Indirect Cost Recovery in U.S. Innovation Policy: History, Evidence, and Avenues for Reform*

Pierre Azoulay† MIT and NBER

Daniel P. Gross‡ Duke University and NBER

Bhaven N. Sampat§ ASU and NBER

April 2025

Comments are welcome and encouraged

Abstract:

The U.S. government has funded university research for nearly 80 years, with a significant share of this funding supporting the fixed costs of science through indirect cost recovery (ICR). We explain the history, objectives, and mechanics of ICR policy and review key controversies. We also provide new empirical evidence on indirect costs at the NIH, a major target of past and present ICR reform. Using data from over 350 institutions, we find that while negotiated ICR rates average 58%, effective rates—what NIH actually pays—average 42%, with relatively little variation across institutions or over time. Our analyses also suggest that a proposed 15% flat rate would significantly cut NIH funding for many grantees, disproportionately affecting institutions most linked to commercial patenting and drug development. We conclude by assessing the current system, and major reform proposals, across several ICR policy objectives: support for research and infrastructure, cost-efficiency incentives, implementation costs, and transparency. No single approach dominates on all dimensions.

JEL Classification: H51, O31, O32, O38

Keywords: science policy, economics of science, biomedicine, indirect cost recovery, NIH

*We thank Bob Cook-Deegan, Kelvin Droegemeier, Jeff Flier, Arpit Gupta, Paul Joskow, Michelle Hanlon, Sherry Glied, Cindy Hope, Ben Jones, Kevin Wozniak, and the Institute for Progress (especially Caleb Watney, Santi Ruiz, and Matthew Esche) for helpful comments. Azoulay and Sampat acknowledge support from the National Science Foundation under Grant No. 1735413. Gross acknowledges support from the National Science Foundation under Grant No. 2420824. Azoulay has also received grants from NIH, and Sampat has consulted for the NIH Office of Science Policy. All authors are employed by research universities that could be affected by any changes to federal indirect cost recovery policy. All errors are our own.

†Address: MIT Sloan School of Management, Cambridge, MA 02142, USA; e-mail: pazoulay@mit.edu.

‡Address: Duke University Fuqua School of Business, Durham, NC 27708, USA; e-mail: daniel.gross@duke.edu.

§Address: Arizona State University, Consortium for Science, Policy, and Outcomes, Washington DC 20006, USA; e-mail: bhaven.sampat@asu.edu.

1 Introduction

The U.S. innovation system is widely recognized as an engine of technological progress, driving improvements in standards of living and economic growth (Jones and Summers 2022). Much of it is now powered by university science. Yet scientific research is costly, requiring a wide range of expenses, including researcher salaries, lab space, equipment, supplies, conference travel, project management, regulatory compliance, and more. Though many of these costs are project-specific, some are shared—much like how businesses incur both costs of goods sold (a variable cost, scaling with output) and general and administrative costs (overhead, a fixed cost).

Since the end of World War II, the federal government has been the main funder of university research, which has long been viewed as a public good (Bush 1945, Nelson 1959, Arrow 1962). In doing so, it has financed not only the direct costs of research, but also the infrastructure and other overhead costs required to make modern university research run.

Today, the U.S. government provides funding for the indirect costs of research at universities (and other research institutions) through a complex system of institution-specific negotiated rates, at which the government pays a set percentage point increment over the direct costs of research. In our view, the current arrangement can be attributed to two root causes. The first is that unlike other countries, the U.S. lacks a centrally-funded national university system (Dupree 1986). The second is a mismatch between the cost structure of science and the way research is supported by the U.S. federal government, which primarily provides project funding rather than institutional or infrastructure funding (Institute of Medicine 1990). Because shared costs are difficult (and in some cases, potentially impossible) to budget into grants as a direct cost of the work, absent federal indirect cost support, institutions would lack the means to cover their fixed costs. Research funding agencies therefore compensate institutions with indirect cost "recovery" (ICR)—and have done so since World War II, when ICR policy was first developed—offsetting some (but today, not all) of the institutional costs of contributing to federally-funded research.

Indirect cost recovery now accounts for a substantial portion of federal funding for scientific research at universities and other institutions (Ledford 2014). From an economic perspective, beyond cost reimbursement ICR also functions as a prospective incentive mechanism that encourages universities and other research institutions to pursue socially valuable research by ensuring that both fixed and incremental research costs are covered. Moreover, unlike project-based grants—which primarily fund the direct costs of research—ICR allows institutions to make long-term investments in research capacity with the expectation of future federal funding. This structure provides universities with flexibility to invest in infrastructure, administrative support, and emerging research

areas—investments that might otherwise be financially untenable.

Since its beginnings, ICR policy has generated controversies around questions of whether institutions are under- or overcompensated for actual indirect costs, how to calculate reimbursement rates, and the right balance between direct and indirect costs in total funding for research (Rosenzweig 1998). With the adoption by most major funders of the modern ICR approach 60 years ago, additional controversies have emerged, including concerns over improper charges to the government, potential distortionary effects of ICR rules on university investment and hiring, the high administrative burden of calculating rates, and whether the system adequately supports university research infrastructure (Institute of Medicine 1990, Rosenzweig 1998, Alberts et al. 2014, Bozeman and Anderson 2014). Such controversies have fueled long-standing calls for indirect cost recovery reform (Rosenzweig 1998, U.S. Government Accountability Office 2013).

In this paper, we seek to clarify the complicated economics of indirect cost recovery and how they relate to these debates. In addition to examining considerations in ICR policy broadly, we pay particular attention to the U.S. National Institutes of Health (NIH), which is the largest funder of biomedical research in the world, a major funder of academic research, and has historically been at the center of ICR reform (U.S. Government Accountability Office 2013). Most recently, in February 2025, the agency proposed a fixed 15% ICR rate for all NIH grantees (National Institutes of Health 2025).[1] The stakes of getting policy right at NIH are high, given evidence on its large role in enabling U.S. medical innovation and drug development (Azoulay et al. 2019b).[2]

We begin in Section 2 by providing historical and institutional context, explaining the origins and current implementation of the U.S. government's ICR policy, and reviewing specific controversies. For decades, however, the dialogue around ICR has been constrained by the limited availability of systematic, empirical facts on indirect costs—including on how negotiated ICR rates compare to the indirect costs the U.S. government actually pays, the characteristics of institutions with higher and lower rates, and the potential impacts of reform. Motivated by these gaps, in Sections 3 and 4 we introduce new data and facts on ICR, focusing on NIH and on 354 institutions which account for roughly 85% of NIH extramural funding over the past 20 years. Building on Ledford (2014) and Graddy-Reed et al. (2021), we show there is a large difference between *negotiated* ICR rates and the *effective* rates actually paid,[3] and argue this is a crucial distinction for empirical assessment of current policy or potential reforms. The negotiated-effective rate gap has also been growing over time: although negotiated rates have increased from a median of roughly 43% to 56% over the past

[1] At the time of this writing (March 18, 2025), this change is being challenged in court.
[2] The NIH focus is also useful from an empirical perspective, as its databases uniquely include grant-level direct and indirect expenditure totals, important for evaluating current policy and potential reforms.
[3] We calculate "effective rates" as total funded indirect costs divided by total direct costs.

40 years, effective indirect cost reimbursement has essentially held steady for decades, at around 35-45% of direct costs for most of the educational institutions in our sample.

In both Section 4 and Section 5, we evaluate the potential impacts of a recently proposed 15% ICR rate, under the presumption that a flat 15% rate would be applied on institutions' total direct costs. Because effective ICR rates are relatively uniform across institutions, the percentage decline in NIH funding under a 15% rate would be as well. However, the dollar declines for many will be large: we project that at least a dozen institutions would lose >$100 million in NIH funding per year. Our data suggest that the institutions that would experience the largest funding declines are the United States' highest-ranked institutions, and that NIH-funded science these institutions produce is linked to more commercial patenting by U.S. firms, more valuable commercial patents, and more new drugs. Nearly all of the institutions with patents on multiple FDA approved drugs in recent decades would experience large funding declines with this reform.

In the final part of this paper (Section 6), we examine the current variable-rate ICR system alongside several potential alternatives, including a fixed 15% ICR rate. We assess how different policy approaches align with the numerous, sometimes conflicting, goals of ICR policy: support for research and research infrastructure, incentives for cost-efficiency, limiting administrative burden, and transparency. The alternatives we identify have tradeoffs, and none dominates the others on all of these objectives. The discussion may nevertheless be clarifying of what each alternative offers—and what it stands to lose. In Section 7 we then conclude by discussing other data that may inform these policy tradeoffs going forward, at the NIH and beyond.

2 Evolution of Indirect Cost Policy

2.1 World War II Origins

Like much of U.S. science and technology policy, the modern approach to indirect cost recovery—and the very idea that federal R&D contractors and grantees should be compensated for both the direct costs of research and overhead—traces its origins to World War II. The war presented a wide range of urgent, new technological problems and catalyzed a coordinated, government-led effort to harness the country's civilian research capacity for war. Between 1940 and 1945, the newly created Office of Scientific Research and Development (OSRD), led by Vannevar Bush, directed and funded war-related R&D at hundreds of U.S. firms, universities, hospitals, and other research institutions. This OSRD-led effort contributed to numerous wartime breakthroughs, including radar, the proximity fuse, the mass production of penicillin, the atomic bomb, and other innovations that were crucial to the Allied victory (Gross and Sampat 2023a).

The scale of the crisis made it essential that OSRD be able to engage all qualified firms and universities, including those with the greatest capabilities (Gross and Sampat 2023b). Together with its patent policies, indirect cost or "overhead" reimbursement was instituted to make it worthwhile for firms and universities to shift their effort—including their facilities, equipment, and best talent—away from existing pursuits towards the war. However, since federal research funding was at the time uncharted territory, these procedures had to be created from scratch. Thus was born indirect cost reimbursement (ICR) as a policy for incentivizing private sector participation in government-funded research by ensuring that relevant costs were covered (Stewart 1948).

OSRD's operating principle for ICR was "no-profit, no-loss": that institutions should be fully reimbursed for participating in wartime work but should not financially benefit otherwise. Though the main focus was firms, ensuring contractors broke even was also important for universities, some of which had previously been averse to accepting government funds out of fear that bureaucratic oversight would infringe on scientific autonomy.[4] Breaking even required not only covering the incremental costs of OSRD-sponsored research (e.g., salaries, equipment, supplies), which were reimbursed by voucher, but also overhead expenses including lab space, shared equipment, and administrative staff that would be difficult to allocate to any one project.

In 1942, Bush established an ICR policy that was "more or less arbitrary but seemingly equitable" (Jewett 1942, p. 9), allowing universities to receive overhead payments of 50% of salaries paid on OSRD contracts, while firms received 100%. Firms were granted higher overhead because, unlike universities, they were subject to taxation (Jewett 1942).

Even during the war, this was viewed as a pragmatic but imperfect solution—potentially over-compensating some institutions while undercompensating others. Complicating matters further, there were no established accounting standards for distinguishing direct from indirect costs (Stewart 1948). While it was impractical to audit all contractors, a small staff audited the largest ones, providing guidance on what costs should be categorized as direct or indirect, effectively determining institution-specific indirect cost rates. Gruber (1995) suggests that negotiations were complicated by the conceptual vagary of indirect cost accounting. Some universities may have attempted to inflate overhead, while government auditors pushed back. James Killian, who would later become President of MIT and the first U.S. Science Advisor, described determining the correct rate to achieve "no-profit, no-loss" as a "metaphysical concept" (Gruber 1995).[5]

Indirect cost recovery was thus originally an instrument to ensure universities and firms would not

[4] As Bush noted in reference to the motivation for OSRD's overhead policy, "Any commercial concern that did not consider overhead part of its costs would not last long" (quoted in Gruber 1995, p. 243).

[5] At the end of the war, after audits were conducted, 51% of large contractors were determined to have been over-compensated by these overhead rates and had to refund the government. See Stewart (1948) and Gruber (1995).

lose money when contributing to a public good and thereby encourage them to take on OSRD work—at that time, supporting the Allied cause in World War II.[6]

2.2 Indirect Costs and the Bush Report

Given the success of the wartime research effort, it was clear even before the war was over that the federal government would play a bigger role in funding research after the war (Kevles 1977, Sampat 2023) than it had before it. In 1944, President Roosevelt asked Bush to draw lessons from OSRD for achieving peacetime goals related to national security, health, and economic welfare. Bush's response, *Science, The Endless Frontier*, delivered to President Truman in 1945, made the case for government funding of basic research at universities as a central pillar of postwar science policy, through a single major agency (the National Research Foundation). In the Report (Bush 1945), Bush sought to make the case for government funding coupled with scientific freedom, allaying previous concerns of some scientists and universities that government funding would mean government control over the direction of science (Kevles 1977).

While the main text of the Bush Report does not address overhead, the advisory committee contributions (included as appendices to *Endless Frontier*) go into more detail on this topic. The report from the Committee on Science and the Public Welfare acknowledged overhead costs and the challenges of indirect cost policy, including variation in university accounting methods and the difficulty of determining "what parts of the costs of laboratory space staff salaries, administrative overhead, and so forth is occasioned by research and what part by teaching" (Bush 1945, p. 105). Given these and other challenges, the main type of funding envisioned by the Committee were "automatic" matching funds which would afford universities "complete freedom in selection of research programs and personnel," freeing both the Foundation and universities from the burdens of grant level peer review and ICR. The Committee also recommended discretionary grants for "promising special projects" and funding for capital equipment "to provide adequate facilities for advanced research" to be shared cooperatively among universities in a region.

