

MASS

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THE JOURNAL OF THE MASSACHUSETTS ECONOMY

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MassBenchmarks provides timely information about the Massachusetts economy, including reports, commentary, and data about the state's regions and the industry sectors that comprise them.

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The editors invite queries and articles on current topics involving the Massachusetts economy, regional economic development, and key growth industries from researchers, academic or professional economists, and others. A description of the topic and a brief biography of each author should be sent to massbenchmarks@donahue.umass.edu.



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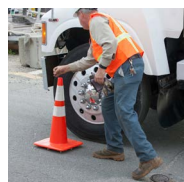
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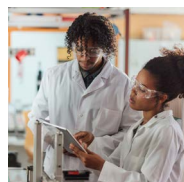


The Price of Middle-Class Life in Massachusetts Today

Elise Rapoza and Benjamin Forman

Despite the state's high wages and high productivity, a recent research report by the MassINC Policy Center has found that a middle-class lifestyle is increasingly difficult to attain—and sustain—for many in the Commonwealth.

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Branner Stewart

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Endnotes: Continued Economic Growth in the Commonwealth Will Depend Largely on Productivity

Alan Clayton-Matthews

Despite flat employment, the Massachusetts economy grew over the past 2 years—all thanks to productivity. If the labor force continues to shrink as projected, understanding productivity growth, and how to nurture it, will be critical to the state's economic health.

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LETTER FROM THE CHANCELLOR



This issue of *MassBenchmarks* arrives as the Massachusetts economy confronts a genuine paradox. By headline measures, the Commonwealth remains resilient, and recent state economic growth has outpaced the nation. Yet job growth has stalled, the cost of living keeps rising, and federal support for research and development has decreased and future support remains uncertain.

The issue opens with an assessment of the state economy. Mark Melnik, director of economic and public policy research at the UMass Donahue Institute, documents a Massachusetts that keeps growing even as employment stays essentially flat. This divergence is being driven by productivity gains, including early returns on artificial intelligence and other technologies. He also highlights the vulnerabilities that lie beneath that strength: an aging workforce, reduced immigration, and persistent domestic outmigration trends that together threaten future labor force growth, compounded by a volatile federal policy environment.

The first feature article, by Elise Rapoza and Benjamin Forman of the MassINC Policy Center, asks a deceptively simple question: What does it actually cost to live a middle-class life in Massachusetts today? Drawing on the Massachusetts Middle Class Status Report and a residual-income framework, the authors show that a middle-class standard of living is increasingly attainable only for households that can combine multiple earners, reliable access to childcare, manageable commutes, and the capacity to save. They document how housing, childcare, healthcare, and higher education have become the "entry fees" to the middle class, how those costs fall unevenly across household types and by race and ethnicity, and how the associated time squeeze on working families erodes civic participation.

The second feature article, by Branner Stewart of the UMass Donahue Institute, examines the federal research funding on which the Commonwealth's innovation economy depends. Stewart details how early-stage federal grants catalyze a pipeline that supports more than one million jobs statewide and how recent funding cuts, grant terminations, and structural changes now jeopardize that engine. While these developments have very real economic costs today, the full cost will be felt in the startups, discoveries, and jobs that fail to materialize a generation from now.

The issue concludes with an Endnote by Alan Clayton-Matthews, senior contributing editor of this journal, who takes up the productivity question directly. If the labor force continues to shrink as projected, he argues, all future economic growth will essentially depend on productivity. He helpfully points toward levers within reach of policymakers, particularly investments in education, training, and the retention and attraction of skilled workers.

This issue also carries a remembrance of Lynn Browne, founding editor of *MassBenchmarks*, whose foundational work helped give rise to this journal and whose legacy endures in it.

I am confident that the research presented in this issue will prove useful to the Commonwealth as it continues to make evidence-based policy decisions and sustain the innovation that drives the state's economy.

A handwritten signature in black ink, appearing to read "Javier A. Reyes". The signature is fluid and stylized, with a long horizontal line extending to the left.

Javier A. Reyes
Chancellor of the University of Massachusetts Amherst

In Memoriam: Lynn Browne

ALICIA SASSER MODESTINO

The MassBenchmarks Board was extremely saddened by the passing of our dear colleague, Lynn Browne, on January 25, 2026, at the age of 79. Specializing in monetary policy, regulatory matters, and regional economic development, Lynn served as an economist at the Federal Reserve Bank of Boston for more than 30 years, retiring as Executive Vice President and Economic Advisor and leaving a legacy of foundational research studies, impactful policy insights, and innovative programs. Her research focused on issues pertaining to the New England economy, including the Boston Fed's landmark study of racial discrimination in home mortgage markets, which exposed the long-term impacts of redlining practices on racial segregation in the Greater Boston area. From 1993 to 2001, she served as the Boston Fed's Director of Research, overseeing the first district's monetary policy analysis and regularly attending meetings of the Federal Open Market Committee, which sets national interest rates. As Executive Vice President, Lynn established the New England Public Policy Center, was the driving force behind the Working Cities project, spurring efforts to revitalize New England's old industrial centers, and helped found the New England Economic Study Group, the precursor to MassBenchmarks—all initiatives that still endure today. After retiring from the Fed, Lynn spent the next decade teaching central banking at Brandeis International Business School.

On a more personal note, Lynn was a pioneer in the field of economics, obtaining her PhD from the Massachusetts Institute of Technology at a time when women held less than 10% of economics doctorates. She was a great role model for the next generation of female economists and was always generous with her time and advice, empowering myself and others whom she mentored to advance within the Federal Reserve and in economics professions more broadly. On top of being a brilliant economist, Lynn was a true Renaissance woman. She was an avid equestrian, a talented instrument-rated pilot, and an ardent conservationist—placing her farm and adjacent land under permanent conservation restrictions to protect it in perpetuity.

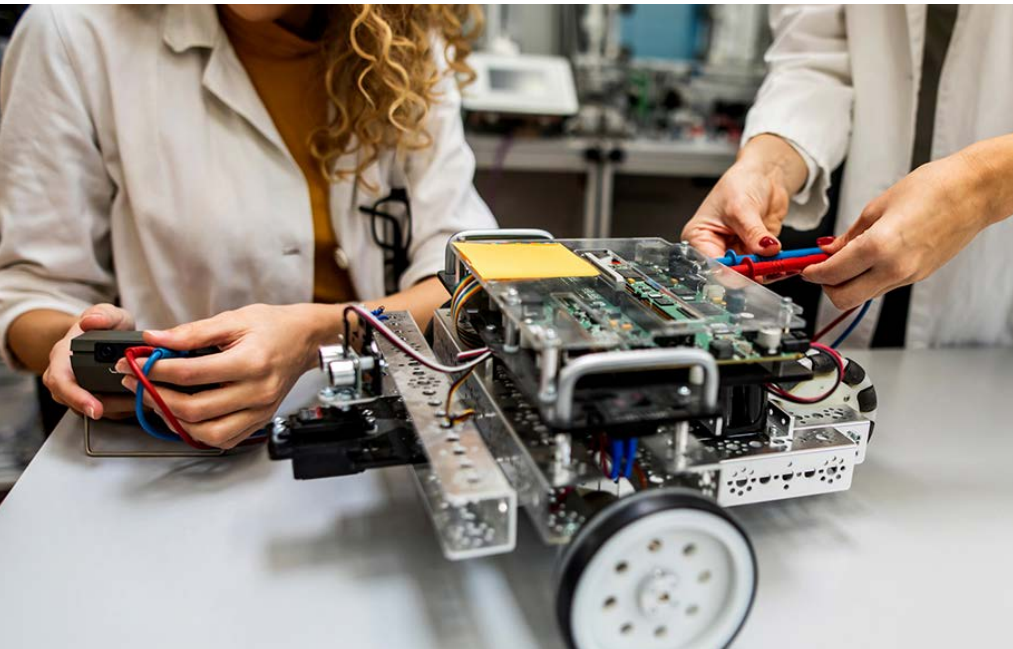
Although her colleagues, community, friends, and family will sorely miss Lynn, we are all deeply grateful for the professional and personal legacies she leaves with us.

Alicia Sasser Modestino is associate professor of public policy and urban affairs and economics, and director of the Kitty and Michael Dukakis Center for Urban and Regional Policy at Northeastern University.



Uneven Expansion and Emerging Headwinds: Massachusetts' Economy Continues to Navigate Divergent Trends

AI-powered investment and rising productivity sustain economic growth, while labor market softening and stagnating jobs raise questions about broad-based prosperity.



GROSS DOMESTIC PRODUCT AND GROWTH

The Massachusetts economy continues expanding, but this narrative masks a troubling reality about who benefits from that growth.

U.S. GDP for the first quarter of 2026 came in at an annualized 2.1 percent, similarly to the 2025 growth rate. What is keeping growth afloat, however, tells an important story: Business investment in equipment and intellectual property—particularly in artificial intelligence—is driving expansion. For Massachusetts and its tech-driven economy, which both supplies and applies AI, the picture is

slightly rosier in terms of GDP growth. State GDP growth came in at 2.4 percent during the first quarter, slightly exceeding the national average. The state is seeing significant activity in the development and application of AI in areas ranging from air-traffic control and robotics to life sciences and machine intelligence. While Massachusetts does not have a “big four” headquarters (tech titans Meta, Microsoft, Alphabet, and Amazon collectively spent half a trillion dollars on capital expenditures in annualized 2026:Q1 terms, predominantly for AI infrastructure), the state’s economic output benefits from

the national surge in AI investment and development.

A critical issue for both the United States and Massachusetts is how this economic growth is distributed. The economy’s expansion is concentrated in business investment whose returns flow largely to equity holders rather than workers. Meanwhile, consumption—the aggregate spending by households across the entire income spectrum—is growing more slowly. The divergence between investment-driven growth and consumption-driven growth suggests that benefits are concentrating among those with capital, not those with labor to sell.

EMPLOYMENT AND LABOR MARKET CONDITIONS

The Massachusetts labor market has entered a cautious pause, with signals suggesting tighter conditions ahead. Payroll employment growth has slowed, with a net loss of 2,300 jobs between May 2025 and May 2026. Recent monthly figures have varied, with some showing growth and others decline, suggesting an unclear trajectory rather than a confident trend.

This ambiguity masks uneven sectoral dynamics. Construction has held relatively steady, fueled by infrastructure projects. Education and healthcare have continued to lead growth, while manufacturing is showing relative stability in job counts. These bright spots, however, cannot offset troubling patterns in other sectors. Notably, business services employment (a broad sector that includes such areas as scientific R&D, law, consulting, engineering, advertising, and computer systems design)—historically a Massachusetts strength—has been conspicuously missing from the job growth narrative, although there were signs of improvement during the spring.

Wage and salary income presents another complicated picture. This segment of income (others being transfer payments like Social Security and investment income from dividends,

interest, and rent) received an unusual boost from a larger-than-normal bonus season, helping to pump up overall income growth figures in Massachusetts (noting that in recent quarters less affected by bonuses, Massachusetts wage and salary payments still grow at a higher rate than that of the United States). However, this surge suggests that much wage and salary growth is concentrated among the types of higher earners who receive bonuses. Millionaire's tax receipts running \$600 million above the prior fiscal year confirm that income gains are flowing disproportionately to top earners, with most Massachusetts workers experiencing more modest income growth.

UNEMPLOYMENT RATES AND LABOR MARKET SOFTENING

The unemployment rate in Massachusetts now exceeds the national rate (4.5 percent in May versus 4.3 percent for the United States)—a reversal of the historical pattern in which the state typically runs about a percentage point below the nation. The U-6 unemployment measure, which includes involuntary part-time workers and marginally attached workers, shows the Massachusetts labor market in slightly better shape than the nation's. Overall, Massachusetts unemployment trends, whether headline or U-6, point to a softness in labor demand in the state's job market.

PRODUCTIVITY

Massachusetts ranks among the nation's most productive states, demonstrating labor productivity (GDP per worker) that is rising faster than both the U.S. average and every region of the country. By this measure, the state ranks sixth nationally (New York is first, buoyed by its large finance sector). The Massachusetts productivity edge is, statistically speaking, a national asset.

However, the mechanism driving our state's high and increasing



productivity masks an uncomfortable truth—production is increasing without job growth. Over the past 5 years, hours worked have increased relatively little. This dynamic—more output but relatively flat labor input—is precisely what artificial intelligence and automation may deliver. That said, the Board did not reach a consensus on what AI's future impact would be on employment and skill levels. New technologies are often disruptive in the short term, but in the longer term, the effects of productivity growth on output and income are the dominant outcome.

LABOR FORCE PARTICIPATION

Labor force participation and resident employment (compared with payroll employment) in Massachusetts have been declining since early 2025, a shift driven by little growth in the working-age population combined with an expanding older population. Age-specific participation rates underscore this pattern: Prime-age workers (typically

25–54) show steady or slightly increasing participation, but overall participation is falling because workers 55 and older are aging out of the workforce and, critically, not being replaced by younger cohorts entering from other age groups. Restrictions on the flow of immigrants into the country is compounding this issue for Massachusetts. The demographics combined with an obstructed flow of foreign workers point toward a tightening labor supply, even if hiring demand has weakened. Education remains a protective factor, with higher education levels correlating with the highest participation rates. Prime-age workers with college degrees remain more robustly employed, but this does not extend uniformly to those without higher credentials or to workers over 55, suggesting that the Massachusetts labor market continues to bifurcate along skill and age lines. Even recent college graduates, however, are no longer seeing their degrees as a guarantee of job market success.

INFLATION AND PRICE STABILITY

Inflation has ticked upward. The personal consumption expenditures (PCE) price index, the Federal Reserve's preferred inflation measure, remains elevated (4.1 percent annualized in May) and well above the 2 percent target. Inflation is broad-based, present in durable goods, non-durable goods, and services—each category running above the 2 percent benchmark. Recent New England inflation figures show the region tracking close to U.S. averages.

Global trade disruptions, supply chain vulnerabilities, and commodity shortages (e.g., fuels and fertilizer) are the key factors driving inflation readings higher. The shock to energy prices is likely dampening consumer purchasing, particularly for lower-income households already constrained by slow wage growth.

ECONOMIC OUTLOOK

The economic outlook carries significant vulnerability. Multiple policy headwinds are weighing on Massachusetts: Immigration restrictions affect labor supply and innovation in high-skill sectors; R&D funding concerns threaten the state's knowledge economy; and Medicaid reductions will constrain consumer spending and healthcare provider employment. Weakening consumption growth, notably for low- to mid-level earners, may be a harbinger of deeper economic problems ahead—a warning sign that households are losing consumer confidence or facing financial strain.

The Board noted the regional disparities in economic opportunity in Massachusetts. Rural areas and western Massachusetts are more sensitive to fuel prices and less likely to see growth from the sectors driving current expansion—technology, finance, biotech, robotics, automation, etc. These regions face a double burden: vulnerability to economic shocks (fuel prices) and less integration with the state's key growth sectors. The metropolitan Boston area's strengths mask a regional divide that could widen if current trends persist.

Board members emphasized that Massachusetts' current economic performance is solid while simultaneously acknowledging that downside risks are real and unevenly distributed. The economy appears to be "hanging in there," but this aggregate stability conceals several areas of concern. For large swaths of the population—younger and older workers and other vulnerable groups struggling to find employment, workers in regions disconnected from AI-driven growth, middle-income households watching wage and salary gains flow to the top—current conditions may already feel like a slowdown. An unanticipated shock or event—a financial market disruption, an extended energy price spike, a geopolitical crisis—could quickly tip forces in the wrong direction, turning what is today a bifurcated expansion into a broader-based contraction.

PREPARED BY BRANNER STEWART,
CONTRIBUTING EDITOR

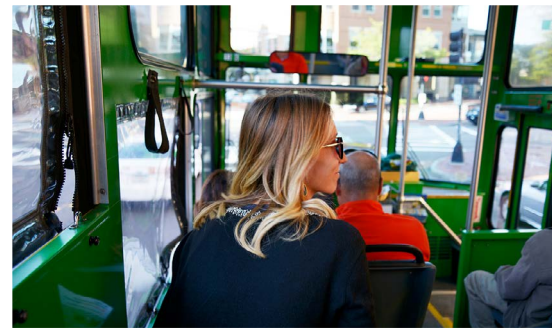


This summary reflects the discussion of the members of the Editorial Board of MassBenchmarks at its spring meeting on May 29, 2026, and it reflects the economic data available up to that date. It was prepared by Branner Stewart, senior research manager at the UMass Donahue Institute, and was reviewed and edited by the members of the Editorial Board. While discussion among the Board members was spirited and though individual members hold a wide variety of views on current economic conditions, this summary reflects the broad consensus of the Board regarding the current state of the Massachusetts economy.

State of the State Economy

MARK MELNIK

Through the first half of 2026, the Massachusetts economy was resilient, with gross state product growth outpacing the nation and productivity gains remaining strong, despite modest employment growth. However, the state faces structural vulnerabilities—including an aging workforce, reduced immigration, and persistent outmigration—that threaten future labor force growth. Amid geopolitical uncertainty and shifting federal policies, Massachusetts faces a critical question: How can the state maintain economic vibrancy in an era of constrained labor availability and heightened global uncertainty?





Introduction

Through the first half of 2026, the U.S. and Massachusetts economies showed resilience amid various mixed signals. Job growth has been slow for much of the last 2 years, though the state has experienced modest job gains in recent months. While unemployment has ticked up over the last couple of years, it remains low by historic standards. Economic productivity, as measured by gross domestic product (GDP), has remained relatively strong over the last several quarters, thanks in part to strong business investments around artificial intelligence (AI). That said, overall economic expansion remains tempered. Geopolitical turmoil was already impacting the economy, between the wars in Ukraine and Gaza and the Trump Administration's evolving imposition of tariffs in trade negotiations. The war in Iran has only further complicated global economic conditions, with energy prices skyrocketing since the beginning of the conflict in late February. Many analysts suggest that, following a final resolution

to the war, it will take months for supply shocks to resolve. Together, these issues, along with policy shifts under the new administration, create significant economic uncertainty heading into the back half of 2026.

