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ECON FOCUS

APPRENTICESHIPS: Training Tomorrow's Rural Workers

Economics of Aging in Place

The Bank of North America

Interview with Christiane Baumeister

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DIRECTOR OF RESEARCH
Anna Kovner

DIRECTOR OF PUBLICATIONS
Lisa Davis

MANAGING EDITOR
Katrina Mullen

EDITOR
Tim Sablik

STAFF WRITER
Matthew Wells

CONTRIBUTORS
R. Andrew Bauer
Halina de Jong-Lambert
Charles Gerena
Bethany Greene
Renee Haltom
Matthew Martin
Joseph Mengedoth
Stephanie Norris
Alexander Tan
Sonya Ravindranath Waddell

DESIGN
Cynthia Cliff, LLC

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www.x.com/RichFedResearch

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DEPARTMENTS

Cover: An apprentice and his mentor at Pioneer Chevrolet in Abingdon, Va.
Credit: Meghan Copenhaver, Southwest Virginia Higher Education Center

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Navigating Supply Shocks

Over the last several years, the U.S. economy has faced wave after wave of supply shocks. Every time one wave recedes, we're hit with another: the COVID-19 pandemic, the Russian invasion of Ukraine, the collapse of Silicon Valley Bank, the tariff tumult, and most recently, the conflict in the Middle East. These shocks affect the available supply of goods and services. After the pandemic, we even saw supply challenges with labor. Typically, these shocks result in higher prices for a time and, in turn, a pullback in demand.

Conventional central bank wisdom says the Fed should look past supply shocks. After all, they typically cause only temporary increases in prices, not sustained elevated inflation. Waves may rock the boat momentarily, but they rarely cause lasting damage.

Raising rates to weaken demand doesn't address the root cause behind supply shock-driven inflation. It doesn't free up trade routes, reopen factories, or melt ice. You wouldn't want to address a bird flu-driven egg shortage by slowing demand across the economy.

This approach of looking through supply shocks has worked well for a generation thanks to what economists call "anchored long-term inflation expectations." Where businesses and consumers expect inflation to be in the future helps shape actual inflation. It informs how individuals negotiate wages and how businesses set prices.

When these expectations are "anchored," consumers understand that temporarily elevated inflation does not mean sustained inflation in the long term. They won't negotiate for an outsized increase in wages because they don't expect outsized increases in rent, groceries, and other expenses to persist. They won't feed inflation by preparing for perceived inflation to come.

Put differently, when an anchor is secure, waves don't push a boat into

the rocks. The same is true here.

That said, I've been asking myself whether we've entered an era where supply shocks will become more frequent. Prior to the pandemic, the U.S. economy had enjoyed decades of relatively smooth sailing: The Berlin Wall fell, the world globalized, demographics boosted labor supply, and geopolitical conflicts faded into the background. But looking forward, it's easy to imagine more challenging conditions: heightened geopolitical tensions, trade fragmentation, more frequent severe weather events, rising government debt, cyber risk, slowing workforce growth, and more. Supply chains could face increased risk.

If that occurs, does the Fed have the luxury of riding out all the waves that come our way? For me, it comes down to how much businesses, consumers, and inflation expectations can take. Allow me to torture the analogy a little further.

First, will businesses get queasy? They have spent the last few years finding efficiencies. They've improved processes. They've invested in technology and automation. They've reaped the benefits of low turnover. But they've largely gotten more productive through attrition, not layoffs. At what point will they more broadly gain conviction that it is time to reduce headcount more actively?

Second, will consumers abandon ship? Thus far, they've continued to spend. They've traded down to lower price products and retailers. They've made trade-offs between spending categories. They've been creative in how they finance their purchases. They're certainly not happy — consumer sentiment remains historically low as measured by the University of Michigan Surveys of Consumers — but they've persisted. As real wage growth slows, tax refunds fade, and trade-down options run their course, will consumers finally reduce their appetite for spending?

And finally: How secure is the inflation expectations anchor? I'm hearing a renewed determination by businesses to pass highly visible, conflict-driven cost increases on to their customers. But, so far, measures of forward inflation compensation beyond the next year and survey-based measures of long-term inflation expectations remain well anchored. With inflation above our 2 percent target for over five years now, it's worth asking whether the cumulative impact of so many waves risks loosening the anchor.

The answers to those questions will determine whether the Fed still has the luxury to look through supply shocks.

Tom Barkin
President and Chief Executive Officer
A longer version of this essay was delivered as an address in Raleigh, N.C., on May 21, 2026.

Macro Minute

Each week, we explore the numbers behind the headlines on the macroeconomy.

RECENT POSTS ABOUT SUPPLY SHOCKS INCLUDE:

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

Steady Overall With Pockets of Stress

Through our economic sensing efforts, we meet with businesses across the Fifth District each month to understand current economic conditions. This provides us with real-time information on our regional economy. In this column, we draw from dozens of conversations with businesses from mid-June to mid-July.

Largely, business-to-business (B2B) firms reported more solid demand growth than business-to-consumer (B2C) firms. Among consumer-facing firms, there was an uptick in reports of divergent spending trends between higher-income and lower- and middle-income consumers, with the former continuing to spend robustly while the latter struggled to stretch their dollars. Travel spending, for example, was strong even in non-World Cup cities, but it was mostly at luxury properties while economy brands were flat. A grocery store executive reported sustained foot traffic but smaller baskets among in-person customers. At the same time, grocery delivery orders, typically associated with higher-income customers, saw no change.

Consumers continued to manage higher prices via strategic choices and trade-offs. Several firms flagged ways that consumers were focused on near-term budgets as they managed cash flow. Consumers bought smaller packages at the liquor store on each visit, while at the hair salon, they kept the same services but extended time between appointments. When they faced issues with their cars or air conditioning, they opted to repair, even if replacement in a year was deemed inevitable. They strategized which bills to pay and when, paying some late but never late enough to default or face repossession. A few borrowed against their 401(k)s. Some grocery executives said that not all spending changes were due to finances; they noted a shift toward more health-conscious options, too.

Uncertainty continued to play a role in decision-making for some firms. Many businesses described high uncertainty as the new baseline, which meant they needed to move ahead anyway with planning and investment. Some firms, however, reported a delay in investment decisions as uncertainty picked up again: They cited new tariffs and a resurgence of conflict in the Middle East. Others hesitated to invest without more certainty that present demand would stick around.

Most firms expected to keep headcount flat through the end of 2026. The majority of firms said they expected to be able to meet demand with current staff, either due to lackluster demand expectations or promising productivity improvements, both from artificial intelligence (AI) and non-AI. A minority of firms noted they expected flat headcount because they didn't foresee finding qualified, available talent to hire.

AI could lead to more hiring after initial rollout. One executive shared that they were planning to hire to take their AI rollout to the next level. They realized they needed staff with fresh ideas and well-developed AI skills, even if they require higher compensation. Several other firms noted that AI was moving from one-off projects to being woven in throughout the organization (e.g., to bolster cybersecurity).

Conflict-related cost pressures continued. Transportation costs, including shipping, freight, and trucking rates, remained elevated. Several contacts pointed out that fuel surcharges did not recede as gas prices did. The rising cost of AI also came up more frequently than in prior cycles.

Several executives at B2B firms, as well as some at B2C firms catering to higher-income consumers, reported successfully passing on rising costs to customers. They met little resistance to 3 percent-plus price increases, as one contact noted that customers had "become largely numb." B2C firms that cater to lower- and middle-income consumers, on the other hand, were much less able to pass on higher costs to their customers.

Some firms received refunds on tariffs they had paid prior to the Supreme Court ruling. Firms that had very visible tariff-related price increases noted they felt little option but to share tariff savings with customers. A few other firms planned to observe customer behavior and wait and see how cost pressures evolved before they determined next steps, mirroring their behavior during the initial tariff roll-out.

This cycle, we'll continue to keep a pulse on many of the same questions: Do consumers continue to find ways to keep spending, or does demand waver? Do firms move forward with investment or hiring, or does renewed uncertainty keep them cautious and steady? Do firms continue to face elevated cost pressure, and if so, do they raise prices, cut costs, or accept smaller margins? **EF**

This column was adapted from "What Businesses Are Saying: Steady Overall With Pockets of Stress," Regional Matters, July 31, 2026.

How Aging Americans Are Navigating (and Shaping) the Housing Market

Deciding where to live isn't easy for older Americans, as health care needs, costs, and limited options all create uncertainty

By Matthew Wells

IMAGE: GETTY IMAGES

A young couple saves up and buys a house in a leafy suburban neighborhood. After a while, they have a few kids. Those kids eventually move away to begin their own lives. The couple considers downsizing, but the neighborhood has become as much a home as their actual house. They decide to stay, unable to imagine life anywhere else. Besides, the nearest senior living community is in a different town where they'd be starting over, and they don't have long-term care insurance, so they'd have to pay completely out of pocket. On the other hand, if they stay in their home, the mortgage will be paid off in a year or two, and the house could someday provide a nest egg for their grandkids.

But as they age, the stairs up to the bedroom eventually get harder to climb for one of them. Bathing, getting dressed, and the other activities of daily living all get more difficult as time goes on. The healthier partner becomes the primary caregiver to the other, preparing food, managing medications and doctors' appointments, and installing modifications like stair ramps and wall grips to make the house safe and accessible. But even with these adjustments, it may become increasingly difficult for them to stay in their home as they age.

This story is increasingly common. Rather than downsizing to smaller, single-story homes or moving into retirement or assisted living communities, more older Americans are aging in place than ever before. And they are relying on home health care (HHC) — provided either by a loved one or health care professional — to make it possible. In doing so, they enjoy the benefits of remaining in a home and community full of memories and connections, as well as the potential to maximize the financial gains that can come from living in a home that is fully paid off and has substantially increased in value.

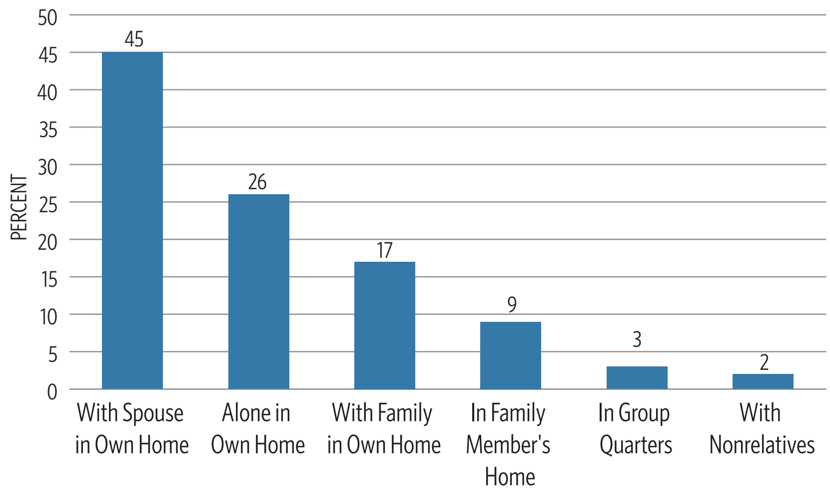
But such stories don't always proceed smoothly. For seniors who want to stay in their homes but are unable to care for themselves or each other, HHC providers can be prohibitively expensive, and relatively few Americans — only about 10 percent of retirees, or under 6 million people — have long-term care insurance. Also, despite efforts to expand HHC access through Medicaid, there simply aren't enough qualified workers and current government funding levels are not enough to draw more providers into the space.

Larger single-family homes can also be expensive to maintain, and installing safety modifications isn't cheap. For these and other reasons, some elderly Americans would prefer to move to environments where their needs can be better met. But even for those who want to downsize or move into a senior-focused community, such options may not be available. Many cities and towns do not have sufficient suitable housing or facilities, as developers tend to focus on building single-family homes. Assisted living and retirement communities also usually require residents to largely pay out of pocket, and the cost can be out of reach for many.

As the 64 million baby boomers continue to age, what factors are driving decisions to age in place? What are the challenges to doing so safely and affordably? What viable options exist for those who would like to move? And what are the implications of those decisions for the economy, especially the housing market?

The Majority of Seniors Live in Their Own Homes

Living situations of individuals aged 65 and over, 2021



NOTES: In own home refers to older adults who live in a home where they or their spouse/partner are the head of the household. Those who live with nonrelatives only may live in their own home or another person's home. In group quarters could include skilled nursing facilities, group homes, residential treatment centers, military barracks, or correctional facilities. Percentages don't sum to 100 because of rounding.

SOURCE: Harvard University's Joint Center for Housing Studies' tabulations of U.S. Census Bureau, 2021 American Community Survey 1-Year Estimates.

AGING IN PLACE TRENDS

The American population aged 65 and older increased to nearly 56 million, according to the 2020 census, and by 2030, one in five Americans will fall into that age group. Surveys suggest a significant majority of these people want to stay in their homes as long as possible. In 2024, AARP found that 75 percent of seniors would prefer to stay in their homes as they age, while a *U.S. News & World Report* survey that same year found 95 percent of Americans aged 55 and older said aging in place was an important goal.

In a 2024 *Economic Brief*, Richmond Fed economists John Bailey Jones and Urvi Neelakantan, along with Yue Li, an economist at the University at Albany – State University of New York, reported that those preferences are leading to changes in behavior as the share of older Americans aging in place has increased significantly in recent decades. Data from the U.S. Census and the Census Bureau's American Community Survey show that older households have become more likely to live in single-generation, owner-occupied homes. In 1970, for example, 67 percent of Americans aged 65 and older lived in homes they owned; in 2022, that share had risen to 79 percent.

These Americans are also more likely to live in houses that are probably bigger than what they need, especially if they live alone or as a couple. In 2022, 25 percent of those aged 65 and up had at least two extra bedrooms compared to only 12 percent of people between the ages of 25 and 64. Only 10 percent of seniors and 3 percent of the younger cohort reported having that extra space in 1970.

Older citizens are also now less likely to move into institutional settings such as assisted living communities or nursing homes. In 1970, 5.5 percent of this population lived in such environments; in 2022, that share had dropped to 3 percent. The data also indicate that single seniors are more likely than couples to live in group environments.

Census data show that most older adults still live in their own homes. Forty-five percent live in their home with a spouse, while approximately another quarter live alone and 17 percent live in their own home with other family members. (See chart.)

WHY MIGHT SENIORS WANT TO STAY AT HOME?

The Health and Retirement Study is an ongoing panel survey of older people. Among other important data, it captures respondents' self-reporting of their ability to perform identifiable activities of daily living (ADLs). In a follow-up *Economic Brief* published earlier this year, Jones, Neelakantan, and Yi used the survey results to understand what factors might shape an individual's calculus about whether to age in place or move to an environment with more support services, such as a nursing home.

The survey data show that the probability of entering a nursing home increases as the number of ADL limitations increases: Forty percent of seniors with four or five limitations are in such environments. (This measure, as a proxy for an individual's overall health, is more predictive of living in a nursing home than age.) Those with two to three limitations, however, are more likely to receive HHC. Being married and owning a home also reduce the likelihood of living in a nursing home. Married seniors are also less likely to receive professional HHC.

