

ENTREPRENEURSHIP AND INNOVATION POLICY AND THE ECONOMY:

INTRODUCTION TO VOLUME 6

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This volume is the sixth installment in the National Bureau of Economic Research (NBER) *Entrepreneurship and Innovation Policy and the Economy* (EIPE) series. Entrepreneurship and innovation are central drivers of long-run prosperity, raising living standards, and advancing human health, while also underpinning national security. The rate and direction of scientific and technological progress also depend heavily on public policy, from public investments in research to the design of tax incentives to the methods of supporting basic research that can spark entire new industries. The annual EIPE conference and associated volume bring leading researchers together to synthesize new insights into innovation policy and to convey those insights into the policymaking community. The series also exposes researchers to the goals and constraints that policymakers face, helping surface key questions that can shape future research.

This year's conference was held at the National Press Club in Washington, DC on May 5, 2026. The seven chapters collected in this volume address major topics in innovation policy, science policy, and entrepreneurship.

The first two chapters take up a foundational question in innovation policy: what does a dollar of public support for R&D deliver? The first contribution comes from the Congressional Budget Office. Sheila Campbell, Jaeger Nelson, Eli Schrag, Heidi Williams, and Caleb Wroblewski describe the frameworks CBO uses to analyze how changes in federal R&D funding affect the economy and the federal budget, providing both methodological insights and up-to-date estimates. The second contribution comes from the Joint Committee on Taxation. Brandon Pecoraro, Nicholas Hoffman, Martin Lopez-Daneri, Elena Derby, Rachel Moore, and Shannon Sledz use confidential administrative tax returns to measure what R&D tax credits and deductions are worth, once their actual use is taken into account. Together the chapters clarify the economic content of innovation policy, providing detailed and practical methods to understand key implications of federal support for R&D.

The next two chapters examine the transformation of the space sector, from technological advances in satellites to launch systems, and provide holistic accounts of the forces and players behind this transformation. Benoit Cornet, Marc-André Chavy-Macdonald, and Dominique Foray analyze how space innovation has moved from a regime organized around technological achievement, driven by government objectives, to one organized around innovation based on market value. Ruben Gaetani and Alexander Whalley bring patent data to bear on when the change occurred, where it occurred regionally, and who drove it, finding that the largest surge came in the 1990s and was led by incumbent aerospace firms rather than the entrepreneurial entrants that arrived after 2005. Both chapters agree that the government's role has been remade, from a buyer of specified hardware toward an investor, customer, and maker of markets, and provide key insights into the policy shifts that encouraged the remaking of the space sector.

The final three chapters all inform the practice of innovation policymaking, with attention to regional development, national leadership, and funding methods. Susan Helper, Resem Makan, and Daniel Shoag ask whether federal research investment can seed innovation ecosystems in places with little prior capacity, using the national laboratories as a setting. Dewey Murdick and Richard Klavans create a map of 100,000 research communities to make national research leadership visible at high resolution, allowing observers to assess where countries are surging ahead and where they are falling behind. Matthew Clancy, Matthew Esche, Siddhartha Haria, Claire McMahon, Christopher Snyder, and Caleb Watney propose a framework for choosing among the dozen or more mechanisms the federal government uses to fund innovation, organizing that choice around the funder's goals and what the funder is in a position to know. Collectively, the chapters examine key dimensions of the innovation policy landscape, offering conceptual frameworks, new measurement, and empirical evidence on central questions that stand before policymakers today.

In "Estimating the Economic Effects of Federally Funded R&D," Campbell, Nelson, Schrag, Williams, and Wroblewski set out the analytical machinery behind the Congressional Budget Office's assessments of federal research funding. The federal government spent roughly \$179 billion on R&D in fiscal year 2024, and when CBO is asked what changes to that figure would do to the economy and the budget, it must produce a point estimate. The authors develop two frameworks in parallel. One approach traces R&D appropriations and expenditure into a

knowledge capital stock that, with lags, creates economy-wide productivity gains. These productivity gains in turn raise GDP and government revenues. A second approach works from the bottom up, splitting R&D funding into labor and nonlabor costs and modeling the effects of these pieces, including the role of additional researchers, on the economy. The authors further assess how an additional federal R&D dollar influences nonfederal R&D, and conclude there is a crowding-in effect, where 1 dollar of federal R&D raises nonfederal R&D by about 25 cents.