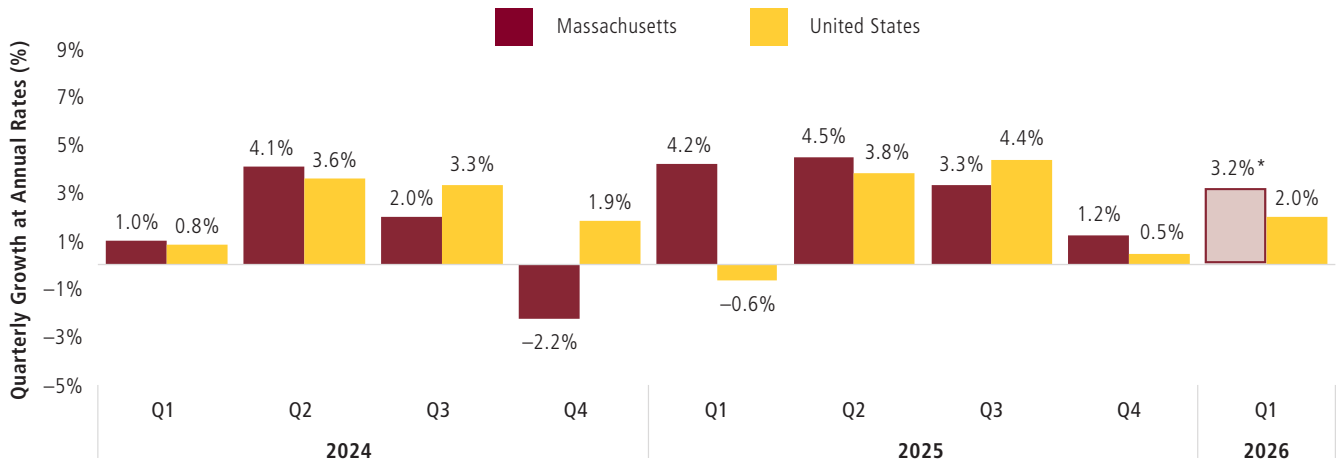
Gross Domestic Product

According to our team at *MassBenchmarks*, Massachusetts' real gross state domestic product increased at an annual rate of 3.2% during the first quarter of 2026, while U.S. GDP increased at an annual rate of 2.0%. Though negatively impacted by the government shutdown in the fall of 2025, growth rates have improved since the fourth quarter of 2025, when GDP grew 1.2% for Massachusetts and 0.5% for the United States, respectively. With the war with Iran beginning at the end of February, the conflict had little effect on growth in the first quarter of this year. Analysts expect that the war will negatively impact growth due to supply disruptions, though the extent of the impact will hinge on the resolution of

the war and the reopening of the Strait of Hormuz. Even before the war, however, the Massachusetts and U.S. economies were expected to grow more slowly in 2026 due to a drop in labor force growth related to an aging working-age population and sharp reductions in net international migration.

As Figure 1 illustrates, the Massachusetts economy has continued to expand over the past few years. Gross state product (GSP) has exceeded GDP in four of the last five quarters, even though the state has experienced very little job growth over the same period. This means that all or almost all economic growth now reflects increases due to productivity gains or to employers extracting more value out of their current labor supply. A rough but reliable proxy for this is growth in real GDP per payroll worker. For Massachusetts, this productivity measure grew 3% in 2025, and in recent quarters, this measure of productivity growth has trended half a percentage point higher than the corresponding measure for the United States.

Figure 1: Growth in Real GDP, Massachusetts and the United States, 2024:Q1–2026:Q1



■ Note: * 2026:Q1 growth rate for Massachusetts is estimated by the MassBenchmarks Current Economic Index.
 Source: U.S. Bureau of Economic Analysis (BEA).
[Access the text-based description of Figure 1: Growth in Real GDP on Google Docs.](#)

Employment Change

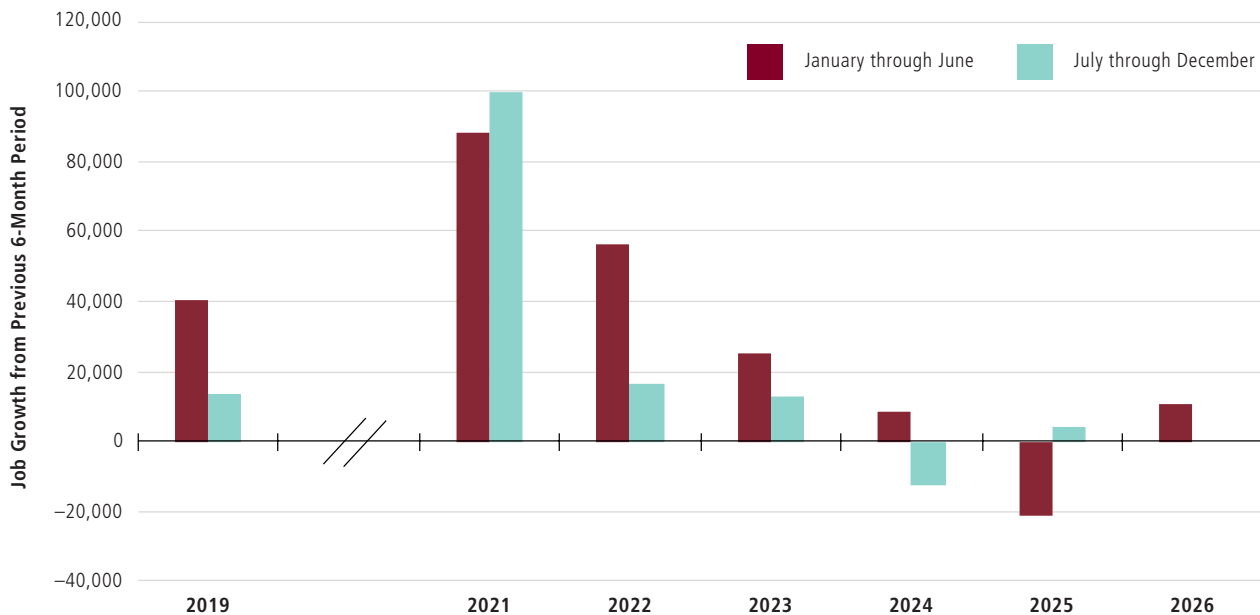
Massachusetts has seen very little employment growth since 2023, with virtually no job growth in the last year. That said, the state appears to have experienced a modest job swing in employment over the last several months.

The state experienced a strong

initial rebound once pandemic-related restrictions began to ease. However, employment gains have decelerated significantly over the past 3 years. As illustrated in Figure 2, which breaks down annual employment growth in 6-month periods, the strongest job creation occurred during 2021 and the first half of 2022. Since then,

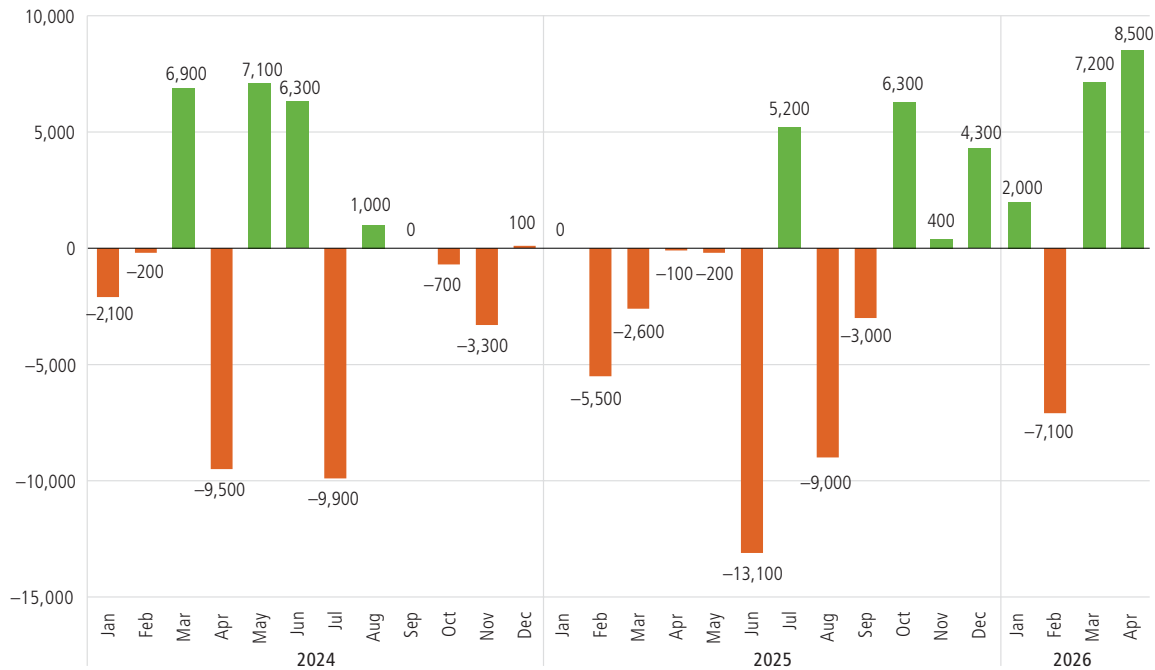
employment expansion has tapered notably. That said, recent employment estimates for the state are trending upward: Since October, Massachusetts is up 21,600 jobs. While these estimates will be subject to later revisions and are modest by historical standards, they do signal a reversal of trends through much of 2025 (see Figure 3).

Figure 2: Massachusetts Job Creation by 6-Month Period, 2019, 2021–2026



■ Note: 2020 omitted for scale. An estimated 545,000 jobs were lost in the Massachusetts economy in the first half of 2020. Data for the first half of 2026 are partial (through April).
 Source: U.S. Bureau of Labor Statistics (BLS), Current Employment Statistics.
[Access the text-based description of Figure 2: Massachusetts Job Creation by 6-Month Period on Google Docs.](#)

Figure 3: Change in Jobs from Preceding Month in Massachusetts, 2024–2026



■ Source: BLS, Current Employment Statistics.

[Access the text-based description of Figure 3: Change in Jobs from Preceding Month in Massachusetts on Google Docs.](#)

As noted earlier, and as shown in Figure 3, despite the state's recent positive employment growth, on balance, Massachusetts has had virtually no job growth over the last year. While this may seem discouraging on the surface, it largely reflects the lack of job growth in the United States over the same period. Figure 4 plots each of the 50 U.S. states regarding the percentage of job growth over the last 12 months for which data are available.

While Massachusetts lags the average job growth in the United States over this period, it does so only slightly and is lumped in with many states experiencing very modest growth or decline over the last year. Currently, Massachusetts ranks 28th among states in job growth over the last 12 months. Aside from the general uncertainty and volatility associated with global affairs and federal policy shifts, the lack of job growth in Massachusetts is also influenced by

demographic factors in the state. That is, the Commonwealth has experienced a slight contraction of the labor force over the last year (see Figure 5), due largely to the combination of older workers leaving the workforce, persistent levels of domestic outmigration from the state, and the sharp reduction in immigration since the beginning of the second Trump Administration.

Currently, Massachusetts ranks 28th among states in job growth over the last 12 months.

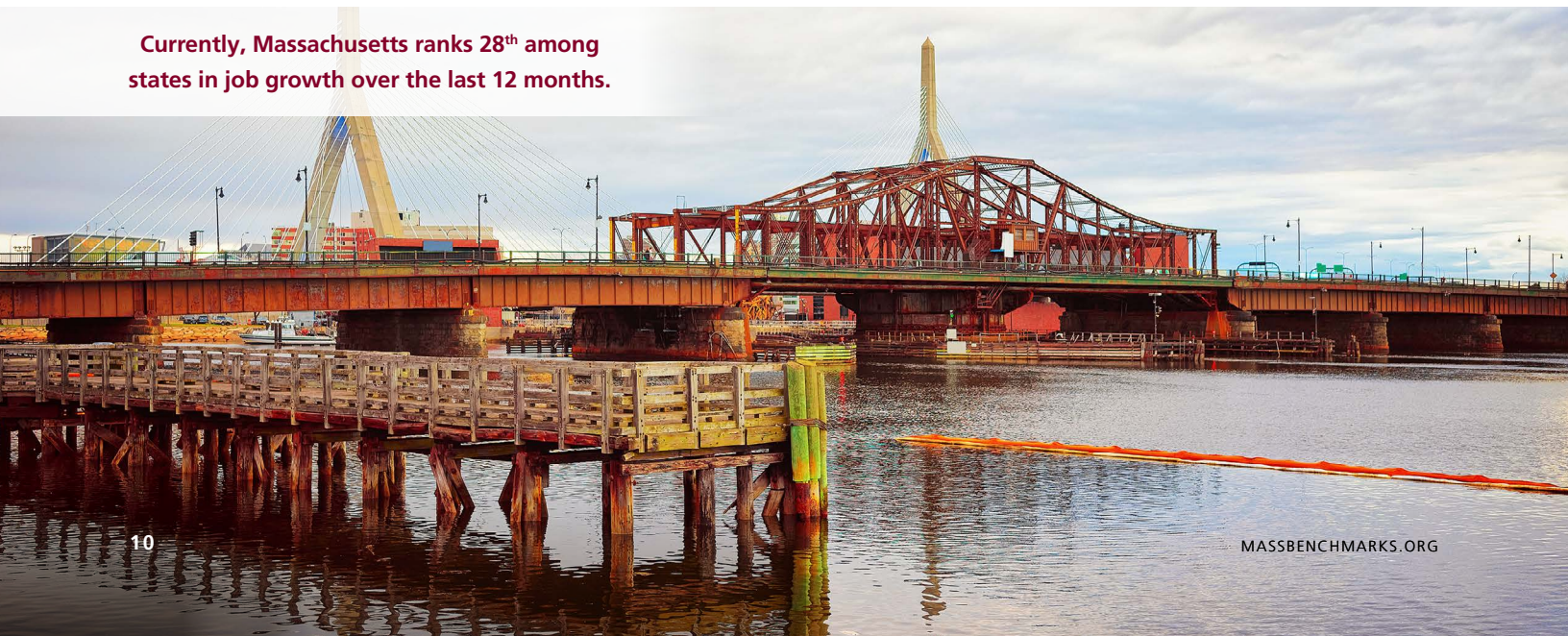
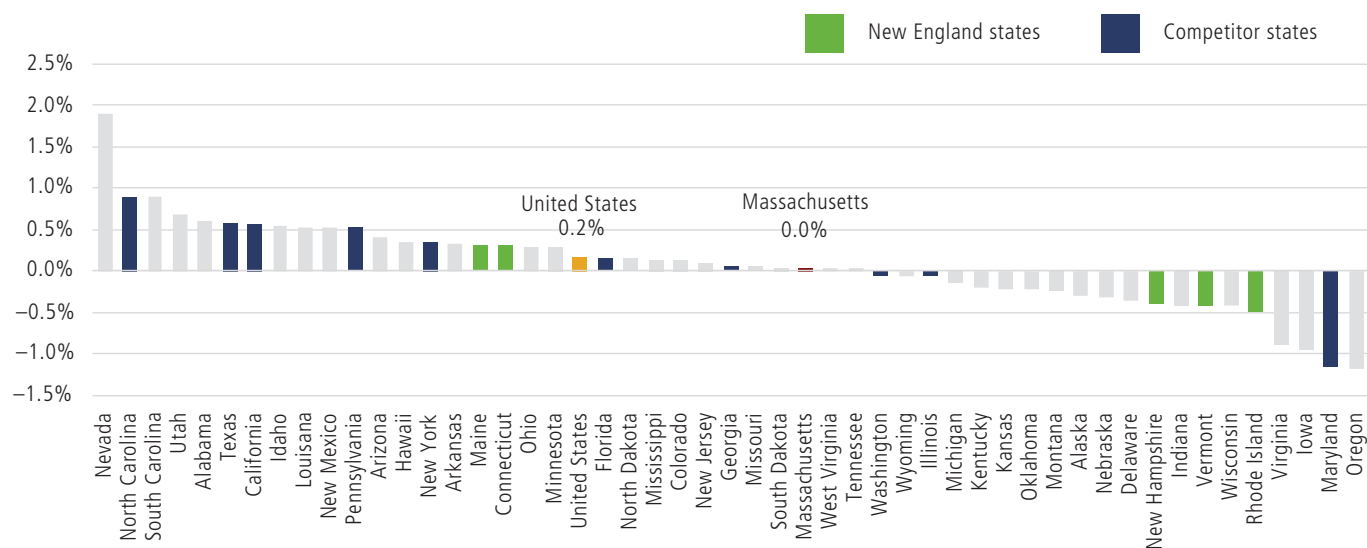




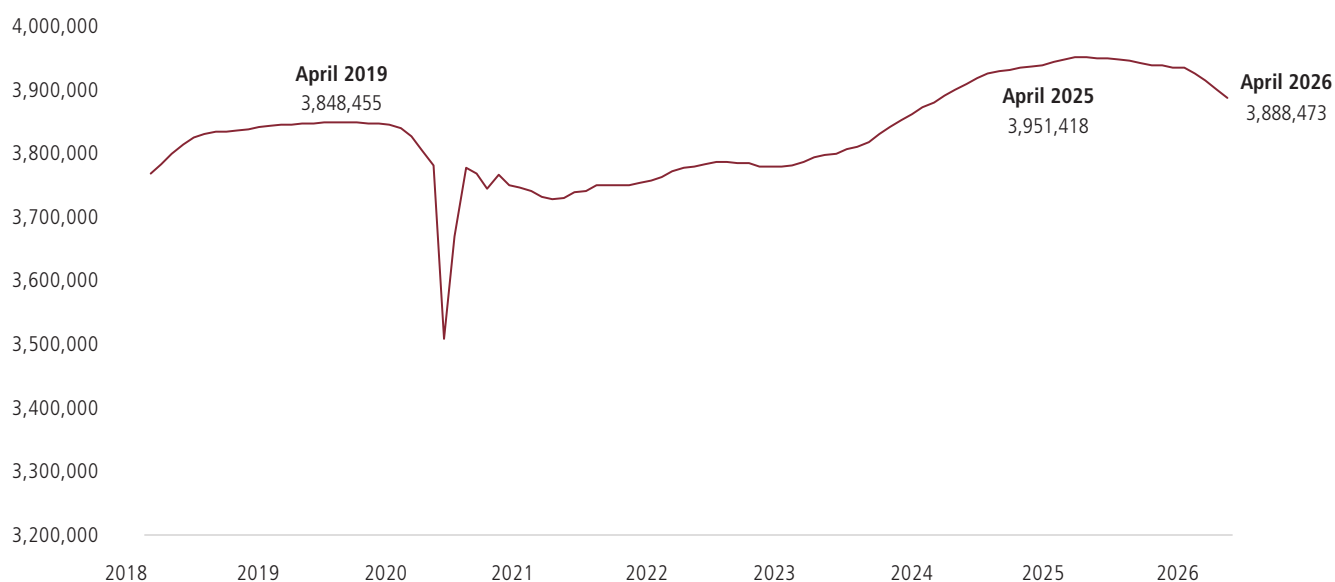
Figure 4: Year-Over-Year Job Growth in the United States and All States, April 2025–April 2026



Note: New England states appear in green. Competitor states—those ranking highly as innovation- and knowledge-based economies—appear in blue.
Source: BLS, Current Employment Statistics.