The researchers suggested that the increasing number of Americans aging at home may be tied to the increasing availability of long-term HHC. They noted this change may be coming through two distinct channels. First, there are more married seniors than ever before. Between 1970 and 2023, the fraction of senior households with a married couple rose by 5 percentage points for those aged 65 to 79 and around 13 percentage points for households aged 80 and above. Spouses can often act as substitutes for paid care.

Second, in 1999, the Supreme Court ruled in *Olmstead v. L.C.* that in accordance with the Americans with Disabilities Act, disabled individuals, including the elderly, should remain in their local communities whenever possible rather than be moved to institutional care. This prompted Medicaid to expand support for HHC, making aging in place a more viable option for seniors: The Centers for Medicare and Medicaid Services' HHC expenditures rose by 38 percentage points between 1967 and 2023. Importantly, more than half of that increase occurred after 2000 and most of it was implemented through Medicaid. (Long-term care services are covered through Medicaid for those who qualify, while Medicare covers acute health care needs as well as shorter-term care or post-hospitalization rehabilitation.)

While some seniors may decide to age at home because the supply of HHC options has increased, the relationship could also run in the other direction. The increase in health care accessibility may be a response to the increased demand to age in place. Among the benefits that may attract seniors to staying are the comforts of familiar surroundings that make a house and community a home.

"Even when a house is no longer an optimal fit, the familiarity can be important," says Jennifer Molinsky, director of the Housing an Aging Society Program at Harvard University's Joint Center for Housing Studies. "Rather than move to a whole different community and relearn everything, you're in a familiar setting. Moving can be daunting."

Seniors might also want to remain in their homes because they want to maximize the value of their homes, increasing the eventual total they pass on to their heirs. Home prices have increased significantly over the past quarter century, according to Jones, Neelakantan, and Yi, with an average real rate of capital gains on housing of 1.9 percent per year, which is more than double the 0.8 percent annual rate from 1975 to 2000. Many markets experienced much greater increases during this high-growth period.

THE DIFFICULTIES OF STAYING PUT

The increases in funding for HHC have not necessarily translated into greater provision of that care. In a 2023 *Health Affairs* article, Amanda Kreider of the University of Pittsburgh and Rachel Werner of the University of Pennsylvania compared the size of the HHC workforce with Medicaid home and community-based services participation and found that despite increased investment, the number of HHC workers per 100 participants declined by almost 12 percent between 2013 and 2019. This number likely declined further in 2020, as the COVID-19 pandemic led elderly adults to prefer HHC over moving to group settings.

Even if professional HHC providers were readily available, staying at home and getting care can still be expensive and difficult for seniors on fixed incomes. The median national rate for private nonmedical HHC is $34 an hour, meaning a person needing 24-hour care would end up paying $816 per day. Even care for just four hours a day, which can be the minimum amount of time a firm will contract for in some cases, would add up to over $4,000 a month. If the person doesn't meet the Medicaid eligibility requirements, that cost would need to be paid out of pocket.

Karen Kopecky is an economist and policy advisor at the Cleveland Fed, and she notes that private long-term care insurance can be difficult to obtain for a number of complex economic reasons, and many seniors decide the benefits are not worth the additional costs relative to Medicaid, which is paid for by tax dollars. But to qualify for Medicaid, middle-income seniors must exhaust all their assets — aside from the home — first. (It should be noted that this dynamic is at play for both those aging at home and those who have decided to move into an assisted living facility or nursing home.)

State and local governments are doing what they can to help manage those costs. For example, Carolyn True, the director of aging and independence for Frederick County, Md., notes that the state enacted a home and community-based waiver in 2000 that would allow people who need the level of care provided in nursing homes to get equivalent Medicaid dollars to spend on HHC. It's a good option for those who can get it, as recipients can receive the care they need and stay in their communities. The problem, she points out, is the waitlist for getting a waiver has several thousand people on it.

Without that financial assistance, many seniors must choose between paying for their care or paying for their other daily needs. In a 2025 article, Molinsky noted 34 percent of all older households were cost burdened in 2023. For elderly homeowners, the cost-burdened rate between 2019 and 2023 went from 24 percent to almost 28 percent. In terms of raw numbers, that's a jump from 6.2 million cost-burdened households in 2019 to 7.9 million in 2023. Cost concerns are especially acute for elderly renters, with 58 percent being cost burdened. That equates to 4.5 million households and an increase of 570,000 between 2019 and 2023.

Fixed incomes make it difficult to keep up with rising homeownership costs (due to property tax and insurance increases as property values increase) and rents, while those with lower incomes have little left for out-of-pocket medical costs, food, and other needs. In fact, in a separate report also from 2025, Molinsky and her colleagues Samara Scheckler and Peyton Whitney found that while one-third of households they studied in 2021 with at least one member aged 75 or older met the definition of cost-burdened, three-quarters of those households could not afford a single daily HHC visit after paying housing and living expenses. Elderly renters are particularly impacted by these costs, as fewer than 1 in 10 could afford such daily assistance.

The Health and Retirement Study further revealed that over a third of households headed by an individual aged 50 or older could not afford the out-of-pocket expenses that might be needed to renovate a home to improve accessibility and safety. Some of those safety issues might include radon contamination or corroded piping, as well as limited access to a second-floor bathtub or shower due to the resident being unable to climb stairs. (Medicare considers stairway chair lifts to be convenience items and typically does not cover them, although state Medicaid programs may cover them through waiver programs like the one in Frederick County.)

While financial assistance programs exist to help the elderly to modify their homes, the need is far greater than current funding levels could cover. Older adults earning less than or equal to 50 percent of their community's median income qualify for federal rental assistance, but Molinsky noted in her 2025 article that as of 2021, only 36.5 percent of those eligible received any financial help.

Ultimately, housing officials in places like Frederick County are most concerned with finding and helping the people who have too much income to qualify for assistance but not enough to make it on their own. True notes her team is eager to find the people who make "one dollar more than the eligibility limit. There's no wiggle room with that dollar, so we are trying to get creative and help those individuals."

NO OTHER PLACE TO GO?

If aging in place safely carries potentially significant financial burdens for much of the population, is it really the case that seniors prefer to stay at home? Or is it possible that something else, such as the absence of an affordable and attractive alternative, could be keeping them there?

In 2020, the Census Bureau reported that only 10 percent of the country's 115 million housing units are suitable for older residents. Nationwide, fewer than 1,900 new senior housing units opened in the fourth quarter of 2025, and inventory growth has been below 1 percent annually. According to the National Investment Center for Senior Housing and Care, occupancy levels for existing senior housing average 89 percent across 31 of the largest U.S. markets. Average occupancy rates in active adult communities sit at about 92 percent and assisted living facilities are around 88 percent full nationwide.

The reasons behind the lack of inventory are complex, involving issues with adequate labor supply and investor confidence, as well as high building costs. Affordable senior housing also requires zoning decisions that can lead to fewer single-family homes, something that may give a community pause.

The supply problem is most acute for middle-income seniors. Medicaid-eligible seniors and those who can pay out of pocket are more likely to get care at a nursing home or other community environment, but for those in the middle, a tight housing supply means higher — and out of reach — prices.

To address these shortfalls, communities are looking to change the conversation away from what new housing might look like to who will live in it. Vincent Rogers is the director of housing in Frederick County, and he is working alongside Carolyn True to inform communities that affordable senior housing in the county will be full of individuals who have lived in the county their entire lives and contributed to making it the place it is. If that housing can't be built, he reminds residents, then "our own family members might not be able to stay here."

Whether the decision to stay in place is driven by a lack of options or a genuine desire to remain at home, it has consequences for the housing market. According to Freddie Mac, aging in place may prevent younger families from entering homeownership by limiting the supply of available houses and increasing the prices of the homes that are available. The National Association of Realtors noted that the average age of first-time homebuyers was 38 in 2024, the highest ever, while the share of first-time homebuyers was the lowest ever, at 24 percent. If younger people are having a harder time finding a suitable home to buy, that delays or even eliminates their ability to begin wealth accumulation through homeownership. And the cycle doesn't stop there: To the extent people rent longer because there are so few affordable homes on the market, these would-be homeowners drive up prices in the rental market as well.

Molinsky argues that the supply problems like those in Frederick County indicate a need for deeper reflection by policymakers. "We need a much more diverse stock of housing to meet the needs of all of our diverse household shapes and types," she says. "We don't have a national aging policy, but to the extent that we do, it just assumes people want to stay in place."

She suggests that if people are given alternatives beyond going to a nursing home or staying at home — such as smaller, more easily maintained apartments and condominiums, intergenerational housing communities such as those offered by Bridge Meadows in Oregon and Treehouse Foundation in Massachusetts, or community senior housing like 2Life Communities in the Boston area — they can still live safely and affordably while maintaining their connections with each other and the people and places important to them.

"We want to keep older adults engaged and active in their communities because it keeps them young," says True. **EF**

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BY MATTHEW WELLS

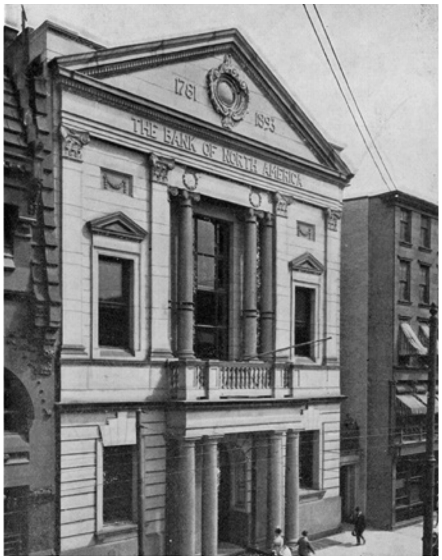
The Bank of North America

Before the First Bank of the United States, another, less well-known institution helped the fledgling United States find its financial footing

John Trumbull's "Surrender of Lord Cornwallis" is one of eight paintings depicting significant moments in American history hanging in the Capitol rotunda in Washington, D.C. It portrays the Oct. 19, 1781, surrender of British troops at Yorktown, Va., after the final battle of the Revolutionary War. While the foreground holds the action, the background is dominated by billowing black smoke from the charred, war-ravaged landscape. It's hard to know if Trumbull intended any deeper meaning, but there's no denying that the war's destruction clouded the future of the newly independent United States.

The nascent country's financial situation was a major source of uncertainty. The weak and decentralized federal government created under the 1777 Articles of Confederation, along with the states, carried a debt burden of at least $70 million, owed to domestic lenders, as well as Dutch banks and the French and Spanish governments. To put the debt in context, the colonial GDP prior to the war was about $170 million. After five years of war, that number was undoubtedly much lower, possibly making the new country's cumulative debt equal to a significant portion of its annual economic output.

To make matters more complex, the U.S. currency was all but worthless thanks to the Second Continental Congress' decision to finance the war by just printing money without the necessary gold or silver specie to back it (giving rise to the expression that items of little or no value were "not worth a Continental"). The Continental dollar, which originally was issued with an exact redemption date, had evolved into nothing more than an unfulfilled IOU — a zero-interest bearer bond with a promise that it could eventually be redeemed for specie at some point in the future. This created the thorny question of whether debts owed in paper money should be repaid at their depreciated market value or at face value. The matter wouldn't be resolved until much later in 1790 in a delicate compromise among Alexander Hamilton, Thomas Jefferson, and James Madison that resulted in the establishment of Washington, D.C. (See "A Capital Compromise," *Econ Focus*, First Quarter 2019.)



The Bank of North America opened its doors in 1782.

Founding Father and *Common Sense* author Thomas Paine summed up the dysfunction: "The measures of government, from the want of money, means, and credit, dragged on like a heavy-loaded carriage without wheels. ... How the public measures were to be carried on, the country defended, and the army recruited, clothed, fed, and paid ... was a matter too gloomy to look at."

Hamilton is credited as the architect of the postrevolutionary U.S. financial system that allowed the country to not just survive but grow and prosper. In 1790 and 1791, he led the effort to charter the First Bank of the United States, the country's first national bank. But in the period between the end of the war and the creation of the First Bank, another smaller, far less well-known institution — the Bank of North America — served as a proof of concept that addressed these initial problems and got the country pointed in the right financial direction. It was chartered by the Confederation Congress in late 1781 and opened for business in Philadelphia in January 1782.

THE VALUE OF DEBT

In a 1781 letter to Robert Morris, the newly appointed superintendent of finance (a position akin to the modern-day Treasury secretary), Hamilton shared his belief that the country's ultimate victory and prosperity depended on the government's ability to borrow. "Tis by introducing order into our finances—by restoreing [sic] public credit—not by gaining battles," he wrote, "that we are finally to gain our object." He noted that Britain had become powerful and successful precisely because of its ability to borrow during wartime, claiming it "is indebted for the immense efforts she has been able to make in so many illustrious and successful wars essentially to that vast fabric of credit raised on this foundation. Tis by this alone she now menaces our independence."

Hamilton was far from the first to recognize the value of credit in wartime, as the Roman statesman

IMAGE: THE HISTORICAL SOCIETY OF PENNSYLVANIA

Cicero famously declared more than two millennia ago that "the sinews of war [are] unlimited money." Given the ceiling on taxation (no one would have incentive to produce anything if they were taxed at 100 percent) and the calamitous inflation that can accompany the overprinting of money relative to the specie backing it, governments had long turned to debt to finance these efforts.

"After 1500, as the means of successful warfare became more and more expensive, the rulers of most European states spent much of their time raising money," noted political scientist, sociologist, and historian Charles Tilly in his book *Coercion, Capital, and European States, A.D. 990-1992*. "[Since] few large states have ever been able to pay for their military expenditures out of current revenues … they have coped with the shortfall by one form of borrowing or another."

A national bank facilitated a government's ability to borrow cheaply by acting as the sole purchaser of its debt, which it could then sell through a centralized bond market. This meant the bank could apply pressure on the government to honor its debts by refusing to lend further money should it default. The Bank of England, the second-oldest central bank after Sweden's Riksbank, functioned according to this logic. Barry Weingast, an economist and political scientist at Stanford University, argued in a 1997 book chapter, "By centralizing the loan decisions in a single intermediary rather than among a large, diffuse community of agents, the bank's charter allowed it to enforce a community credit boycott."

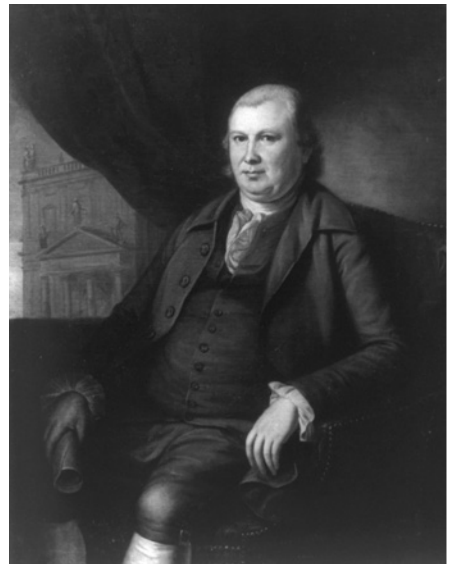
Governments without such banks were usually still able to borrow, but they were often viewed as riskier investments, presumably because they lacked the commitment mechanism described above. There is empirical evidence to support the value of a national bank when it comes to borrowing: Paul Poast, a political scientist at the University of Chicago, found in a 2015 *International Organization* article that during the 19th and early 20th centuries, countries with national or central banks had lower wartime borrowing costs than those that did not.