2.3 Indirect Costs at the NIH: The Era of Capped Rates (1946-1966)

As is well known (Kevles 1977, Mowery 1997), many of the specific institutional mechanisms that Bush and his advisors proposed in *Science, The Endless Frontier* did not come to pass. As Congress considered Bush's and competing proposals, various mission-oriented agencies absorbed wartime research. By the time the agency that both Bush's and competing proposals envisioned as the

[6]The official OSRD history concluded: "In practice, the overhead provision as administered seems to have served the purpose of leaving the institutions whole, neither richer nor poorer for having devoted a part of their facilities to this phase of the public interest in a period of great national peril" (Stewart 1948).

single major research funder—now called the National Science Foundation—was created in 1950, much of the research landscape was already spoken for by other agencies, leaving the NSF a "puny partner" in the overall research policy enterprise (Kevles 1977). The NIH, which had been small and primarily focused on intramural research before the war, absorbed OSRD's medical research contracts at the end of the war, tripling its budget and forming the foundation for its extramural research program, which expanded rapidly afterward (Sampat 2023).

One consequence of this disintegration was that each funder developed its own policies, including those related to indirect costs. In 1947, the Office of Naval Research (ONR) established guidelines for reimbursing indirect costs through campus-wide average rates, calculated based on universities' financial reports and specific categories of expenses. The goal, as in wartime, was "no gain, no loss"—ensuring full cost reimbursement without profit (Rosenzweig 1998). Rates were not uniform, but rather varied by institution based on their overhead cost estimates.

NIH's funding approach was different from what Bush and his advisors had proposed. It decided to allocate the bulk of its funds through bottom-up grant competitions reviewed first by scientists, and then by administrators, adopting the basic peer review process developed by OSRD's Committee on Medical Research during the war (Sampat 2023). NIH also took a different approach to indirect costs. Unlike military R&D, where the government was buying the research, the new grants program was viewed primarily as "grants-in-aid", intended to support "projects developed upon the initiative of the scientist" (Public Health Service 1951). That is, NIH did not originally aspire to full cost-reimbursement. Its initial rates were a blanket 8% on a grant's base value. This rate was also viewed as easy to apply, as it did not require calculation of indirect costs or audits.

Over the next several years, however, as the NIH extramural program grew beyond expectations, universities began to claim that participation was taxing universities. For example, a letter from a University of Minnesota administator to the NIH grants division noted that these costs diverted resources from teaching and infrastructure, threatening both scientific progress and broader academic stability (Middlebrook 1951). A 1954 internal NIH memo to the head of the extramural program, Cassius Van Slyke, warned that the 8% cap was a "hindrance to the full development of research activities in this country" (quoted in Allen 1954).

The argument that universities could not sustain participation in NIH research under an 8% rate ultimately prevailed, leading to an increase in indirect cost recovery to a maximum of 15% of direct costs in 1958, followed by a further rise to 20% cap in 1963.[7] At the same time as the cap increases

[7]These changes were met with some controversy at the time. For example, when the increase from 8% to 15% was being deliberated, Mary Lasker, the influential Washington socialite who played a key role in expanding the NIH's postwar budget, expressed worries that the change would be akin to "throwing away 7 percent of the money for additional overhead" (quoted in Van Slyke 1954).

enabled greater indirect cost recovery, however, the conversion of a blanket rate to a capped rate also created new administrative requirements to measure indirect costs in order to justify reimbursement up to the cap (National Institutes of Health 1965). Congressional investigations of the NIH during the 1960s also focused on whether the actual costs were being overcompensated through the new capped rates (House Committee on Government Operations 1962).

However, many universities generally continued to complain of losing money when participating in NIH research under the 20% cap (Greenberg 1963). In response, Congress removed the cap in 1966 (Walsh 1965), and NIH joined other federal funders in adopting variable, uncapped, institution-specific rates, entering the negotiated rates era that continues to this day.

2.4 Indirect Costs at the NIH: Negotiated Rates and Controversy

2.4.1 Mechanics of modern variable rate ICR

To provide uniform government-wide procedures for determining indirect costs, in 1958 the Bureau of the Budget (now OMB) issued Circular A-21, which standardized accounting practices around indirect costs, codifying rules developed by ONR (and later the Department of Defense) for determining institution-specific rates. This document, revised several times over successive decades (Rosenzweig 1998), became the main guidance for ICR policy at most federal research funding agencies, including at NIH after it moved to negotiated rates in 1966.

The principles of A-21—now incorporated into the Code of Federal Regulations (at 2 CFR § 200), and informally known as the "Uniform Guidance"—remain the basis for determining indirect cost recovery rates today. All institutions seeking federal funding must have a federally-approved "F&A" rate (an acronym for Facilities and Administration, the principal categories of overhead expenses). The process for doing so is complex, requiring detailed accounting, audits, and negotiation with a "lead" or "cognizant" federal agency, which for most institutions is the Department of Health and Human Services (the parent agency of the NIH), though universities and other institutions that have historically had significant defense research funding (e.g., MIT, Stanford) negotiate with the Office of Naval Research (a part of the Department of Defense) instead.

According to the Uniform Guidance, to initiate this process, institutions must prepare an Indirect Cost Rate Proposal, which is structurally similar for universities and other research-performing institutions but somewhat more expansive for universities due to their larger number of cost centers. To simplify the exposition, we will explain the process for universities.

The process of preparing a rate proposal essentially follows three steps. The first step begins with university's ordinary cost accounting, which includes total direct and indirect costs in conventional

accounting frameworks. Universities then remove unallowable expenses from indirect costs (overhead which cannot be reimbursed, such as marketing costs or alumni-related activities) and applies exclusions to the direct cost base, excluding equipment above certain limits, patient care costs, subcontract accounts over a specific amount, and other exceptions. Remaining costs are the sum of Modified Total Direct Costs (MTDC) and allowable indirect costs.

Next, the institution reallocates these costs to a set of four federally-recognized activities: organized research, instruction, other sponsored activities, and other institutional activities. A rate proposal produces estimates of direct costs and overhead for each. Direct costs include salaries (or salary shares, via allocated employee effort), consumable supplies, and other inputs. Overhead expenses are divided into nine broad cost pools which group into either Facilities or Administration (F&A), where the cost pools for the 'F' include (i) building depreciation, (ii) interest, (iii) equipment and capital improvements, and (iv) operations and maintenance, and the cost pools for the 'A' include (v) general university administration, (vi) departmental administration, (vii) sponsored project administration, (viii) library services, and (ix) student administration.

Having determined the total dollar value of overhead expenses associated with organized research (or other activities), and the MTDC of organized research (and each other activity), dividing the overhead by MTDC gives the proposed F&A rate, subject to one important restriction: since 1991, the Administration component has been capped at 26%.[8] Putting the pieces together, a proposed F&A rate for organized research obtains from the following calculation:

$$\text{F\&A Rate} = \left(\min \left(0.26, \frac{\text{Administration Costs}}{\text{MTDC}} \right) + \frac{\text{Facilities Costs}}{\text{MTDC}} \right) \times 100 \tag{1}$$

Noll and Rogerson (1998) note that these determinations involve making a large number of seemingly arbitrary judgments, such as what share of library costs should be allocated to federal research (e.g., based on surveys of people entering libraries), or what share of space in an office or lab should be allocated to federal research (e.g., based on square footage, measured using "space studies"; University of Washington 1992). It also presupposes that time ("effort") can be precisely allocated across functional activities (e.g., research and instruction) or to federal grants versus other sources of funding. As Noll and Rogerson (1998, p. 17) describe it, *"these studies [and calculations] are*

[8] At the same time, the Uniform Guidance gives universities the option of a fixed allowance for administrative costs at either 24% of MTDC or 95% of its most recent negotiated F&A rate for administrative cost pools (whichever is lower) without preparing a cost proposal. For universities which prepare administrative cost proposals, the administrative burden is implicitly less than 5-10% of anticipated administrative ICR (otherwise, these universities would choose a 5-10% reduction in administrative F&A over preparing a new proposal).

often quite expensive and detailed, and involve extensive data collection and complex algebraic calculations, all of which tend to give them a patina of objectivity and technical respectability"—but the process ultimately forces numerous discretionary judgments.

After the university conducts its costing studies, the several-hundred-page proposals are reviewed by federal auditors from the cognizant agency and audited through site visits and review of records (Bourne and Vermillion 2016). After this auditing, representatives of the cognizant agency negotiate a rate with the university. According to at least Bourne and Vermillion (2016, p. 45), the government has all of the bargaining power in these negotiations and can make "take it or leave it" offers, given the reliance of universities on federal grants.

These costing studies and negotiations are typically conducted every two to four years, since they are costly and cumbersome. Although negotiated rates are calculated from historical data (typically, a recent year), they are applied prospectively to "recover" indirect costs for new grants going forward until rate agreements expire, triggering a new negotiation cycle. In situations where an audit reveals a predetermined rate overcompensated or undercompensated institutions in the previous period, the difference is typically incorporated into future rate-setting.

At the end of this process, an institution comes away with a negotiated F&A rate. On ordinary grants, this F&A rate is applied to grants' MTDC (total direct costs less exclusions) to calculate the associated indirect cost payments. But not all NIH grants are subject to this rate: for example, the NIH caps indirect cost recovery on training grants at 8%. Moreover, the rates are not applied to all direct costs for funded grants, but to MTDC, subject to the same exceptions above. As a result of these caps and exclusions, as well as of the federal government's bargaining power, a university's *effective* (i.e., actual) indirect cost recovery on federal research may be substantially lower than its negotiated rate (Ledford 2014)—similar to how firms' effective corporate tax rate is often lower than the statutory rate (Dyreng et al. 2017). Finally, it is worth noting that although the Uniform Guidance focuses on universities and other non-profit institutions, NIH uses similar procedures to reimburse indirect costs of firms performing NIH-funded research, which are primarily funded through the Small Business Innovation Research (SBIR) program (see National Academies of Sciences, Engineering, and Medicine 2022 for a review).

2.4.2 Sources of controversy

The capped rates which defined NIH's ICR policy in its first two decades were implicitly a form of cost-sharing, whereby institutions shared in the costs of any NIH grants, particularly when overhead costs exceeded the cap. Following the adoption of variable negotiated rates in 1966, NIH created requirements for mandatory cost-sharing by recipients (NIH Office of Program Planning

1965) though these were later removed in 1986.[9] While this would seemingly at long last commit NIH to full-cost reimbursement, following OSRD and ONR's early precedent, the introduction of new caps (such as the 26% cap on administrative reimbursement, or ICR caps on specific grant categories) has preserved cost-sharing as a central feature of ICR policy.

Despite these caps, negotiated ICR rates have climbed rapidly, especially for private institutions. This has been controversial. In some cases academics and agencies have expressed concerns that rising indirect cost reimbursement reduces the available funds for direct research funding (Rosenzweig 1998, Ehrenberg and Mykula 1999). In others, some academics have worried that their institutions' high rates may disadvantage their applications in peer review relative to competing proposals from lower-ICR institutions (Ehrenberg and Mykula 1999).[10]

Another source of concern has been creative accounting, particularly in light of a handful of cases where universities may have charged inappropriate expenses to the indirect cost pool used to calculate rates. Perhaps the most notorious example is Stanford University's charging an antique commode and depreciation on a yacht as "administrative expenses" for overhead cost purposes, leading to the resignation of the Stanford President in 1991 and the OMB enacting a cap of 26% on the administrative cost component of F&A (Brainard 1995).

Other concerns around indirect cost reimbursement are that it may introduce potential distortions in incentives. Higher ICR rates mean that each dollar of direct costs generates more indirect cost recovery, which may incentivize institutions to inflate direct costs. It may also encourage spending on facilities and administration beyond socially optimal levels. Rosenzweig (1998), for example, suggests that changes to OMB Circular A-21 in 1982 allowing interest on construction debt as an indirect cost may have contributed to a campus building boom.

Similarly, in 2010, a former president of the National Academy of Sciences wrote that the federal government's current ICR policy incentivizes growth of "soft money" faculty and supporting infrastructure. Not only is depreciation on new buildings recoverable via ICR, but, as Alberts (2010,

[9] The 1966 appropriations act which removed ICR caps—converting NIH to a variable rate system—mandated "none of the funds provided herein shall be used to pay any recipient of a grant for the conduct of a research project an amount equal to as much as the entire cost of the project," essentially requiring grantee institutions to share in costs of grants. Though the legislation lacked specifics, Congressional floor debate at the time suggests it contemplated cost-sharing of about 5% of the grant (NIH Office of Program Planning 1965).

