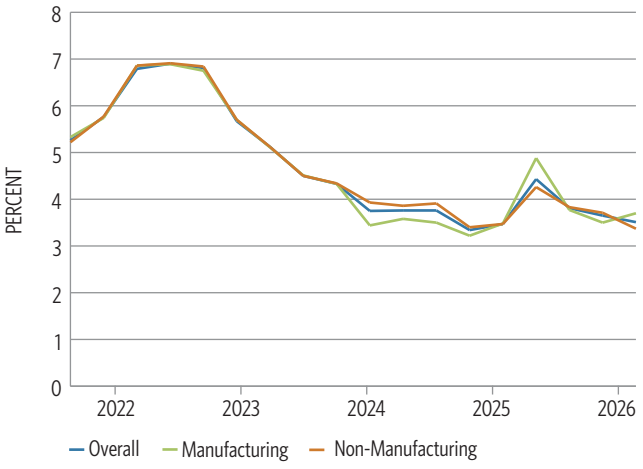
Each month, the Richmond Fed hears from business leaders who provide real-time insights that inform monetary policy and support economic decision-making. These surveys help us better understand current business activity and expected changes in economic conditions across the Fifth District.

At the start of each quarter, the Richmond Fed also includes the Business Attitudes on Pricing and Inflation (BAPI) questions to measure:

- One-year and five-year inflation expectations
- The extent to which firms follow aggregate inflation measures
- The importance of factors such as inflation, costs, and competitive pressures in pricing decisions

Expected CPI Growth in the Next 12 Months

Average Expected Percentage Growth



NOTE: This data has been winsorized at 2.5% and 97.5% to remove the potential influence of extreme values. Prior to April 2025 this question was only asked to respondents who follow inflation measures somewhat or very closely. Sample sizes: Overall n=170 to 270, Manufacturing n=50 to 155, Non-Manufacturing n=120 to 200.
SOURCE: Federal Reserve Bank of Richmond Monthly Business Surveys of Business Conditions

Scan here to learn more about our business surveys and BAPI.