Hamilton was committed to the idea of a national bank well before the end of the war. The 1781 letter to Morris was one in a series of essays in which he called for the United States to adopt such an institution to act as the country's fiscal agent, supplying funding to the government, handling its accounts, and managing its debt. (These were common functions for central banks during the period before World War I; since then, central banks have focused more on monetary policy rather than managing a state's fiscal affairs.)

The national bank would also put forward a new, stable currency, as the Continental dollar had fallen to below one-eighth of its original value by the end of 1779 and would fall further still. Through prudent financial administration, Hamilton believed it would be able to pay off any war debt in just a few decades, making it "a national blessing … [a] powerfull [sic] cement of our union."

FINANCIER OF THE REVOLUTION

Morris was also a firm believer in the need for a national bank, having been among the first to raise the idea in 1763 for the purpose of facilitating the colonies' ability to trade. Born in Liverpool, Morris came to America at age 13. He grew up to become a Philadelphia-based merchant and owned a shipping company. In addition to his business career, he funded a clandestine arms trade from Europe, and he chaired a secret congressional committee tasked with securing foreign assistance in the run-up to and during the Revolution. Given the monicker "Financier of the Revolution," he was one of only two individuals to sign three of the country's founding documents: the Declaration of Independence, the Articles of Confederation, and the Constitution.



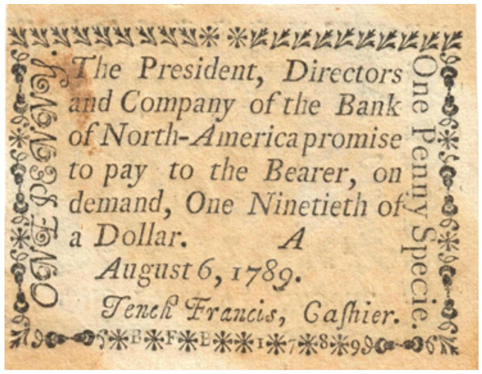
Robert Morris, known as "Financier of the Revolution," was a firm believer in the need for a national bank.

In January 1781, the army was in rough shape. Pennsylvania soldiers, frustrated at not being paid and forced to stay beyond their three-year enlistment, mutinied and threatened to march on Congress unless their grievances were addressed. Their threats were taken seriously, and those who had served at least three years were paid and discharged, with an option to reenlist if they wished. (Only 1,150 of the original 2,400 Pennsylvania soldiers chose to stay, although many would reenlist later.) Perhaps shockingly, rather than pay the troops, a member of Congress suggested they be allowed to pillage and plunder the surrounding towns and countryside.

All this meant Morris was under tremendous pressure when he was elected superintendent of finance by Congress in February 1781. George Washington summarized the difficulties that lay ahead: "I have great expectations from the appointment of Mr. Morris; but they are not unreasonable ones, for I do not suppose that by any magic art he can do more than recover us by degrees from the labyrinth into which our finances are plunged."

Lawrence Lewis, the 19th century historian, echoed many of Morris' contemporaries, who saw him as the natural choice to take on the responsibilities of the office: "Full of energy

IMAGE: DETROIT PUBLISHING COMPANY



This one penny note was printed by Benjamin Franklin Bache, who was Benjamin Franklin's grandson. These small denomination notes were issued in 1789 to help with a coin shortage.

and self-reliance, he was, perhaps, by his business talents and mercantile experience, better qualified than any man in America to control and direct its financial affairs."

BUILDING A NATIONAL BANK

Hamilton urged Morris to move quickly in establishing a national bank, which he believed should have at least $3 million in capital to get started. Morris agreed a bank was needed but believed such a sum was too large.

Morris submitted his plan to Congress on May 17, 1781. He called for the bank to raise $400,000 with shares costing $400 each, payable in gold or silver specie. Subscribers with at least five shares would pay half of what they owed at the time of purchase and the rest within three months. The bank would have 12 directors who were not paid unless authorized by the shareholders, and the bank's president would be chosen from among those directors. Morris, as superintendent, would get daily reports, except for Sundays, on the accounts. Bank notes, issued as government wages or paid out to merchants who brought promissory notes or bills of exchange to the bank, could be redeemed for specie on demand. To facilitate their nationwide use, they could be used to pay all taxes in every state.

The plan was quickly, but not unanimously, approved by Congress, with James Madison arguing that creating such an institution exceeded Congress' authority. He was outnumbered, however, and the plan was approved in late May.

The bank began organizing itself shortly after. It would take some time to get a meaningful number of domestic subscriptions, as many potential lenders doubted the bank would succeed and feared losing their fortunes. But by the fall of that year, the list began to grow, and by 1782, it was gathering the necessary capital. William Bingham, thought to be the richest man in America after the Revolutionary War, bought 9.5 percent of the available shares.

Morris also used around $470,000 in silver invested from France to fund the bank, which then lent that money to Congress. It is unclear whether Morris had the authority to make that transaction, as the money may have been intended for Congress directly. Also unclear is whether some of that amount went toward Morris' rumored purchase of 63.3 percent of the bank's shares — about $254,000 — on behalf of the government, as several sources suggest the transaction was made possible by French and Dutch loans.

By the end of the year, the shareholders felt they had sufficient capital to begin operations, and Congress granted the Bank of North America its charter on Dec. 31, 1781. The shareholders elected Morris' business partner, Thomas Willing, as president of the bank. (Willing would also serve as the first president of the First Bank of the United States a decade later.) The bank opened its doors on Jan. 7, 1782, at 307 Chestnut Street in Philadelphia.

UP AND RUNNING

Business started off somewhat slowly for the bank, as individual subscribers hadn't yet fully paid in, and there were concerns about the low amount of specie in its vault. But eventually, deposits picked up and large shipments of specie arrived from Europe and the West Indies, which provided solid backing to its notes, giving users confidence they could redeem them for gold or silver whenever they wanted. Holding specie also disciplined the bank's lending, as it wanted to be sure it had sufficient reserves to meet any potential demand. The bank also lent to governments at every level, as well as private and commercial interests, including army contractors and other businesses involved with the government.

At the same time, the bank's directors thought credit and efficiency might increase if it was granted a charter from Pennsylvania. The commonwealth's assembly approved the charter that spring, but the decision wasn't without controversy. Some members were concerned that the bank was allowed to own property, and the charter had no sunset clause. Others questioned Willing's patriotic bona fides, as the bank's president had been accused of urging the people of Philadelphia to accept British control of the city in 1777.

In the first half of 1782, Morris' complex role as both the government's superintendent of finance and the manager of the government's investment in the bank caused some unease. Because Morris bought over 63 percent of the original shares on behalf of the government and the bank charged

IMAGE: FEDERAL RESERVE BANK OF PHILADELPHIA interest on its loans to the government, Lewis noted that "what [Morris] thus paid in with one hand he may be said to have drawn out with the other," meaning that the government would make money from money it had lent itself. Bank officers were unsurprisingly uncomfortable with this arrangement, and Morris sold the government's stock throughout 1783, most of it directly to the bank as well as to Dutch financiers. At this point, it became a strictly private institution, as the government no longer held any shares. (This granting of access to bank assets by international actors, but not necessarily domestic ones, would also be a source of grievance when Pennsylvania revoked its charter in 1785.)

During this time, the bank performed its key operations, allowing the nation to begin finding its financial footing. Most importantly, it extended short-term loans to the federal government (as well as to Pennsylvania) for payroll, supply contracts, and debt servicing. It even loaned Philadelphia money to light the city's streets and feed its citizens who could not afford food. These governments could then repay the bank whenever they received revenue, which allowed them greater flexibility and the chance to avoid default. Morris believed that the bank's lending practices to the government were worthwhile, as it meant "the army was in every point on a much more respectable footing than formerly."

The circulation of a stable national currency also brought confidence to the new country's financial system. The national government and the states could all conduct transactions, including taxation, without the frictions that came with the different actors having to determine the value of competing and overlapping currencies.

Despite its successes, the Bank of North America remained dogged by critics. The bank kept bank notes mostly stable relative to specie, but in Pennsylvania, its tight control over lending and the money supply led to accusations of malicious intent. Britain also flooded the market with its goods at the war's end, which led much of the specie that had accumulated to leave the country. This meant money was scarce, and lenders charged a premium.

These realities only gave further fodder to the bank's organized opposition, comprised mostly of those with a negative view of a strong central government and banking system. Characterizing the bank as the root of most economic problems, they accused it of favoritism, extortion, and undue commercial and political influence. They also argued it engaged in systematic usury, leading many borrowers to financial ruin, while high dividends of 14 percent only further separated its wealthy stockholders from the general population. Those opponents petitioned Pennsylvania to revoke its charter in March 1785, with the assembly ultimately revoking the charter that September.

MODERN LEGACY

Despite these criticisms, the bank's Pennsylvania charter was reissued in 1787, but it was much narrower: The bank would need to be rechartered after 14 years, it could no longer hold property (except in a very narrow set of circumstances necessary for conducting its business), and its capital was capped at $2 million. Its national charter, on the other hand, would become void when the body that issued it — the Confederation Congress — was replaced by the new U.S. Congress in 1789. Along with the First Bank of the United States and the Bank of New York (founded in 1784), the Bank of North America's shares would be the first traded on the New York Stock Exchange.

The bank would keep its Pennsylvania charter until 1864 and remain in existence under its original name in some form until 1929, when, operating as the Bank of North America and Trust Company, it merged with the Pennsylvania Company for Insurances on Lives and Granting Annuities. That company was bought and sold several times, most recently by Wells Fargo in 2008.

Morris, however, would struggle. He became heavily involved in land speculation, but it was a boom-and-bust industry, and he racked up significant debt, eventually losing everything. He spent three and a half years in a debtors' prison and was destitute when he died in May 1806.

While Hamilton would ultimately receive much of the credit for righting the nation's finances, he viewed Morris' brainchild, the Bank of North America, as a pivotal step along that journey. It funded the fledgling Philadelphia-based government, serving as a credible agent of the government's finances while giving domestic and foreign investors the confidence to lend. And it provided the stable, specie-backed currency that the country needed. Perhaps it wasn't hyperbole when, in the same letter arguing that credit was a key to victory, he let Morris know just how crucial his project would be: "You may render America and the world no less a service than the establishment of American independence!" **EF**

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IMAGE: GREG PERSINGER

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BY CHARLES GERENA

Researching Payments System Changes

The Federal Reserve has supported the smooth operation of the nation's payments system since its founding in 1913. It has done this by providing services directly — from distributing currency to processing checks and ACH, wire, and instant payments. It has also implemented regulations intended to maintain the system's safety and stability for all users. At the same time, the Fed has convened industry stakeholders and has worked with them to help the payments system meet the evolving needs of businesses and consumers.

Aside from these roles, the Fed has studied the payments system to better understand user needs, detect emerging risks, and identify inefficiencies and service gaps. "Understanding the system we support and regulate isn't just beneficial, it's essential to fulfilling our mandate and serving the public interest," notes Zhu Wang, vice president for research in financial and payments systems at the Federal Reserve Bank of Richmond. "Many employees across the Fed work on payments, spanning research, operations, supervision, legal, community outreach, and other departments."

Economists at the Richmond Fed have studied various aspects of the payments system over the years. Research during the 1990s examined the Fed's role as a service provider in the system, while more recent work has focused on changes in how consumers pay for goods and services. These include the shift from cash to card and mobile payments, the rise of digital currencies, and the emergence of buy now, pay later installment loans.

"We have also studied the changing payments industry landscape, such as the diffusion of online banking and the lifecycle of the ATM and debit card industry," describes Wang. He has researched payments-related topics alongside economists from around the world as well as other researchers at the Richmond Fed, including Huberto Ennis, group vice president for micro, macro, and financial economics; Alexander Wolman, vice president for monetary and macroeconomic research; and Russell Wong, a senior economist and research advisor.

According to Wang, this research has deepened the Fed's knowledge of the payments system beyond the operational aspects of moving funds from point A to point B. "Researchers and policymakers need to understand the complexity of the system and its innovations to design effective policy and regulation," he explains. "We need nuanced, context-specific policies that enhance the system's efficiency, safety, and accessibility while still preserving incentives for beneficial innovation."

One thing that the Richmond Fed's economists have learned is that adoption of a new payment method isn't guaranteed. Wang says it depends on the market pricing and structuring of that new service, as well as how widely it is used by both consumers and merchants. "A payment method is only valuable if both sides of the transaction can use it," he notes. This is an example of what economists call network effects: The more merchants accept a payment method, the more valuable it becomes to consumers, and vice versa. Regulatory constraints and the responses of competitors can also shape the adoption of payment innovations.

Another key finding of the Richmond Fed's payments research is that "innovation can cut both ways when it comes to market power," says Wang. "Some innovations create opportunities for new entrants to challenge established players, while others may actually reinforce existing market advantages through scale economies or network effects."