[10] Although budgets are not a formal evaluation criterion in the first stage of NIH peer review, peer reviewers are asked to assess whether budgets are "fully justified and reasonable in relation to the proposed research" (National Institutes of Health 2024). Anecdotally, when examined, consideration of budgets at this stage of review typically emphasizes direct costs (not indirect costs) and whether key activities are sufficiently funded. In the second stage of review (by the reviewing Institute), budgetary considerations can influence final funding choices, but indirect cost rates—negotiated separately between institutions and NIH—appear to be accepted as given. To the extent that cost factors influence funding decisions, it is the total project cost that matters. Brown (1981) notes "there is no evaluative step at which an exceptionally high indirect cost rate reduces the probability that grant proposals from that university will be funded"—a pattern we understand continues to hold today.

p. 1257) writes, "any institution that draws on its own finances to pay its professors is doubly disadvantaged: It must not only use its own funds but also loses the overhead on the salaries that it would otherwise accrue." Together, these features encourage growth of the research enterprise. Though evidence suggests returns to the marginal research dollar may be high (e.g., Azoulay et al. 2019b, Babina et al. 2023), this growth may also contribute to broader systemic challenges. These include a focus on incremental, fundable research over what is most socially valuable (Packalen and Bhattacharya 2018), an unsustainable increase in grant applications that strains peer review (Sampat 2023), and hypercompetition in science (Fang and Casadevall 2015).[11]

There are several other longstanding concerns. One is that the system creates hidden cross-subsidies across disciplines and type of funders (Graddy-Reed et al. 2021). Another is that managing grants and indirect costs contributes to the administrative cost of research, which can in turn drive up indirect cost rates (at least up to the 26% cap on administration).

While much of the concern from Congress, agencies, and faculty has been about rates that may be too high, university representatives have made the opposing argument. Specifically, they have argued that with the 26% cap on administration, universities bear costs of rising administrative burdens on research (University of California Office of the President n.d.). Evidence of this can be seen in the negotiated rates of a handful of universities which have made their cost pools public—all of which are hitting the 26% cap (e.g., University of Cincinnati 2015, Bourne and Vermillion 2016). A second source of consternation for universities has been the growing exceptions to the set of grants that receive the full negotiated rate, and to the set of direct costs to which the negotiated rate applies (Bozeman and Anderson 2014). The exclusions used to calculate MTDC have grown over past decades. With this, and the 26% cap on administrative overhead, universities argue that even with uncapped rates (since 1966) and the removal of cost-sharing (since 1987), despite high and rising negotiated rates universities are effectively bearing a significant portion of the costs of each federal grant. Bourne and Vermillion (2016), for example, document that in 2014, UCSF recovered only 64% of indirect costs associated with its federal grants.[12] This evidence is consistent with Droegemeier (2017), who shows that U.S. universities on average recover only around 70% of their federal F&A costs and plug the gap with institutional funds.

[11] It has also increased financial risk: Alberts (2010, p. 1257) observes that "The possibility that the NIH will ultimately pay for both new building costs and new staff [has] encouraged a large number of institutions to expand 'on spec,' taking out loans and gambling that they will win enough NIH research grants to pay for the expansion." Because these investments have grown faster than the NIH budget, Alberts argues universities are effectively betting on their faculty being able to outcompete others' for the limited funding available.

[12] Roughly two-thirds of the gap between incurred and recovered indirect costs was due to caps and exclusions (particularly, the cap on administrative expenses and salary exclusions, as well as ICR caps on specific grant types), and one-third was due to negotiation outcomes (Bourne and Vermillion 2016).

3 Measuring ICR Policy and Implicated Outcomes

In addition to potential disagreement over the objectives of ICR policy, efforts at reform have also suffered from limited data for understand the contours of indirect cost reimbursement and the potential impacts of proposed reforms—both on specific institutions and grantees and on the U.S. innovation system more broadly. In the coming sections we introduce new empirical evidence on ICR, which informs our evaluation of policy alternatives in Section 6.

Our empirical analyses build on and extend previous work that seeks to explain variation in negotiated ICR rates across institutions. Most recently, Johnston et al. (2015) examined negotiated rates over the 2006-2010 period (using data from the Council on Government Relations database of indirect cost rates) for the 100 institutions with greatest NIH funding in 2010, and found that geographic region, total NIH funding, whether a university is public or private, and cost of living scores are significantly related to an institution's negotiated ICR. A related line of research focuses on differences between negotiated and actual ICR rates. A 2014 article in *Nature* used data (obtained via FOIA from the NIH) on the negotiated ICR rates for about 800 institutions (Ledford 2014). The author combined these data with actual NIH funding data in 2013 and 2014 (including total direct and indirect funding for the same institutions) and found that actual recovery is often less than the negotiated rates, a point which we also explore below.

3.1 Data Sources: F&A rates, institutions, and outcomes

We combine several sources of data to evaluate the incidence and potential impacts of a 15% ICR rate. Throughout the next two sections we limit our analysis to a set of 354 NIH-funded institutions which (i) received more than (2023 USD) $1 million of average annual NIH funding between 2005 and 2024, based on our tabulations of NIH RePORTER data, and (ii) received NIH funding in at least 15 of these 20 years. Together, these institutions account for close to 85% of NIH extramural research grant expenditures over this period, and 91% in 2024.

We then match these institutions to their negotiated ICR rates, which originate from three distinct sources. First, we collected institutions' negotiated F&A rates in effect in or around FY2024 for on-campus organized research, which we extract from public copies of their rate agreements. Rate agreements were obtained from the FDP Clearinghouse[13] and institution websites, where universities (and to a lesser degree, other institutions) typically post copies of current (and sometimes

[13] Available at https://fdpclearinghouse.org/. See https://fdpclearinghouse.org/organizations/101 for an example institution profile, with a link to the institution's most recent negotiated F&A agreement.

past) agreements.[14] This results in data on 330 institutions' F&A rates.[15]

We merge these measures with data on institutions' historical negotiated F&A rates, which we obtained through two distinct FOIA requests. A first request, filed in 2008 (henceforth "FOIA1") returned the full text of 5,849 unique agreements negotiated between federal agencies and research institutions (including universities, hospitals, and non-profits). Each individual agreement file generally contained ICR rates covering (i) a single institution (e.g., University of Vermont or the Oklahoma Medical Research Foundation), (ii) different functions (e.g., Research or Instruction), (iii) different locations (e.g., On Campus or Off Campus) and (iv) the dates in effect (typically one to three years). In some cases, the agreements covered multiple related institutions that we wish to consider separately (e.g., Harvard's agreements often reported Harvard Medical School and Harvard School of Public Health separately from Harvard University at large, with distinct rates). Because universities and hospitals often have numerous sub-institutions, many of which could be arguably treated as separate institutions, we define an institution as an organization for which we could assign a unique NIH Institutional Profile File (IPF) code.

Different types of rates are negotiated by institutions: provisional, final, pre-determined, and fixed. The most common type used by major research institutions contracting with the NIH are pre-determined rates which result from periodic re-negotiations (see Section 2). We focus on these rates in our analysis. FOIA1 yielded pre-determined F&A rates for 338 distinct IPFs out of the 354 institutions in our sample. On average we obtained nine years of agreements for each IPF, and about 90% of the rates provided by these agreements had effective dates between 1995 and 2009. To extend this panel further backwards, we filed a second FOIA request in 2017 with the Department of Health and Human Services (henceforth, "FOIA2") for their data on indirect cost rates for educational institutions from 1980 to the (then) present. Rather than individual agreements (as in FOIA1), FOIA2 produced a short document titled listing F&A rates. We digitized this file, manually linking each reported institution to an IPF code. FOIA2 yielded rates between 1982 and 2017 for 167 IPFs out of our 354 institution sample—including most research-intensive public and private universities—with an average of 19 years per institution.[16]

We supplement our data on negotiated F&A rates with data on the total value and actual (realized) ICR rates on NIH grants since 1965: ICR paid by NIH in proportion to direct costs for the institution

[14] HHS is the cognizant agency for most of these agreements; where it is not, ONR is. In the analysis in Section 5 we assume a flat 15% ICR rate would apply to all NIH sponsored research, irrespective of the cognizant agency.

[15] We have F&A rates in effect in FY2024 for 317 (95%) of these institutions; where the FY2024 rate could not be determined, we measure F&A rates for the nearest year before or after (typically FY2023).

[16] We combine these data sources, retaining information from FOIA2 only where there is at least one overlapping year between FOIA1 and FOIA2 and their reported rates in overlapping years match. More details (and the full dataset of negotiated rates) are available in Azoulay et al. (2019a).

as a whole (i.e., $\frac{\text{Indirect Costs}}{\text{Direct Costs}}$)—which we will henceforth refer to as the "effective rate." Grant values are inflated to 2023 using the NIH Biomedical R&D Price Index (BRDPI). We calculate institutions' effective ICR rates annually by aggregating grant-level data from NIH RePORTER (since 2006) and NIH's Consolidated Grant Application File (CGAF, up to 2005).

A majority of these grantees are higher education institutions (henceforth "universities," including liberal arts colleges and standalone medical schools such as the Medical College of Wisconsin), whereas the remainder are independent hospitals (e.g., Memorial Sloan-Kettering Cancer Center) and independent research institutes (e.g., the Salk Institute). For the university grantees, we supplement our data with institutional measures obtained from the U.S. Department of Education's Integrated Postsecondary Education System (IPEDS), which reports university characteristics, financial performance, and more. We specifically measure each university's operative control (public vs. private), Carnegie classification, whether it operates a medical school or medical center, FY2023 employment and enrollment, and FY2023 year-end endowment value. Looking beyond IPEDS, we also measure each university's US News global university rank.

We additionally measure commercial patenting between 2005 and 2024 associated with institutions' NIH-funded research. To do so, we make a three-step linkage: we (i) identify NIH grants issued to an institution (via CGAF and RePORTER), (ii) identify scientific publications supported by those grants (using the grant outputs reported by principal investigators), and (iii) identify patents referencing those publications in their description or claims (using data from Marx and Fuegi (2022) on patent citations to science)—commonly used measures of links between scientific articles and private sector patenting (Bryan et al. 2020).[17] We supplement these data with measures of these patents' private value to their owners, where possible (i.e., the private sector value creation NIH-funded science is associated with), computed from abnormal stock market returns realized by patent owners when each such patent is issued (Kogan et al. 2017). We aggregate these measures to the institution level. Importantly, the Kogan et al. (2017) measures of private sector value can only be calculated for publicly-traded firms and are thus a lower bound, as they will not account for value accruing to privately-held firms (including startups).

Beyond commercial patents citing NIH-funded publications, another measurable outcome of NIH-funded research is drug innovation: existing evidence suggests NIH-funded research has significant enabling effects on private-sector drug development (Sampat and Lichtenberg 2011, Li et al. 2017, Galkina Cleary et al. 2018, Azoulay et al. 2019b). In some cases, NIH grants directly generate patents that are listed in the FDA's Orange Book as core patents on patented drugs (Sampat and

[17] To be conservative, we weight each patent by the number of cited institutions—effectively subdividing each patent across cited institutions, rather than double-counting. For example, if a patent cites research from MIT, Duke, and Arizona State, each institution is credited with one-third of a linked patent.

Lichtenberg 2011, Ouellette and Sampat 2024). More broadly, university research—whether or not directly developed through NIH grants—can also result in Orange Book-listed patents. Using the Orange Book, we identify patents related to drugs approved between 2005 and 2023 and determined which drugs had a patent assigned to a U.S. university, medical center, or research institute. We then count the number of drugs each institution is associated with.

3.2 Combining data sources into an institution panel

Our next task is to connect these data sources at the institution level. Linking is made challenging by each data source having distinct identifiers—or sometimes none at all—and sometimes providing measures at different levels of aggregation. For example, NIH and IPEDS have their own identifiers (IPF codes and UnitIDs, respectively), and the level at which they are reported can vary, with some changing over time. Other sources—such as patent data, or the FDA Orange Book—provide institution names (e.g., patent assignees) but no numeric identifiers.

Two steps are thus required to link our data sources together. Because the reporting level varies across data sources, the first step is to group identifiers within each source to a common unit—particularly for IPF codes in the NIH data. We do so manually, grouping to the level at which F&A rates are reported. The second step is then crosswalking these sources to each other, which we also do manually, linking (i) negotiated F&A institutions, (ii) IPEDS UnitIDs, (iii) patent assignees, and (iv) Orange Book drug originators to (grouped) NIH IPF codes.

3.3 Final sample: 354 institutions

Of our sample of 354 institutions, 69% are universities (36% medical schools, 33% other university divisions, such as arts and sciences), 18% independent hospitals and medical centers, and 13% independent research institutes. Among the higher education institutions in our sample, roughly half are public and half are private. We compute effective F&A rates for all these institutions and years, and were able to collate information from various sources on negotiated rates for 338 of these institutions in an unbalanced panel spanning 1965 to 2024.[18]

Table 1 presents additional characteristics of this sample. The average institution received $81 million per year in NIH funding over the past 20 years (median $28 million), supporting on average nearly 100 investigators per institution per year. Whereas institutions' average negotiated F&A rate in 2024 was 58%, the average effective rate was 42%.

[Table 1 about here]

[18] Note that our measurement of negotiated F&A rates over time is uneven, with 111 institutions in the 1980s, 233 in the 1990s, 328 in the 2000s, 29 in the 2010s, and 274 institutions in the 2020s.