[Access the text-based description of Figure 4: Year-Over-Year Job Growth in the United States and All States on Google Docs.](#)

Figure 5: Massachusetts Labor Force, 2018–2026 (Seasonally Adjusted)



Source: BLS, Local Area Unemployment Statistics (LAUS).

[Access the text-based description of Figure 5: Massachusetts Labor Force on Google Docs.](#)

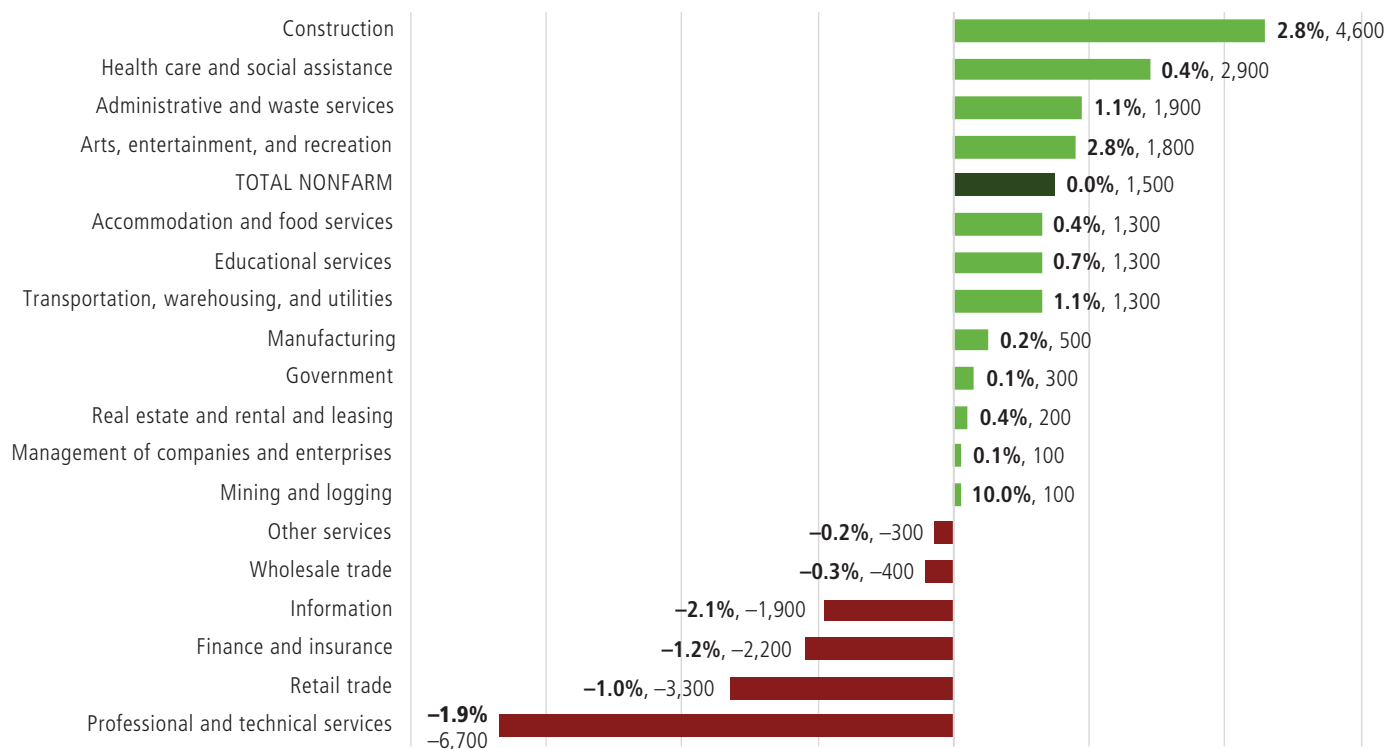


While the total number of jobs in the state has largely stayed the same over the last year, there has been some employment movement within industries in Massachusetts (see Figure 6). Over the last year, the construction sector in the Commonwealth has added 4,600 jobs, with much of that increase occurring over the last few months. While recent employment numbers will be subject to back revisions over time, this

movement in construction is nonetheless notable. The sector has experienced particularly robust job growth in heavy and civil engineering, which points to infrastructure projects. The healthcare and social-assistance sectors grew 2,900 jobs over the same period. Conversely, professional and technical services, a sector that has long been a driving force in the Massachusetts economy, has lost 6,700 jobs over the last year. Much

of that job loss has been in computer system design and related services and in scientific research and development (R&D), due in part to shifts in federal research funding, drug-approval processes, and perhaps the role of AI in computer support roles. This issue of the journal includes a deeper examination of the R&D ecosystem in Massachusetts, authored by Branner Stewart, a senior research manager at UMDI.

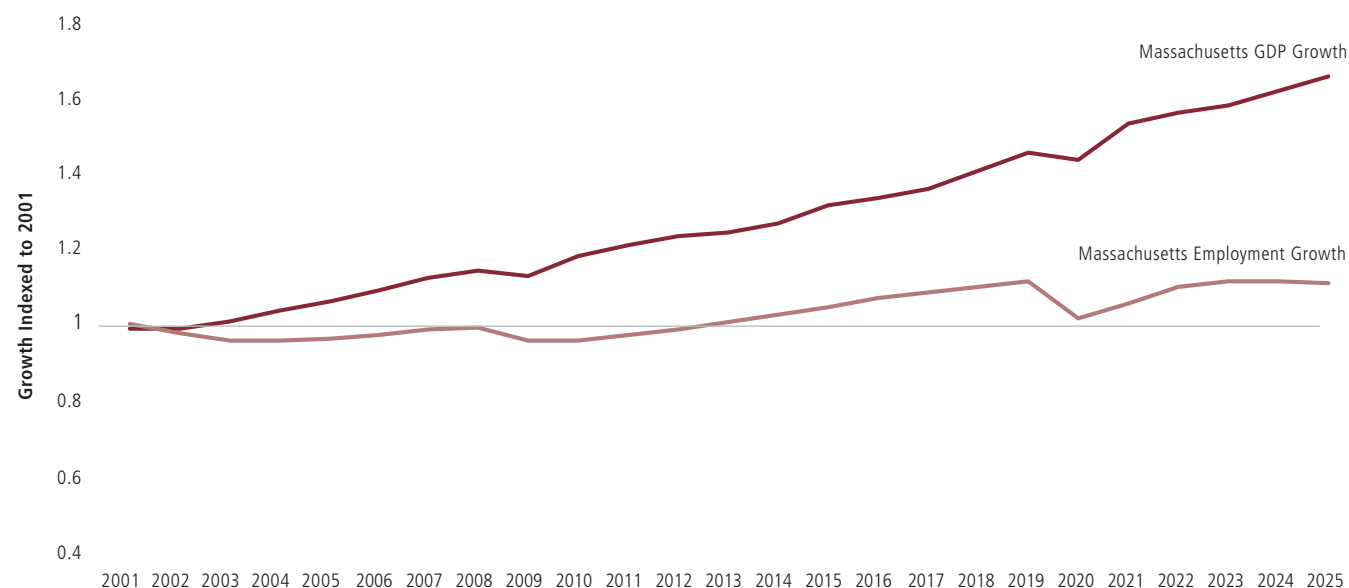
■ **Figure 6: Change in Employment by Industry in Massachusetts, April 2025–April 2026**



■ Source: BLS, Current Employment Statistics.

[Access the text-based description of Figure 6: Change in Employment by Industry in Massachusetts on Google Docs.](#)

■ **Figure 7: GDP and Employment Growth in Massachusetts, Indexed to 2001**



■ Source: BEA; BLS, Quarterly Census of Employment and Wages.

[Access the text-based description of Figure 7: GDP and Employment Growth in Massachusetts on Google Docs.](#)

One of the more notable economic themes to emerge recently is the combination of continued growth—as measured by concepts like GDP—and sluggish job gains. Alan Clayton-Matthews, senior contributing editor for *MassBenchmarks*, wrestles with this phenomenon in more detail in this issue’s “Endnotes” section. That said, this statewide trend has existed for much of the last 25 years. Figure 7 indexes GSP and employment in Massachusetts to 2001. As illustrated, Massachusetts GSP has grown much faster than employment over the last 25 years, with the separation appearing to accelerate with each recession during that period. On the one hand, this makes sense, as the Massachusetts economy has shifted in recent decades to highly productive and high value-add industries, such as life sciences, high tech, and pharmaceutical manufacturing. In addition, advancements in technology and process are often adopted with the express intent to extract more value out of labor effort. This helps contextualize how the Massachusetts economy continues to show strong economic growth relative to the United States, even as employment

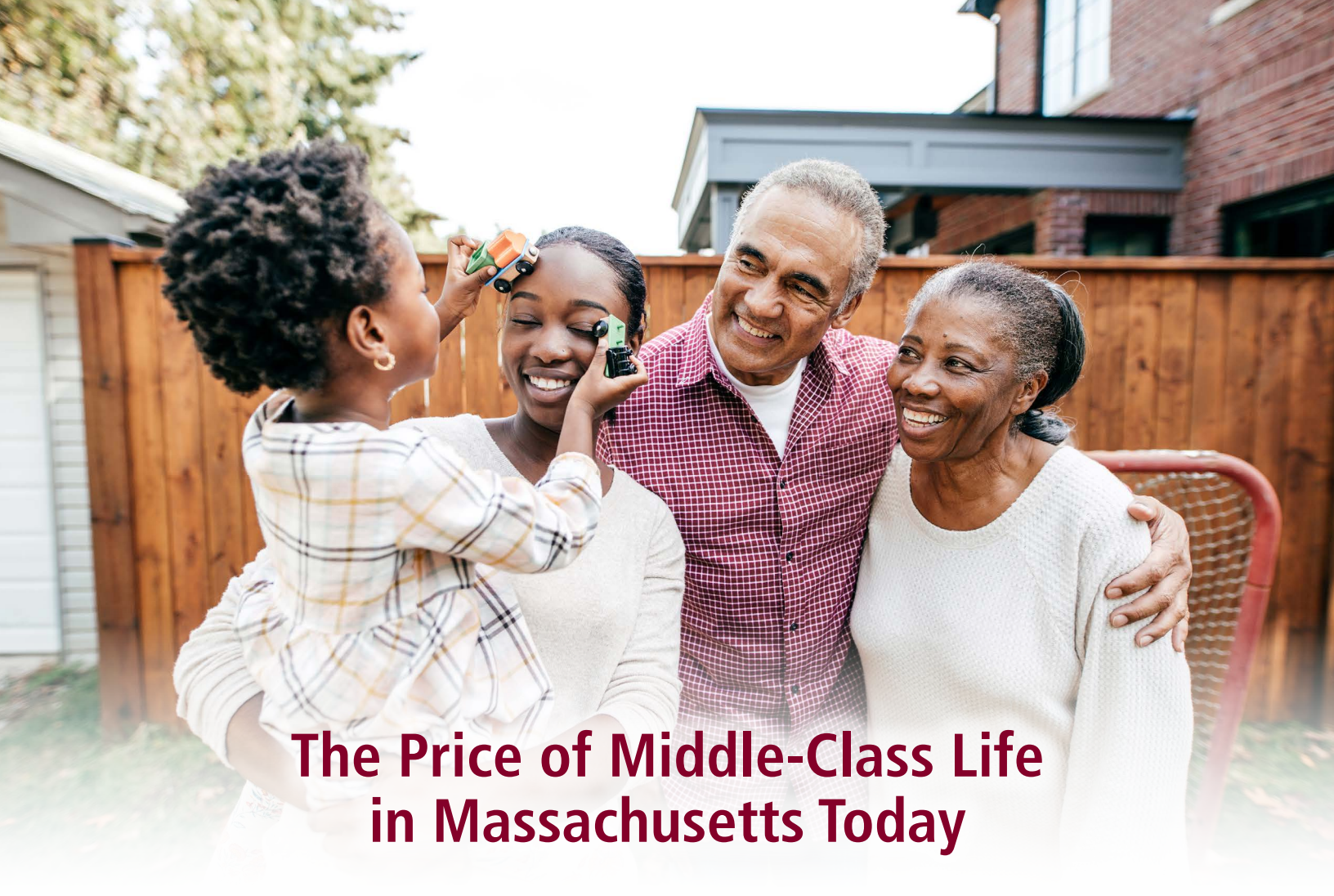
growth lags somewhat. Nevertheless, this does raise compelling questions about how we think about economic performance and growth in the coming years, especially in an environment with slow labor force growth resulting from an aging workforce and potential restrictions on immigration.

As Massachusetts moves through the remainder of 2026, the state’s economy presents a complex but broadly resilient picture characterized by fundamental contradictions. While gross state product growth continues to outpace the United States and productivity gains remain strong, the marked divergence between economic output and job creation reflects both structural strengths and emerging vulnerabilities. The state’s high-value industries and technological advantages have enabled continued expansion with minimal employment growth, yet this dynamic also masks demographic headwinds that threaten future expansion. The combination of an aging workforce, reduced net immigration, and persistent outmigration will likely constrain labor force growth in the years ahead, potentially limiting the state’s ability

to sustain productivity-driven growth. Meanwhile, geopolitical uncertainty, evolving federal trade and immigration policies, and shifts in research funding and pharmaceutical development present near-term risks that could disrupt current modest employment gains. Looking ahead, policymakers and business leaders must grapple with a critical question: How can Massachusetts maintain its position as an economic leader when traditional employment-based measures of growth may no longer capture—or adequately measure—the state’s true economic health? The answers to this question will shape not only how we evaluate success in coming years but also what policies and investments are needed to ensure broad-based prosperity in an era of constrained labor force growth and heightened global uncertainty.



Mark Melnik is the director of the UMass Donahue Institute’s Economic & Public Policy Research Group and senior managing editor of this journal.



The Price of Middle-Class Life in Massachusetts Today

ELISE RAPOZA AND BENJAMIN FORMAN

The Massachusetts Middle Class Status Report is a MassINC Policy Center project that gives renewed focus to the organization's founding concern about middle- and working-class prosperity. At the report's core is a guiding question: Is economic growth in Massachusetts still creating broadly shared economic opportunity as well as the conditions residents need to realize their full potential and participate fully in public life?

Massachusetts has high wages, a highly educated workforce, and industries associated with 21st-century prosperity. Yet many residents describe a difficult reality: They work hard and earn what seems like a good income but still struggle to save. That disconnect between state averages and actual individual experience is the puzzle the Massachusetts Middle Class Status Report seeks to address.

The report—a research project recently launched by the MassINC Policy Center—returns to a question that has animated the center since its founding: What do the conditions of the middle class tell us about the Commonwealth's economic health and civic vitality? The project's analysis and findings (which are being released as a series of "chapters" published in phases) paint a mixed picture. Massachusetts remains a high-

income state, and many households do earn enough to meet a middle-class standard of living. However, the income required to do so is higher than many might expect, and achieving it often depends on substantial collective household effort: two earners, long work hours, coordinated schedules, reliable childcare, and enough flexibility to manage the competing demands of work and family life.

This feature article summarizes our framework and principal findings. It also explains why a residual-income approach to defining the middle class—focused on what households can do with what they earn, rather than where they fall within an income distribution—is more useful for policymakers than conventional percentile-based definitions.

Measuring What It Means to Be Middle Class: Moving Beyond Percentiles

The standard definition of the middle class—that is, households sitting in the middle of the income distribution—has the virtue of simplicity. Yet this definition indicates nothing about whether households can afford the expenses typically associated with middle-class life.

The middle class has always been understood as more than an income category; rather, it is the social stratum in which financial security and material independence enable broad participation in economic and public life. Only by measuring whether households can actually afford the costs of a stable, self-directed life can we honestly evaluate the health of the middle class as an institution.

In the Massachusetts Middle Class Status Report, a household is considered securely middle class if it can afford the “entry fees” associated with pursuing the American Dream. These include not only the essentials covered in most cost-of-living budgets but also higher education, adequate saving for emergencies and retirement, and a very modest leisure budget. The report’s approach builds on a movement in housing-affordability research—notably Michael Stone’s residual-income framework¹—positing that what matters is not what households earn but what they have left after unavoidable obligations.

Because households have varying cost structures, we created model budgets for five representative household types: single adult; two adults with no children; single parent with two children; two parents with two children and two earners; and

two parents with two children and one earner. We estimated these budgets across five life stages: ages 26–34, 35–44, 45–54, 55–64, and 65-plus.

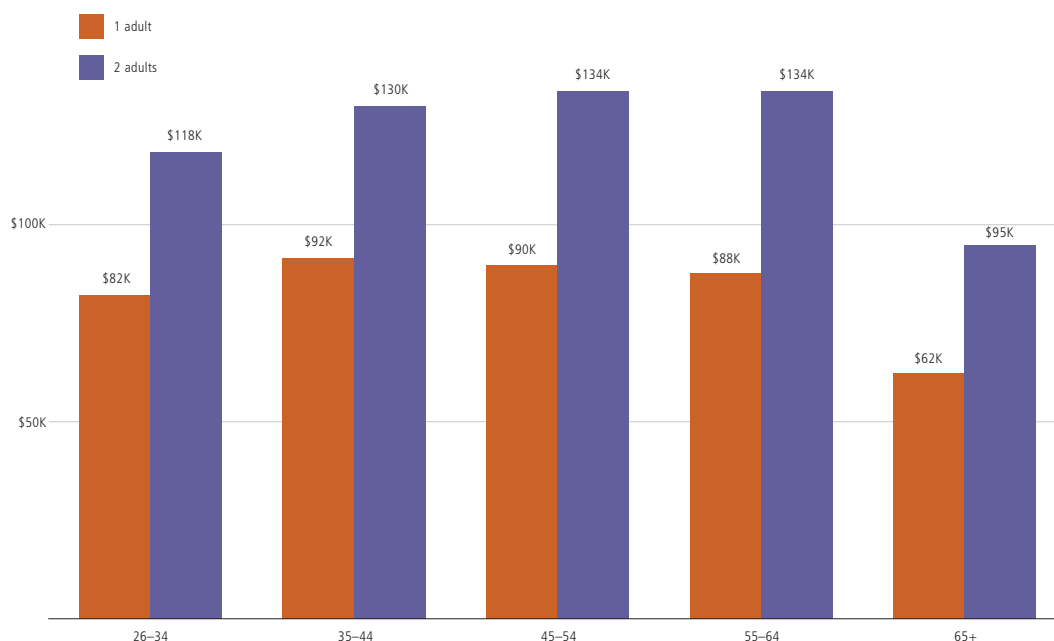
Cost data came from a variety of sources, including HUD Fair Market Rents, the American Community Survey (ACS), BLS Consumer Price Index (CPI) subcomponents, the Medical Expenditure Panel Survey, USDA Food Plans, the National Database of Childcare Prices, College Scorecard net price data, and NBER’s TAXSIM—with support from IPUMS and the Ludwig Institute for Shared Economic Prosperity in making the data usable for our model.