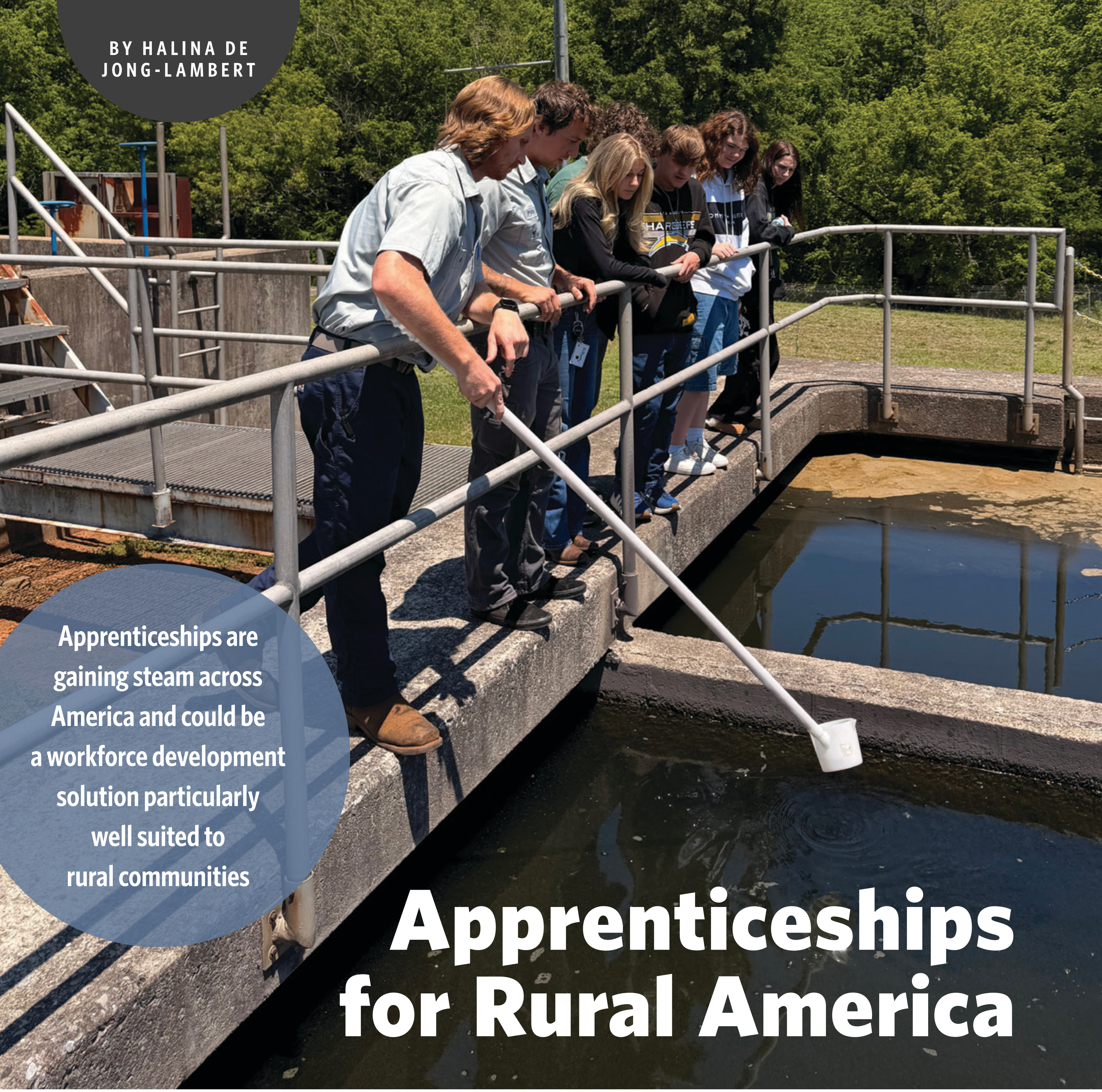
Some of this research has leveraged large, anonymized datasets. For example, in 2016, Wang and Wolman analyzed 2 billion transactions at a discount retailer to identify factors that influence consumers' use of cash. More recently, Wang and Wong estimated the cost to consumers of phasing out the penny using data from the Fed's Diary of Consumer Payment Choice. Other Richmond Fed research has used payments industry data to track market trends and cross-country datasets to understand how different regulatory and market structures shape payments systems around the world.

The Fed continues to monitor the evolution of conventional payment services as well as emerging platforms. A Payments Innovation Conference was held at the Federal Reserve Board of Governors in October 2025, while a conference on the future of finance and payments was co-sponsored by the Richmond Fed, the Atlanta Fed, and the Boston Fed last February.

The Richmond Fed's ongoing payments research will focus on the evolution of instant payments following the July 2023 launch of FedNow, the first new U.S. payment platform launched by the Federal Reserve in 50 years. "We need to understand adoption patterns, usage cases, and how instant payment availability affects consumer and business behavior," says Wang. The Bank's economists will also be exploring the implications of other innovations, such as stablecoins, artificial intelligence, and the embedding of payment services into nonfinancial platforms like social media.

"By studying these innovations systematically using diverse datasets and methodologies, we can provide evidence-based guidance for policy, regulation, and our own operational decisions," concludes Wang. **EF**

BY HALINA DE JONG-LAMBERT



Apprenticeships are gaining steam across America and could be a workforce development solution particularly well suited to rural communities

Apprenticeships for Rural America

IMAGE: GAFFNEY BOARD OF PUBLIC WORKS

During his first semester at Belmont Abbey College, Nolan Cassidy's life changed dramatically. Entering college as a student athlete playing basketball, he chose a degree that aligned with his passion: "I started off in psychology. I wanted to stick around sports, so I thought I would be a sports psychologist."

But just a couple months in, he shattered his metatarsal, a key bone in the foot. Unable to continue playing, his sports scholarship was revoked. Without a way to pay for college, he needed to find a new way forward.

Troy Cassidy, Nolan's father, has been in the utility business for over 40 years. He served as a superintendent and public works director across member utilities of the Florida Rural Water Association and now works for the North Carolina Rural Water Association, ensuring safe drinking water access and wastewater management for rural counties across North Carolina. The National Rural Water Association is a nonprofit organization created in 1976 in the wake of the Safe Drinking Water Act and the Clean Water Act to help rural communities meet the new standards for drinking water through training, supporting, and promoting wastewater professionals. Every Fifth District state hosts a branch of the National Rural Water Association, and all except Virginia have a corresponding apprenticeship program, training apprentices to become water and wastewater professionals in rural areas.

Troy sees those apprenticeships as a strong path into the profession: "It's great for students coming out of high school, great for students who went to college for a couple years, and for those coming out of the military and trying to find a new way of getting back into society."

When Troy introduced Nolan to the North Carolina Rural Water Association's apprenticeship program, Nolan knew it was exactly what he was looking for. "I wanted something that would give me career growth and a good opportunity for myself."

Sociologists and economists alike have identified a strong desire among many rural Americans to remain in their communities. A 2022 study conducted with 68 individuals in rural Pennsylvania described participants as "valuing the ability to remain in their hometowns over seeking better pay and opportunity elsewhere." A similar sociological study, conducted by sociologist Ryan Parsons at the University of Mississippi, found that rural youth struggled with the idea of leaving their communities. Could apprenticeships be a pathway for rural residents to build careers closer to home?

Helping people stay in their communities can be the entire drive of an apprenticeship program.

APPRENTICESHIPS GAIN ATTENTION

Apprenticeships, as defined by the U.S. Department of Labor (DOL), "combine paid on-the-job training with classroom instruction to prepare workers for highly-skilled careers." Many potential apprentices are attracted to the path by the direct pipeline it offers to steady work. ApprenticeshipsUSA, a DOL informational resource on apprenticeships, estimates that 93 percent of apprentices in Registered Apprenticeships are hired by their training company after completing the program. Registered Apprenticeships are programs that meet certain DOL standards, including being industry vetted and paid, providing structured job training, and offering supplemental classroom education.

For decades, apprenticeship programs have existed in the United States as a lesser-used option for job training. But recent years have seen an increasing appetite from private sector employers to offer these programs. In May 2026, Apprenticeships for America published a report sharing ideas from leading U.S. employers with developed apprenticeship programs. These companies argued that four-year degree programs are not evolving quickly enough to meet new job expectations stemming from increased automation and artificial intelligence implementation. They cited worker shortages in health care, infrastructure, advanced manufacturing, and technology as evidence that the current degree-focused workforce pipeline is not meeting demand, and they pointed to apprenticeships to fill these labor market gaps.

"Employers across industries are increasingly recognizing apprenticeship as a powerful tool," the authors of the report wrote. However, they also identified a major barrier to apprenticeship programs' wider adoption: "insufficient" national policy efforts.

According to a 2023 study by the Urban Institute and Mathematica, administrators from eight states' apprenticeship programs noted that state and federal guidelines and subsidies can offset costs that might dissuade firms from establishing apprenticeship programs. Some of the participating states said that these payments mitigate startup costs for apprenticeship programs, which are especially helpful for small businesses, and keep continued expenses low. The study also found that "incentives have helped states strengthen connections with employers, reach underrepresented populations of potential apprentices, increase the overall number of apprentices, and diversify apprenticeship industries."

For policymakers looking to bolster employment in critical industries, supporting apprenticeship programs may offer an attractive solution. The National Apprenticeship Resource Hub asserts that apprenticeships can support key U.S. industries by addressing common workforce issues, such as labor shortages and the need to keep pace with rapidly evolving skill requirements. By providing a direct pipeline to industries and a training resource, apprenticeships can help fill shortages in sectors such as advanced manufacturing, health care, transportation and logistics, and education. For sectors including energy, professional services, and finance and insurance, the resource hub finds that apprenticeships address widespread needs for more skills and experience.

Without public support, it can be difficult to grow and sustain apprenticeship programs, says Heather Somers, executive director of the North Carolina Rural Water Association. The funding her apprenticeship program receives from the DOL and the U.S. Department of Agriculture (USDA) pays the salary of her apprenticeship coordinator, but the apprenticeship program still runs a deficit every year. "We're happy with what we get, and we make it work, but it gives us no outlet to fund outreach." If the North Carolina Rural Water Association could offer more money to utility companies hosting apprentices, she believes it would incentivize greater participation. "If companies are on the fence or unsure if this is the right fit for them, that takes away a little bit of the risk so that they're willing to give it a try."

According to Miranda Lough, apprenticeship coordinator of the West Virginia Rural Water Association, support of state agencies like WorkForce West Virginia can also ensure programs expand where they are most needed. When discussing towns in West Virginia where the loss of the coal industry hit the job market particularly hard, she said, "The goal is that we would always be there to provide the apprenticeship as a service to that community, to try to help people who are unemployed." In her experience, working with a state agency has helped them have that impact. "A good thing about working with WorkForce West Virginia so closely is that they have rapid response. There's a WARN notice when a company is going to close, and we try to make sure that anytime that happens, we are there."

INVESTIGATING STATE SPONSORSHIP

Across the Fifth District, states are increasingly bolstering apprenticeship programs by strengthening informational resources and subsidies.

Apprenticeship Carolina, part of the SC Technical College System, is South Carolina's well-established state apprenticeship organization. Started in 2007, it now encompasses 16 technical colleges across the state and has produced 55,501 Registered Apprenticeships. There are also pre-apprenticeship programs to familiarize potential participants with an industry and provide a pathway into Registered Apprenticeship programs. Devin Orr, pre-apprenticeship coordinator of the South Carolina Rural Water Association, emphasizes that pre-apprenticeships can have a transformative impact on teenagers. "They're learning increased responsibility, they're developing a work ethic, and they're maturing as they're working in a professional environment."

Julianne Dunn, senior program officer on the Workforce and Financial Prosperity team of Rural LISC (Local Initiatives Support Corporation), is a major proponent of economic programs that bolster rural areas. Rural LISC fosters apprenticeships "that meet the unique needs of rural areas" across rural Arkansas and Mississippi through regional collaboratives. In *Workforce Realigned, Vol. II*, a 2025 book compiling skill development approaches for workers across the country, she wrote, "By equipping residents with in-demand and transferable skills, apprenticeships can foster local talent retention and enable rural communities to thrive in an increasingly competitive job market while maintaining the small-town culture most rural communities prefer."

While many industries could potentially implement apprenticeships, there are certain fields that may be well poised for success because of their existing presence in rural communities. Rural Youth Catalyst, an organization supporting rural youth, and Jobs for the Future, a workforce development organization, came together to study rural apprenticeships and identify roles in essential services, such as police, firefighting, health care, civil service, and education. In their 2025 Rural America at a Glance report, the USDA found these industries to comprise a large share of the rural U.S. economy. In addition, essential services match the community-centric mindset of many close-knit rural areas.

Another way apprenticeships could help in rural settings is by training participants for business succession. This may be most applicable in agriculture, where the average age in the profession is 58, and hands-on experience is essential. (See "Virginia's Small Farmers Weather Unpredictability," *Econ Focus*, Fourth Quarter 2025.) One successful program is the Dairy Grazing Apprenticeship, which stretches across 16 states and matches more than 200 dairy farmers with apprentices to work side by side for two years.

Even outside of rural places, apprenticeships may be gaining relevance due to shifting conditions in the labor market. Laura Ullrich, director of economic research in North America at the job search website Indeed's Hiring Lab, uses the term "experience creep" to describe the growing trend of employers asking for increasing levels of experience for entry-level jobs. A recent report from Strada Education Foundation, an organization that aims to bridge the gap between educational institutions and employers, analyzed the preferences of executives in the hiring process and found they are looking for candidates with internships and other industry experience and deprioritizing academic performance. This shift in expectations between the employer and potential employee could make apprenticeships appealing to employers looking for more skills in entry-level employees.

EMPLOYMENT IN RURAL AMERICA

Apprenticeships may also be attractive to rural residents seeking to enter the workforce, as the availability of jobs in rural places often lags urban markets. According to a 2026 USDA article, nonmetropolitan total employment had not yet fully recovered to pre-Great Recession levels as of 2022, whereas metropolitan areas reached that level in 2013. Labor force participation rates also decreased at a faster rate in nonmetro versus metro areas from 2007-2019, which the article noted "suggests that rural workers faced a choice between moving to urban areas to find work and remaining in rural areas where there were fewer jobs post-Great Recession."

According to Lough, apprenticeships could offer a third option. "Once people understand apprenticeships or know that there's an apprenticeship available, there's usually a lot of excitement," she says. In her opinion, part of the appeal comes from stability. "An apprenticeship lays out what you're going to be making in the program and your wage progression. There's never any doubt or confusion about whether you will be able to keep progressing and growing."

Another attraction is the promise of stable work in one's own community. A pair of articles in the 2022 volume of the *Russell Sage Foundation Journal of the Social Sciences* titled "Growing Up Rural: How Place Shapes Life Outcomes" point to the importance of a rural identity in career choices. One study found, "The vast majority of participants had a common goal for their future selves: to remain steadily employed throughout their adult lives. In fact, nearly all stated that not working was not acceptable in adulthood. ... Yet participants also spoke of communities undergoing drastic economic changes—labor-market shifts that left their hometowns to languish. Despite the value placed on paid work, they grew up in areas where finding paid work could be difficult."

For rural men, their relationship to work appears closely intertwined with a commitment to staying in their communities. A study of 61 working-class men in rural Pennsylvania found that most chose "upskilling," or postsecondary education or training, that reinforced their identities as working-class men and helped them remain in their communities. A mixed gender study of 68 rural individuals found the families of working-class women strongly emphasized college for them — more so than for their male siblings. For those who didn't feel pushed toward college, they found their "parents encouraged them to attach their identity to paid work." At the same time, a desire to remain close to families and communities prompted working-class women in several instances to downsize their ambitions and not pursue higher-paying occupations away from home.

To James Blevins, director of the Virginia Rural IT Apprenticeship Program at the Southwest Virginia Higher Education Center, helping people stay in their communities can be the entire drive of a rural apprenticeship program. "The purpose is to bring high-paying, quality jobs to rural areas so people can make a good living where most of them grew up."

In his experience as a technical assistant/trainer with the North Carolina Rural Water Association, Troy Cassidy found the outreach was often well received when it helped people remain in rural areas. "I work with all the rural communities in Western Carolina, and it can be really community based. There are certain towns I go to, and participants live there their whole life. They don't want to leave, and through our program, they're able to stay and get their license."

That said, his son Nolan says apprenticeships are also a good fit for rural young adults wanting to gain skills close to home while retaining the flexibility to roam. "At the end of the program, you're able to be a journey worker, and that license can be transferred wherever you plan on moving."

LIMITS TO BROADER IMPLEMENTATION

Despite these benefits, developing large-scale apprenticeship programs faces significant challenges in the United States.

From the perspective of top employers, there needs to be significant evolution in how apprenticeship programs are introduced to businesses to make widespread adoption feasible. The representatives of firms convened by Apprenticeships for America saw both complex navigation requirements and program design as barriers to entry for companies considering offering a Registered Apprenticeship. They also identified an incompatibility between the long-term multiyear mindset that companies bring to workforce planning and the widespread perception of apprenticeships as a one-off program to fill immediate hiring needs. They attributed this misperception to insufficient and unpredictable federal and state grants, which disincentivize the kind of sustained investment that would help companies view apprenticeships as a long-term workforce development tool.