Each institution's NIH funded science is on average cited by 140 U.S. patents issued between 2005 and 2024 with at least $6.1 billion in value for U.S. firms, including $640 million in each research institution's own state. Multiplied across the 354 institutions in our sample, this adds to roughly $2.2 trillion in innovation over 20 years linked to NIH-sponsored research, with $228 billion in the same state—amounts which are lower bounds, based on NIH-funded science at only these institutions, and only patents owned by publicly-held firms. By comparison, the total inflation-adjusted NIH budget over these 20 years was $860 billion.[19]

NIH grantee institutions are on average projected to face a $20 million per year decline in funding under a flat 15% ICR rate, equivalent to roughly 17% of their recent NIH funding, with 13 institutions projected to lose more than $100 million in annual funding based on their 2024 grant totals and effective rates (see Section 4 for calculation details). The collective decline across institutions in this sample is projected to be $7 billion per year.

4 Five Facts about Indirect Cost Recovery

Though historical ICR policy offers limited variation in the negotiated ICR rate era to causally evaluate its effects, gaps nevertheless remain in understanding simpler descriptive facts, such as how negotiated ICR rates compare to what ICR is paid, how ICR rates vary across institutions, and how they have changed over time. Our goal in this section is to provide evidence on these questions. After doing so, we examine the incidence of a flat 15% ICR rate across U.S. universities, documenting which types of institutions are likely to be most affected.

4.1 How do effective rates compare to negotiated rates?

Our first fact is that despite the sticker shock that NIH grantees' (and especially universities') negotiated ICR rates may evoke, effective ICR rates in practice are substantially lower. Figure 1 illustrates this, showing the distribution of negotiated rates (in blue, shifted right) and effective rates (in red, shifted left). Whereas most institutions' negotiated F&A rates are between 50% and 70%, effective rates in practice are generally between 25% and 45%.[20]

[Figure 1 about here]

[19] Source: Historical NIH appropriations reported at https://www.nih.gov/about-nih/what-we-do/nih-almanac/appropriations-section-2, inflation-adjusted to 2023 using the BRDPI.

[20] In a separate sample of 816 small businesses with NIH SBIR/STTR grants in FY2024, we find that effective ICR rates have an interquartile range of 20% to 40% (median 30%), highlighting that firms also incur overhead costs—albeit lower than those of the larger and more complex research institutions in our main sample. These small businesses may also be bound by ICR policy reforms. Firms may additionally receive up to a 7% profit margin on SBIR/STTR awards, per NIH regulations (National Institutes of Health 2020).

Table 2 compares mean negotiated and effective rates across different categories of grantee institutions. Our second fact is that among all NIH grantees, universities on average have the lowest negotiated ICR rates (around 55-60%), which are similar for medical and non-medical campuses, and slightly higher for private than public universities. Negotiated rates are higher for non-university hospitals (average 70%) and highest for independent research institutes (average 82%). Effective rates are substantially lower across all categories, however, and are more compressed in their variation, though universities also have lower effective ICR rates (in the mid-30s) than hospitals (average 40%), and research institutes have the highest rates (average 53%).

[Table 2 about here]

These initial facts have three important implications for current debates around ICR policy reform, especially with respect to NIH's recent proposal for a flat, 15% ICR rate, motivated by a concern that ICR is excessive and inefficient. First is that negotiated rates do not provide a very useful window into ICR policy in practice. The material outcome for both NIH and its grantees is funds transferred, and this is nearly always lower than negotiated ICR rates, due to existing caps and exclusions. For this reason, much of our empirical and policy analysis will focus on effective ICR rates observed in the data. The second implication is that the potential effects of a 15% ICR rate (relative to the status quo) on federal research funding are smaller than one would project from negotiated rates—though still binding on every institution in our sample. The third implication is that these effects will be largest for independent research hospitals (such as St. Jude Children's Research Hospital in Memphis, TN) and non-profit institutes (such as Cold Spring Harbor Laboratory on Long Island, NY).

4.2 How have effective ICR rates changed over time?

Figure 2 shows how effective and negotiated ICR rates have changed over time. We plot the median and interquartile range of institution ICR rates in the 1980s, 1990s, 2000s, and 2020s. This chart provides our first view of long-run changes in indirect costs, and establishes our third fact: whereas negotiated ICR rates have been consistently increasing over the past four decades—at the median, rising roughly 13 percentage points since the 1980s, to roughly 56% in 2024—effective rates have been roughly constant over this period, hovering between 38-40%. The gap between them has thus grown in recent decades from a few percentage points to nearly twenty.

[Figure 2 about here]

Though effective rates represent the ICR that occurs in practice (and is thus more material), an inevitable question this evidence raises is why negotiated rates are so much higher and have been growing for decades. The evidence that effective rates are mostly unchanged over the past 40 years suggests against substantial indirect cost growth—or at least indicates institutions' indirect cost funding has scaled proportionally with total direct costs (TDC, off which our effective rates are calculated). The growing gap between negotiated and effective rates appears to be due to ICR caps and exclusions (increasingly) limiting ICR funding. Paradoxically, exclusions mechanically increase negotiated F&A rates, *even when indirect costs are unchanged*, because negotiated rates are defined by the Uniform Guidance as indirect costs divided by modified total direct costs (MTDC; see Equation 1), which decline as ICR exclusions grow. All else equal, institutions must then receive higher rates off a smaller base to recover their indirect costs.[21]

Figure 3 shows a time series of annual average effective rates from 1965 to 2024. Panel (A) compares rates for three categories of institutions: universities (including medical schools), independent hospitals, and research institutes. Our fourth fact is that the differences seen in Table 2 have been present since the late 1980s, prior to which hospitals had similar rates to universities. Between 1965 and 1985, however, effective indirect cost funding grew substantially for all institution types. Panel (B) compares public and private universities, which show similar patterns over time, including a modest, sustained gap—with private universities' effective ICR rates consistently about 8 percentage points higher than public universities rates since 1980.

[Figure 3 about here]

4.3 How do effective ICR rates vary across institutions?

For the remainder of this section, we focus our analysis on university recipients of NIH funding, where we can better assess how variation in ICR rates relates to institutional characteristics. Figure 4(A) presents a scatterplot of individual universities' effective ICR rate in 2024 against their direct cost funding that year. Figure 4(B) plots effective rates against FY2023 year-end endowment value. Marker color represents universities' global rank, with sharper blues representing higher-ranked universities, and those outside the global top 300 shown in light gray.

[Figure 4 about here]

[21] Appendix Figure A.1 provides more direct evidence that differences between TDC and MTDC explain the gap between negotiated and effective rates: within a sample of "no-frills" R01 awards where MTDC exclusions are unlikely to apply, and thus MTDC≈TDC, we see that the negotiated-effective gap closes. Given that these "no-frills" R01s' effective rates grow with negotiated rates, but that overall effective rates are more or less unchanged over the past four decades, an implication is that caps and exclusions have sufficiently limited indirect cost recovery on other grants to keep overall effective rates stable over time.

This chart establishes our fifth fact: effective ICR rates are unrelated to endowments, university rank, or NIH direct cost funding. Put differently: universities' effective ICR rates are comparable across many observable dimensions—including others not shown here. Thus, although negotiated rates can vary, the indirect cost share of grant funding is similar across universities of all types—including the wealthier and less wealthy, higher and lower ranked, and more vs. less heavily funded by NIH—generally hovering in the 35-45% range for them all.

4.4 Assessing the incidence of a 15% ICR rate

The combination of this evidence suggests that a flat 15% ICR rate will affect research institutions across the country. To assess these impacts, we calculate the projected decline in universities' indirect cost funding by applying a 15% ICR rate on 2024 direct costs and comparing it to the actual indirect costs paid. In doing so, we assume indirect cost recovery at a flat 15% of total direct costs without further caps or exceptions, and that NIH savings are not reallocated to additional grants but rather are treated as cost savings for the federal government. We assume that a 15% rate will be applied to TDC rather than MTDC, but if applied to MTDC, indirect cost funding may turn out to be meaningfully lower than we project in this exercise.[22]

Figure 5 shows the distribution of our projected declines in ICR as a percent of institutions' 2024 NIH funding. Because universities have roughly similar effective ICR rates, a 15% flat rate is likely to produce roughly similar percentage declines in total NIH funding across them, with most institutions losing between 15-20% of current NIH funding.

[Figure 5 about here]

In Figure 6, we evaluate the projected dollar declines against total NIH direct cost funding in 2024 and endowment value in FY2023.[23] We find that the universities which NIH currently funds most heavily, which also are the United States' highest-ranked and wealthiest universities, would lose the most funding—not because their ICR rates are high, but rather due to their scale (roughly similar percentage reductions in ICR recovery off a larger base). Based on their 2024 funding levels,

[22] We also assume a flat 15% rate will be applied to all grants (as stated in the NIH notice promulgating this policy, NOT-OD-25-068) despite the 8% statutory ICR cap on certain categories of NIH grants (primarily training grants), which conflicts with this guidance. This choice further implies our estimated declines in funding are conservative, though the impacts on our results are relatively minor: grants subject to the 8% cap are a small share of grants in our sample (5.2% of direct cost expenditures, 3.9% of total costs).

[23] Our calculations of the reform's financial impact may differ slightly from those performed by the affected institutions for three reasons. First, we allocate the entirety of a project's budget to the contact principal investigator listed in NIH Reporter, whereas institutions can parse out grant budgets to account precisely for their subawards. Second, we eliminate from our funding totals a number of grant corresponding to non-research mechanisms. Third, the totals we present are adjusted for inflation using the BRDPI (base year 2023).

we project that 12 universities—most of them highly ranked—would lose more than $100 million annually in indirect cost funding if a 15% ICR rate were applied.[24]

[Figure 6 about here]

5 Potential Effects on Commercial Innovation

Biomedical research funding has the potential to impact the U.S. and global high-tech economy, in biotechnology and beyond. We next examine the relationship between NIH-supported institutions and commercial innovation by tracing linkages from their NIH-funded science (since 2005) to U.S. firms' patents (between 2005 and 2024). Figure 7 evaluates the correlation between: (i) institutions' projected decline in NIH funding under a 15% ICR rate, calculated as the difference between actual and counterfactual indirect cost funding over the 2005–2024 period, and (ii) the number of linked private sector patents (Panel A) and their estimated commercial value (Panel B).

[Figure 7 about here]

Figure 7 indicates that institutions facing the largest potential funding reductions have the largest citation-based links to private sector innovation. On average, institutions facing a 10 percentage point larger decline in NIH funding under the proposed ICR rate are associated with 30% more commercial patents—and nearly 50% greater commercial patent value.

Research from institutions with ICR rates well above the flat 15% rate is also linked to a significant number of new drugs. Table 3 lists institutions in our sample that had a patent on at least two drugs over this time period, along with the number of unique linked drugs and an example drug. Unlike the patent linkages above, these are cases where the institutions themselves were generating patents that private-sector firms identified as core components for a marketed drug. We also list the negotiated and effective ICR rates in 2024, average annual NIH funding between 2005 and 2024, and the change in funding that would result from a flat 15% ICR over the same time period. In all cases, a flat 15% rate would have resulted in substantial funding cuts for the institutions that contributed the most to new drug development over the past 20 years.

[Table 3 about here]

[24] The universities with the largest projected declines are (in order): Johns Hopkins University, University of Pennsylvania, Yale University, UCSF, University of Michigan, University of Pittsburgh, Columbia University, Washington University in St. Louis, Stanford University, UCSD, Duke University, and Vanderbilt University.

6 Policy Alternatives

In Section 2, we highlighted several competing objectives of indirect cost recovery policy: ensuring adequate incentives for participating in federal research and support for research and research infrastructure; maintaining incentives for cost-efficiency by grantee institutions; minimizing administrative burden, and promoting transparency. Table 4 evaluates several approaches against these objectives, each with distinct strengths and drawbacks.

[Table 4 about here]

6.1 Negotiated rates based on audited F&A costs, with overhead caps on certain indirect cost pools (the current system)

As Noll and Rogerson (1998, p. 26) point out, there is a case to be made in defense of the current approach to indirect cost recovery. The negotiated rate system in place at NIH since 1966 creates incentives to participate in federal research and to invest in infrastructure to support it. Moreover, it provides the flexibility to pursue potentially high-impact, high fixed-cost research programs, including those requiring resources such as primate centers, biocontainment labs, gene sequencing centers, imaging facilities, or clinical trial infrastructure. Various caps on and exceptions to negotiated rates make the system fall short of full-cost reimbursement—far from OSRD's original no-gain/no-loss model. However, even with some cost-sharing, the system appears to create substantial incentives for universities to engage in federally funded biomedical research.

Despite its strengths, the present system also has costs. The actual bookkeeping costs of determining and auditing F&A rates are high. Paradoxically, these drive up indirect costs for universities, though the 26% cap on the administrative portion of F&A means that any reduction of these and other administrative costs may not meaningfully lower indirect cost payments. The system also lacks transparency regarding how indirect cost pools are calculated and how indirect funds are spent—though in principle, government auditors have access to this information. Perhaps most importantly, the system may make universities cost-insensitive. This could lead to infrastructure or faculty investments beyond what is socially useful, favoring expensive over inexpensive research. It may also incentivize recruitment, retention, and strategic decisions that prioritize faculty eligible for (and skilled at obtaining) grants with high federal overhead rates over others, which may not reflect the optimal social allocation across fields or types of research.