The result is a comprehensive, cross-state, longitudinal measure of middle-class budget thresholds. If the results seem high, it is because they include categories central to middle-class life that most cost-of-living calculators omit, such as retirement contributions and family contributions to higher education.

What It Costs to Be Middle Class in Massachusetts

The income required to sustain a middle-class standard of living in Massachusetts varies by household type and life stage. During their working years, a single adult requires between \$80,000 and \$90,000 to achieve this status, while two-adult households without children require between \$118,000 and \$134,000 (see Figure 1). (There is slight life-stage variation due to housing costs and our temporal assumptions about saving for retirement).

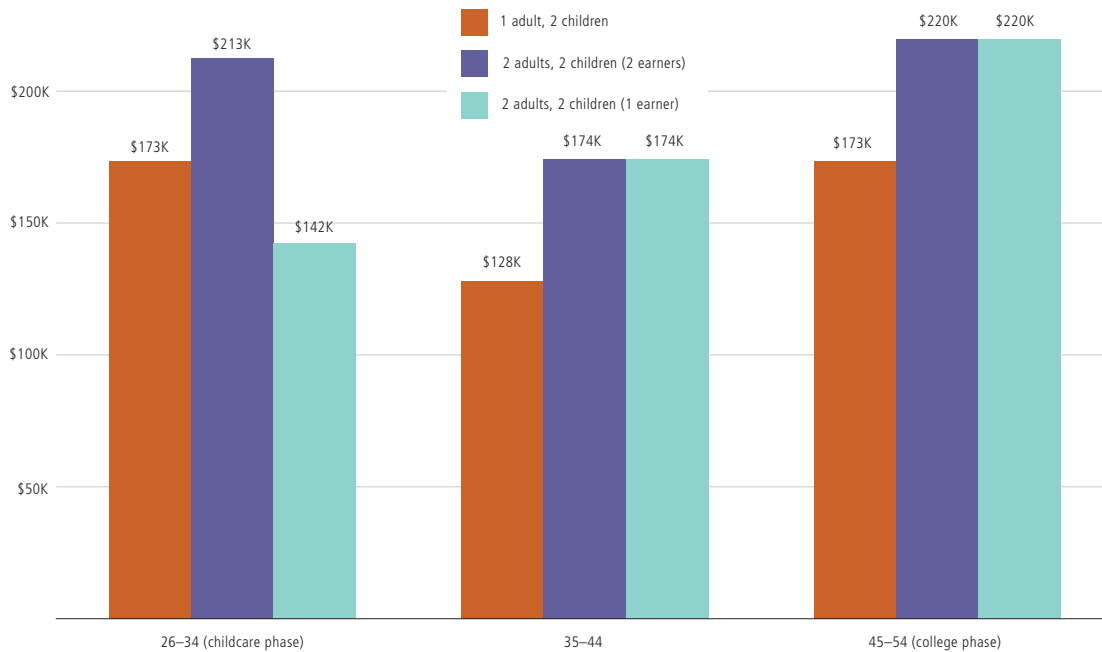
■ **Figure 1: Household Income Threshold by Age, No Children**
Gross income for a middle-class budget in Massachusetts in 2024



■ Source: MassINC Policy Center.

[Access the text-based description of Figure 1: Household Income Threshold by Age, No Children on Google Docs.](#)

Figure 2: Household Income Threshold by Age, Two Children
Gross income for a middle-class budget in Massachusetts in 2024



■ Source: MassINC Policy Center.

[Access the text-based description of Figure 2: Household Income Threshold by Age, Two Children on Google Docs.](#)

For households with two children, the income required to sustain middle-class lifestyle status is substantially higher and follows a different age profile (see Figure 2). In the early-childhood years (ages 26–34), the required income ranges from about \$142,000 for a two-adult, one-earner household to about \$213,000 for two earners—the difference driven primarily by the cost of formal childcare. The required income then declines in the 35–44 range, when children become eligible for public schooling, and rises again in the 45–54 range, when expected family contributions toward higher education begin to appear in the budget. At that stage, the required income reaches about \$173,000 for a single parent and nearly \$220,000 for a two-adult household.

Two patterns are worth highlighting. First, sharing a household reduces per-person costs but not proportionally: Many fixed expenses still scale with an additional adult. Second, the gap between one- and two-earner thresholds among households with young children—about \$70,000—substantially exceeds the cost of childcare alone because the additional earner also generates additional taxes and other income-linked obligations. The structure of these costs means that the second earner must generate substantial income before the two-earner arrangement meaningfully improves the household's net financial position.

Across most household types, housing is the largest expense, typically accounting for 20% to 30% of total costs for households without children. For families with children, however, housing

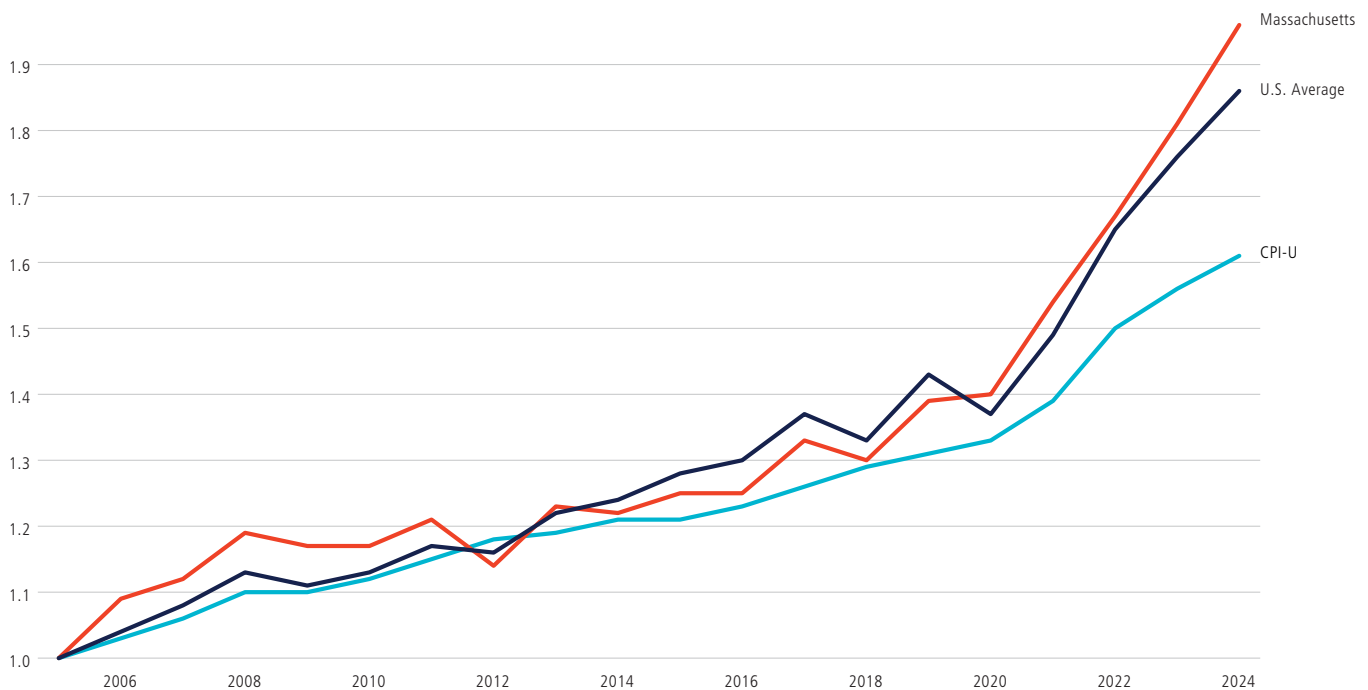
represents a smaller share of the total budget, accounting for 15% to 25% of the budget—not because housing is inexpensive but because childcare absorbs a larger share of household resources. Childcare alone can exceed \$20,000 per year per child, making it one of the largest single cost drivers for families with young children.

The Cost Drivers: Where the Pressure Comes From

The composition of the middle-class budget has shifted markedly over the past 2 decades. Between 2005 and 2024, the Consumer Price Index—the standard measure of cost inflation—rose by about 61%. Several categories central to middle-class households grew considerably faster: health-related costs by about 151%, housing-related costs by 115%, family contributions to higher education by 93%, and childcare by 72%. Clothing prices, by contrast, rose just 6%.

The most intense inflation pressures have occurred in the post-COVID-19 period. Between 2019 and 2024, the CPI rose by 23%, while housing-related costs increased about 52%. During this time, the income required to sustain a middle-class standard of living for a single adult in Massachusetts climbed from about \$65,000 in 2020 to more than \$91,000 in 2024—a 40% increase that outpaced the CPI by 18 percentage points (see Figure 3).

Figure 3: The Middle-Class Budget vs. the CPI Inflation Rate
One-adult households ages 35 to 44, indexed to 2005



Source: MassINC Policy Center and the Bureau of Labor Statistics.

[Access the text-based description of Figure 3: The Middle-Class Budget vs. the CPI Inflation Rate on Google Docs.](#)

When one isolates the costs that do not automatically rise with income (referred to here as “fixed costs,” though they do change over time), the contribution of each category becomes clearer. For single-adult households, housing accounts for 53% to 59% of the increase in fixed costs across age groups, with transportation contributing 19% to 25%. For two-adult households with two children, housing accounts for 34% to 45% of fixed-cost growth, with childcare contributing about 18% of the increase during early-childhood years and higher education emerging as a meaningful pressure point by the 45–54 stage.

These are not categories in which productivity gains have historically been easy to achieve. Economists frequently invoke Baumol’s “cost disease”²—the tendency of labor-intensive service sectors to experience slower productivity growth and therefore rising relative prices over time—to explain the trajectory of healthcare, education, and care services. In housing, low-productivity growth in construction combines with local supply constraints to drive sustained price increases. The fastest-growing parts of the household budget are therefore precisely those in which market mechanisms alone are least likely to deliver relief.

**Many residents describe a difficult reality:
They work hard and earn what seems like a
good income but still struggle to save.**



Who Makes It to the Middle Class

If the threshold is the floor, the next question is, How many households can clear it? Linking the budget model to American Community Survey microdata, the Status Report finds that the share of Massachusetts households meeting or exceeding the middle-class threshold varies substantially by household type, life stage, and race and ethnicity.

Households without children are generally more likely to meet the threshold than households with children, and two-adult households are more likely to meet it than one-adult households (see Figure 4). Among households without children, the share with incomes sufficient to support a middle-class lifestyle ranges from about one-quarter of single adults in retirement to about two-thirds of young two-adult households sharing expenses.

As shown in Figure 5, for families with children, the early-childhood years are the most difficult. Earnings are often lower earlier in adulthood, while childcare costs are at their highest. Among households with children headed by adults ages 26 to 34, only about 1% to 27% meet the middle-class threshold, depending on the number of adults and earners in the household. Attainment rises when children enter public school. Among families headed by adults ages 35 to 44, the share reaching the threshold rises to 56%, then remains relatively high at 48% among those ages 45 to 54, even as some families begin taking on college-related costs.

The Status Report also documents persistent racial and ethnic disparities. Across nearly every household type, Black and Hispanic households are substantially less likely than White households to attain the middle-class threshold. Asian households generally show comparable or higher rates than White households. The gap is largest among two-adult, two-earner households with children, with a more than 30 percentage point difference between White households and Black or Hispanic households.

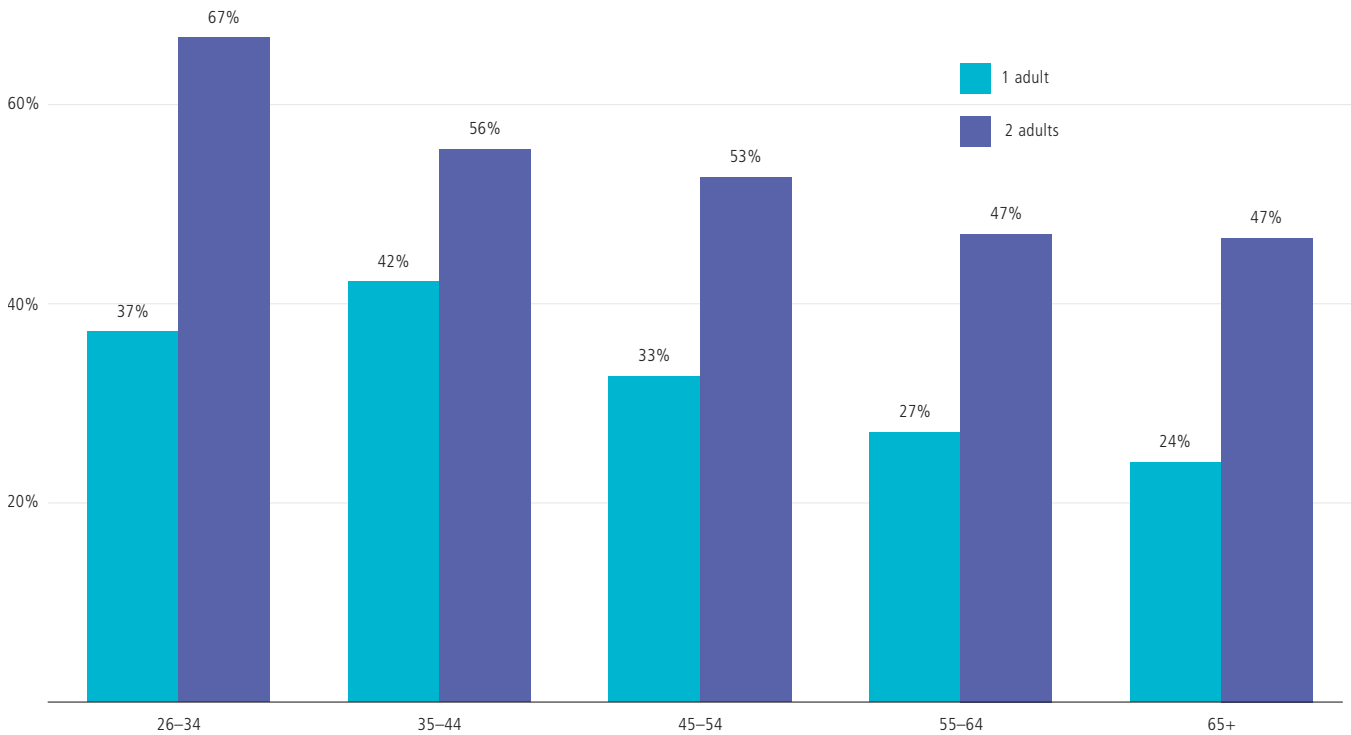
One purpose of the Status Report is to track the expansion or contraction of the middle class over time. Within many household types, the share meeting the middle-class threshold rose in the years leading up to the pandemic and during the initial COVID-19 stimulus period, then edged slightly downward afterward. Because the estimates use 5-year averages that still include the COVID-19 era, the available data may understate the extent of the more recent decline. Future updates will provide a clearer picture as more recent ACS data replace the pandemic-period observations.

These estimates may also understate the pressure on middle-class lifestyles because households adapt to high costs by changing the timing and structure of family formation itself. If high costs are delaying household formation, reducing family formation, or pushing some residents out of Massachusetts altogether, the measured share meeting the middle-class threshold may look stronger than the underlying opportunity structure actually is.

The early years of family formation are especially exposed. Young households simultaneously face high housing costs, peak childcare expenses, student loan repayment, and still-developing earnings.



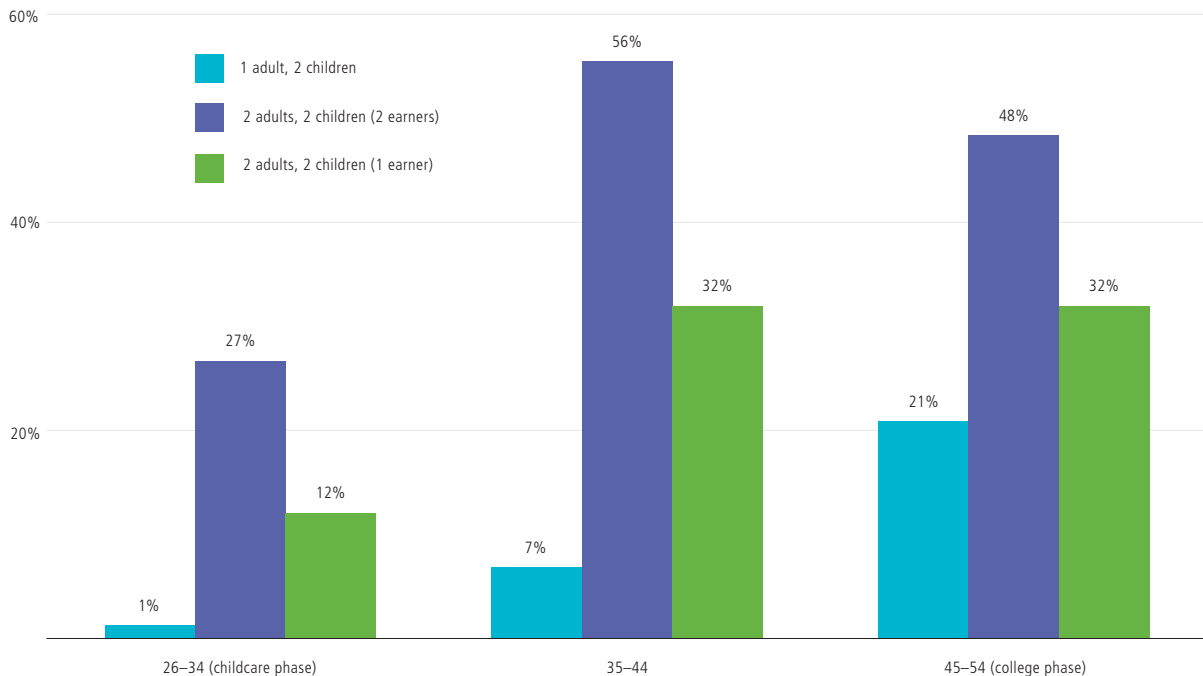
Figure 4: Share of Households with Incomes Above the Middle-Class Threshold
Massachusetts, 2020–2024 5-year average



Source: American Community Survey.