Applied to an illustrative increase of \$30 billion in nondefense R&D appropriations per year for a decade, and giving equal weight to the two methods, each federal dollar raises the present value of GDP by roughly \$3.57 to \$3.82 over thirty years, depending on financing assumptions. This indicates that additional R&D spending can raise standards of living meaningfully, with the benefits to the economy being a substantial multiple over the cost. The budgetary picture is more complicated: faster productivity growth raises revenues but higher interest rates raise interest costs. The interest rate effect is more costly when the R&D spending is deficit financed. A deficit-financed increase is estimated to raise the total deficit by about \$2.32 per R&D dollar while a deficit-neutral one would raise it by about 11 cents. Of course, in comparison to federal spending that don't have the future revenue benefits, R&D funding looks relatively advantageous. Overall, the analyses suggest that R&D funding is of extraordinary value to the economy as a whole, but that is not an easy fix for the federal budget.

In "Estimating the Present Value of R&D Tax Benefits in the United States," Pecoraro, Hoffman, Lopez-Daneri, Derby, Moore, and Sledz examine the a major instrument of innovation policy that doesn't pass through appropriations but rather through the tax code. The federal R&D credit and deduction generate more than \$100 billion in claims each year. What a firm can claim and what it receives are different things, however. Firms in a loss position often cannot use deductions and credits in the year they arise, and instead accumulate carryforwards that may be used only years later, if at all. Ordering rules compound this, since older vintages must be exhausted first, so a firm carrying large past losses may wait a long time before this year's research yields any tax saving. The authors track these attributes for annual cohorts of R&D spending from 2012 through 2016. By using confidential IRS corporate tax-return data for C-corporations, they are able to shed light on questions that previously have been difficult to answer.

The results reveal that the R&D tax credits are difficult to fully utilize, with systematic heterogeneity across firm types. A dollar of R&D generates about \$0.35 in realized present-value tax benefits on average, falling to roughly \$0.26 for firms in loss status and to about \$0.16 for firms in loss status that are both young and small. About 97 percent of the value of deductions is realized contemporaneously, but only about 56 percent of credits, and once an attribute is carried forward only about a fifth appear usable before it expires. Thus R&D cost measures built from statutory parameters may substantially mismeasure the incentives firms actually face. Two other implications of the analyses are especially notable. First, the firms whose spending tilts most heavily toward research are frequently those least able to convert a statutory incentive into cash. This includes entrepreneurial firms that run at losses in their early years. Thus R&D tax policy may favor incumbents over disruptive entrants. Second, and related, a refundable tax credit (meaning a firm can use it when in loss status) could help these R&D-intensive and often young firms. That said, the paper's illustrative refundability exercise also shows an important design tradeoff: because large firms generate most R&D credits, most of the static fiscal cost of broad refundability would accrue to large firms that already monetize their credits relatively quickly. Overall, this paper greatly sharpens evidence on the use of R&D tax incentives, providing new bases to understand their effects and to assess potential design tradeoffs and improvements.

In "Defining Innovatisation: The Case of NewSpace and the Changing Space Sector," Cornet, Chavy-Macdonald, and Foray analyze how the U.S. space sector has moved from a regime organized around technological achievement toward one based on discovering economic value. Their central conceptual distinction is that technological achievement asks whether something can be done, whereas innovation asks whether it also works economically; that is, whether customers value it, whether its costs are sustainable, and whether producers can capture enough of that value to justify investment. Apollo exemplifies the first regime: NASA and the Department of Defense were dominant customers, with national prestige and national security taking precedence as objectives, and where cost-plus contracting insulated suppliers from many of the market pressures that ordinarily encourage cost reduction and experimentation.