6.2 Low (15%) flat rate: The proposed 2025 change

The first alternative to variable rate ICR we consider in Table 4 is the recently proposed reform: a flat 15% ICR rate, which we label a "low flat rate" alternative. Although implementation details are scarce, we assume based on the guidance in NIH notice NOT-OD-25-068 (February 7, 2025) that the change would be to a uniform rate rather than a rate cap.[25] A low flat-rate system creates high incentives for cost-efficiency with relatively low administrative burden. It would reduce incentives to spend on activities that increase indirect costs (namely F&A, by requiring institutions to cover costs above 15% of direct funding and allowing them to keep savings below it), and by reducing the markup, reduce incentives for seeking federal grant funding.

However, as we emphasized in the empirical analysis, these changes would come at considerable risk. A low flat rate would reduce funding for research infrastructure and may discourage investment in equipment and facilities or discourage high-potential but high fixed-cost research. It could also disincentivize research more broadly—for any activity where ICR is awarded. In doing so, a low flat rate could threaten the large economic and social benefits that are linked to NIH-funded research. Even if some of the savings were redirected to direct costs, the fundamental problem of paying for the fixed cost of modern biomedical research would remain unresolved.[26]

One motivation for the NIH notice announcing the 15% rate is a view that grantees' true overhead costs are closer to 10-15% of direct research spending, because most universities accept philanthropic foundation funding which caps ICR at these rates. Putting aside comparability issues—foundations sometimes count different expenses as direct and indirect costs than does the government—two reasons why universities can accept lower foundation rates are that (i) foundations comprise a small share of funding and (ii) the federal government funds infrastructure at higher levels.[27] At a low fixed federal rate, it is unclear that foundations would increase their ICR to cover the difference. Low flat rates may even have the opposite effect: if infrastructure is not funded, scientific research may

[25] We make this determination based on NOT-OD-25-068 advising that "Pursuant to this Supplemental Guidance, there will be a standard indirect rate of 15% across all NIH grants for indirect costs in lieu of a separately negotiated rate for indirect costs in every grant," and later that "NIH is accordingly imposing a standard indirect cost rate on all grants of 15%." See https://grants.nih.gov/grants/guide/notice-files/NOT-OD-25-068.html. We do not attempt to reconcile potential conflicts between this guidance and existing statutory ICR caps for certain categories of grants, but rather take it as written that the proposed reform is a uniform rate.

[26] Even some of the intended administrative benefits may not materialize: a low flat rate might trigger efforts to find ways to convert fixed costs into incremental costs (e.g., by charging rent for facilities and equipment, which requires metering usage), complicating cost accounting and potentially requiring audits.

[27] We thank Sherry Glied and Cindy Hope for bringing these points to our attention. According to National Center for Science and Engineering Statistics (2024), foundations are currently the source of roughly 6% of university research funding. The federal government is the source of 55% of funding, and institutional resources 25%; state and local government and private sector funds are most of the remainder. See Glied (2025) for a fuller discussion of potential consequences of reformulating federal ICR around foundation policy, including the level of foundation support and universities' responsiveness to NIH versus philanthropic priorities.

become less productive, and philanthropic funders may choose other investments beyond university research. This is particularly problematic for NIH, since biomedical foundations often support research different from NIH but crucial to achieving its mission.

More generally, it is unclear whether active involvement in federal research and the provision of public science would make sense for many leading universities under a low fixed rate—which is one of the reasons NIH moved from fixed to negotiated rates in the 1960s.

6.3 Higher flat rate

An alternative to both negotiated ICR rates and a low flat rate is a "high" flat rate at the average or median of the current effective rates (40-42%), or a return to Bush's "arbitrary but seemingly equitable" wartime flat rate for universities of 50%, which created sufficient incentives for universities to participate in a salient public good: research to help win the war.

Such a system would be simpler to administer, would make universities more cost-sensitive than the current system, and on average would support research incentives and infrastructure as well as the current system. Although incentives to expand direct research activities would be unchanged on average (relative to the status quo), flat rates in general will tend to put downward pressure on indirect costs by introducing greater cost-sharing. This could be for better or worse, depending on whether or not the reductions correspond to socially useful activities.

Like all flat rate policies (including low flat rates), there are drawbacks. A fixed, flat rate at the current average or median effective rate would overcompensate low-cost institutions and undercompensate high-cost ones—similar to uniform patent terms, which overcompensate some inventions and undercompensate others (Budish et al. 2015). Policy would also need to be designed with mechanisms to determine whether, when, and how much to adjust the flat rate as research costs, and opportunities, change over time. High flat rates present some of the same challenges as high negotiated rates, such as incentives to prioritize federally-fundable research over other activities or sources of funding. They also share some of the same features as low flat rates, including eliminating the need for detailed accounting—though this would also lower the (limited) insight into universities' overhead costs currently obtained from regular audits of ICR rate proposals in the course of periodic university-agency negotiations.

6.4 Benchmarked rates using peers' F&A

As previously noted, Noll and Rogerson (1998) proposed an alternative approach to a flat rate to break the link between actual indirect costs and reimbursement, and thereby limit universities'

(and other institutions') incentives to inflate indirect costs: setting rates based on peer institutions' overhead costs. Under this proposal, universities would maintain minimal financial records, subject to random audits, with this data being used to establish reimbursement rates for institutions in the same peer group. Theoretically, this method offers advantages by allowing adjustments for differences in institution type, geography, utility costs, and research intensity, ensuring that high-cost and low-cost institutions are compensated appropriately. One obvious challenge lies in selecting appropriate peer institutions. Notably, the peer benchmark proposal is motivated by the Medicare DRG (diagnosis-related group) system for determining reimbursement levels, which is notoriously prone to gaming and politicking (Silverman and Skinner 2004).

There are other disadvantages of benchmarked rates: for example, an overly blunt peer group risks failing to account for meaningful cost differences, whereas a highly specific approach could unravel to become as complex and administratively burdensome as the current system. This approach may also struggle to accommodate institution-specific cost shocks or unique research opportunities that drive indirect costs above those of nominal peer institutions.

6.5 Eliminating ICR: "Above the line" cost accounting

A final approach that has been suggested is to make all costs direct, bringing them "above the line". Graddy-Reed et al. (2021) note that this is what some countries that do not fund high indirect costs do instead, as do foundations that pay lower rates than the federal government. For example, the Howard Hughes Medical Institute (HHMI) does not pay overhead but instead "makes occupancy payments to the host institution in connection with an Investigator's research and office space and pays certain other expenses" (Howard Hughes Medical Institute 2021).

In one of the major historical evaluations of the NIH, the 1965 Wooldridge Report (NIH Study Committee 1965, p. 29) also discussed the problem of indirect costs and argued for bringing overhead above the line:

> Reliance upon an arbitrary indirect cost percentage [the then-prevailing 20% cap] should be abandoned. Instead, each institution should be encouraged to present a complete accounting of all of the costs of 'doing business' that it can support as chargeable or allocable to the project in question, with a minimum of emphasis on formal direct/indirect distinctions. The proportionate cost of paying the salary of the President of the university, of trimming the campus trees, or of maintaining the university public relations office should be considered as real and appropriate, in calculating the cost of supporting a research grant, as the salary of the investigator or the price of his materials.

As we note in Table 4, this approach would likely increase transparency around grantee institutions' overhead, but with significantly higher administrative burden for universities and the NIH alike than

the current system imposes. Determining how to allocate joint costs across projects (e.g., a library usage, or the President's salary) would be difficult, if not impossible, as would be agency reviews of these requests for appropriateness on a grant-by-grant basis. If anything, some current indirect costs may end up duplicated and double-funded across labs in the same institution, particularly if each lab has to budget for its own equipment that could otherwise be shared.

When it comes to funding science and scientific infrastructure, transitioning to direct cost-only funding would require metering usage and charging (and budgeting) user fees. Not only is this administratively costly (see footnote 26), but it also delays payback on investments (by extending the time between when up-front investments in high fixed-cost infrastructure are sunk and recouped), making these investments economically less attractive. The complexity and uncertainty of future revenue streams might discourage investment altogether, as reimbursement depends on future utilization and the ability of investigators to secure grants that charge against it. In short, an "above the line" approach may come at the expense of reduced incentives for and increased risk in making infrastructure investments, at least relative to the current system.

6.6 Other possible reforms

6.6.1 Alternative funding vehicles: Institutional grants

For decades, indirect costs have been the primary mechanism for government support of scientific infrastructure needed for biomedical research. As we discussed in Section 2, the Bush Report at the end of World War II recommended a system of nearly automatic institutional grants over peer review, providing scientific freedom and decentralized control while supporting institutions directly. Though institutional funding has not been a mainstay of the U.S. innovation system, the institutional or infrastructure block grants remain a possible alternative to ICR.[28] Mowery (1997), for example, claims that Bush's proposal may have avoided the "tortuous accounting" needed to pay for infrastructure under the current reimbursement system.

Although rare in the U.S. federal funding system, infrastructure funding through means other than indirect costs is common elsewhere. In countries with national university systems, infrastructure is directly financed by the government. China has recently made substantial investments in research

[28] Block grants were more common in the 1960s and 1970s, though even then were dominated in total value by project funding. Examples of historical institutional grant programs include the NIH Biomedical Research Support Program, which provided flexible funds to institutions beyond the dominant R01 project grants, or NSF's Science Development Program, which awarded large institutional grants to universities (Cristelli 2025). Infrastructure grants were also more common in this era, funding investments in a wide range of research tools and facilities—from scientific computing, to particle accelerators, to radio astronomy observatories, to materials science programs and research centers. Mowery (1997) notes that in the late 1950s the Advanced Research Projects Agency (ARPA) funded institutions in the emerging field of computer science as well, but in general "institutional funding has been rare and has seldom been sustained for long periods."

infrastructure to strengthen its universities' global standing. In the UK, major funders provide additional baseline infrastructure funding alongside project grants. Germany offers core institutional funding to support its universities and research institutes. In many European countries, block grants are common (Stephan 2012). And of course, even in the U.S., much of public universities' basic research infrastructure is supported by their state.

Though attractive for being intentional and less subject to gaming and other distortions, like the other options discussed above, institutional or infrastructure grants are not a panacea. In the 1960s and 1970s, questions of how a peer-review system designed for project grants could reliably and cost-effectively review institutional grants vexed the NIH (Strickland 1988, Mandel 1996). With nearly 3,000 NIH applicant institutions, "automatic" institutional grants like those proposed in the Bush Report seem infeasible today. While these grants offer significant scientific freedom, they may limit transparency on how the funds are spent, and thus (like proposals for funding "people not projects") be less politically sustainable than project-based grants. Grants for specific infrastructure also require NIH to decide what infrastructure is worth funding; in comparison, ICR enables decentralized choices where institutions closer to the research, with potentially better information, can determine and invest in their own needs.

6.6.2 Non-ICR reforms: Regulatory requirements

Among the many drivers of university indirect costs, the costs of complying with federal regulations have increased over time (Droegemeier 2017). For example, the portion of NIH's Grants Policy Statement covering regulatory requirements has expanded from six pages in the early 1980s to 56 pages in 2024, listing nearly 80 specific regulations grantees must follow—covering areas such as safety, privacy, environmental protection, and human trafficking. Similarly, the Council on Government Relations (2025) has identified roughly 270 federal regulations introduced since 1991 that impose constraints on how research is conducted. For many universities, these compliance costs push the administrative ("A") component of F&A costs above the 26% cap on administrative expenses (Bourne and Vermillion 2016). Droegemeier (2017, pp. 14-15) argues that one consequence of the 26% cap is under-recovery of costs of adhering to "increasingly numerous, unfunded federal mandates," which institutions are therefore funding themselves.

One of the goals of notice NOT-OD-25-068, which announced the 2025 NIH policy change, is "to ensure that as many funds as possible go towards direct scientific research costs rather than administrative overhead." Although ICR policy reforms could reduce administrative costs directly related to implementing the current ICR system, additional policy changes would be needed to contain the growth of the myriad non-ICR-related administrative costs of research. More importantly, while

reducing regulatory burdens may lower administrative *costs*, these reductions alone will not necessarily affect ICR *rates* or federal expenditures on indirect costs, since the administrative component of ICR is already capped at 26% for many institutions.

7 Conclusion

Since the creation of federal research policy in the mid-20th century and the introduction of ICR, the goals of ICR policy have shifted from "no gain, no loss" to "simply a subsidy" (not full-cost reimbursement) to full-cost reimbursement in principle, but reduced or clawed back through a complex system of caps and restrictions. ICR now appears to serve many purposes: as a (prospective) incentive mechanism, a (retrospective) reimbursement for overhead expenses, a way to encourage efficiency via cost-sharing, a means of providing financial slack, and more. This patchwork today is a contrast to ICR policy in the early postwar period, when research funding agencies each had specific goals their policies were designed around. The current range of goals—or even disagreement over what the goals are—may be an important driver of disagreement over the desirability of specific reforms and what their incidence and impacts might be.

With the benefit of new data, we make several contributions to the current debate. First, we show that due to various exceptions to the grants and costs that get the full negotiated rate, there are large differences between negotiated and effective ICR rates (for example, on average 54% vs. 36% for private universities in 2024). Moreover, although negotiated rates have risen substantially over time, and the costs of research have grown, effective rates have been flat for several decades. The main approach to ICR policy reform over this period—exceptions to the Uniform Guidance—thus appears to have limited ICR growth, albeit in a convoluted way.