[Access the text-based description of Figure 4: Share of Households with Incomes Above the Middle-Class Threshold on Google Docs.](#)

Figure 5: Share of Households with Incomes Above the Middle-Class Threshold
Massachusetts, 2020–2024 5-year average



Source: American Community Survey.

[Access the text-based description of Figure 5: Share of Households With Incomes Above the Middle-Class Threshold on Google Docs.](#)

Massachusetts in Comparative Perspective

California, Hawaii, and Massachusetts rank consistently as the three most expensive states in which to sustain a middle-class standard of living. This relative ranking depends on household structure. For adult-only households, California tends to be slightly more expensive, reflecting higher average housing costs. For families with children, Massachusetts often surpasses California due to higher childcare and education-related expenses. Full-time childcare for two young children averages roughly \$46,000 per year in Massachusetts—the highest in the United States—compared with about \$35,000 in California. College costs also contribute to the gap: After assigning half of net public 4-year university costs to parents and half to student loans, the model estimates annual parental contributions of about \$22,000 for two children in Massachusetts compared with about \$16,000 in California.

Massachusetts often relies on high wages to compensate for high costs, and in many respects, that strategy works. The Commonwealth's economy generates many high-paying jobs, particularly in healthcare, higher education, finance, technology, professional services, and scientific research. High household incomes move many families above the middle-class threshold, despite the high-cost structure.

Yet high average incomes do not guarantee broad affordability, as shown in Figure 6. Massachusetts ranks near the top nationally in the share of two-adult households, both with and without children, that achieve middle-class status, but it performs far worse for single-parent households. This pattern implies that the

reliance on high wages is insufficient to compensate for higher costs for households that cannot combine two incomes, cannot share costs, or must purchase care to sustain employment.

Jobs That Support a Middle-Class Lifestyle

About 30% of jobs in Massachusetts provide wages sufficient to support a middle-class budget for a single adult. These include a range of management, professional, and technical roles—for instance, general and operations managers, registered nurses, software developers, accountants, and auditors—concentrated in healthcare, finance, technology, and business services. Meanwhile, many of the largest occupations in the state, including home health aids, retail workers, food service employees, and administrative support roles, fall well below the threshold.

An additional 10% of jobs carry middle-class social prestige—as measured by occupational prestige scores derived from survey research—but pay below the middle-class income threshold.

Looking ahead, many occupations that provide middle-class earnings, particularly in management, analysis, and technical fields, involve tasks that artificial intelligence and automation are likely to reshape. The net effect on middle-class employment will depend on whether these technologies complement workers and raise their productivity or substitute for a significant share of higher-paid roles—a question that will require sustained monitoring.

Figure 6: How Massachusetts Ranks Across States in Middle-Class Attainment, by Household Type

2024	State Rank
1 adult	26
2 adults	7
1 adult, 2 children	43
2 adults, 2 children (2 earners)	8
2 adults, 2 children (1 earner)	10

Note: Lower values reflect a higher share meeting the threshold.

■ Source: MassINC Policy Center analysis of American Community Survey 5-year estimates.

Income is only half the story—households also have a fixed budget of waking hours for paid work, caregiving, household management, commuting, civic participation, rest, and leisure.



The Time Side of the Ledger

Income is only half the story. Households also have a fixed budget of waking hours for paid work, caregiving, household management, commuting, civic participation, rest, and leisure. If reaching the middle-class threshold requires substantially more hours of paid work and commuting, households may be financially middle class on paper but operationally stretched in practice.

The Status Report examines this dimension using the American Time Use Survey, ACS commute data, and the Current Population Survey Volunteer Supplement. The findings show that middle-class households with children are devoting an increasing share of their time to work and commuting—a trend that corresponds with a sharp decline in civic participation.

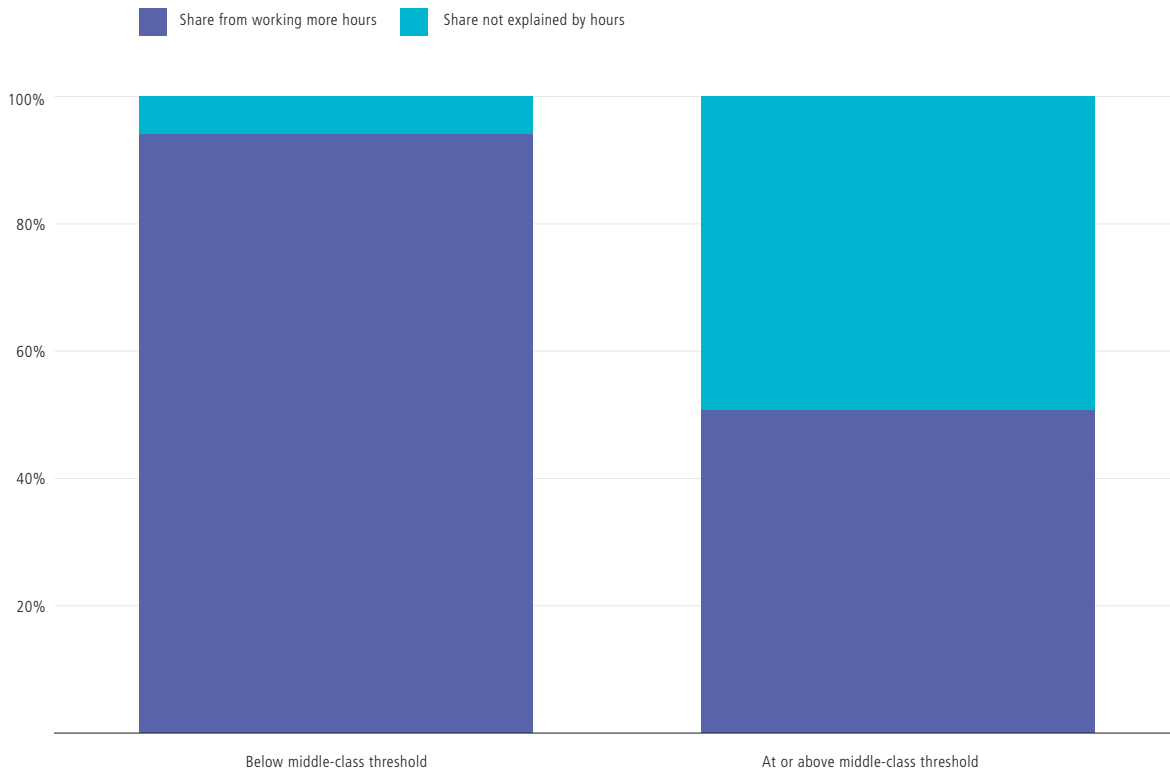
In 2024, adults in middle-class-or-higher households averaged 39 to 45 hours of paid work per week. Single parents averaged the most—about 43 hours per adult—while adults in below-threshold households averaged 26 to 33 hours. The gap reflects barriers to full-time employment as much as differences in individual work effort, but the underlying finding is clear: Middle-class status in Massachusetts depends increasingly on all working-age adults in the household being able to sustain full-time employment.

Among two-adult households with two children, the share with both adults working full-time rose from about 70% in 2007 to about 88% in 2024, surpassing dual-earner rates among childless households. Real household income for these families grew by about 22% over the same period, but a decomposition of that growth shows that roughly half came from additional household work hours rather than higher real hourly compensation. Total household work hours rose by nearly 10%, meaning that a substantial share of the apparent income gain came with a direct time tradeoff.

The pattern looks different for two-adult, two-child households below the middle-class threshold. For this group, real household income grew by only about 5.6% over the past 2 decades, and more than 90% of that modest gain came from working more hours. Income growth not explained by additional hours contributed just 0.3 percentage points. In other words, below-threshold families gained almost nothing beyond what they earned by putting in more time.

When income rises partly because households work more hours, the gain comes with a sacrifice: fewer hours left for caregiving, rest, household management, and community participation. Additional work hours can also generate offsetting expenses—related, for instance, to childcare, prepared meals, afterschool programs—meaning that some of the added income is spent simply making more work possible.

Figure 7: Share of Income Growth by Source
Massachusetts households with two adults and two children, 2005–2007 to 2022–2024



Note: Inflation-adjusted using the Consumer Price Index.

■ Source: Analysis of American Community Survey Public Use Microdata Sample (PUMS).

[Access the text-based description of Figure 7: Share of Income Growth by Source on Google Docs.](#)

Making Time to Volunteer

The importance of the middle class has never been understood in purely economic terms. It has also mattered because of what middle-class security makes possible: enough time, stability, and autonomy to participate in family, community, and civic life. This makes the increasing time demands faced by two-adult households with children more than a private concern. When paid work and caregiving consume more of the week, households may have less capacity for the civic activities that help communities function.

As seen in Figure 8, the volunteering data show a consistent downward trend. Average annual volunteer hours among non-retired Massachusetts households under age 65 fell from about 49 hours per household in 2006–2010 to 25 hours in 2021–2023—roughly halving in 15 years. Nationally, the same measure fell from about 57 hours to 26 hours over the same period.

Among households with children, volunteering rates rise with paid work hours up to a point, then decline when all adults are working full-time or more, consistent with a time-

crowd-out effect. This pattern does not establish causality, but it is consistent with a broader finding across the Status Report: As the cost of a middle-class lifestyle has risen, households have allocated more time to paid work, leaving less time for everything else.

What the Findings Mean for Massachusetts

Massachusetts remains one of the nation’s highest-wage, highest-productivity states, and many households still reach a middle-class standard of living here. However, the findings point in a consistent direction: A middle-class lifestyle is increasingly attainable only under demanding conditions—multiple earners, stable full-time work, reliable childcare, manageable commutes, and enough breathing room in the household budget to save for major expenses. That pattern has several implications for how we understand economic strength in the Commonwealth.

First, the affordability challenge is not limited to low-income households. Many families earn too much to qualify for public assistance but still face cost pressures that make middle-class stability difficult to sustain. Housing, childcare, healthcare,



Housing, childcare, healthcare, transportation, higher education, and savings are not discretionary extras. They are entry fees into the modern middle class.

transportation, higher education, and savings are not discretionary extras. They are entry fees into the modern middle class and the infrastructure that makes economic participation possible.

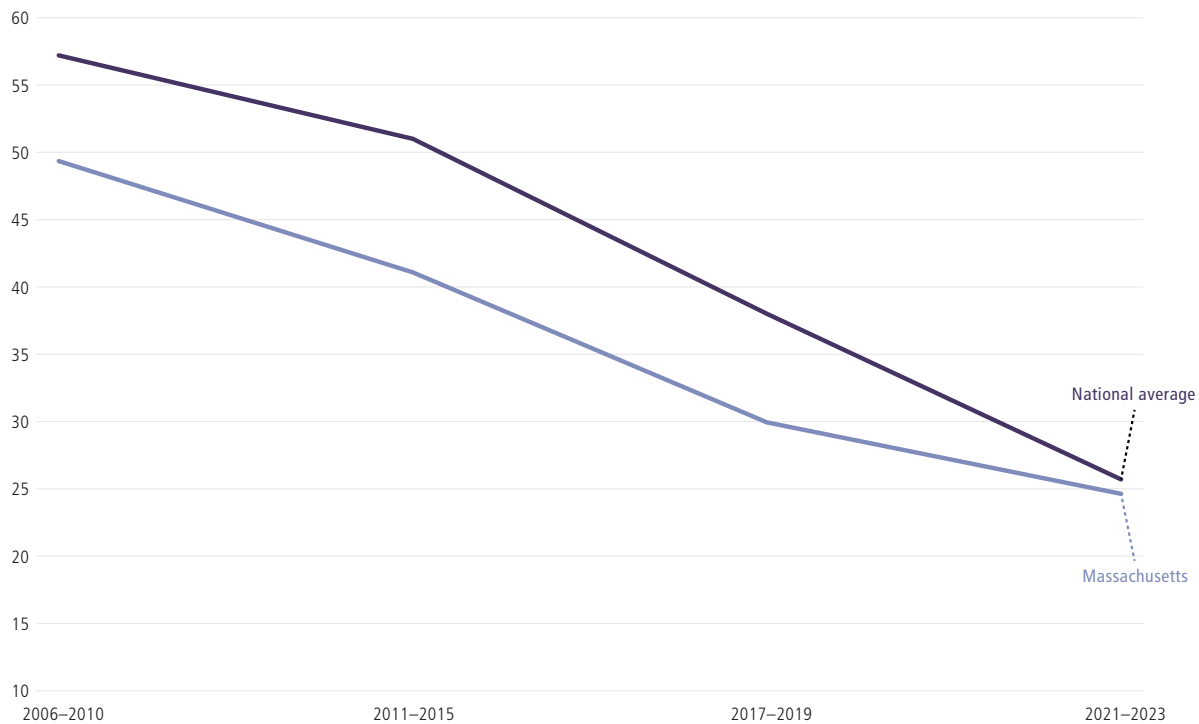
Second, household structure now plays a central role in determining who can reach that standard. Two-adult households can combine incomes, share fixed expenses, and divide unpaid caregiving and household labor. Single adults and single parents have fewer levers to adjust for rising costs.

Third, the early years of family formation are especially exposed. Young households simultaneously face high housing costs, peak childcare expenses, student loan repayment, and still-developing earnings. These pressures can shape decisions about whether to have children, where to live, whether to remain in Massachusetts, and whether households can begin building savings or wealth.

Fourth, the middle-class question is inseparable from considerations of time availability. Some households reach the income threshold only through long hours, multiple full-time earners, and significant commuting and caregiving demands. If maintaining a middle-class standard of living leaves less time for family routines, rest, volunteering, and community participation, then income alone may overstate how the quality of middle-class life actually feels.

Finally, the Commonwealth's high-wage economy can mask important vulnerabilities. Massachusetts performs well in many income comparisons, especially for dual-earner households, but many essential jobs still do not pay enough to support middle-class living standards, including those in education, health, and human services.

Figure 8: Average Annual Volunteer Hours per Household



Note: Non-retired households under age 65.

■ Source: Current Population Survey via IPUMS.

[Access the text-based description of Figure 8: Average Annual Volunteer Hours per Household on Google Docs.](#)

Middle-class security makes possible enough time, stability, and autonomy to participate in family, community, and civic life.

The health of the middle class is a measure of how well the Commonwealth translates economic growth into broadly shared prosperity and civic capacity. On that test, the evidence is mixed. Massachusetts remains a high-income state, and relatively large shares of the most common household types meet or exceed the middle-class threshold. In that sense, the Commonwealth is still delivering middle-class living standards for many households. Yet the same findings also show how uneven and conditional that success has become. Notably, Black and Hispanic households are substantially less likely than White and Asian households to reach the middle-class threshold. In addition, across the population as a whole, many two-adult households reach the threshold only by spreading expenses across two full-time earners, while single adults and single parents have fewer ways to make up the difference. Even for households that make it, middle-class status may leave too little time, flexibility, and security for the family, community, and civic life it is supposed to support.

Full methodology, data sources, and component reports are available at <https://massinc.org/research/the-massachusetts-middle-class-status-report/>

Endnotes

- 1) Stone, M. E. (2006). What is housing affordability? The case for the residual income approach. *Housing Policy Debate*, 17(1), 151–184.
- 2) Baumol, W. J. (2012). *The cost disease: Why computers get cheaper and health care doesn't*. Yale University Press.



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Federal research funding serves as the critical catalyst for transforming early-stage research into commercialization, investment, and job creation.

The innovation process that has driven Massachusetts' success for decades now faces an unprecedented challenge.