The group had a few ideas for solutions: Clear, standardized frameworks for programs; intermediaries to help with cumbersome administrative tasks; and technological tools that simplify navigation and design. They also thought apprenticeships should be more closely aligned with college and other credit-bearing paths so they aren't an isolated option.

Rural LISC identified some specific hurdles with bringing apprenticeships to rural areas. One logistical challenge is getting potential participants to training centers, as public transportation is often "relatively nonexistent" in rural communities. Another is an educational barrier, with potential apprentices "lacking the basic skills in math, literacy, and technology necessary to learn more complex skills usually related to apprenticeships."

Sherri Buckner, apprenticeship and eLearning coordinator for the South Carolina Rural Water Association, was able to address those issues with more flexible learning options. "We offer a variety of training classes throughout the month. We have roughly 10 to 12 options every month, and to stay on track, they only have to come to two classes. Offering those options makes the program work for smaller towns."

In *Workforce Realigned, Vol. II*, Dunn emphasized the importance of educational and workforce partners in the community scoping out existing skills, training, and positions, as well as a "workforce assessment" to better understand the barriers to employment in an area.

Somers agrees that this kind of intentional community assessment is essential. "There's a saying among rural water people that if you've seen one rural water community, you've seen one rural water community, because every community has different challenges. To have that regional lens is so valuable." In her view, "funding will continue to be the biggest barrier and opportunity." But seeing the results for program participants makes overcoming these challenges worth it. "We had an apprentice who had no water or wastewater experience, she completed her apprenticeship four or five months early, just worked really hard, and then about six months later, the system came back to us and said they'd like to hire another apprentice."

Driven apprentices are a theme across the National Rural Water Association branches. Buckner notes that "many have actually gone on to complete higher-level licensing while they were in my program, which has led to increases in pay for them and also job offers from other local utilities."

With their focus on hands-on learning and ability to ground employment in hometowns, apprenticeships are being increasingly recognized by the private sector and state governments alike as a tool well suited to rural labor markets. They are discovering what those championing and completing apprenticeships in rural America already know: These programs can provide a transformative opportunity to enter a new field with confidence under the stability of guided and paid training. **EF**

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Christiane Baumeister

On measuring the effects of oil shocks, changes in global energy markets, and forecasting tail risks

At an age when most children would be looking at storybooks, Christiane Baumeister was drawn to supply and demand graphs. "My father was a high school economics teacher, and I loved to spend time in his office browsing through his books," she says. "When I had to pick my field of study in high school, I picked economics, and I never looked back."

The selection of her research specialty was similarly serendipitous. When she entered her Ph.D. program in economics at Ghent University in 2005, oil markets were about to experience a remarkable run-up in prices. Between the start of that year and the summer of 2008, the global price for a barrel of Brent crude more than tripled. But, to the puzzlement of many economists at the time, this historic price surge was not immediately accompanied by the slowdown in economic activity and the rise in inflation witnessed during past oil price shocks. That piqued Baumeister's interest, and she decided to focus her research on "understanding and quantifying the drivers of oil price fluctuations as well as their time-varying effects on the macro economy." This task was complemented by her other interest: exploring new econometric modeling methods.

After completing her Ph.D. in 2010, she joined the Bank of Canada as an analyst and researcher until 2015. That summer, she began teaching at the University of Notre Dame, where she is currently the Lambert Family Professor of Economics. She has published numerous papers in academic journals such as *Econometrica, American Economic Review,* and the *Journal of Monetary Economics* about modeling and forecasting oil price fluctuations, an area of research that has left her with no shortage of work.

"Oil markets are never dull," she says. "One thing I've learned is that even when things are calm, the next price shock is just around the corner."

Tim Sablik interviewed Baumeister in June.

EF: How does an oil shock move through the economy? What is the timing of that process?

Baumeister: From a macro perspective, we tend to focus on the effects of oil supply disruptions on consumer prices and real economic activity. When thinking about the passthrough of oil prices to consumer prices, you can divide that into a direct and an indirect mechanism. Given that households do not directly consume crude oil, the first stage of passthrough really happens in oil-related products. The price passthrough is reflected in energy goods and services that form part of the consumer basket, and price developments in these oil-related products then are summarized by the energy component of consumer prices. These effects tend to show up very quickly, typically within the same month of the shock, and they also drive up headline inflation, roughly one-for-one with the share of the energy component.

Indirect inflationary pressures are the result of higher energy prices increasing the cost of inputs for firms. As a result, the oil shock can also have an effect on the production of non-energy goods and services. If firms decide to pass those costs on to consumers, that will show up in core inflation. This component follows a more staggered process, since not all firms raise their prices at the same time. Historically, it can take about three to six months to reach the peak response.

Another important channel is inflation expectations. Given that oil price changes are so highly visible — they're covered in the media all the time, and households witness the effects at the pump right away — means that households might disproportionately react to changes in oil prices when forming expectations about future inflation. Higher inflation expectations can then set in motion second-round effects via a wage-bargaining mechanism, but the strength and the

IMAGE: COURTESY OF LEAH INGLE, UNIVERSITY OF NOTRE DAME persistence of these effects depend very much on the credibility of monetary policy and the ability of the central bank to keep inflation expectations anchored.

Another transmission channel on the real side of the economy is consumer confidence, which is an early indicator for future household spending. A drop in consumer confidence can precede a decline in real GDP, but this typically happens more gradually than the inflation effects. The trough in economic activity is more or less reached between one and two years after the initial shock. So, the timing of the effects on inflation and economic activities is different. Unexpected changes in oil prices show up faster in prices than in the real variables.

EF: Do the effects of an oil price shock differ depending on whether it is the result of a change in supply or a change in demand?

Baumeister: That distinction matters a lot. Broadly speaking, supply shocks tend to be bad news. When oil production gets disrupted, as we're experiencing right now, the economy has less oil available and at a higher price. On the one hand, that's good for oil producers. They can sell more of their product at a higher price and make a higher profit. But other firms face higher production costs, which they might choose to pass on to consumers.

Consumers, then, spend a larger share of their budget on oil-related products — transportation, heating, and all energy-intensive activities. That means that they have less money to spend on other goods and services. Eventually, private consumption will drop and investments get delayed, except possibly in the oil sector, which might have an incentive to expand capacity, but that depends in large part on the duration of the supply disruption. Still, the costs of higher oil prices are pretty widely distributed, whereas the benefits are concentrated among fewer firms.

Crucially, the strength of these effects depends on the elasticity of oil demand, how much households and firms are able to reduce fuel consumption as a result of the oil price increase, and to what extent a country depends on oil imports. If a country depends on oil from abroad, a price increase results in a greater transfer of income abroad.

Demand shocks, on the other hand, are typically a sign that the economy is doing well overall, so oil prices rise

> **"What sets the current crisis apart is the sheer size of the supply disruption."**

because there's more demand for oil, which is induced by strong economic growth. While this will still lead to higher consumer prices, the economic environment in which that happens is usually one where incomes are also rising, so households' real purchasing power is not necessarily diminished.

Now, higher demand for oil can also originate from greater uncertainty about the future, which prompts refiners to store more oil in anticipation of future physical shortages. In that case, higher oil prices are still the result of greater demand, but because those oil purchases are being accumulated in inventories instead of fueling economic growth, those higher prices have the potential to depress economic activity.

EF: One point that comes across in your research is that it can be difficult to disentangle whether a change in oil prices is primarily driven by supply or demand. Is the oil price response to the current crisis in the Middle East an example of a straightforward supply shock, or is it more complicated than it might appear on the surface?

Baumeister: Typically, an oil price shock is the result of different drivers, and what matters in a crisis episode is the relative importance of these various determinants. Sometimes supply dominates, sometimes demand, and every historical event is different. But I think what we're experiencing right now is probably the cleanest example of an oil supply shock that we've had in decades. It really follows the blueprint of a classical supply shock: There's a war in an oil-producing country or region where production facilities and energy infrastructure get destroyed, and, in this case, a major waterway gets blocked. That leads to a loss of oil output, which then induces a spike in oil prices.

What sets the current crisis apart is the sheer size of the supply disruption and the fact that it has affected all the countries in a region. Historically, these types of supply shocks have often been the result of conflict between neighboring countries, but the effect of this disruption has spread widely across the most important oil-producing region in the world.

There is also considerable uncertainty about whether we will be able to return to the prewar situation and how long it will take. This uncertainty acts more as an amplification mechanism rather than a separate exogenous shock, and it is likely to exacerbate the real economic consequences of the unexpected loss of oil supplies. This uncertainty puts additional downward pressure on economic activity on a global scale.

EF: When the conflict began, many people compared the disruption in oil supply to the energy supply shocks of the 1970s. How has the U.S. economy's responsiveness to oil shocks changed since the 1970s, and what are some of the factors that have driven those changes?

Baumeister: The current narrative is that the U.S. economy is less vulnerable to oil supply shocks than it was in the 1970s because of reduced reliance on petroleum. Following the oil price surges of the 1970s, industries gradually switched away from oil to alternative sources of energy. In addition to relying more on renewables, they also developed more energy-efficient technologies and improved energy conservation, all of which then led to a decline in the oil intensity of production, meaning they need less oil to obtain the same output. These efforts were also supported by government policies aimed at reducing oil use in the economy and increasing consumers' energy awareness. The sectoral composition of U.S. economic activity has also changed. There has been a structural shift away from manufacturing toward services, which tend to be less energy intensive.

But as a result, oil consumption is now concentrated in sectors such as transportation, where there are fewer alternatives. In the case of automobiles, electric vehicles are a substitute, but they're still pretty expensive and may not be a viable option for the average household. Depending on the duration of the shock, more households might reach the point where the initial investment in an electric vehicle is attractive, but I think it would take quite a lot to see that kind of shift on a large scale. So, while the overall energy share of consumption has been falling over time, gasoline dependence is still high, particularly among low-income households.

On the supply side, the U.S. has become the world's largest oil producer, which means that higher oil production revenues as a result of higher prices stay in the U.S. instead of flowing abroad. Yet, I think that the U.S. economy would not be fully insulated if we experience a global economic slowdown sparked by lower consumption and investment in other parts of the world. So, to me, it's not so clear that the U.S. economy is as shielded from the effects of an oil supply shock as many people have suggested. I think the macroeconomic consequences for a shock of the current size will still be substantial.

Christiane Baumeister

PRESENT POSITION

Lambert Family Professor of Economics, University of Notre Dame

SELECTED ADDITIONAL AFFILIATIONS

Research Associate, National Bureau of Economic Research; Research Fellow, Center for Economic Policy Research; Fellow, International Association for Applied Econometrics; Research Professor, Deutsche Bundesbank Research Center

EDUCATION

Ph.D. (2010), Ghent University; M.Sc. (2006), Catholic University of Leuven; M.A. (2003), University of Siena; B.A. (1999), University of Bayreuth

EF: What role did monetary policy play during the oil shocks of the 1970s, and have economists' views on how monetary policy should respond to oil shocks changed since then?

Baumeister: There's an old debate among economists about whether oil price shocks themselves or the Fed's contractionary monetary policy response to them trigger a recession. As we discussed, it is important to distinguish between supply- and demand-driven oil price increases, which can generate very different economic environments. The first scenario poses a trade-off between the Fed's dual mandate, while the latter might not necessarily do so.

At the beginning of the 1970s, it was believed that inflation was mostly caused by structural supply side factors that were not really amenable to policy measures, so the central bank could do little about them. That prompted little monetary policy reaction to inflationary pressures, including those generated by the oil shocks of the 1970s. That changed with the Volcker disinflation, but even today, the conventional narrative is that central banks cannot and maybe even should not do anything about temporary supply side shocks, including oil supply shocks. Instead, the central bank should look through them because they're only causing relative price changes.

To me, that view is really outdated. I don't think that's how central banks should behave in the face of a major oil supply shock. Most central banks only have an inflation mandate (the Fed is a special case since it has both an inflation and employment mandate) and in my view, if there are risks that inflation is getting out of hand, central banks should act decisively because there's always the threat that inflation expectations could become unanchored.

EF: What role have oil inventories played in the response to the current oil supply crisis, and what role do you expect them to play over a longer time horizon?

Baumeister: We have seen a very rapid drawdown of oil inventories, both from the strategic petroleum reserves in a coordinated effort by the International Energy Agency member countries, as well as from commercial stocks. To a large extent, this has cushioned the impact of the loss of supply from the Middle East. But oil stocks can only be drawn down once, and then you have to rebuild them down the road. In that sense, inventory drawdowns are buying us some time, but they are no solution to the massive loss of oil supply.

Looking at the longer run, I expect prices to stay elevated for a prolonged period, even after the reopening of the Strait of Hormuz. Not only will it take considerable time to start production and exports up again — think of all the energy infrastructure that has been destroyed, and all the oil tankers that are somewhere else in the world — but oil inventories will have to be refilled. So, there will be delays in getting more oil online, and at the same time there will be sustained demand from two sources: current oil consumption and stock rebuilding. I think those forces will bolster higher oil prices for a considerable period, at least until the end of 2027.

EF: In a recent paper with James Hamilton, you examined how the oil market is shaped by the different responses of individual producers and consumers. One of your findings was that Saudi Arabia has historically played a key role in stabilizing the price of oil by adjusting its supply in response to shocks. How have oil suppliers responded to the most recent crisis?

Baumeister: Saudi Arabia has not really been able to assume its role as a swing producer as it has done historically because it's geographically constrained. A large part of Saudi oil goes through the Strait of Hormuz. That said, Saudi Arabia has been quick to redirect some of its oil flows through the east-west pipeline to the Red Sea port of Yanbu, effectively increasing tanker loadings to around 4 million barrels per day after the outbreak of the war. But the scope for increasing that capacity further is limited, so I don't think that it can really play an important stabilizing role this time around.

Now, there has been some talk that the U.S. is the new swing producer. It has all the earmarks of it. Shale oil provides more flexibility in terms of expanding production quickly, and the U.S. is the largest oil producer in the world right now at 13 million barrels per day. Recently, U.S. oil exports have really ballooned, which would suggest it is increasing supply in response to the shock. But I think that's a little bit deceiving because if you look at some of the underlying indicators of the domestic oil sector, they tell a different story. Both oil production and active drilling rigs have not really increased all that much. In the U.S., we're in the lucky position that we have weekly updates about oil production and drilling rigs, so we can track changes in a very timely fashion. The boost in U.S. oil exports can really be traced to releases from the Strategic Petroleum Reserve (SPR). There has been less domestic demand, but Europe and Asia have been tapping the U.S. SPR.

The reason why I don't believe that the U.S. is in a position right now to act as a swing producer is that the business model for shale oil in the U.S. is very different from the business model for oil producers in Saudi Arabia. Especially since the pandemic, there has been a major shift in priorities from increasing spending on exploring, drilling, and producing oil to generating returns for shareholders, and I don't think that will change anytime soon. There are also concerns about the duration of any shock. Shale oil producers are cautious about expanding drilling because of the volatility in prices and the uncertainty about future demand.

EF: Have different demand responses across countries affected how the current shock has unfolded?