Our simulation of the effects of a 15% ICR rate suggest it would affect high-ranked, high-endowment universities most in dollar terms, but that is due to the size of their research enterprises, not to high current rates. We also provide data showing the institutions that would experience the largest reductions in total research revenues with a 15% rate are those linked to the most commercially valuable private sector patents. Finally, all of the institutions directly responsible for patents on multiple drugs since 2005 have (effective and negotiated) indirect cost rates at least twice as high as 15%, and would experience large funding declines with the proposed change. While we cannot estimate the causal impact of a 15% rate, the data suggest the incidence would be broad geographically and by institution type, but would disproportionately fall on institutions with the most links to private sector innovation and drug development.

In the final section, we compared the current system, the proposed cap, and other approaches to

indirect cost reform, against the main historical objectives of indirect cost recovery policy. While none of the proposals dominates on all dimensions, we offer a menu of alternatives for policymakers to consider in addressing the age-old problem of indirect cost reform.

Our analyses highlight the need for greater transparency in indirect cost pools, as the opacity of these expenditures limits our ability to assess their social value. Indirect cost proposals to HHS (the input to rate negotiations) are not publicly available. Even tracing the evolution of negotiated rates over time required years of FOIA requests for historical rate data. This makes it hard to know what type of investments would be affected by reductions in indirect costs, and whether the corresponding expenditures are socially valuable. Information on the negotiations, including potential heterogeneity in "leniency" across negotiators, would also be valuable. Unlike firms' R&D costs, which are protected as trade secrets, there is a strong case for greater disclosure of full R&D costs in publicly funded research. Increased transparency would not only facilitate better evaluation of existing policies and potential reforms but could also help identify and reduce inefficiencies in the system. Sunlight may not only be a powerful disinfectant but also enable the kinds of analyses needed for informed, evidence-based indirect cost policy reforms.

Despite well-documented issues with the current system—such as cost insensitivity among universities, administrative burdens, and a lack of transparency in indirect cost allocations—we close by emphasizing that most analyses showing strong links between NIH-funded research and commercial patenting or drug development are based on grants awarded in the era of high and rising negotiated rates (Sampat and Lichtenberg 2011, Li et al. 2017, Azoulay et al. 2019b). Like other aspects of NIH research policy, modern ICR approaches have significant shortcomings that warrant reform. However, the best available evidence consistently indicates high returns to NIH funding. This suggests that any policy changes should be implemented cautiously, ensuring that the historically large benefits of federally-funded biomedical research are preserved.

References

Alberts, Bruce. 2010. "Overbuilding Research Capacity." *Science* **329**(5997):1257-1257.

Alberts, Bruce, Marc W. Kirschner, Shirley Tilghman, and Harold Varmus. 2014. "Rescuing US Biomedical Research from Its Systemic Flaws." *Proceedings of the National Academy of Sciences* **111**(16):5773-5777.

Allen, Ernest M. 1954. *Justification for Increasing PHS Research Grant Overhead*. June 21, 1954. Available from U.S. National Archives and Records Administration, Record Group 443, Box 130, Indirect Costs (Part 3).

Arrow, Kenneth. 1962. "Economic Welfare and the Allocation of Resources for Invention." In *The Rate and Direction of Inventive Activity: Economic and Social Factors*, pp. 609-626. Princeton: Princeton University Press.

Azoulay, Pierre, Andrew Breazeale, and Bhaven Sampat. 2019a. *Indirect Cost Recovery Rates: A New Dataset*. Unpublished Manuscript, available at https://github.com/bhavensampat/indirectcostdata/.

Azoulay, Pierre, Joshua S. Graff Zivin, Danielle Li, and Bhaven N. Sampat. 2019b. "Public R&D Investments and Private-sector Patenting: Evidence from NIH Funding Rules." *The Review of Economic Studies* **86**(1):117-152.

Babina, Tania, Alex Xi He, Sabrina T. Howell, Elisabeth Ruth Perlman, and Joseph Staudt. 2023. "Cutting the Innovation Engine: How Federal Funding Shocks Affect University Patenting, Entrepreneurship, and Publications." *The Quarterly Journal of Economics* **138**(2):895-954.

Bourne, Henry R. and Eric B. Vermillion. 2016. *Follow the Money: Funding Research in a Large Academic Health Center*. San Francisco, CA: University of California Medical Humanities Press.

Bozeman, Barry and Dennis M. Anderson. 2014. "Public Policy and the Origins of Bureaucratic Red Tape: Implications of the Stanford Yacht Scandal." *Administration & Society* **48**(6):736-759.

Brainard, Jeffrey. 1995. *The Ghosts of Stanford*. Chronicle of Higher Education, available at https://www.chronicle.com/article/the-ghosts-of-stanford/.

Brown, Kenneth T. 1981. "Indirect Costs of Federally Supported Research." *Science* **212**(4493):411-418.

Bryan, Kevin A., Yasin Ozcan, and Bhaven Sampat. 2020. "In-text Patent Citations: A User's Guide." *Research Policy* **49**(4):103946.

Budish, Eric, Benjamin N. Roin, and Heidi Williams. 2015. "Do Firms Underinvest in Long-term Research? Evidence from Cancer Clinical Trials." *American Economic Review* **105**(7):2044-2085.

Bush, Vannevar. 1945. *Science, The Endless Frontier: A Report to the President*. Washington, DC: Government Printing Office.

Council on Government Relations. 2025. *Matrix of Science & Security Laws, Regulations, and Policies*. Available at https://www.cogr.edu/sites/default/files/1991%20Excel%20Database%20Dec%202024%20Update.pdf. Accessed March 2025.

Cristelli, Gabriele. 2025. *Funding the Ivory Tower: The Effects of NSF Institutional Grants on Universities and Local Innovation*. Working Paper, Stanford University.

Droegemeier, Kelvin K. 2017. *Written Testimony on "The Role of Facilities and Administrative Costs in Supporting NIH-Funded Research"*. Submitted to the Appropriations Sub-Committee on Labor, Health and Human Services, Education and Related Agencies, United States House of Representatives, October 24, 2017.

Dupree, A. Hunter. 1986. *Science in the Federal Government*. Baltimore, MD: Johns Hopkins University Press.

Dyreng, Scott D., Michelle Hanlon, Edward L. Maydew, and Jacob R. Thornock. 2017. "Changes in Corporate Effective Tax Rates Over the Past 25 Years." *Journal of Financial Economics* **124**(3):441-463.

Ehrenberg, Ronald G. and Jaroslava K. Mykula. 1999. *Do Indirect Costs Matter?* NBER Working Paper No. 6976.

Fang, Ferric C. and Arturo Casadevall. 2015. "Competitive Science: Is Competition Ruining Science?" *Infection and Immunity* **83**(4):1229-1233.

Galkina Cleary, Ekaterina, Jennifer M. Beierlein, Navleen Surjit Khanuja, Laura M. McNamee, and Fred D. Ledley. 2018. "Contribution of NIH Funding to New Drug Approvals 2010-2016." *Proceedings of the National Academy of Sciences* **115**(10):2329-2334.

Glied, Sherry A. 2025. "Aligning NIH's Indirect Cost Recovery Rates With Foundation Rates Is Bad Policy." *JAMA Health Forum* **6**(4):e251700.

Graddy-Reed, Alexandra, Maryann Feldman, Janet Bercovitz, and W. Scott Langford. 2021. "The Distribution of

Indirect Cost Recovery in Academic Research." *Science and Public Policy* **48**(3):364-386.

Greenberg, D. S. 1963. "Education Aid: University Survey Finds That Despite Difficulties, U.S. Programs 'Highly Beneficial'." *Science* **141**(3576):136-138.

Gross, Daniel P. and Bhaven N. Sampat. 2023a. "America, Jump-started: World War II R&D and the Takeoff of the US Innovation System." *American Economic Review* **113**(12):3323-3356.

Gross, Daniel P. and Bhaven N. Sampat. 2023b. "The World War II Crisis Innovation Model: What Was It, and Where Does It Apply?" *Research Policy* **52**(9):104845.

Gruber, Carol. 1995. "The Overhead System in Government-sponsored Academic Science: Origins and Early Development." *Historical Studies in the Physical and Biological Sciences* **25**(2):241-268.

House Committee on Government Operations. 1962. *Administration of Grants by the National Institutes of Health (Reexamination of Management Deficiencies)*. House Report No. 1958, 87th Congress, 2d Session. Washington, DC: Government Printing Office.

Howard Hughes Medical Institute. 2021. *Investigator Program FAQ (2021)*. Chevy Chase. Available at https://www.hhmi.org/sites/default/files/investigator2021-faq.pdf. Accessed March 2025.

Institute of Medicine. 1990. *Funding Health Sciences Research: A Strategy to Restore Balance*. Washington, DC: National Academies Press.

Jewett, Frank B. 1942. "The Mobilization of Science in National Defense." *Science* **95**(2462):235-241.

Johnston, S. Claiborne, Susan Desmond-Hellmann, Stephen Hauser, Edward Vermillion, and Nilo Mia. 2015. "Predictors of Negotiated NIH Indirect Rates at US Institutions." *PLoS ONE* **10**(3):e0121273.

Jones, Benjamin F. and Lawrence H. Summers. 2022. "A Calculation of the Social Returns to Innovation." In *Innovation and Public Policy*, edited by Austan Goolsbee and Benjamin F. Jones, chapter 1, pp. 13-59. Chicago: University of Chicago Press.

Kevles, Daniel J. 1977. "The National Science Foundation and the Debate over Postwar Research Policy 1942-1945: A Political Interpretation of Science—The Endless Frontier." *Isis* **68**(1):5-26.

Kogan, Leonid, Dimitris Papanikolaou, Amit Seru, and Noah Stoffman. 2017. "Technological Innovation, Resource Allocation, and Growth." *The Quarterly Journal of Economics* **132**(2):665-712.

Ledford, Heidi. 2014. "Keeping the Lights On." *Nature* **515**(7527):326.

Li, Danielle, Pierre Azoulay, and Bhaven N. Sampat. 2017. "The Applied Value of Public Investments in Biomedical Research." *Science* **356**(6333):78-81.

Mandel, Richard. 1996. *A Half Century of Peer Review, 1946-1996*. Bethesda: National Institutes of Health.

Marx, Matt and Aaron Fuegi. 2022. "Reliance on Science by Inventors: Hybrid Extraction of In-text Patent-to-Article Citations." *Journal of Economics & Management Strategy* **31**(2):369-392.

Middlebrook, W. T. 1951. *Letter from W. T. Middlebrook to Ernest Allen, Acting Chief, Division of Research Grants, NIH*. January 17, 1951. Available from U.S. National Archives and Records Administration, Record Group 443, Box 130, Indirect Costs (Part 3).

Mowery, David C. 1997. "The Bush Report after 50 Years: Blueprint or Relic?" In *Science for the 21st Century: The Bush Report Revisited*, edited by Claude E Barfield. Washington, DC: American Enterprise Institute.

National Academies of Sciences, Engineering, and Medicine. 2022. *Assessment of the SBIR and STTR Programs at the National Institutes of Health*.

National Center for Science and Engineering Statistics. 2024. *Higher Education Research and Development: Fiscal Year 2023*. NSF 25-314. Available at https://ncses.nsf.gov/surveys/higher-education-research-development/2023. Accessed March 2025.

National Institutes of Health. 1965. *Report on Review of Implementation of Indirect Cost Policy*. Available from U.S. National Archives and Records Administration, Record Group 443, Box 130, Indirect Costs (Part A).

National Institutes of Health. 2020. *SBIR/STTR Instructions for NIH and Other PHS Agencies*. Available at https://grants.nih.gov/grants/how-to-apply-application-guide/forms-f/sbir-sttr-forms-f.pdf. Accessed March 2025.

National Institutes of Health. 2024. *Guidance for Reviewers: Budget and Period of Support Information*. Available at https://grants.nih.gov/grants/peer/guidelines_general/budget_information.pdf. Accessed March 2025.

National Institutes of Health. 2025. *Implementation of the Revised Common Rule for the Federal Policy for the*

Protection of Human Subjects (45 CFR 46, Subpart A). Available at https://grants.nih.gov/grants/guide/notice-files/NOT-OD-25-068.html. Accessed March 2025.

Nelson, Richard R. 1959. "The Simple Economics of Basic Scientific Research." *Journal of Political Economy* **67**(3):297-306.

NIH Office of Program Planning. 1965. *Memorandum to Institute Directors and Division Chiefs: House Action on 'Indirect Costs'*. Available from U.S. National Archives and Records Administration, Record Group 443, Box 131, Indirect Costs.

NIH Study Committee. 1965. *Biomedical Science and Its Administration: A Study of the National Institutes of Health*. Washington, DC: Government Printing Office.

Noll, Roger G. and William P. Rogerson. 1998. "The Economics of University Indirect Cost Reimbursement in Federal Research Grants." In *Challenges to Research Universities*, edited by Roger G. Noll. Washington, DC: Brookings Institution Press.

Ouellette, Lisa Larrimore and Bhaven N. Sampat. 2024. "Using Bayh-Dole Act March-In Rights to Lower US Drug Prices." *JAMA Health Forum* **5**(11):e243775.

Packalen, Mikko and Jay Bhattacharya. 2018. *Does the NIH Fund Edge Science?* NBER Working Paper No. 24860.

Public Health Service. 1951. *Overhead Allowance on Research Grants: Information Presented for Joint Council Discussion*. February 17, 1951. Available from U.S. National Archives and Records Administration, Record Group 443, Box 130, Indirect Costs (Part 3).