The new era, in their account, arose from a process of "innovatisation," representing mutually reinforcing changes in supply, demand, and institutions. On the supply side, technological advances in miniaturization, software, and many other areas reduced the cost of experimentation,

production, and access to space. On the demand side, market opportunities expanded beyond traditional government customers to engage large private markets, including for communications, internet access, Earth observation, and other domains. Institutionally, NASA moved from cost-plus contracting toward fixed-price, milestone-based partnerships such as the Commercial Orbital Transportation Services program, under which firms retained intellectual property and invested their own capital alongside the agency. The ultimate declines in cost are striking: access to low Earth orbit fell from roughly \$10,200 per kilogram in the mid-1990s to about \$2,600 by 2020. Entrepreneurship and venture capital rose substantially, with global venture investment in space rising from \$186 million across all of 2000 to 2005 to \$9 billion in 2021 alone, and the public share of U.S. space R&D fell from more than 90 percent in 2010 to roughly 70 percent in 2020. The chapter closes by noting that market forces also bring challenges, for example in the externalities and worsening problem of orbital debris as well as newly concentrated market power, which call for public policy to correct market failures.

In “Old Space, New Space: A Commercial Revolution in Innovation?,” Gaetani and Whalley subject prevailing accounts of the transformation in the space sector to systematic measurement. The familiar narrative portrays a government-dominated industry of legacy aerospace contractors as giving way in the 2000s to a more innovative New Space economy led by entrepreneurial and venture-backed entrants. Yet there has been little systematic evidence about when the shift in innovative activity actually occurred or which firms drove it. The authors use patent data to investigate these transitions. Because many space technologies are dual-use and originate in other fields, they construct three definitions of the sector, ranging from a narrow one based on launch vehicle classifications to a broad one drawn in part from a European Space Agency taxonomy.

Their findings complicate the standard narrative. First, the largest surge in space patenting came in the 1990s, rather than after 2005, and was concentrated in satellites, communications, and navigation, rather than launch vehicles. That surge coincided the creation of appropriable commercial markets through spectrum allocation and licensing reforms and with rapidly growing demand for telecommunications, internet, and GPS applications. Second, the commercialization of innovation was real but was driven primarily by established private firms: government patenting declined substantially, while incumbent private firms produced the majority of private-

sector space patents and most of the increase. Entrants' share grew, particularly in broader space technologies, where it rose from 11.8 percent in 1985 to 32.9 percent in 2017, but it remained a minority, and VC-backed firms account for an even smaller portion of the overall expansion. Third, the geography of innovation shows striking continuity: regions prominent during the Cold War remained prominent through the New Space period. The evidence is descriptive rather than causal, but it suggests that New Space is more continuous with Old Space than the disruption narrative implies. Consistent with the prior chapter, the government's most consequential contribution may have been institutional, in shifting policy and procurement rules to help create markets in which private innovation could earn returns.

In “Local Returns to Federal Innovation Investment: Evidence from the National Laboratories,” Helper, Makan, and Shoag examine whether large-scale federal research investments can stimulate sustained innovation and economic development in regions that initially lack strong technological ecosystems. The authors view the establishment of U.S. national laboratories as a particularly useful setting for examining this question, because many laboratory locations were selected primarily for their security and isolation rather than their economic potential, reducing concerns that federal investment simply flowed to places already well positioned for growth. Drawing on historical patent records, newly digitized county-level economic data, and linked Census records, the study finds that counties hosting national laboratories experienced substantial and persistent increases in non-laboratory patenting by inventors unaffiliated with the laboratories, as well as growth in retail sales, income, and educational attainment. The authors argue that these patterns demonstrate that federal research infrastructure can generate significant knowledge spillovers and help establish durable regional innovation ecosystems, even in areas with limited prior research capacity.

The study further investigates why the economic returns to federal investment varied across laboratories. The strongest evidence points to the importance of institutional design and local connections: laboratories with university affiliations, greater institutional embeddedness, and more open structures exhibit larger spillovers into their surrounding economies. The authors also grapple with the question of whether observed local gains represent genuine increases in productivity rather than merely the relocation of workers and innovative activity from elsewhere. Wage increases among residents who lived in laboratory counties before the facilities were

established, together with the absence of measurable productivity declines among the former collaborators of scientists who relocated to laboratories, suggest that the laboratories created new economic value rather than simply redistributing existing activity geographically. The authors more speculatively suggest that the historical effects of national laboratories may represent a lower bound on the potential regional returns from place-based innovation policies, since the laboratories were often intentionally isolated and secretive rather than being located or governed to maximize local economic spillovers.