Baumeister: Demand elasticities play a crucial role. A country's ability to reduce its demand for oil in response to a shock depends a lot on its energy mix and its dependence on oil imports. When it comes to the energy mix, I think China has been very forward-looking, in the sense that they have invested a lot in renewables and alternative energy sources. They also have been very strategic in building up oil reserves. They have the largest stockpiles of oil, and it seems they've been very cautious about drawing on them. With China, we don't always have access to hard data, so it can be hard to verify the actual situation on the ground. But we know they have options for fuel switching because of their investments in electric vehicles and alternative energy sources.

EF: A big focus of your research is building models to forecast oil price movements. To many, this might seem like an impossible task. Oil and gas prices are so volatile that they would appear to be inherently unpredictable. How have you gone about developing models for forecasting oil prices?

Baumeister: The conventional view is that the best guess of the price of oil tomorrow is the price today, which implies unpredictability. This stems from the observation that oil prices behave like asset prices, and asset prices are deemed unpredictable in efficient markets. I've challenged that view in my research. What is different for oil compared to financial assets is that oil has an important physical component. That raises the question of whether the forecast performance can be improved when we carefully model the physical market reality. This requires a good understanding of the market structure, the fundamental determinants of oil prices, the role of institutional features, and their development over time. It's these aspects that have guided my selection of suitable predictor variables as well as the choice of the appropriate modeling framework for forecasting success.

When it comes to the variables on the demand side, you want to look at the key determinants. For example, global fuel consumption, so the amount of petroleum products, such as gasoline, diesel, or jet fuel, determines the demand for crude oil by refiners. Another important factor is the profit margin of refiners — how much they can earn by transforming crude oil into petroleum products. Typically, the greater that margin, the more upward pressure on prices. The strength of demand also depends on the state of the global economy. On the supply side, global drilling activity is an important indicator of future production. How much oil we have in storage, so once again inventories, is also important.

So, we have a relatively good understanding of the economic drivers of oil prices, but we also need to be able to accurately measure them and to obtain them in a timely fashion for forecasting. That poses additional challenges because some of these variables, like global petroleum inventories, are only available with considerable delays. For other variables, there's an outright measurement challenge. How do you approximate the state of the global business cycle, for example? That often requires the construction of suitable indicators from scratch.

Another important aspect that speaks more to the modeling itself is that energy markets have undergone substantial transformations over time, and that can also affect the forecasting ability of models. There are structural changes that can influence the demand for energy: shifts in the energy intensity of production, technological progress, changes in the energy mix, and so on. You need to have a flexible model that accounts for all these changes.

EF: Has it also become more important to consider tail risks when building models to forecast oil price movements? After the oil shocks of the 1970s, there were several decades where oil shocks were rare and relatively short-lived when they did occur. But in the last few years, we've experienced the energy shock from the war in Ukraine and now from the conflict in the Middle East.

Baumeister: Definitely, tail risks have been on the rise in global oil markets. We're experiencing more severe events with greater frequency, which makes it imperative to take tail outcomes into account in our models. Multiple approaches have been proposed in the literature to incorporate these risks in forecasting models, mostly in relation to assessing macroeconomic tail risks. This means looking at risks to growth, inflation, and public debt, for example.

In some of my recent research, we were curious to see whether the takeaways from that literature carry over to oil price risks. We conducted a horse race using three different model classes that are popular for studying tail behavior: quantile regressions, Bayesian VARs with stochastic volatility, and nonparametric machine learning models. We found striking differences between the macro forecasting setting and the oil market. Quantile regressions are widely used in macro forecasting, but they perform abysmally for oil prices, which favor the more flexible machine learning models.

Taking tail risks into account means moving away from focusing on the most likely outcome and factoring in uncertainty by looking at the entire distribution to assess the probability of future extreme oil price realizations. What we propose is to use the predictive distributions to construct early warning indicators to monitor the buildup of oil price risks in real time. We can also assess the likelihood of oil prices exceeding an upper threshold, which is what matters to consumers, or the likelihood of oil prices falling below a lower threshold, which is important for producers. We design what we call consumer and producer distress indices as a way to convey the probability of upside and downside risks of tail events.

"We're experiencing more severe events with greater frequency, which makes it imperative to take tail outcomes into account in our models."

I think it's important to have a device that succinctly communicates these types of risks for the purposes of stress testing and risk management. It's always probabilistic, of course, but I think it's still useful if you have to make decisions under uncertainty that you at least know the probability of a possible tail outcome. Then it's up to the decision-maker to decide how much weight to attach to that risk.

EF: Economists' understanding of oil market dynamics has evolved considerably over the last four decades. What are some ways that your own thinking on this topic has changed over the course of your career?

Baumeister: Let me maybe start by telling you what has not changed. Throughout my entire journey of researching oil markets, the one thing that I came away with is that elasticities are really key. I think a lot of progress has been made to estimate them better, but there's room for more. And this is where my thinking has evolved. It is really important to shift our focus from the aggregate to the disaggregate and study heterogeneity across countries — how oil producers and oil consumers adapt to oil shocks. Understanding the differences in country-specific supply and demand elasticity is very important in the beginning of an oil shock, but also for understanding the transmission to the macro economy. How does an oil shock propagate through the economy at the sectoral level? There's a lot of heterogeneity hidden in the aggregates that we tend to look at, and to really understand the aggregate dynamics, it's important to dig deeper and look under the hood at what's happening at the firm and consumer level.

I'm looking at disaggregated dynamics in various projects right now with the goal of better understanding how macroeconomic shocks impact microeconomic units, such as firms, households, and countries. I'm also taking nonlinearities into account in these models. In order to do that, I'm working with a couple of co-authors to develop a flexible micro-macro modeling framework that integrates multivariate time series models with nonlinear panel models, where the nonlinearities are inferred using machine learning techniques. It brings together a lot of my previous research in terms of techniques.

We want to use this framework to examine how households adjust their inflation expectations in response to oil supply shocks of different sign and size, and also to analyze to what extent households respond heterogeneously to these shocks and whether those different responses are driven by demographic characteristics like gender, age, income, and home country. The ultimate goal is to run a counterfactual scenario of current events to see the differential effects that a large oil shock can have on different types of households. **EF**

BY ALEXANDER TAN

What Foot Traffic Reveals About Demand

Marina Azzimonti, David Wiczer, and Yang Xuan. "Estimating Demand Shocks from Foot Traffic: A Big-Data Approach." Federal Reserve Bank of Richmond Working Paper No. 26-05, March 2026.

How do economists measure sudden changes to demand and estimate how firms respond to those shocks? In manufacturing, factories and warehouses generate detailed records of production, making it easier to trace changes to supply and demand. But in the business-to-consumer economy — which adds more value to GDP than manufacturing and accounts for about one-third of U.S. employment — demand is intrinsically determined by the flow of customers, which is influenced by various factors.

This makes demand in consumer-facing industries remarkably difficult to measure and to separate into its two drivers: exogenous shocks (unexpected shifts in customer numbers due to weather, local events, or changing tastes) and firms' own strategic choices. Previously, economists relied on annual sales figures released with substantial delays, which may be impacted by firms' behaviors. A new working paper by Marina Azzimonti of the Richmond Fed, David Wiczer of the New York Fed, and Yang Xuan of Louisiana State University in Shreveport takes a closer look using high-frequency foot traffic data.

The authors constructed a detailed dataset of monthly visitor counts at individual businesses via SafeGraph, a firm which aggregates anonymized cellphone location data. They narrowed the sample to nearly 6,000 branded establishments in the retail, service, and health sectors across Manhattan, Brooklyn, and the Bronx from 2018 through 2019. The focus on brands such as Macy's or Starbucks let the authors control for business-level differences like pricing, promotions, and advertising, assuming variation in foot traffic from one Starbucks to another reflects local demand, not a manager's marketing ability.

To tell those stories apart, the authors built a model that separates brandwide decisions from the local variation reflecting actual demand. The authors then characterized each establishment by three metrics: average annual growth, monthly volatility, and average foot traffic.

Based on these three characteristics, a clustering algorithm — an unsupervised machine learning technique that categorizes data points into groups by similarity — identified three distinct types, or clusters of firms, each with its own characteristic pattern of demand. "High-traffic" establishments experience steady streams of visitors, "fast-growing" locations show strong year-over-year expansion, and "low-traffic" stores have visitor counts that are smaller and more erratic.

In the high-traffic group, a strong month tends to be followed by another strong month: Roughly 80 percent of a demand shock persists into the next period. Low-traffic establishments show the opposite pattern: One month's demand shock barely predicts anything about the next. Fast-growing locations sit in between, with about 60 percent of each demand shock persisting into the next month. The magnitude of shocks also differs substantially across groups. Low-traffic establishments experience much larger fluctuations, with the standard deviation of shocks roughly twice that of high-traffic establishments, indicating greater demand volatility. Importantly, the three clusters cut across industry categories and brands, betraying latent diversity in these demand processes that cannot be explained by sector, strategy, or geography alone.

A popular assumption in macroeconomic modeling is that every firm within a sector or region draws demand shocks from a common probabilistic process. But a model that pools all firms in the sample into a single group yields a demand shock persistence of 71 percent, overstating persistence at low-traffic stores and understating it at high-traffic stores, misrepresenting the population as a whole.

These differences in demand behavior directly affect how firms invest. When a business decides whether to make a costly investment, such as opening a new location, hiring additional workers, or expanding capacity, it weighs the upfront cost against the value of future profits. When demand shocks are persistent, those expected future profits are more certain. For high-traffic businesses, a moderately good present may justify paying the cost. When shocks are transient, as they are for low-traffic businesses, the same decision requires much stronger current conditions because good news today reveals less about the future.

Understanding the investment behavior of consumer-facing firms in response to demand shocks matters for policymakers interested in shaping that behavior. Azzimonti, Wiczer, and Xuan show that compared to their three-cluster model, a model with a singular demand process systematically overpredicts movement in aggregate investment when treatments such as deregulation, innovation subsidies, or monetary policy adjustments shift the cost of investing. When businesses face very different demand dynamics irrespective of sector, locale, and brand strategy, policymakers must account for this underlying heterogeneity or risk misjudging the economy's response to policy. **EF**

BY STEPHANIE NORRIS AND SONYA RAVINDRANATH WADDELL

Community Colleges: Beyond the Numbers

Community colleges contribute to local and regional workforce development in ways that can be difficult to measure

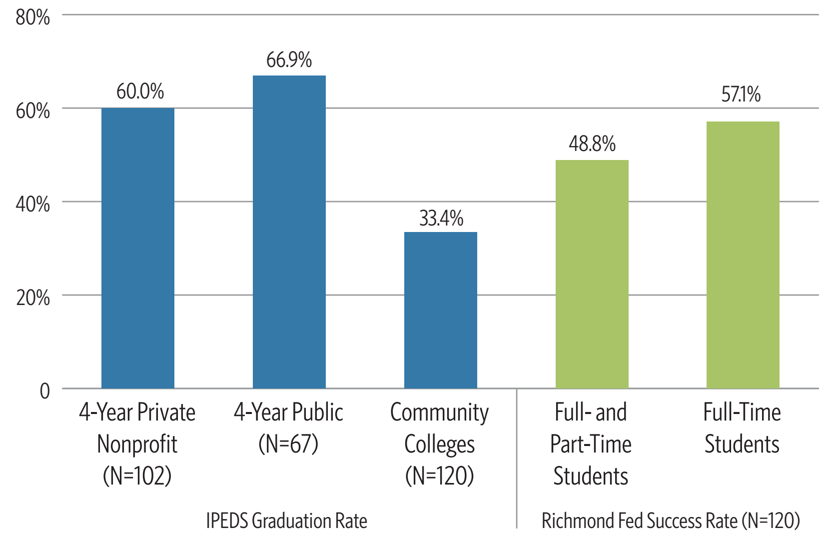
There is enduring demand for post-secondary education that can provide the diverse range of skills, knowledge, and experience required for the jobs of today. For some post-secondary institutions, traditional metrics designed around the four-year degree model (i.e., graduation rates for first-time, full-time, degree-seeking students) are reasonable measures of how successfully they provide that training. For other institutions, such as community colleges, metrics like the Richmond Fed's Survey of Community College Outcomes are designed to more accurately measure what they do and who they serve. Yet despite their strengths, neither of these measures can capture students' ultimate labor market outcomes, and both also fail to capture other aspects of how colleges, and in particular community colleges, serve their regions and the broader labor market.

Each of the 122 community colleges in the Fifth District serves a unique geography. These colleges are mission-driven to meet the needs of their communities — educating students while ensuring that local employers have the workers necessary to keep their regional economy running. By engaging with community college leaders throughout the Fifth District, the Richmond Fed has not only collected data, but also gained a better understanding of what makes these colleges critical parts of the region's workforce development infrastructure and unique as individual institutions.

A key takeaway is that context matters, and it is important to understand the workforce role community colleges play — both in engaging those who might otherwise remain on the sidelines of the labor market and by delivering programming (credit and non-credit) that gives students the skills to find jobs and careers in critical occupations. Combining quantitative and qualitative data provides policymakers with a more robust understanding of the challenges and opportunities faced by community colleges and the important role they play in workforce development.

Redefining Community College Success

Comparing the Richmond Fed success rate and traditional graduation rate



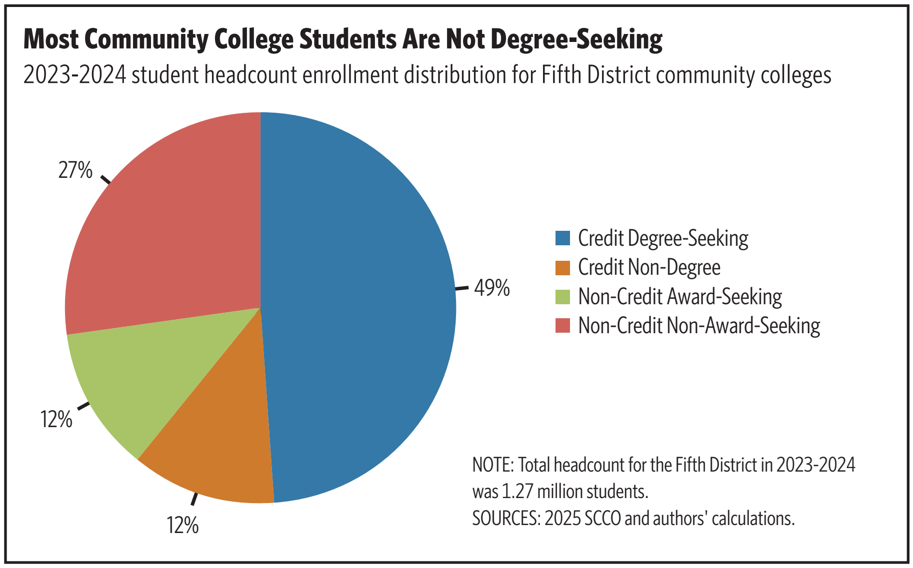
NOTES: N represents number of institutions over which students are aggregated. IPEDS graduation rates include only full-time, first-time, and fall entry students.

SOURCES: 2025 SCCO, NCES 2023-24 IPEDS, and authors' calculations.