Rosenzweig, Robert M. 1998. *The Politics of Indirect Costs*. Washington, DC: Council on Governmental Relations.

Sampat, Bhaven N. 2023. *The History and Political Economy of NIH Peer Review*. Building a Better NIH Project White Paper, available at https://www.brookings.edu/collection/building-a-better-nih/.

Sampat, Bhaven N. and Frank R. Lichtenberg. 2011. "What are the Respective Roles of the Public and Private Sectors in Pharmaceutical Innovation?" *Health Affairs* **30**(2):332-339.

Silverman, Elaine and Jonathan Skinner. 2004. "Medicare Upcoding and Hospital Ownership." *Journal of Health Economics* **23**(2):369-389.

Stephan, Paula. 2012. *How Economics Shapes Science*. Cambridge, MA: Harvard University Press.

Stewart, Irvin. 1948. *Organizing Scientific Research for War: The Administrative History of the Office of Scientific Research and Development*. Boston: Little, Brown, and Company.

Strickland, Stephen Parks. 1988. *The Story of the NIH Grants Program*. Lanham: University Press of America.

University of California Office of the President. n.d. *The Challenge of Under-Recovery of Indirect Costs on Sponsored Projects*. Available at https://www.ucop.edu/research-policy-analysis-coordination/policies-guidance/indirect-cost-recovery/challenge-of-under-recovery.html. Accessed March 2025.

University of Cincinnati. 2015. *A Primer on Facilities and Administrative Costs*. Available at https://researchhow2.uc.edu/resources/DownloadFile/8f74161b-87de-451a-8ebe-6f8989abab39. Accessed March 2025.

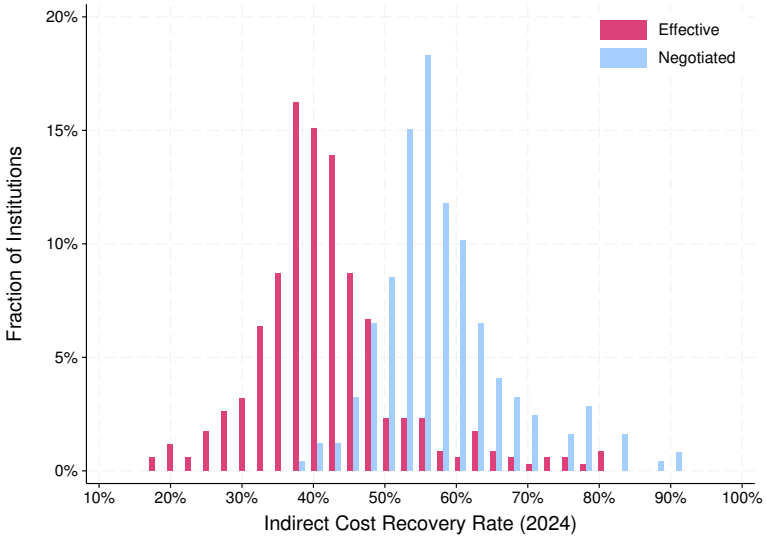
University of Washington. 1992. *A Primer on Indirect Costs*. Available at https://www.cogr.edu/sites/default/files/SKM_C36818013111170.pdf. Accessed March 2025.

U.S. Government Accountability Office. 2013. *NIH Should Assess the Impact of Growth in Indirect Costs on Its Mission*. Report GAO-13-760.

Van Slyke, Cassius. 1954. "Memo from Cassius Van Slyke to NIH Director William Sebrell." National Archives and Records Administration (NARA), Record Group 443, Box 130, Indirect Costs (Part 3).

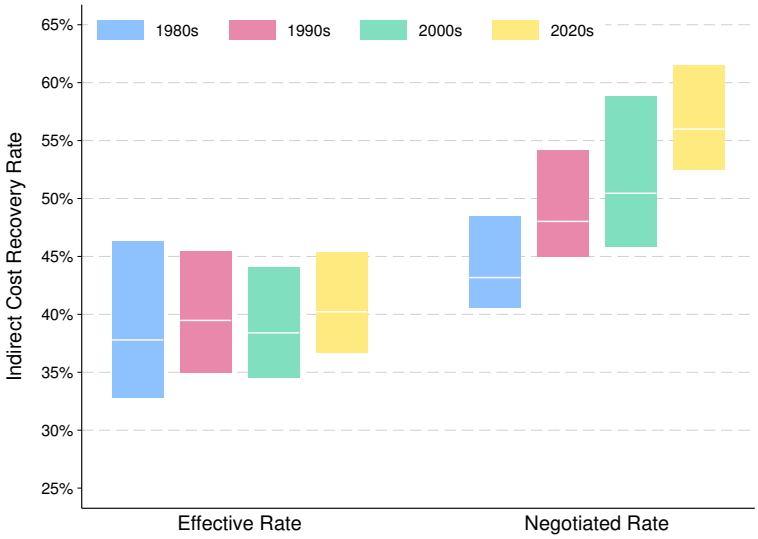
Walsh, John. 1965. "Indirect Costs: House Legislation Embodies New Cost-Sharing Formula for Federal Research Grants." *Science* **149**(3683):525-526.

Figure 1: Effective ICR rates are significantly lower than negotiated rates



Notes: Figure shows the distribution of FY2024 negotiated ICR rates (246 institutions, in blue) and FY2024 effective rates (345 institutions, in red).

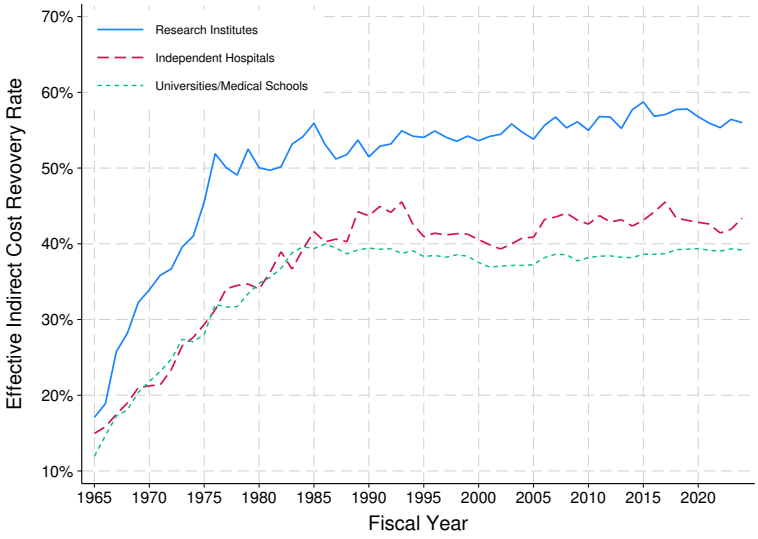
Figure 2: Negotiated ICR rates have risen since 1980, but effective rates are unchanged



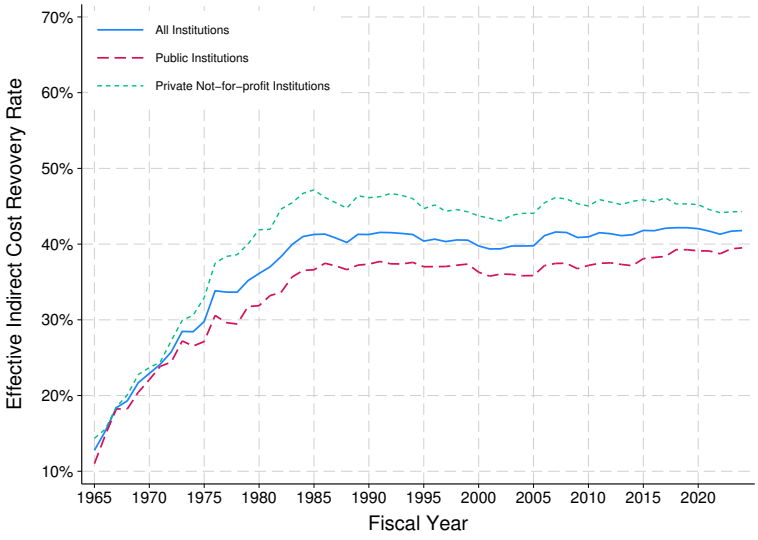
Notes: Figure shows median ICR rates of NIH funding recipients in the 1980s, 1990s, 2000s, and 2020s, and the associated interquartile range, for effective rates (left) and negotiated rates (right). Data from manually-collected institutional F&A agreements for 1980-2007 and 2024, NIH RePORTER, and the NIH Consolidated Grant Application File. Too few negotiated rates are available for the 2010s to include in the graph.

Figure 3: Effective ICR rates have varied similarly over time for institutions of all types

Panel (A): Universities, hospitals, and institutes

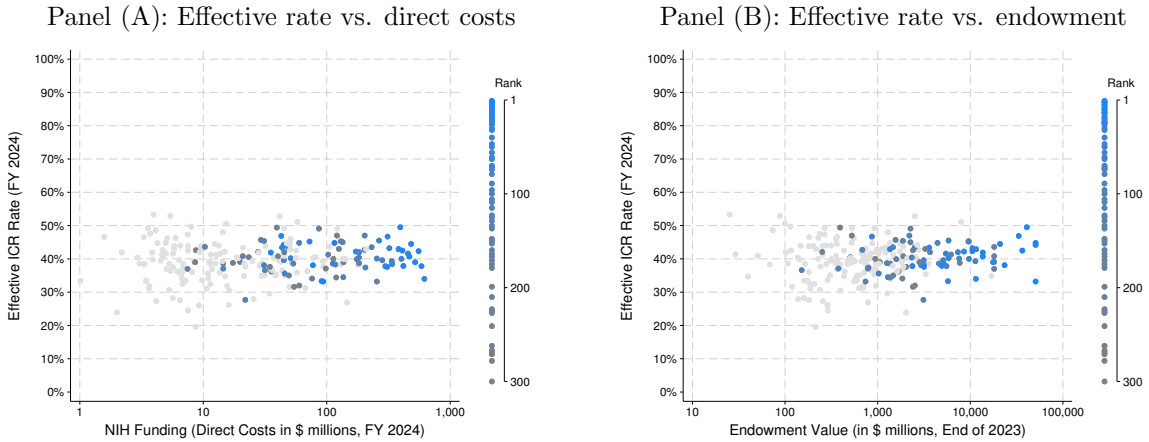


Panel (B): Public vs. private institutions



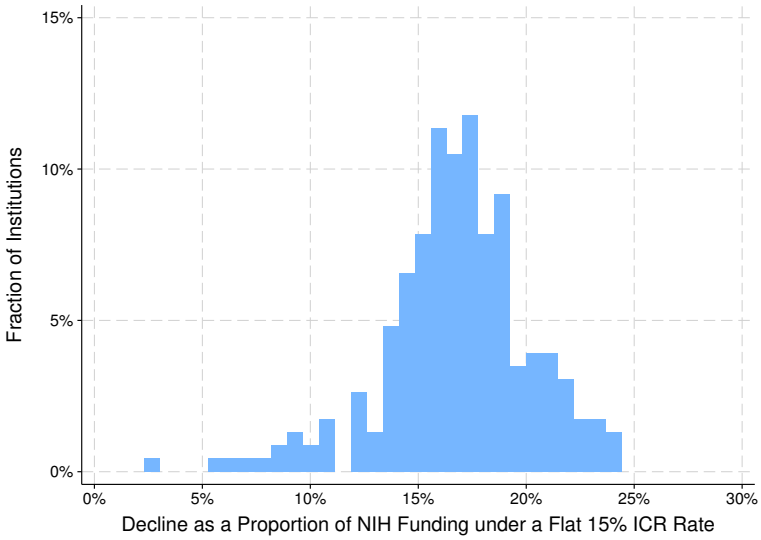
Notes: Top panel shows average effective ICR rates of (i) universities and academic medical centers, (ii) independent hospitals, and (iii) independent research institutes since 1965. Bottom panel shows average rates for public versus private universities. Data from NIH RePORTER and NIH's Consolidated Grant Application File.

Figure 4: Current effective ICR rates are unrelated to rank, endowment, and NIH direct cost funding



Notes: Left panel presents a scatterplot of effective ICR rates against total NIH direct cost funding in FY2024. Points represent individual universities and are color coded by global rank (based on U.S. News rankings). Blue hues represent the United States' highest-ranked universities, and light gray hues represent universities below global rank 300. Right panel presents a scatterplot of effective ICR rates against universities' endowment value at the end of FY2023, and with analogous color coding. In both panels, the sample comprises 223 universities which (i) we project will lose at least $10,000 under the proposed reform and (ii) have an endowment >$1 million in at the end of 2023. Data from NIH RePORTER and IPEDS.