In “Keeping Pace with the Frontier: National Research Portfolio Dynamics,” Murdick and Klavans develop a data-driven framework for evaluating how national research portfolios are positioned relative to the evolving scientific frontier. The authors argue that conventional categories such as artificial intelligence, quantum technology, or broad scientific disciplines are too coarse and slow-moving to guide timely research portfolio decisions. Instead, they use OpenAlex bibliometric data to organize scientific publications into approximately 100,000, fine-grained research communities intended to capture communities that share questions, methods, and bodies of prior work. Using three overlapping snapshots of the research landscape, they construct predictive models that estimate future citations per paper from characteristics of these communities. The resulting framework provides two complementary views of national research performance: a “research leadership” view that identifies areas in which countries publish more intensively than their overall share of global research would predict, and a “portfolio agility” view that evaluates how rapidly countries expand their activity in communities with the strongest signals of future scientific influence while reducing emphasis on communities with the weakest signals.

The cross-national results reveal substantial differences in the speed with which research systems respond to changes at the scientific frontier. Across ten national systems, India and China generally rank among the most agile, with India placing first or second and China combining relatively high agility with an exceptionally large research base. By contrast, the United States and European Union consistently rank in the bottom third in measures of portfolio reallocation, despite maintaining very large and scientifically influential research systems. Murdick and Klavans caution that these findings should not be interpreted as simple rankings of scientific quality or as prescriptions for shifting research funding. Slower reallocation may reflect

deliberate portfolio breadth, institutional constraints, or objectives—such as national security, resilience, health, and commercialization—that their indicators do not capture. Rather, the framework is intended as a diagnostic tool that allows policymakers and research managers to identify emerging areas, potential portfolio blind spots, and differences in national responsiveness before those developments become apparent in conventional aggregate statistics. More generally, the study demonstrates the potential value of frequently updated, high-resolution bibliometric analysis as a key tool for informing research strategy assessments.

Finally, “Selecting Innovation Funding Mechanisms: A Framework for Policymakers” develops a practical framework for determining which public funding mechanisms are best suited to different innovation challenges. Clancy, Esche, Haria, McMahon, Snyder, and Watney begin from the observation that the U.S. federal government spends roughly \$200 billion annually on research and development through a wide range of instruments, yet policymakers lack a systematic method for choosing among them. Rather than attempting a conventional cost-benefit comparison, which is difficult because technological outcomes and innovators’ capabilities are highly uncertain, the authors frame the choice of an appropriate mechanism as an information and classification problem. Their framework centers on three questions: whether policymakers can clearly articulate the problem that innovation should solve, whether they can define a successful solution in observable and verifiable terms, and whether they can identify the most capable performers in advance. The answers reveal which tools the government may most effectively pursue.

The appropriate funding mechanism depends fundamentally on where relevant information resides and how readily performance can be observed. When policymakers can specify both the problem and the desired outcome, mechanisms that reward measurable results—such as prizes, milestone payments, or advance market commitments—can harness competition while shifting technological risk toward performers. When the appropriate solution or even the precise research problem remains uncertain, more flexible mechanisms, such as traditional grants, can delegate greater discretion to researchers and program managers and accommodate experimentation and learning. The authors also emphasize that additional considerations, including financing constraints, coordination requirements, institutional capacity, and implementation feasibility, should refine the choice once policymakers have identified a viable set of mechanisms. The

paper therefore treats funding mechanism design as a central component of innovation policy rather than a secondary administrative decision: effective public investment requires matching the allocation of incentives, risks, and decision-making authority to the information available to government and innovators. By translating insights from information economics and contract theory into observable questions policymakers can answer, the framework organizes a complex menu of funding instruments and provides a practical method for choosing appropriate funding designs to meet a particular innovation objective.

The seven contributions collectively engage critical features of R&D policy, from its role of driving economic growth to regional benefits to national leadership. We also see the critical importance of institutional design, whether in encouraging space innovation and the growth of new industries or more generally in choosing the appropriate funding instrument for particular research opportunities.

This volume, its conference, and the broader EIPE series stand at the nexus between research and policy, highlighting policy opportunities and new research questions and building a community of researchers and policymakers who seek to better understand and advance the U.S. innovation and entrepreneurship system.

We thank the authors for their excellent contributions!

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