ALWAYS START WITH THE DATA

Degree-seeking students at community colleges tend to look very different than degree-seeking students at many four-year colleges. In 2024, the Richmond Fed piloted a measure to include a larger share of community colleges' degree-seeking populations in the Survey of Community College Outcomes. The Richmond Fed's success rate captures outcomes for part-time students as well as students for whom this is not their first time attempting college, for example. In addition to expanding the criteria for inclusion, the success rate broadens the definition of student success to capture common pathways for community college students, like transferring to a four-year institution prior to earning an award at the community college. As an alternative to the traditional graduation rate, an institution's success rate provides a more expansive picture of how it serves its students. (See chart.)

While more representative of what community colleges do, the Richmond Fed success rate has limitations. Like a graduation rate, an institution's success rate is a static, aggregated measure of short-term student success that does not capture program-specific outcomes or longer-term outcomes like individual employment and earnings. In addition, unlike most four-year institutions, which primarily (often exclusively) serve students seeking degrees, community colleges offer options designed to support students along each step of their workforce pathway. In the Fifth District, only 49 percent of the 1.27 million students enrolled in community colleges in the 2023-2024 academic year were in degree programs. And this varies widely even among community colleges: At Spartanburg Community College in South Carolina, 82 percent of students were in credit-bearing degree programs, but at Allegany College of Maryland, the share was only 23.5 percent. Measuring a community college solely by the success of degree-seeking students would miss most of the students that many community colleges serve. (See chart.)



Who are the non-degree-seeking students that community colleges serve? First, there are credit non-degree-seeking students, who include high school students dually enrolled in community colleges and earning college credits or students enrolled in four-year colleges who choose to take a class at a community college and transfer the credits. Second, there are non-credit students, such as those seeking a General Educational Development credential, or GED, or those enrolled in a language course or a short-term workforce-oriented program. These programs are an important part of the role community colleges play across states.

But even if the success rate captured these non-degree-seeking students, there are still aspects of the work community colleges do that would be difficult to quantify. These include programs in key industries, training specific to the needs of a local economy, and education and training for students who would not otherwise have access to postsecondary education.

EVERGREEN OCCUPATIONS IN EVERYDAY INDUSTRIES

Community colleges provide training programs for critical occupations in industries that are important to everyday life in every community. In some cases, students earn traditional credentials such as certificates and associate degrees. In other cases, training is provided through short-term programs that offer hands-on instruction and connections to local employers through work-based learning opportunities. Regardless of credential type, community colleges often provide the primary pipeline — and sometimes the only public, low-cost pipeline — of workers into these occupations.

For example, most community colleges offer traditional programs in skilled building trades — such as welding, construction, and installation and repair of HVAC, electrical, and plumbing systems. Cape Fear Community College and Guilford Technical Community College in North Carolina, for example, are among the 16 North Carolina community colleges that partner with the Carolinas Associated General Contractors to offer construction boot camp programs that prepare students for entry-level construction work with hands-on training and nationally recognized credentials in just a few months. The length of the program is not unique. To accommodate students seeking a quicker path to the workforce and to help employers fill critical roles, many community colleges offer short-term intensive programs that provide stackable credentials and industry-ready training. Given that HVAC, electrical, and plumbing systems are critical to any functional building, just about every industry and every company needs the workers that community colleges are training.

Health care is another industry where community colleges play an outsized workforce development role. Nurses are critical across all health care specialties and settings. While a bachelor's degree in nursing is an increasingly common pathway into entry-level nursing jobs, a student who successfully completes an associate degree program in nursing from a state-approved program is qualified to apply for a registered nurse (RN) license from their State Board of Nursing and sit for the National Council Licensure Examination for

Registered Nurses exam. In 2024, nearly half of registered nurses reported that a postsecondary credential less than a bachelor's degree qualified them for their initial RN license. Community colleges may also help students stack credentials through certificates and gain valuable experience in health care fields as they prepare to complete a degree program for a more advanced role. Students may stack certificates within the field of nursing, moving from certified nursing assistant to licensed practical nurse before completing an associate degree. This also includes students who begin a career as a paramedic or a respiratory therapist, for example, and then leverage their skills and training to transition to a nursing pathway.

There are other health care roles that rely on community colleges, such as phlebotomists, dental hygienists, surgical technicians, radiology technicians, and emergency medical technicians. In many cases, training programs for these jobs are designed with input from local hospitals and health care providers that view community colleges as workforce development partners. For example, when health care leaders in rural southwest Virginia identified a need for diagnostic sonographers, Southwest Virginia Community College worked with the local hospital system (Ballad Health) to set up a program to develop a local workforce pipeline. With resources provided by Ballad and additional funding from Clinch Valley Health and the Virginia Tobacco Region Revitalization Commission, Southwest Virginia Community College launched a program in 2022. Strong industry partnerships often facilitate access to top-of-the-line equipment and high-quality instructors, who are otherwise difficult to recruit due to the wage gap between teaching and working in the field.

Another key industry that relies on community college programming is transportation. Many community colleges offer commercial driver's license and truck driver training programs, which are critical for communities across the country that rely on the work of truckers and the diesel mechanics who keep the vehicles running. Aviation maintenance training facilities at Pierpont Community and Technical College in West Virginia and Blue Ridge Community College in Virginia produce technicians who are qualified for Federal Aviation Administration certification and who work on aircraft both locally and across the country.

Many critical occupations do not require bachelor's degrees but do require hands-on training. Community colleges are well suited to understand and adapt to industry demands and facilitate student success while providing the workers that local industries need.

POWERING LOCAL AND REGIONAL INDUSTRY CLUSTERS

In addition to training students for evergreen occupations such as construction, transportation, or health care, community colleges try to prepare students for roles that are important to local and regional industries.

In some communities, geographic characteristics and natural amenities drive workforce demand. For example, the waterways, mountains, and oceans across the Fifth District draw substantial tourist populations, and communities near those amenities often rely on community colleges to train and educate workers in tourist industries. Carteret Community College in Morehead City, N.C., and Horry-Georgetown Technical College in coastal South Carolina have robust culinary programs that provide a pipeline of skilled service industry workers and other hospitality professionals for the many restaurants and hotels in their respective regions. In Western Maryland, Garrett College offers programs in outdoor leadership and adventure education and marine technology to support the outdoor recreation industry around Deep Creek Lake and the Appalachian Highlands.

Community colleges are often prime partners for manufacturing companies eager to develop a strong workforce pipeline as well. A February 2025 report from the Education Design Lab, a nonprofit focused on education-to-workforce models, emphasized the importance of the relationship between community colleges and employers in providing the hands-on, relevant training that can lead to positive workforce outcomes. In particular, the report highlighted meaningful employer relationships that provide "feedback loops to ensure alignment between education offerings and workforce needs" as well as "create opportunities for co-developing curricula and providing work-based learning experiences."

In the Fifth District, community colleges often partner directly with employers to develop training programs. In some cases, they also play a role in regional economic development partnerships designed to build and sustain momentum around locally important industry clusters. AdvanceNC is a collaborative effort between community colleges, universities, workforce development boards, and employers in central North Carolina to ensure the continued growth of the region's advanced manufacturing workforce pipeline. AdvanceNC supports collaboration, rather than competition, among the 12 participating community colleges, which represent counties with a diverse mix of manufacturing employers with unique workforce needs.

In Johnston County, N.C., the Workforce Development Center is focused on the pipeline for the local life sciences and biopharmaceutical industries. The result of a unique public-private partnership, the center is operated by Johnston Community College in partnership with the local economic development authority and the local school district. Through partnerships with key employers like Grifols and Novo Nordisk, Johnston Community College works to develop and deliver programs for secondary and postsecondary students in high-demand fields.

SERVING A BROADER REGION AT SCALE

While community colleges tend to prioritize serving the students and employers in their home region, some have unique offerings that draw in students from a broader geography. In some cases, these specialized workforce programs involve partnerships with other institutions. For example, Danville Community College in Virginia partners with the Institute for Advanced Learning and Research and others to support the Accelerated Training in Defense Manufacturing program to train adult learners for careers in the defense industrial base. Students travel to Danville from across the country for a 16-week intensive training in fields like additive manufacturing, computer numerical code machining, and welding using top-of-the-line equipment in programs designed with guidance from the Department of Defense. Tuition, housing, and transportation are fully covered for students in the program, which helps attract students who plan to train in Danville and work in other locations.

Some occupations require training on costly equipment or other infrastructure. In these cases, multiple regions might rely on a community college for workforce training. At Fayetteville Tech's Regional Fire and Rescue Training Center in North Carolina, first responders from across the region train for complex rescue scenarios that involve navigating fast-moving water at the swift water rescue facility. The facility was developed after Hurricane Matthew hit eastern North Carolina and is designed to help communities prepare for the unique challenges that arise when storms cause waters to rise. With a 140,000-gallon water tank and technology to simulate a range of challenging conditions, this is an expensive operation to run, and not every college can (or should) build one. Rather, first responders across multiple states can train at Fayetteville Tech's facility and apply the training in their communities.

Certified electrical power line technicians are needed anywhere there are power lines, but the physical infrastructure required to train these workers is prohibitive for many community colleges. Community colleges in rural settings, such as Wytheville Community College in southwest Virginia and Cleveland Community College in south central North Carolina, often have the necessary space to build out the structures needed for hands-on training. As a result, these programs draw students from far outside their service areas who relocate for intensive 10- to 14-week programs and earn multiple industry certifications. In many cases, these students will then return to their home locations.

PROVIDING ON RAMPS FOR NONTRADITIONAL STUDENTS

As open-access institutions, community colleges serve students who span educational and socioeconomic backgrounds. For many students, attending a community college reduces the financial barriers to higher education. Tuition and fees are often lower than at four-year institutions, and low-cost dual enrollment and transfer courses allow community college students to make incremental progress toward degrees and credentials.

The relationship between community colleges and economic mobility is complicated. There is evidence that community colleges offer significant value for students who could not otherwise access higher education. For example, a 2022 *American Economic Review* article by Jack Mountjoy of the University of Chicago links education and earnings registries and finds significant value added for two-year entrants who otherwise would not have attended college. Importantly, cost of attendance is not the only obstacle for some students. To serve less-traditional students, community colleges develop pathways and support to help navigate significant life challenges, thus enabling more students to succeed and add value to the labor force.

For example, students with learning challenges or intellectual disabilities may require support systems and guidance in a setting close to home. Community colleges in the Fifth District have established programs designed to recognize and address the barriers these students face while building on their interests and abilities. Institutions take different approaches to training students with intellectual disabilities for placement in local industry jobs. For example, the Brunswick Interagency Program at Brunswick Community College in North Carolina is a cross-sector partnership designed to support local students with intellectual and developmental disabilities as they transition into the workforce and into adulthood. At the state level, the T-STEP Program in North Carolina is designed to help students with autism gain employment.

Community colleges also make postsecondary education possible for adult students who have significant nonacademic responsibilities. In some cases, students may have previously started but not finished a degree program. The NC Reconnect program is a targeted effort in North Carolina to engage students between the ages of 25 and 64 who have some credits toward a postsecondary credential. Community colleges will often serve students who are working full-time or otherwise unable to be on campus every day by offering courses at a range of times or in different formats.

College students who are parenting minor children may require a unique set of supports beyond flexible course offerings. Some community colleges have on-site child care facilities for students with young children. At Carroll Community College in Maryland, the Littlest Learners Child Development Center offers discounted child care for students with children between the ages of 2 and 5. To be sure, offering on-campus child care for students is not feasible for many schools. Financial and regulatory concerns are frequently cited by community college leaders as barriers to providing child care on campus, and many communities already face persistent challenges meeting existing demand for child care.

Caregiving responsibilities can prevent individuals from completing — or even enrolling in — postsecondary programs to increase their income or grow their career. In response, some community colleges have found creative ways to support parenting students through family-friendly campus spaces and resources to help navigate local child care options. For example, Laurel Ridge Community College in Virginia designed the Parent Scholars Program to provide targeted support for students balancing caregiving and education. They also created the Cub House, a lounge on campus with a children's play area where parenting students can study while their children are occupied.

Recognizing the value of engaging parents in the workforce, the Virginia Foundation for Community College Education launched the College Attainment for Parent Students (CAPS) initiative to provide wrap-around support services for low-income parents of young children at five pilot schools in 2023. Program participants receive financial and academic coaching, career navigation, peer support, and direct financial support to defray the costs of child care, technology, and other expenses. The goal of the CAPS program is not just to improve labor market outcomes for a parent. It is also designed to ensure quality child care that can help a family emerge from generational poverty.

Completing further education and training can also be difficult for veterans transitioning to civilian life. Veterans separating from the military have valuable skills and expertise but may need support navigating higher education and the civilian labor market. The Fifth District is home to large military installations, and many community colleges are near bases, such as Fayetteville Tech (Fort Bragg), Coastal Carolina (Camp Lejeune), Frederick (Fort Detrick), and Tidewater (Naval Station Norfolk). Community colleges support veterans as they navigate financial aid programs and provide spaces on campus designed to support and build community for student veterans. Community colleges can participate in the SkillBridge Program, designed by the Department of Defense to "bridge the gap" between the military and post-military life. Students are paired with industry partners to receive hands-on training during their last 180 days of military service (while still getting military compensation) at no cost to the employer. In addition to serving individuals separating from the military, some community colleges have programs to serve the families of service members who may be navigating changes in school or work after moving to a new location.

EVOLVING THE WORKFORCE DEVELOPMENT LANDSCAPE

Each institution of higher education plays a role in developing the workforce. Measuring that role and its efficacy is both important and difficult. Developing a workforce is much more than providing courses and certificates. Workforce development is about offering access for everyone and ensuring that the skills and training provided are relevant to the current local, regional, and national economy.

Community colleges play a unique role in the nation's workforce development system. Accurately quantifying this role at an institutional and individual level ensures that everyone from potential students to policymakers to funders understands the costs and long-term benefits of postsecondary programming. Recognizing the programming that community colleges provide and the students they serve is important both for enabling more accurate data collection and ensuring that local, regional, and workforce development needs and opportunities are well understood. **EF**

2025 Survey of Community College Outcomes Is Live

Community colleges play a critical role in workforce development, but existing data collected across states do not fully describe the range of positive outcomes achieved by these students.

In 2021, the Richmond Fed launched the Survey of Community Outcomes as a pilot study with 10 schools.

It has expanded each year since, and in 2025, the team collected data on 189 community and technical colleges, including 121 schools in the Fifth District.