Federal Research Funding and the Innovation Ecosystem: Massachusetts at a Critical Crossroads

Massachusetts stands as a cornerstone of the U.S. economy through its uniquely integrated innovation ecosystem that unites world-class universities, research hospitals, businesses, and nonprofits to generate breakthroughs in life sciences, clean energy, advanced materials, automation, medical equipment, and defense. Recent federal funding cuts to research and development, along with policy uncertainties, threaten to disrupt this virtuous cycle by undermining talent retention, weakening global competitiveness, and harming the state's ability to attract and sustain top researchers. While signs of restored research support heading into 2026 offer some encouragement, a renewal of federal predictability alongside sustained state-level investments will be essential for preserving Massachusetts' leadership in innovation and ensuring long-term economic growth.¹

BRANNER STEWART

Introduction

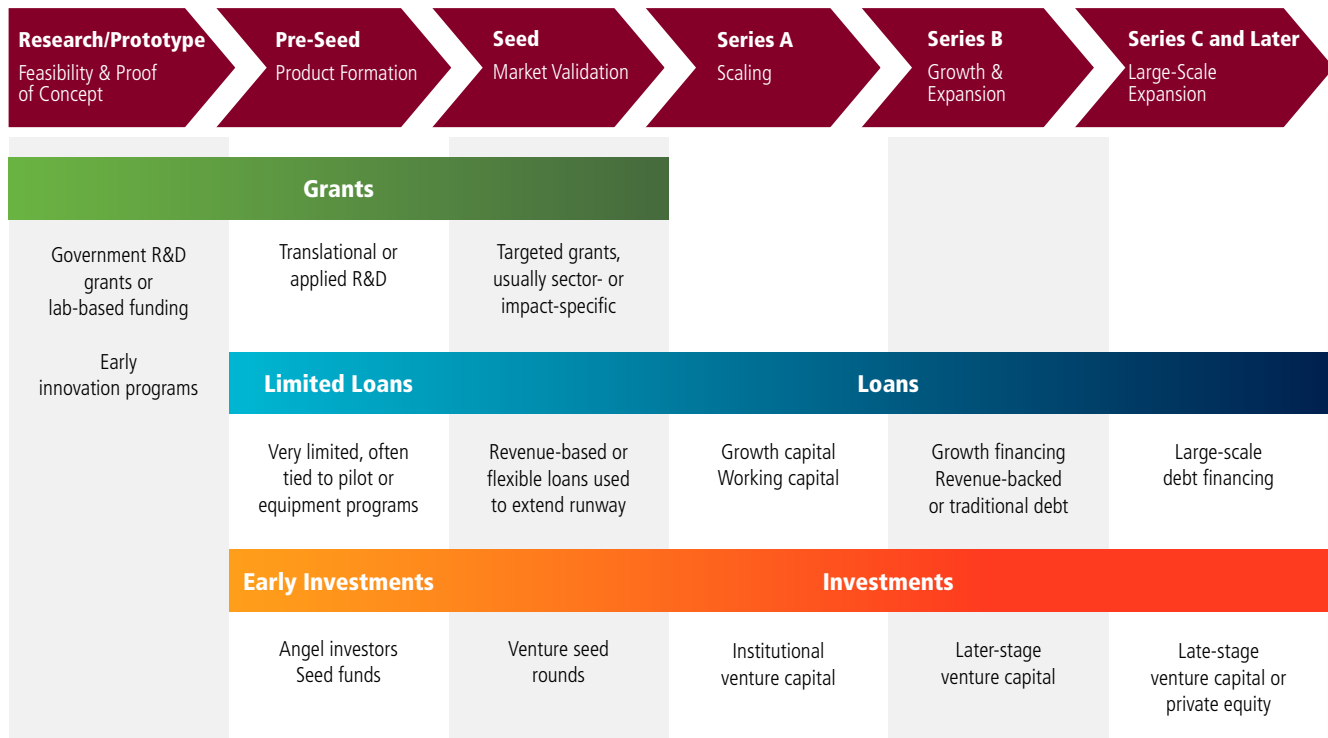
Massachusetts plays an outsized role within the greater U.S. economy as one of the most important generators of specialized knowledge and innovation. The state's innovation ecosystem is unique, with universities, businesses, medical institutions, and nonprofit organizations forming an agglomeration with mutually reinforcing interactions that spur technology development, advancement, and commercialization. Thanks to this dynamic, Massachusetts is at the forefront of making breakthroughs that create industry growth in sectors like life sciences, clean energy, semiconductor machinery, and defense that are foundational to the national economy and lynchpins for future growth.

Innovation and the industries it seeds are critical engines for stimulating investment and, as this article shows, providing jobs for Massachusetts residents. The jobs growing

out of innovation are associated not only with tech industries, such as medical equipment, radars, and robotics, but also industries like construction and food services that benefit from the expansion and scaling of businesses rooted in Massachusetts research.

Yet the innovation process that has driven the Commonwealth's success for decades now faces an unprecedented challenge. Federal research funding—particularly from agencies such as the National Institutes of Health (NIH), the National Science Foundation (NSF), and the U.S. Department of Energy (DOE)—has long served as the critical catalyst for transforming early-stage research into commercialization, investment, and job creation. Cuts announced in early 2025 and systemic changes in the granting of research awards threaten to fundamentally disrupt this carefully balanced ecosystem, with implications that extend far beyond the research community itself.

Figure 1: Funding Timeline



■ Source: MassVentures and UMDI analysis.

[Access the text-based description of Figure 1: Funding Timeline on Google Docs.](#)

The Innovation Continuum and Federal Funding's Role

Understanding how Massachusetts maintains its competitive advantage requires an examination of the innovation continuum and the crucial role that federal funding plays within it, notably at the earliest stages. Federal research funding is channeled to the beginning phases of the research and development (R&D) innovation continuum. This funding, usually in the form of grants, is intended for early, basic research and the later prototyping phases. Federal involvement in this early-stage research provides the catalyst for setting in motion the entire innovation process—which can take years or even decades (not unusual for the successful introduction of a novel medication, for instance).

This fundamental research is often perceived as too risky and loss-prone by private industry and therefore depends mostly on public funding. A research team at a university, medical center, or nonprofit organization developing a concept can use federal funding to test ideas and create early versions of what will eventually become their final product. For follow-up work and development, funding begins to shift to the private sector, including venture capital, as the innovation becomes more promising for commercialization. At this point, a new

company may start up to build and market the new product, or an existing business may license or pay royalties for use of the invention. During these latter stages of innovation, the private sector, sensing less risk and more future opportunity, increases its involvement and becomes willing to manage the final stages of research needed to introduce new technology and products to the market.

A prime example of an innovative company seeded through Massachusetts' advanced research capabilities and federal R&D support is Alnylam Pharmaceuticals, based in Cambridge, Massachusetts, now a major player in the state biotech industry. In the early 2000s, Alnylam benefited from licensing patented innovations from MIT, the Whitehead Institute for Biomedical Research, and the University of Massachusetts Medical School. One of the company's most important acquired patents, "Tuschl-1," was developed with funding from the NIH. Alnylam has grown steadily, developing advanced RNA interference-based medical treatments and expanding the company's physical footprint in the state, investing \$250 million to break ground on a high-tech manufacturing facility in Norton, Massachusetts, in 2025. More than 20 years after those early patents, which were supported by government funding, Alnylam is still expanding its footprint in the state.

The Massachusetts Research and Development Ecosystem: Scale and Scope

To fully appreciate the significance of federal research funding to Massachusetts, one must first understand the magnitude of the state's research and development ecosystem. Massachusetts currently has 105,307 jobs in the “scientific research and development” industry, and since 2014, the industry has more than doubled in size, growing at more than twice the rate of the industry nationwide. In 2024, Massachusetts accounted for one of every nine U.S. jobs in the scientific research industry, far exceeding its one-in-40 share of total U.S. nonfarm employment. The scientific research and development industry is central to the R&D ecosystem. By definition, this industry comprises firms “conducting original investigation undertaken on a systematic basis to gain new knowledge (research) and/or the application of research findings or other scientific knowledge for the creation of new or significantly improved products or processes (experimental development).”²

Including research-intensive industries such as aerospace, medical equipment, pharmaceuticals, computer systems design, etc., there are about 376,000 direct jobs in the R&D ecosystem in Massachusetts, comprising about 10% of the state’s total employment. However, the importance of R&D to the Massachusetts economy is, in fact, much larger when one considers the spinoff effects—also known as “multiplier effects”—associated with business-to-business interactions (“indirect” effects) and consumer spending (“induced” effects) across the entire Massachusetts economy.

Using the highly regarded IMPLAN input–output econometric model, the total economic impact of the R&D ecosystem in Massachusetts, including multiplier effects, supports:

- just over one million jobs, representing 28% of 2024 employment;
- \$142 billion in labor income, representing 40% of all wages in the state;
- \$218 billion to gross state product, representing 28% of the state economy;
- \$347 billion in total economic activity;
- \$8.7 billion in state taxes, equivalent to 15% of the FY2024 state budget; and
- \$4.6 billion in local taxes.

The indirect and induced effects of the Massachusetts R&D ecosystem create tens of thousands of jobs in industries that are typically not thought of when considering the research economy but that benefit from the economic activities initially generated by scientific discovery and the research-intensive industry activities taking place in the state. Specifically, indirect and induced employment totals over 57,000 in real estate and construction, 50,000 in food services and drinking establishments, 36,000 in ambulatory healthcare services, and 26,000 in social assistance.

Table 1: Annual Economic Contributions of the R&D Ecosystem in Massachusetts

Impact	Employment	Labor Income	Value Added	Output
Direct	376,300	\$81.50	\$115.40	\$188.30
Indirect	241,100	\$27.70	\$43.70	\$70.10
Induced	389,700	\$33.20	\$58.50	\$88.60
Total	1,007,100	\$142.30	\$217.70	\$347.00

Note: Jobs rounded to nearest 100 and dollars in billions.
 ■ Source: BLS QCEW 2024 and BEA satellite accounts 2023, IMPLAN, UMDI calculations.

Figure 2: Induced and Indirect Jobs in Non-R&D Industries



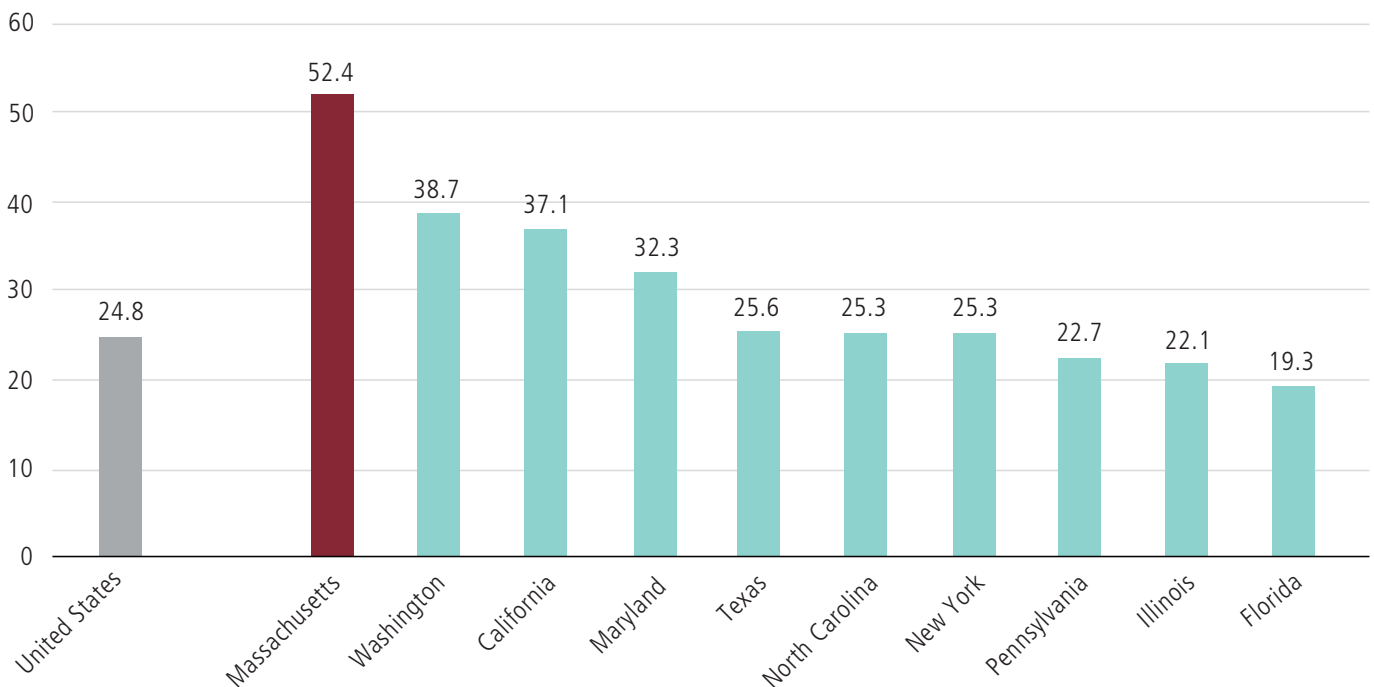
■ Source: BLS QCEW 2024 and BEA satellite accounts 2023, IMPLAN, UMDI calculations.

[Access the text-based description of Figure 2: Induced and Indirect Jobs in Non-R&D Industries on Google Docs.](#)

Massachusetts has an outsized impact on the R&D economy nationwide. The state's R&D ecosystem is a quarter the size of California's and just over half the size of Texas's, despite having a fraction of the population of either state. Yet Massachusetts

maintains a remarkable concentration of advanced technology employment. Regarding per capita employment, for every 1,000 residents in Massachusetts, 52 are employed in the R&D ecosystem—the highest of any state.

Figure 3: R&D Ecosystem Employment per 1,000 Residents, Massachusetts and Competitor States, 2024

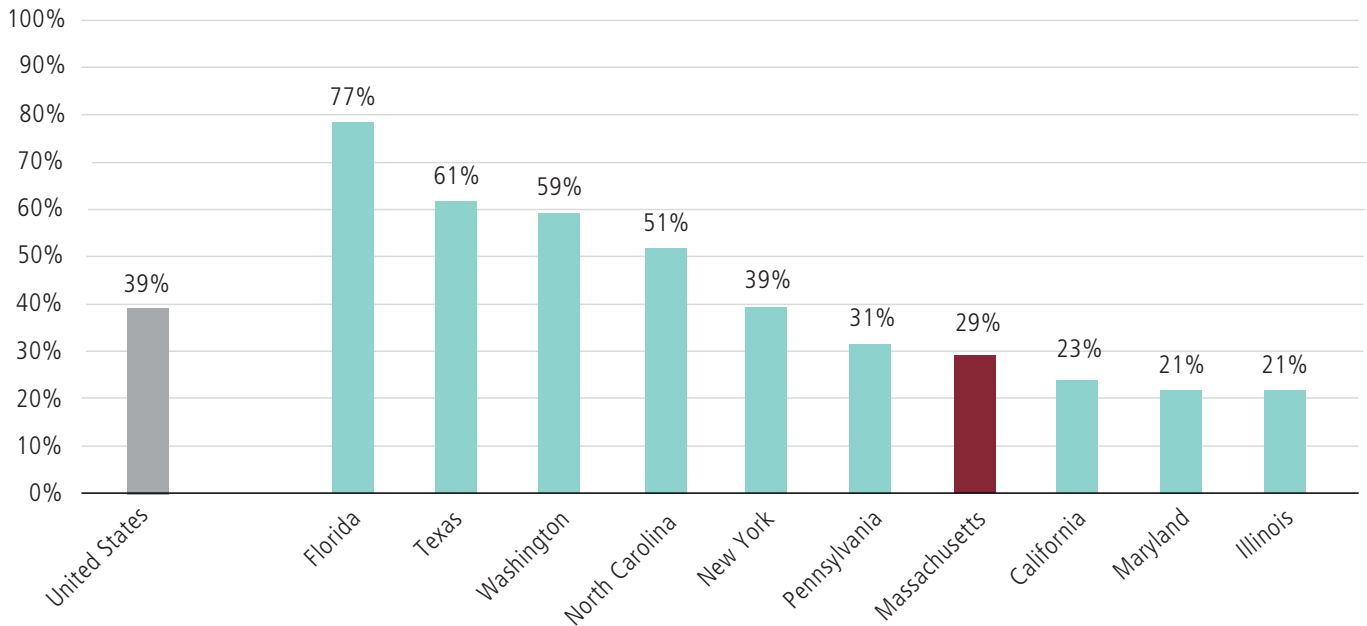


Note: Includes 2023, BEA R&D satellite accounts data on higher education institutions. Detailed cross-state data on healthcare-related research jobs were unavailable, so that industry was excluded.

■ Source: BLS QCEW, BEA R&D satellite account, and U.S. Census Population Estimates, 2024.

[Access the text-based description of Figure 3: R&D Ecosystem Employment per 1,000 Residents, Massachusetts and Competitor States, 2024 on Google Docs.](#)

Figure 4: Percent Change in R&D Ecosystem Employment, 2014–2024



Note: Includes BEA R&D satellite accounts data for 2023 (latest available, held constant through 2024) on higher education institutions. Detailed cross-state data on healthcare-related research jobs were unavailable, so that industry was excluded.

■ Source: BLS QCEW and BEA R&D satellite accounts, 2014–2024.

[Access the text-based description of Figure 4: Percent Change in R&D Ecosystem Employment on Google Docs.](#)

This concentration underlines not only how strong Massachusetts' R&D ecosystem is but also how uniquely vulnerable the state is to changes or disruptions in research funding. For decades, the Massachusetts economy has benefited from its strengths in key innovation industries, but these jobs and future growth are now under pressure from any diminishment—regarding both dollar amount and availability—in the foundational federal research grants that help catalyze the private-sector elements of innovation.

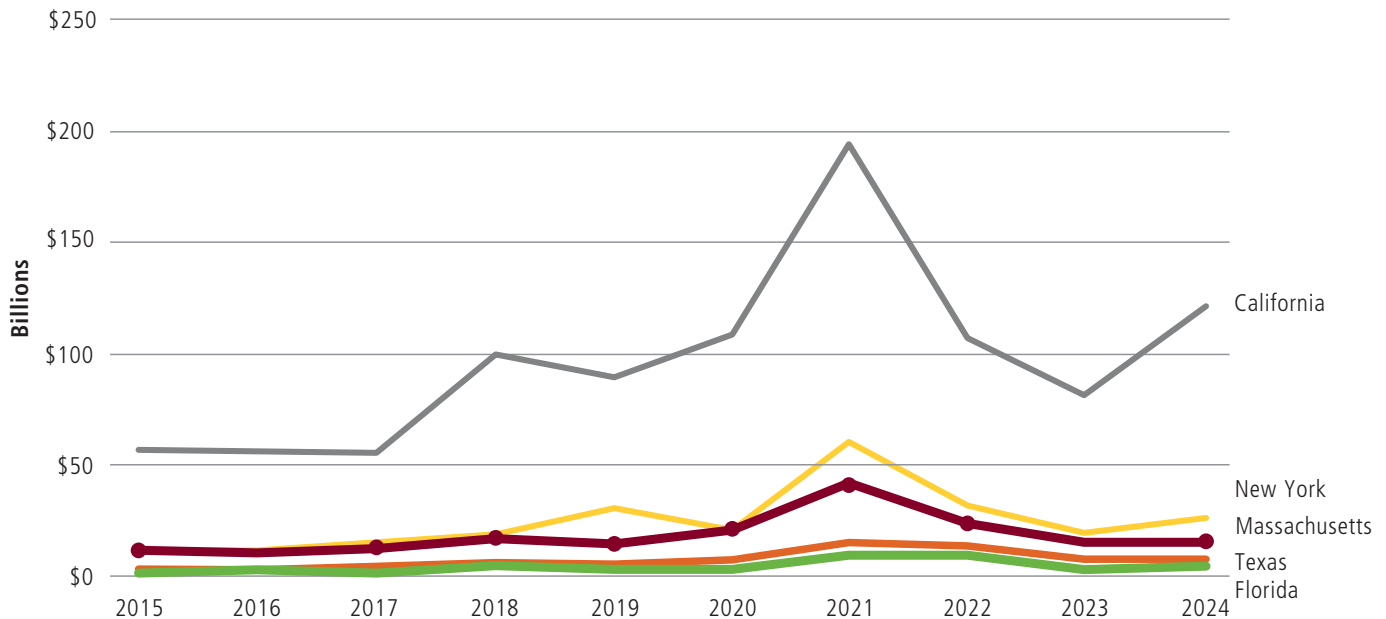
While Massachusetts is far ahead on many metrics of R&D ecosystem performance, other states are gaining ground. Job numbers for the state's R&D ecosystem grew by 29% between 2014 and 2024, below the national rate of 39% and ranking Massachusetts only seventh among competitor states for growth. Between 2023 and 2024, employment in the ecosystem fell statewide for the first time since 2015.