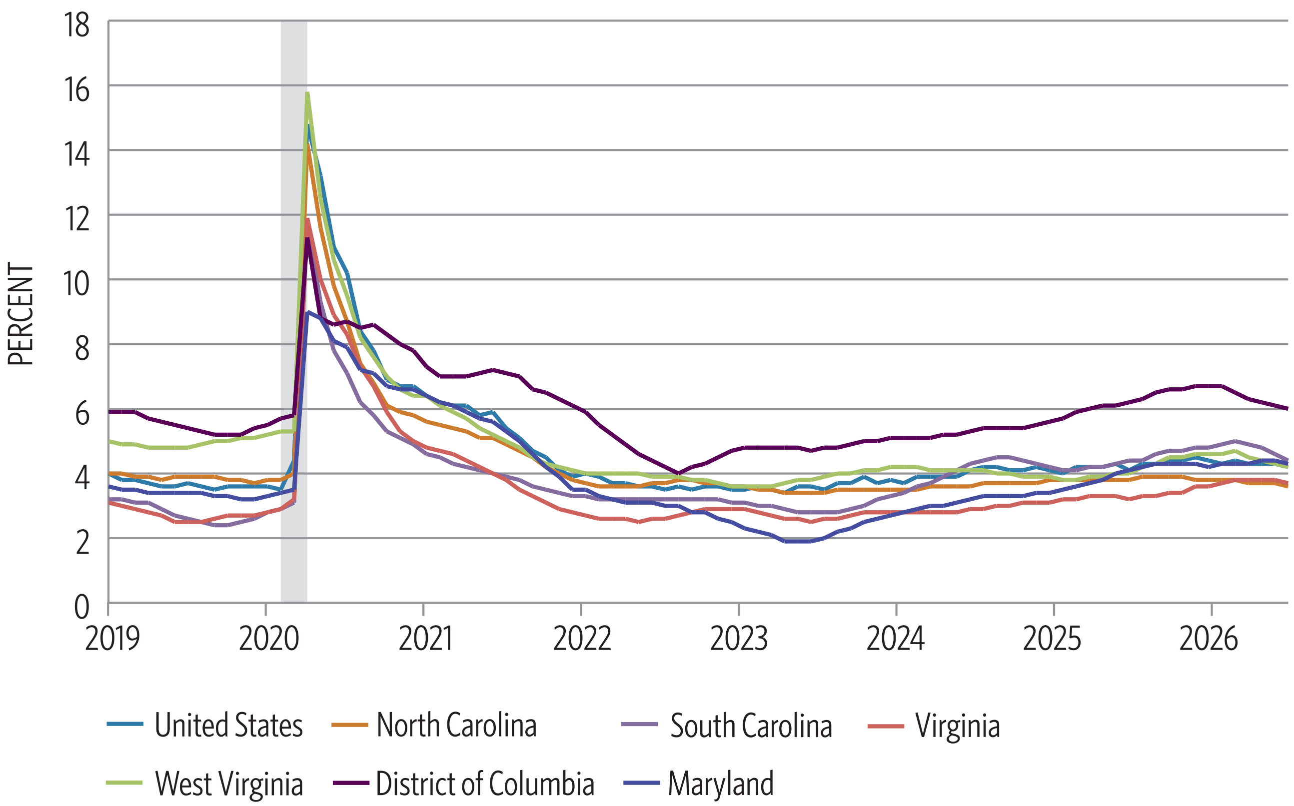
Scan here for the results from the 2025 SCCO

Labor Market Indicators

BY BETHANY GREENE AND JOSEPH MENGEDOTH

Payroll employment growth in the Fifth District was relatively flat in June, declining by 700 jobs on net (0.0 percent). Job gains were mixed across industries. The largest monthly increases in employment were in professional and business services (4,400 jobs) and education and health services (3,400 jobs). Job gains were partially offset by losses in other industries, but mostly in trade, transportation, and utilities (7,900 jobs). On an annual basis, Fifth District employment decreased by 15,300 (0.1 percent) on net, mostly due to employment declines in Virginia (43,600 jobs), the District of Columbia (36,100 jobs), and Maryland (18,700 jobs). Year over year, job losses were largest in government (33,200 jobs), professional and business services (21,000 jobs), and manufacturing (20,800 jobs). The only industries with positive job growth were education and health services (48,100 jobs), leisure and hospitality (24,600 jobs), and construction (18,300 jobs). The Fifth District unemployment rate is currently 4.0 percent, having decreased slightly by 0.1 percentage point in June.

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 July 2026.
Scan the QR code or visit Regional Economic Snapshot on RichmondFed.org for the most recent data.

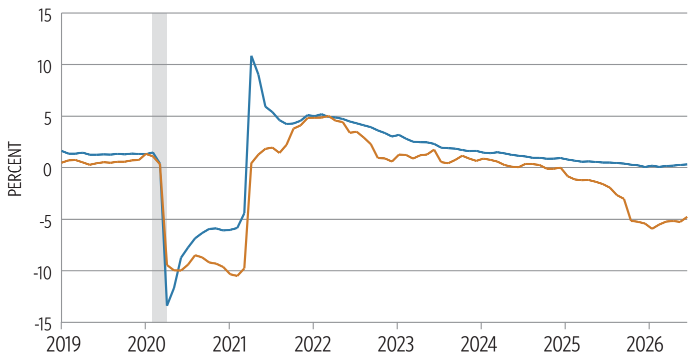
Fifth District Employment Growth

Total Nonfarm Employment Growth

Seasonally Adjusted, Year-over-Year Percent Change

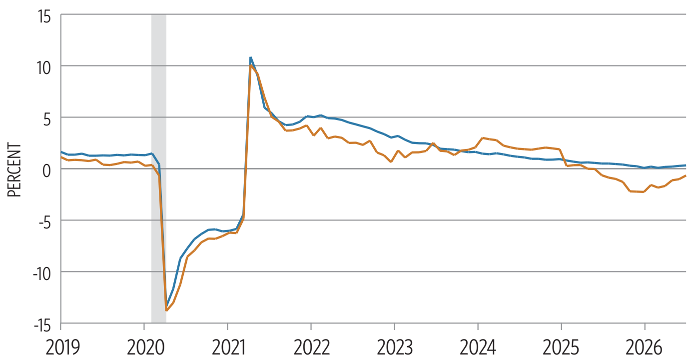
United States — DC/State — Indicates Recession

District of Columbia



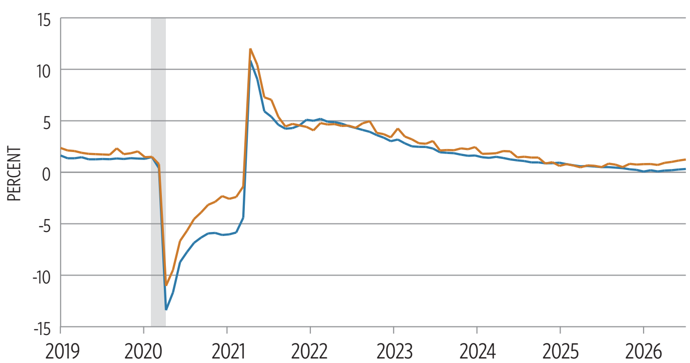
The District of Columbia's labor market improved marginally in June as total payroll employment increased and the unemployment rate declined slightly. On a year-over-year basis, total payroll employment in the District of Columbia declined by 36,100 jobs (4.8 percent), on net. Most job losses have come from the government sector, which is down 26,600 jobs from last year.

Maryland



Maryland's labor market improved slightly in June as total payroll employment increased, the unemployment rate declined, and the labor force expanded. On a year-over-year basis, total payroll employment in Maryland is down by 18,700 jobs (0.7 percent), on net. The most jobs were lost over the year in trade, transportation, and utilities (15,000 jobs), and government (12,300 jobs).

North Carolina



SOURCE: Bureau of Labor Statistics, Haver Analytics

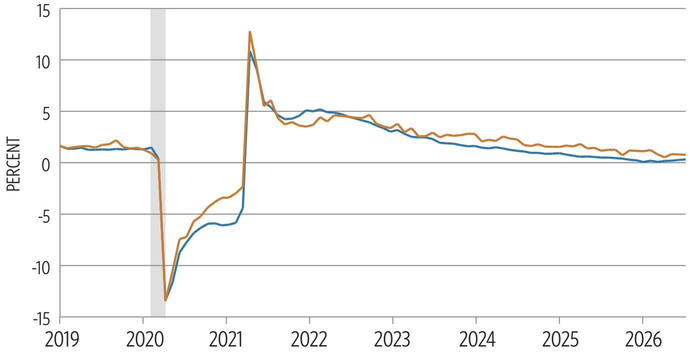
North Carolina's job growth was relatively flat in June, adding only 400 jobs, on net. Payroll gains were concentrated in construction and largely offset by declines in professional and business services. On an annual basis, payroll employment increased by 62,900 jobs (1.2 percent). The industries with the highest annual job growth were education and health services (21,800 jobs), leisure and hospitality (15,600 jobs), and construction (15,500 jobs). Three industries saw annual declines: manufacturing (10,000 jobs), information services (2,900 jobs), and trade, transportation, and utilities (300 jobs).

Total Nonfarm Employment Growth

Seasonally Adjusted, Year-over-Year Percent Change

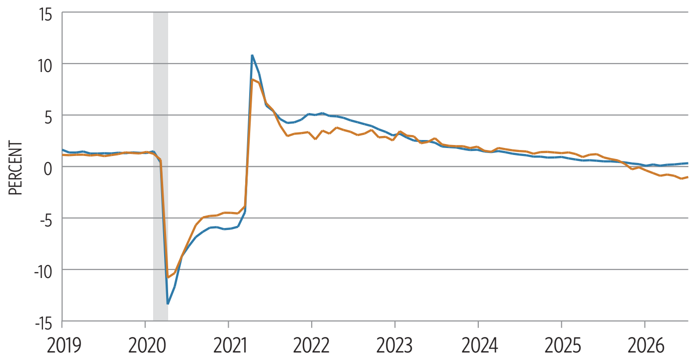
United States | State | Indicates Recession

South Carolina



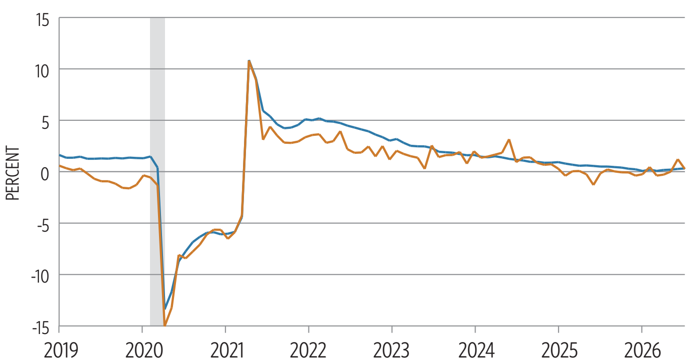
South Carolina's job growth stalled in June, with a decline of 400 jobs, on net. Many industries saw either flat or declining employment. On a yearly basis, payroll employment grew by 18,300 jobs (0.8 percent). Annual job growth was led by education and health services (8,100 jobs), leisure and hospitality (5,600 jobs), and government (4,300 jobs). Overall employment gains were partially offset by annual losses in professional and business services (4,400 jobs), information (2,500 jobs), and trade, transportation, and utilities (200 jobs).

Virginia



Virginia's labor market improved modestly in June as total payroll employment increased and the unemployment rate declined slightly to 3.7 percent. On a year-over-year basis, payroll employment in Virginia declined by 43,600 jobs (1.0 percent), on net. Compared to last year, most jobs were lost in professional and business services (20,500 jobs), manufacturing (10,100 jobs), and government (5,000 jobs).

West Virginia



West Virginia's labor market contracted in June, giving up nearly all the government sector payroll employment gains from May. On a year-over-year basis, total payroll employment in West Virginia increased by 1,900 jobs (0.3 percent), on net. Compared to last year, most jobs were added in education and health services (3,400 jobs) and construction (1,300 jobs).

SOURCE: Bureau of Labor Statistics, Haver Analytics

OPINION

BY ANNA KOVNER

Is AI Taking Over?

Artificial intelligence (AI) is taking over — at least in the popular press, the equity market, podcasts, and, increasingly, economics research. Richmond Fed economists are no exception, with many of my colleagues studying AI adoption and its implications for productivity and the economy. In this column, I'll take stock of what we know, what we can forecast from theory, what we can extrapolate, and the implications. In 1980, economist Julian Simon famously bet against biologist Paul Ehrlich in favor of human innovation over resource depletion and won. Will AI be the innovation that creates so much abundance that scarcity is irrelevant? Or will innovation make human contributions obsolete?

First, what do we know? AI adoption is already widespread among firms and associated with measurable labor productivity gains, yet evidence that it is disrupting employment is more limited. In 2025, the Richmond Fed, together with the Atlanta Fed and Duke University's Fuqua School of Business, surveyed more than 700 corporate executives across a wide range of sectors, geographies, and firm sizes. Eighty percent of large firms and around half of small firms reported investing in AI, and they expect those investments to continue growing. The motivation for this investment is rarely to put people out of work. Rather, executives cite improving production efficiency, enhancing decision-making speed, and strengthening output as both their motivations for investing in AI and the areas where the largest AI benefits have been realized.

AI adoption is already widespread among firms and associated with measurable labor productivity gains, yet evidence that it is disrupting employment is more limited.

Second, what can we forecast from economic theory? Theories estimating the impact of AI on U.S. productivity growth tend to look at different occupations and the extent to which their tasks can be replaced with or automated by AI. Then these occupations are weighted by output or wages and added up. This gives rise to estimates of productivity growth ranging from 0.5 percent to 1.5 percent. These results depend on differing assumptions about the speed of and cost savings from adoption, among other factors. A key difference from past general-purpose technologies is AI's potentially disruptive impact on higher wage, college-educated workers.

Third, what can we extrapolate? Experience suggests that technology can automate some tasks, but it doesn't eliminate jobs immediately. For example, consider ATMs, which automated routine cash handling tasks, or check sorting machines, which automated check processing. At first, bank teller employment grew after these inventions lowered bank branch costs and enabled expansion. It took the emergence of mobile banking to reduce branch tellers.

Generative AI has early adoption patterns like personal computers, which may have reduced the number of stenographers but exponentially grew the number of memos. Research that looks at AI's impact on tasks finds larger productivity benefits for less experienced and lower-skilled workers. The ultimate impact will depend on the extent to which AI substitutes for more educated workers rather than enhances their productivity — and we are too early into AI adoption to do more than speculate.

For now, it seems likely that AI will reshape jobs rather than eliminate them. AI is unlikely to perform all job tasks, even in occupations exposed to AI. Yet we cannot be complacent. Transformative technologies always have winners and losers, and one lesson of trade liberalization was that some workers proved less adaptive and were unable to replace high-quality jobs.

One risk often left out from these analyses is the potential productivity destruction from AI used for cyberattacks or other malicious purposes. To the extent that AI lowers the costs for nuisance attacks, this may detract from the productivity gains estimated.

A final topic of particular interest for the Fed is AI's impact on inflation. In the short run, red-hot demand for AI could increase inflation through higher demand for scarce resources such as computer chips, construction inputs, and electricity. In the long run, if AI results in increased productivity, prices should fall as lower production costs and improved resource allocation (not to mention labor-saving innovation) reduce marginal costs.

On the other hand, if AI is used to better estimate demand and adjust prices accordingly, firms with pricing power may use it to achieve higher markups, making its impact inflationary. A recent study found that the share of job vacancies that mention AI and pricing rose more than tenfold from 2010 to 2024. Appropriate monetary policy will require careful research to disentangle inflationary demand for scarce inputs and productivity gains, not to mention anticipatory demand from higher productivity expectations. **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
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