Venture Capital Dynamics and Competitive Positioning

Venture capital is a crucial funding stream, particularly for research-driven innovations in the later stages of their development and commercialization processes. Massachusetts has a well-developed venture capital ecosystem that serves as a critical resource for growing and scaling up innovative companies within the state. With nearly \$16 billion in venture capital in 2024, Massachusetts ranked third among major R&D states, behind California and New York.

Massachusetts remains a national leader in R&D intensity, but recent employment growth has lagged key competitor states.

Figure 5: Venture Capital Totals for the Top Five Competitor States, 2015–2024



■ Source: Pitchbook NVCA Venture Monitor summary; Consumer Price Index, adjusted to 2025 dollars.

[Access the text-based description of Figure 5: Venture Capital Totals for the Top Five Competitor States, 2015–2024 on Google Docs.](#)

Although the dollar values are high, there is concern that both California and New York, driven by investments in artificial intelligence, have been pulling away from Massachusetts in recent years. Until about a decade ago, Massachusetts consistently ranked second behind California in venture capital funding, but the growing strength of New York City’s R&D ecosystem has firmly placed New York as the number two state for venture capital. Without the venture capital needed for further commercialization and growth, Massachusetts’ strengths, such as a strong network of universities and research institutions and ample lab space, would not be catalyzed to the same degree.

California receives the most venture capital funding by far—unsurprising considering its large population combined with the presence of significant tech hubs like the Bay Area, Los Angeles, and San Diego. All states saw a spike in venture capital investment in 2021 due to zero interest rates and federal stimulus designed to combat the effects of the pandemic, before declining in 2022 and 2023 as interest rates rose. Funding began rising again in 2024 but concentrated largely in California and New York for AI technologies. Preliminary data for 2025 show that venture capital funding grew in Massachusetts but also that both California and New York are pulling further ahead.

Massachusetts does have notable advantages in private business research spending. On a per capita basis, Massachusetts was the number one recipient of funding through Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) awards in 2024, well ahead of any competitor states, attracting just over twice as much funding per capita compared with second-place California. The scale of business spending on R&D in Massachusetts is substantial (\$49 billion in 2023) and reflects that industry is recognizing the state as an effective location for transforming ideas into marketable products and services. Massachusetts ranks third in the United States in business spending on research, behind only California and Washington state.

Federal Funding Shifts: Magnitude and Immediate Consequences

As mentioned previously, federal support for research and development provides the spark that sets the innovation process in motion. However, the stability of the federal research-funding pipeline has been dramatically shaken by recent

policy announcements and resulting uncertainties concerning research grant awards. The current administration made cuts to research funding a major part of its FY2026 budget, proposing to eliminate \$18 billion from the NIH, a nearly 40% reduction, and \$3.9 billion from the NSF, a 56% reduction. Additional cuts were proposed for the National Aeronautics and Space Administration (NASA), the DOE, and the Department of Education (ED), among others. Research funding from the NIH, NSF, and DOE is particularly critical for supporting the innovation pipeline in Massachusetts.

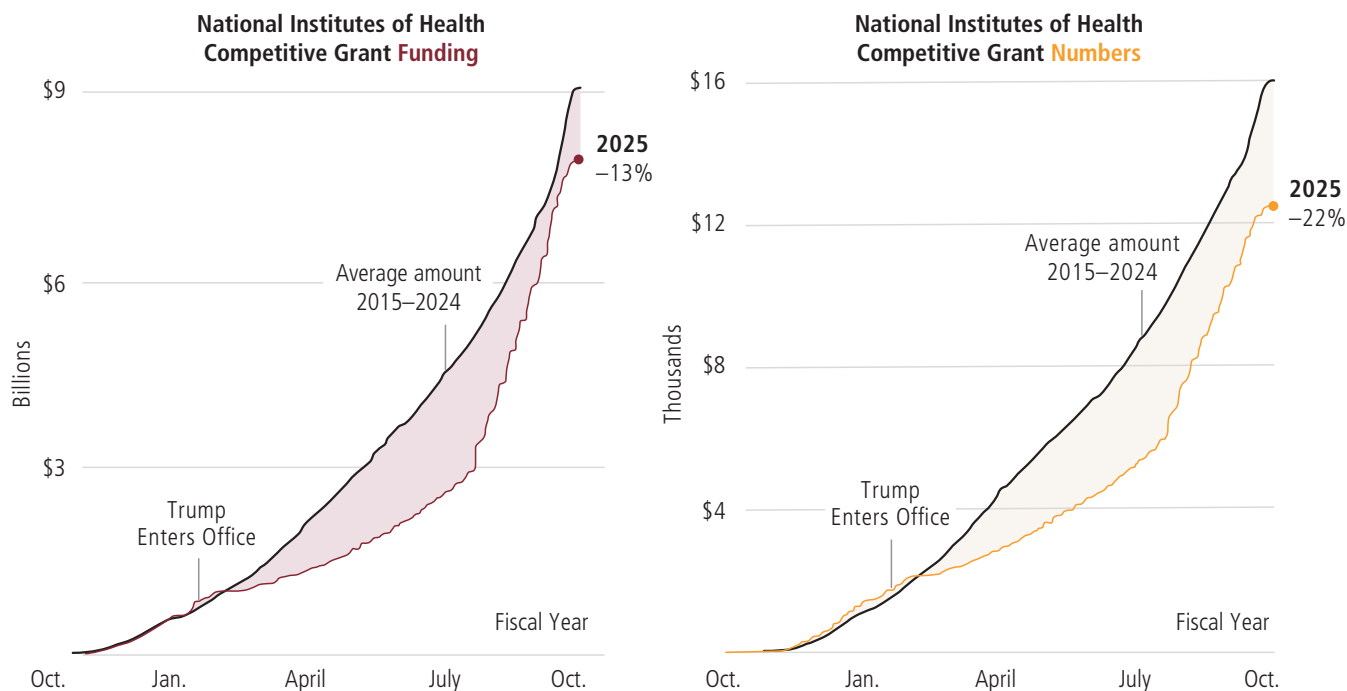
There is considerable uncertainty around federal funding for research even as this *MassBenchmarks* article reaches publication in August 2026. Despite a bipartisan victory to restore research funding appropriations to agencies like the NIH and the NSF in the early months of this year, it is still far from certain that funds will be distributed as appropriated by the U.S. Congress or according to established processes. The flow of dollars to scientists is not occurring at the rate it needs to, which, in some instances, is halting progress or shutting down established laboratories altogether. Though Congress rejected R&D funding cuts, grant terminations and firings are essentially allowing those cuts to take effect regardless, and the funds that the White House has dispersed to agencies like the NSF have

been far less than what Congress intended.³ The innovation process can take years to decades, and the combination of uncertainty and a lack of confidence about consistent future funding is profoundly disruptive to ongoing efforts in the research pipeline.

In Massachusetts specifically, the impact has already been significant. As of October 15, 2025, out of 7,388 NIH grants active at some point in that year, the federal government terminated 1%, equivalent to about \$35.5 million in lost funding. Ten percent of Massachusetts' grants were terminated by the federal government at some point in 2025, though reinstatements brought back most of that award funding. In the current fiscal year (2027), this funding is again at risk, in keeping with the proposed budget. A May 2025 report on NSF grant terminations found that the state had lost tens of millions of dollars in grant funding from that agency.

Changes to grant distribution have negatively impacted research beyond funding reductions. Nationally, NIH grants were 41% below their 10-year average dollar amount as of summer 2025. Over the following months, the amount of grant money awarded increased, nearing the 10-year average, but that money was distributed across a smaller number of grants.

Figure 6: Change in the Dollar Amount and Number of NIH Grants, October 2024 to October 2025



■ Source: "The U.S. Is Funding Fewer Grants in Every Area of Science and Medicine," *New York Times*, Dec. 2, 2025.
[Access the text-based description of Figure 6: Change in the Dollar Amount and Number of NIH Grant on Google Docs.](#)

The current administration is prioritizing fewer, larger grants. Additionally, targeted grant cancellations have occurred for grants containing language related to diversity, equity, and inclusion (DEI). Consequently, in 2025, the NIH awarded 25% fewer new grants than in prior years. Without federal funding grants to support research, entire projects have been halted, postponed, or cancelled.

SBIR and STTR Program Disruptions

Small Business Innovation Research and Small Business Technology Transfer programs represent a critical funding pathway for early-stage research that can ultimately benefit the nation through breakthroughs in such areas as defense and health technologies. In Massachusetts, for example, Linguistic, Inc. (in Cambridge) is a beneficiary of this type of research funding support. The company applied an award to finalize an AI-powered learning tool that helps adult immigrants and non-native English speakers learn the language while also training for jobs in fields like healthcare. Starting from a basic question-and-answer app used by a few hundred students, Linguistic has already developed a smarter system that adapts to each learner's level and field of interest and supports over 100 languages, and the company plans to use the SBIR award to make it even more effective and widely available.

Massachusetts ranks consistently as a leader in receiving this type of funding, following only the much larger state of California. However, these programs, like the NIH grants, have been disrupted by federal funding uncertainties. In late 2025, awards under these programs were paused as they awaited congressional reauthorization. Following a 6-month lapse, funding was restored through September 2031, but the

uncertainties have already caused significant damage. Award numbers are expected to recover toward those of previous years, but 2026 totals will almost certainly be the lowest in recent history.

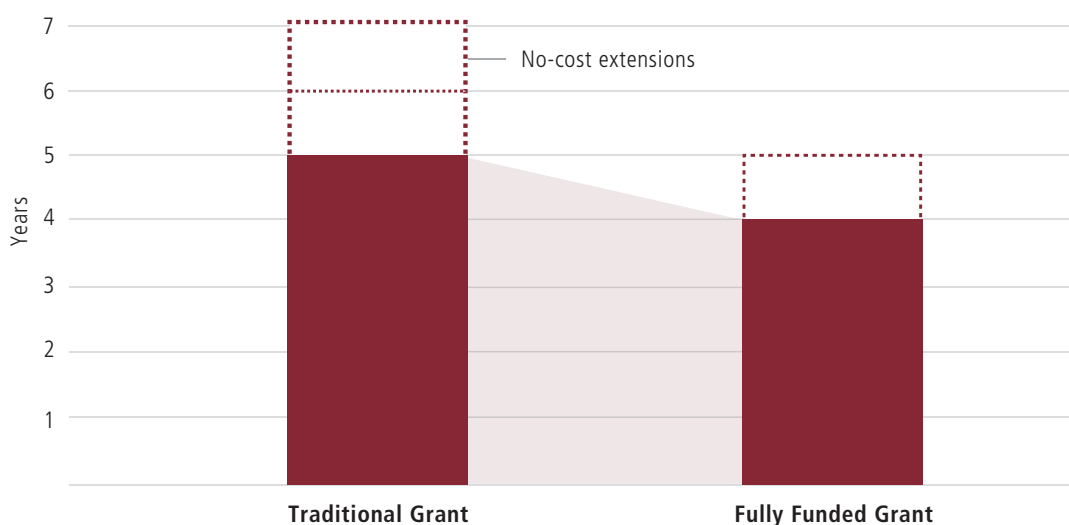
Data for the early part of FY2026 suggest a sharp national decline in awards due to the pauses in funding. Five months into the last fiscal year, only 154 SBIR and STTR awards were recorded nationwide, compared with annual totals of well over 6,000 in prior years. In Massachusetts, just 22 grants were awarded in the early part of FY2026 versus more than 500 annually in previous years. These figures from the Small Business Administration and other agencies are still preliminary, but this drop represents a dramatic contraction in funding, one that could be catastrophic for many small businesses. The impact is likely to be especially severe in metropolitan Boston, where awards are typically concentrated and where small firms, which often lack a dedicated advocacy voice, are sensitive to disruptions in cash flow.

Grant Structure Changes and Their Practical Implications

Beyond the dollar amounts of cuts, structural changes to how grants are awarded have profound implications for researchers and institutions. NIH grants are traditionally awarded for 5-year periods, with up to 2 years of no-cost extensions. The current administration has constrained these to 4 years, with only a single year of extension.

While on the surface this could appear to be a modest change, in practice this means researchers have less time to complete their work and less funding annually, on average.

Figure 7: Change in Grant Timing, 2025



Source: "The U.S. Is Funding Fewer Grants in Every Area of Science and Medicine," *New York Times*, Dec. 2, 2025.

[Access the text-based description of Figure 7: Change in Grant Timing, 2025 on Google Docs.](#)

For example, the change in funding mechanisms for the UMass Chan Medical School translates into a roughly 15% reduction of research support. NSF grants follow similar patterns.

Fewer and shorter grants mean that researchers have fewer opportunities to participate in research. New researchers must compete against more seasoned researchers for a smaller pool of projects. Without funding, today's young researchers may not have the opportunity to become the next generation of innovators in future decades. This represents a long-term loss for both Massachusetts and the United States.

There have also been considerable delays in the awarding of grants. The first delays took place in January 2025 in response to executive orders from the Trump Administration, with agencies like the NSF freezing payments to grantees. More recently, an extended government shutdown prevented agencies like the NSF from awarding grants for over a month. There is also uncertainty about the future availability of grant funding given proposed cuts. Researchers have hesitated to apply for grants in response to the proposed budgetary cuts for 2026, further delaying potential research. A pervasive sense of uncertainty, compounded by the federal funding cuts, is slowing or halting research momentum and preventing new research from starting.

The presidential budget proposal includes additional threats to the research pipeline. Proposed capping of indirect reimbursement rates on grants to 15% (approximately 30% is more typical) poses a significant institutional burden as funding for infrastructure, facilities, and activities that support research (e.g., building and equipment maintenance, computing power, key personnel, etc.) is reduced, stymieing research efforts and longer-term investments. Ideas have been floated for reforming these reimbursements, but unilaterally capping them amounts to another reduction in the ability to conduct research.

The Threat to Talent Retention and Workforce Development

One of the most troubling consequences of federal funding cuts is the disruption to the pipeline of research talent. Nationwide, scientists and researchers refer to the summer of 2025 as a "summer of despair" for STEM education. Widespread federal cuts to STEM education and research funding resulted in canceled grants and halted training programs, reducing opportunities for students and early-career scientists and weakening the STEM talent pipeline. Sharp reductions at the NSF and the NIH, including major cuts to STEM education programs, are disrupting workforce development efforts and increasing the risk that researchers, especially early-career scientists, will choose to leave the United States to pursue stable funding and career opportunities elsewhere.

The Department of Defense's proposed FY2026 budget includes a billion-dollar increase in science and technology spending compared with FY2025, which provides some counterbalance to announced reductions in other areas. However, it is unclear how the distribution of that spending will change between states. Additionally, the proposed budget includes \$30 million in spending cuts related to DEI initiatives. While the threatened large-scale slashing of research budgets did not transpire as initially feared in early 2025, the disruptions caused by these proposals have created great uncertainty, especially for early-career researchers. Looming research funding battles for FY2027 add to the unpredictability and further undermine confidence.

Cuts to federal funding and reductions in indirect cost limits harm educational and medical institutions, which account for 10% of the broader R&D ecosystem employment in the analysis (i.e., 35,744 of jobs at higher education and medical institutions are estimated to be in R&D). These

institutions host critical early research, which feeds the R&D ecosystem. In the absence of federal funding for research, these institutions would continue to operate in a service capacity, albeit in a diminished form and at great expense to the state and national economies. Academic professionals interviewed for the report on which this article is based indicated that these cuts have a serious negative impact on training and hiring of research staff, with sharp declines in doctoral program enrollment across universities in the state.

The impacts are not limited to domestic researchers. Other countries are beginning to draw U.S. talent by incentivizing researchers through increased hiring and boosts to their own government research spending. Scientific employers in Switzerland and Australia have already identified an increase in applications from U.S. researchers, and a March 2025 survey by the journal *Nature* found that 75% of surveyed U.S. scientists were considering moving abroad. *Nature* also found a 32% increase in the number of U.S. applicants for positions abroad in early 2025 compared with the same period the year before. A *Boston Globe* survey found that one in six surveyed NIH researchers in Massachusetts had lost staff to other countries.

Prominent U.S. researchers such as California-based Fields Medal-winning mathematician Terrence Tao have expressed uncertainty about remaining in the United States after having funding frozen or cut. This uncertainty has been accelerated by reductions in funding and a decline in the number of admissions of PhD candidates in U.S. schools. For instance, the University of Pennsylvania and the UMass Chan Medical School are two major universities that have rescinded PhD admissions in response to cuts to research funding. *The Boston Globe* reported that in the previous school year, UMass Chan accepted 73 PhD students but, in the current school year, accepted only 13, after withdrawing many offers to students in response to funding cuts.



The UMass Chan chancellor, Michael Collins, anticipates a larger PhD class next year, but it will still be below average because of declines in federal grants.

Competitor states are quickly developing new initiatives designed to substitute for federal cuts and attract out-of-state researchers. The \$3 billion Dementia Prevention and Research Institute of Texas (DPRIT), approved by voters in a ballot measure, authorizes \$3 billion in state surplus funds to be awarded over 10 years to Texas-based researchers for work in Alzheimer's, Parkinson's, and other diseases. Another recent example is the Illinois Quantum and Microelectronics Park (IQMP), a first-of-its-kind campus for quantum scale-up and other related quantum and advanced microelectronics R&D. IQMP received \$500 million in funding from the Illinois legislature and has already attracted established tenants like IBM and DARPA, as well as numerous quantum startups and researchers. In addition, California has proposed the \$23 billion California Foundation for Science and Health Research, designed explicitly to counter disruptions in federal funding and operate as a general funding mechanism, much like current SBIR/STTR and NIH grants.

The promulgation of these types of initiatives by competitor states raises the risk for Massachusetts to lose researchers and future technology development to areas in which key investigators can see clear funding support.

State-Level Response and Its Limitations

Recognizing the threat posed by federal funding reductions, Massachusetts has taken steps to support its research and development ecosystem. New initiatives reinforce existing efforts, as the Commonwealth has already been a leader in providing capital for research and innovation for decades. The state created the first publicly funded venture capital

fund in 1946 through the American Research and Development Corporation. Building on that history, Massachusetts continues to maintain a network of publicly supported organizations that help innovation find financial support, such as the Mass Life Sciences Center (MLSC), the Mass Clean Energy Center (MassCEC), and MassVentures.

State-supported programs like the MLSC and MassCEC have succeeded in helping firms commercialize their innovations. These kinds of public support offerings for innovation help startups build on the early-stage support received from federal sources of R&D funding. Signed into law on November 20, 2024, the Mass Leads Act is a multibillion-dollar initiative aimed at strengthening Massachusetts' leadership in key leading-edge industries, including climatetech, life sciences, and AI. Similarly, the Massachusetts Strategic Hub for Innovation, Exchange and Leadership in Defense (SHIELD) initiative supports innovation in the state's defense industries. Other state proposals to add further funding for R&D, such as the \$400 million Massachusetts Discovery, Research, and Innovation for a Vibrant Economy (DRIVE) Act, are intended to counteract federal reductions and signal the state's ongoing support for R&D.

Tangible demonstrations of innovation support backed by funding help provide confidence to entrepreneurs, startups, and businesses that Massachusetts offers the foundations for long-term growth. However, interviews conducted for the UMass Donahue Institute's report indicated that state funding alone is unlikely to be an adequate replacement for billions in federal funding that could be at risk. While state-sponsored programs for technology development and enterprise scaling send a positive signal to the research community about Massachusetts' commitment to innovation, the scale of potential federal funding losses vastly exceeds what the state can realistically replace through its own resources.

Proposed federal funding cuts may not have an immediate impact on active research, but the seeds not planted today will not bear fruit 10, 20, or 30 years from now.



Conclusion

Cuts in federal research support could have a cascading effect that will become increasingly visible in the future. While the economic ramifications may not be immediately visible, there will be a shortage of new startups and new innovations because of actual cuts as well as administrative disruptions to the flow of grants to support research. Early-stage research supported by federal funding plants the seeds for future growth, which is especially important to Massachusetts' innovation-based economy. Without consistent federal support for fundamental research, the innovations that drive economic growth in future decades will be fewer and farther between, and those innovations may be developed elsewhere rather than in Massachusetts.

Significantly, the innovation process can take years to decades to bear fruit. The disruption caused by federal funding cuts, combined with uncertainties about future funding and disruptions to grants, creates an existential threat to this carefully balanced ecosystem.

Federal research funding from the NIH, the NSF, and the DOE has been essential to catalyzing the private-sector elements of innovation in Massachusetts. The proposed cuts may not have an immediate impact on active research, but the seeds not planted today will not bear fruit 10, 20, or 30 years from now.

While early signs of restored research support in 2026 offer a degree of encouragement, continued federal stability in tandem with sustained state-level investments will be essential to preserving Massachusetts' leadership in innovation and ensuring long-term economic growth. The state's unique concentration of research talent and resources, though a competitive advantage, also creates vulnerability to disruptions in the federal funding pipeline. Federal and state policymakers must recognize that the innovation pipeline is not built quickly and cannot be rebuilt quickly once disrupted. The investments made today in research funding determine the innovations, companies, and jobs that will exist in Massachusetts in the decades to come.



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Endnotes

1) This article draws largely on research conducted by UMDI in late 2025 and early 2026, the findings of which are published in the report *The Research and Development Ecosystem: Engine of the Massachusetts Economy*. Policies and practices concerning the release of federal research dollars are frequently changing, but uncertainty remains a constant. For readers, the core findings of the report and this article hold firm, but specified dollar values concerning the extent of the funding cuts as well as Massachusetts' (and other states') policy responses continue to evolve. To view the full report, please visit <https://donahue.umass.edu/news-events/institute-news/report-research-development-ecosystem-is-the-engine-of-the-state-economy>.

2) <https://www.naics.com/naics-code-description/?code=5417>

3) <https://www.aau.edu/newsroom/new-reporting-shows-nih-grantmaking-slowdown-is-shrinking-american-science>



ENDNOTES

Continued Economic Growth in the Commonwealth Will Depend Largely on Productivity

ALAN CLAYTON-MATTHEWS

Despite flat employment, the Massachusetts economy grew over the past 2 years—all thanks to productivity. If the labor force continues to shrink as projected, understanding productivity growth, and how to nurture it, will be critical to the state's economic health.

Massachusetts payroll employment has been flat since mid-2023, and the labor force is no larger than it was 2 years ago. Nevertheless, real state gross domestic product (GDP) grew at an average annual rate of 2.5% since mid-2023 and an average annual rate of 2.2% over the last 2 years. All the economic growth during this time has been due to growth in productivity. The U.S. Bureau of Labor Statistics (BLS) projects that the working-age population will remain flat in 2026, which, combined with a demographic shift toward older age cohorts, suggests that the state's labor force could continue to shrink in the future. If these projections are realized, economic growth this year will only be possible with continued growth in productivity.

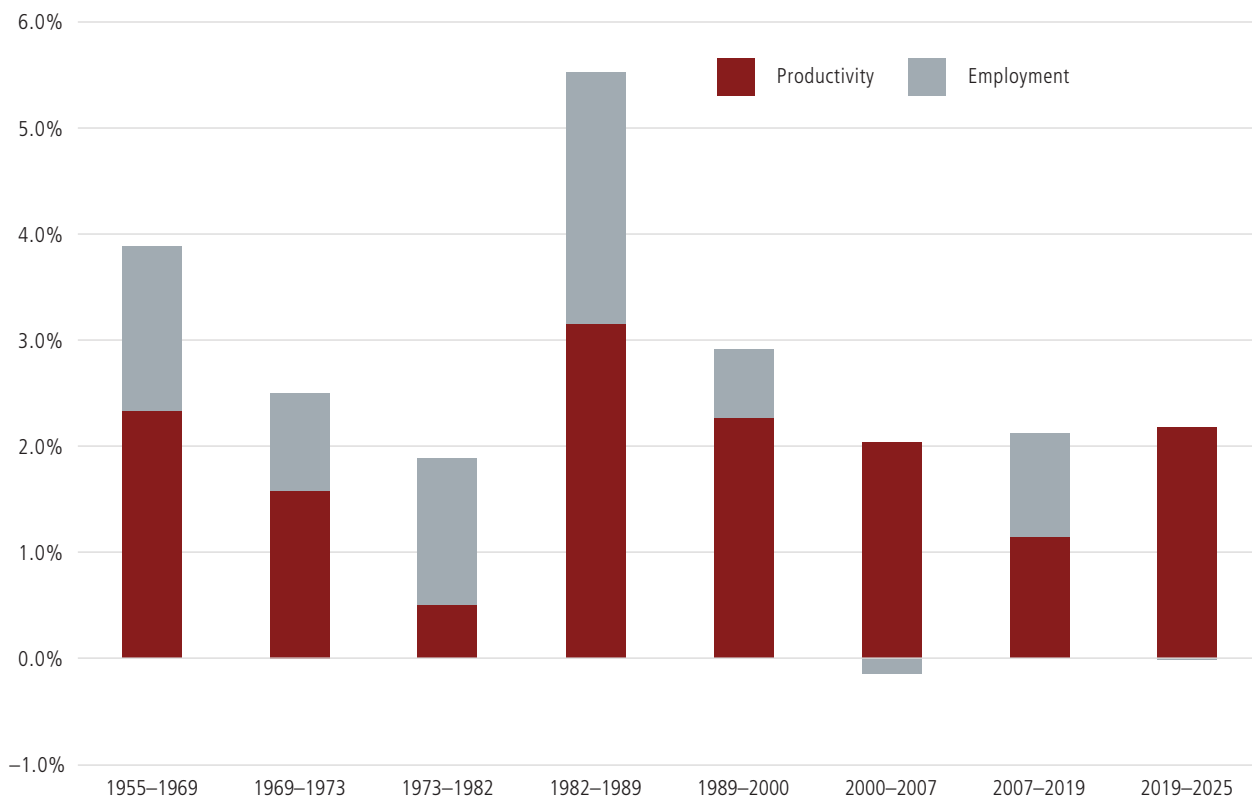
If the state's economic health relies on productivity growth, it is important to understand how to nurture it. What is productivity, and how does it relate to economic growth? How is it measured? How productive is Massachusetts relative to other states and the nation? Are there public policies that can boost productivity?

Productivity is measured by output per worker or, more precisely, output per unit of labor input.¹ The BLS defines productivity as real value added (i.e., real GDP) per hour of work.² Economic output, that is, GDP, is the product of aggregate hours of work multiplied by productivity; and the growth of output is equal to the growth of hours worked plus the growth of

productivity. For example, consider the 2.2% annual average rate of growth in Massachusetts GDP from the fourth quarter of 2023 to the fourth quarter of 2025. Total hours of work subtracted 0.3 percentage points from that growth, and productivity added 2.5 percentage points to that growth.³

Figure 1 shows the breakdown of Massachusetts GDP growth by productivity and employment. Since a historical series on output per worker-hour was not available, the figure relies on data on growth in output per payroll worker. These two alternative measures of productivity growth are highly correlated.

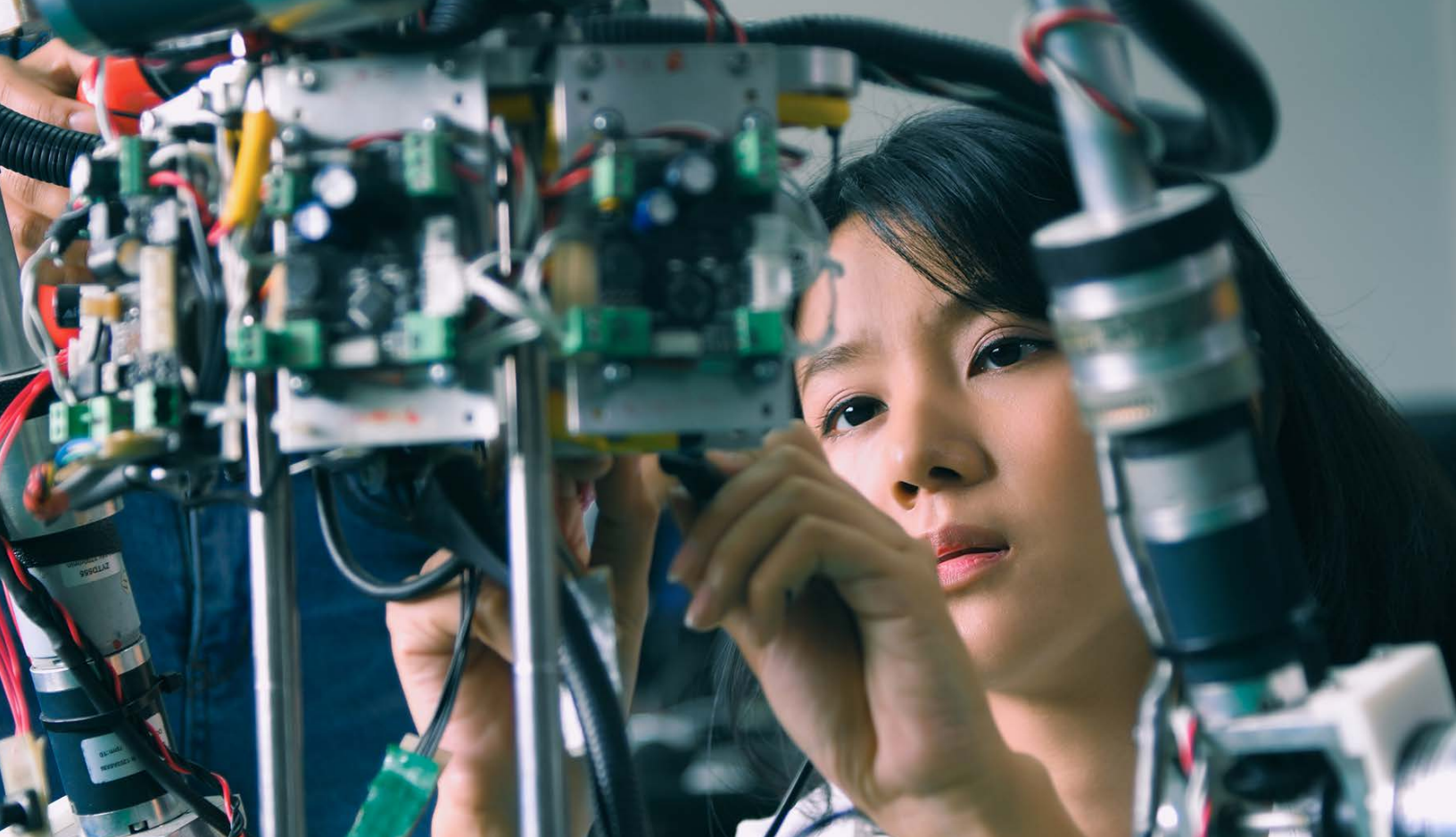
■ **Figure 1: Massachusetts Annual Average GDP Growth by Period and Component**



■ Note: Periods correspond to business cycles.

Source: GDP, U.S. Bureau of Economic Analysis and the Federal Reserve Bank of Boston; employment BLS CES statistics.

[Access the text-based description of Figure 1: Massachusetts Annual Average GDP Growth by Period and Component on Google Docs.](#)



Productivity is inherently good: Higher productivity is associated with higher per capita output, higher incomes, higher educational attainment, and many other indicators of positive social welfare.

Among all U.S. states, Massachusetts ranked sixth in productivity in 2024—the most recent year released by the BLS—at \$93.09 per worker-hour (in 2017 dollars). New York led the nation at \$107.03, followed by Washington, the District of Columbia, California, and Delaware.⁴ Productivity is inherently good: Higher productivity is associated with higher per capita output, higher incomes, higher educational attainment, and many other indicators of positive social welfare. It also results in greater capacity for the provision of public goods and services and public and private investment—for example, in infrastructure and education—with positive feedbacks on productivity growth.

Productivity growth is essential in an environment characterized by low population and labor force growth. Relative to the base year of 2017 in the BLS's statistical releases on productivity, Massachusetts ranked sixth in the United States, with productivity growth

of 20.4% during the 2017–2024 period. Washington state led the nation, with productivity growth of 31.9%, followed by California, Maine, Utah, and Nebraska.⁵

Robert Solow's aggregate production model provides a decomposition of labor productivity that is useful for policy analysis.⁶ The growth in labor productivity is equal to the growth in technology plus the capital-weighted growth in the capital-to-labor ratio ("capital deepening") plus the labor-input-weighted growth in labor composition. The weights refer to the shares of capital and labor in output and are not important here in understanding how policy affects productivity growth.⁷

Labor composition is a factor applied to hours worked. The product of hours and labor composition is the value of labor input in production, operationalized by cost-share weighting the hours of different groups of workers based on age, sex, education, and

class of worker (i.e., wage and salary vs. self-employed). Here, the policy implications are clear: Improving the quality of education, graduation rates, post-graduation education and training, the retention of college graduates, and the attraction of skilled workers all increase labor composition and, therefore, productivity.

Capital deepening relates to the industrial mix of the economy. Policies that attract businesses producing more output per worker can lead to economic growth even in an environment with no population or labor force growth. It may be less clear than in the case of labor composition what specific policies would have the greatest impact, but they would include tax policy, infrastructure investments that lower the costs or boost the profitability of businesses, and regulations that encourage business formation, all with the objective of attracting high-value employers.

Technology is less directly affected

by state policy. The federal, rather than state, government has the primary role of supporting basic research and development (R&D), given the positive externalities involved. The state can tap into federal sources of R&D funds through its support for public universities. Massachusetts is also fortunate to have private institutions of education and health that attract R&D grants. Entrepreneurship, which involves the creation of new businesses, often by applying technology innovations, tends to use highly skilled workers and to attract private investor capital, thus increasing a region's productivity. However, the role of state policy is not clear here. For example, aside from the risk, the gains from public subsidies could be lost if successful startups move out of state. Perhaps state policy can be effective in facilitating clusters of innovation with efficient but limited use of public resources. Can the Commonwealth's bold and, by most measures, successful

industrial policy of supporting biotechnology be repeated? Should it?

So, what's next? An analysis of trends in labor composition, contributions of capital and labor input, and technology (total factor productivity) may be useful to inform future policy. The BLS estimates these trends at the national level and for detailed industries and capital asset categories. Though these estimates are not available at the state level, there may be ways to derive estimates for states using the national data and other data available at the state level such as the U.S. Bureau of Economic Analysis estimates of state GDP by major industry.



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Education, training, and skilled workers are among the most important drivers of productivity growth.



Endnotes

1) This measure is more fully described as "labor productivity," and in the context of this article, the terms are used interchangeably. The term "labor productivity," however, is somewhat of a misnomer because productivity in the sense of value of output is due not just to labor but also to the combined impact of all factors of production. The terms "productivity" and "labor productivity" refer simply to the concept of output per hour of labor input.

2) The BLS's headline aggregate measure is for the private nonfarm business sector, which accounts for roughly three-quarters of U.S. GDP. It excludes farming, general government, nonprofit institutions, and households (including owner-occupied housing). A slightly broader measure that includes farming accounts for a percentage point more of GDP.

3) This assumes that average annual hours of work per worker in this period were unchanged and that payroll employment growth was proportional to total employment growth. Both assumptions are approximately true.

4) The ranks of the other New England states were as follows: Connecticut, seventh; New Hampshire, 21st; Rhode Island, 33rd; Maine, 44th; and Vermont, 47th, at \$59.96.

5) The ranks of the other New England states were as follows: New Hampshire, 10th; Vermont, 33rd; Rhode Island, 40th; and Connecticut, 44th.

6) Solow, R. M. (1957). Technical change and the aggregate production function. *The Review of Economics and Statistics*, 39(3), 312–320. A technical summary of this model and a description of the data and measures that the BLS uses are available in the BLS's *Handbook of Methods*, Office of Productivity and Technology (<https://www.bls.gov/opub/hom/opt/home.htm>).

7) "Technology" is the term Solow used; the BLS uses the terms "total factor productivity" or "multi-factor productivity." This growth component includes not only technological change but also other factors such as improvements in managerial organization and economies of scale. The BLS measures this term as the residual between output and the contributions of capital and labor.

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