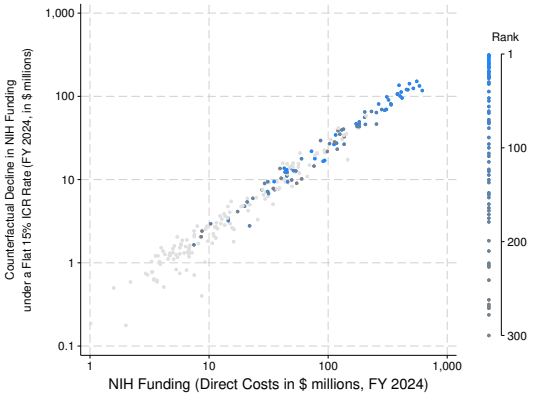
Figure 5: Most universities would lose 15-20% of their annual NIH funding under a 15% ICR rate



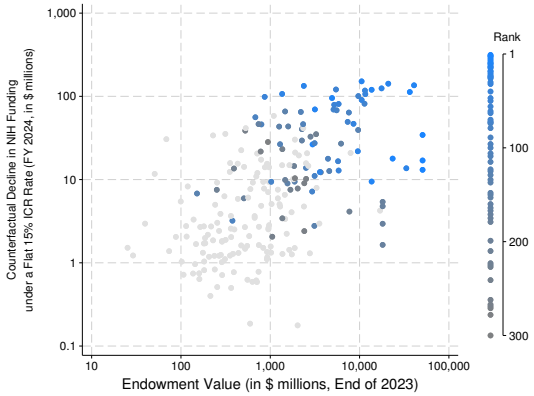
Notes: Figure shows the distribution of universities' counterfactual annual funding declines under a 15% ICR rate, based on their total 2024 direct and indirect cost funding, calculated as a share of total 2024 NIH funding.

Figure 6: Dollar decline in funding under a 15% ICR rate would mechanically be largest for wealthier, higher-ranked universities, which perform the most NIH-funded research

Panel (A): Funding decline vs. direct costs



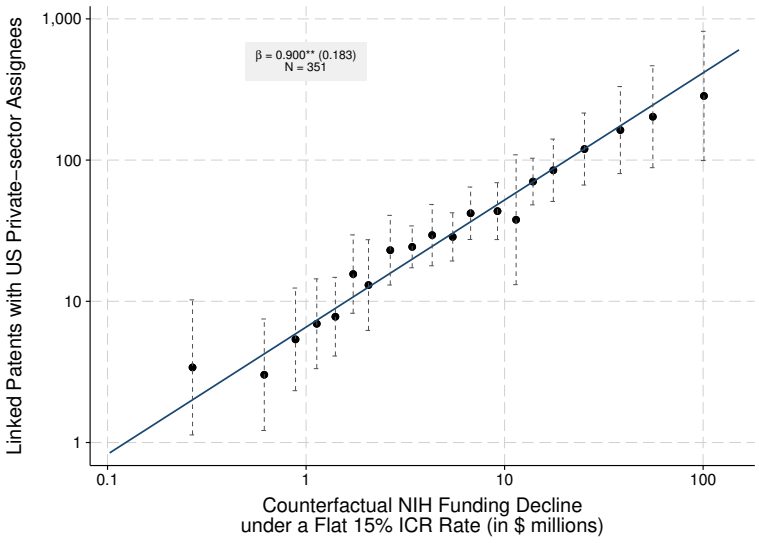
Panel (B): Funding decline vs. endowment



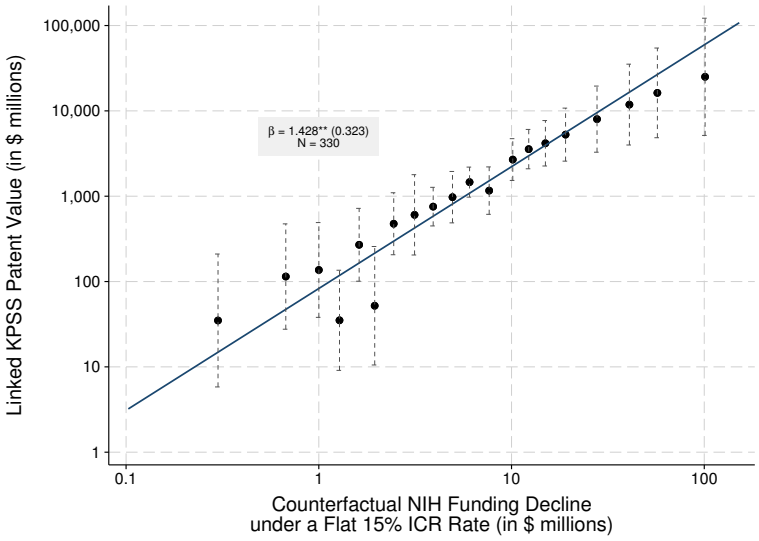
Notes: Left panel presents a scatterplot of counterfactual funding declines under a 15% ICR rate against total NIH direct cost funding in fiscal year 2024. Points represent individual universities and are color coded by global rank (based on U.S. News rankings). Blue hues represent the United States' highest-ranked universities, and light gray hues represent universities below global rank 300. Right panel presents a scatterplot of the funding decline against universities' endowment value at the end of FY2023, and with analogous color coding. In both panels, the sample comprises 223 universities which (i) we project will lose at least $10,000 under the proposed reform and (ii) have an endowment >$1 million in at the end of 2023. Data from NIH RePORTER and IPEDS.

Figure 7: Institutions with the largest potential declines in funding linked to significantly more commercial innovation over the past 20 years

Panel (A): U.S. Private-sector linked patents



Panel (B): Linked patent value (KPSS)



Notes: Top panel shows a binned scatterplot of (i) the number of private sector patents between 2005 and 2024 building on NIH grantee institutions' scientific research (measured as patents citing their NIH-funded science), against (ii) the grantee institutions' counterfactual funding decline in FY2024 under a 15% ICR rate. Bottom panel weights by the estimated (private) value of this innovation, as reflected in stock market reactions to patent issuance (Kogan et al. 2017). Data from USPTO, Kogan et al. (2017), and NIH RePORTER.

Table 1: Characteristics of NIH grantee institutions in baseline sample

Category	Variable	Mean	Median	Std. Dev.	Min	Max
Institution type	Medical School	0.36	0	0.48	0	1
	University, Other Divisions	0.33	0	0.47	0	1
	Independent Hospital	0.18	0	0.38	0	1
	Research institute	0.13	0	0.33	0	1
Ownership type	Public (State or Federal)	0.52	1	0.5	0	1
	Private, Not-for-Profit	0.48	0	0.5	0	1
NIH funding	Total NIH Funding (Annual Average, × $ millions)	80.6	28.1	131.4	1.1	801.7
	NIH Direct Costs (Annual Average, × $ millions)	57.0	20.6	93.0	0.8	560.4
	NIH Indirect Costs (Annual Average, × $ millions)	23.6	7.9	38.6	0.3	241.3
	Indirect Cost Recovery Rate (Negotiated, 2024)	58%	56%	10%	38%	97%
	Indirect Cost Recovery Rate (Effective, 2024)	42%	40%	10%	16%	81%
	Nb. of Funded Investigators	99	39	147	3	879
	Decline in NIH Funding under a Flat 15% ICR Rate (× $ millions)	-15.1	-4.7	-24.8	-0.1	-157.2
	Decline as a Proportion of Overall NIH Funding	-0.18	-0.17	-0.05	-0.02	-0.39
Assoc'd patents	Linked Patents with US Private-sector Assignees (US-wide)	141	29	299	0	3,503
	Linked Patents with US Private-sector Assignees (in-state only)	19	1	57	0	510
	Linked KPSS Patent Value (× $ millions. US-wide)	6,178.5	1,280.2	11,768.4	0.0	71,342.0
	Linked KPSS Patent Value (× $ millions, in-state only)	645.0	0.0	2,436.4	0.0	24,534.0

Notes: Table summarizes characteristics of the 354 NIH grantee institutions in our sample. NIH dollar values inflated to 2023 using the NIH Biomedical R&D Price Index (BRDPI). Kogan et al. (2017) patent values inflated to 2023 using the CPI. Annual average values computed over the 2005-2024 period.

Table 2: Average negotiated and effective ICR rates in FY2024, by institution type

Institution type	Negotiated rate	Effective rate	Difference
Medical school	56.5%	37.8%	-18.7%
University, other divisions	54.3%	36.0%	-18.3%
Independent hospital	70.3%	40.0%	-30.3%
Research institute	82.3%	52.7%	-29.6%

Notes: Table presents average negotiated and effective ICR rates, and their difference, by institution type. Data from manually-collected institutional F&A agreements for FY2024 and NIH RePORTER.

Table 3: NIH funding recipients with patents on at least two FDA-approved drugs between 2005 and 2024

Institution	Nb. of Drugs	Example Drug	Negotiated Rate (2024)	Effective Rate (2024)	Total NIH Funding	Under a 15% ICR Rate: Change ($)	Change (%)
Emory University	12	Atripla	56.5%	39.3%	$408,179,642	$74,133,688	18.2%
Tufts Medical Center	12	Janumet	78.0%	31.6%	$49,165,584	$9,646,336	19.6%
University of Pennsylvania	6	Juxtapid	62.5%	44.5%	$660,914,606	$135,168,704	20.5%
University of California at San Diego	6	Procysbi	58.0%	42.9%	$527,257,440	$92,952,400	17.6%
Eastern Virginia Medical School	6	Lo Loestrin Fe	45.3%	32.1%	$5,245,246	$717,295	13.7%
The Scripps Research Institute	4	Vyndaqel	89.5%	56.6%	$248,797,407	$71,556,104	28.8%
Johns Hopkins University	3	Eysuvis	63.8%	42.3%	$801,713,638	$157,217,984	19.6%
University of Missouri at Columbia	3	Zegerid	56.5%	44.8%	$63,419,837	$11,955,638	18.9%
Purdue University	3	Cytalux	57.0%	42.0%	$55,982,606	$10,163,262	18.2%
University of Kansas at Lawrence	3	Epaned	53.0%	40.5%	$39,794,781	$6,311,149	15.9%
Duke University	3	Latisse	61.0%	42.9%	$531,075,906	$97,808,944	18.4%
University of Illinois at Chicago	3	Prezcobix	59.9%	47.0%	$174,287,948	$36,574,944	21.0%
Memorial Sloan Kettering Cancer Center	3	Folotyn	76.0%	60.8%	$193,053,226	$59,284,996	30.7%
University of Tennessee Health Science Center	3	Dexycu	54.0%	43.9%	$49,371,098	$9,207,363	18.6%
University of Massachusetts Medical School	2	Onpattro	67.5%	49.1%	$197,192,897	$46,803,956	23.7%
Massachusetts Institute of Technology	2	Spiritam	59.0%	38.1%	$148,403,982	$29,146,066	19.6%
Icahn School of Medicine at Mount Sinai	2	Givlaari	69.0%	46.7%	$346,651,195	$72,373,400	20.9%
University of California at Los Angeles	2	Erleada	57.0%	37.6%	$514,523,358	$80,009,984	15.6%
University of Michigan at Ann Arbor	2	Cerdelga	56.0%	39.0%	$603,751,233	$112,751,624	18.7%
University of North Carolina at Chapel Hill	2	Zokinvy	55.5%	38.4%	$498,763,422	$76,590,408	15.4%
Northwestern University	2	Lyrica	60.0%	43.2%	$344,205,382	$62,134,536	18.1%
University of Texas at Austin	2	Hysingla Er	58.5%	33.3%	$85,396,295	$15,118,326	17.7%
Columbia University Health Sciences	2	Olumiant	64.5%	40.7%	$512,552,861	$95,553,720	18.6%

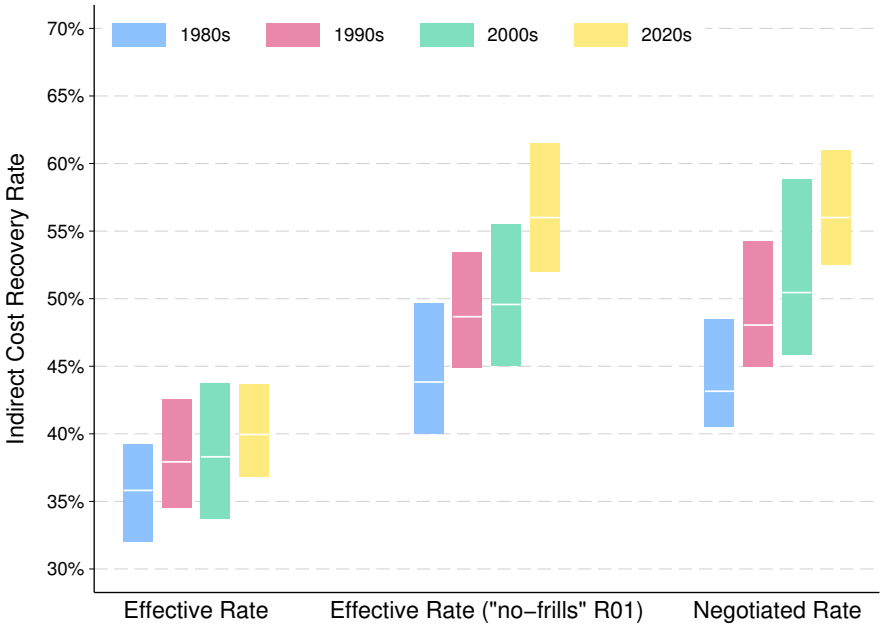
Notes: Table lists NIH grantee institutions that are universities, hospitals, or research institutes and are listed as assignees on at least two FDA-approved drugs between 2005 and 2023. For counting purposes, a drug is defined as a unique trade name associated with a New Drug Application (NDA) listed in the FDA Orange Book. Assignee names are sourced from PatentsView. To construct this sample, we started by focusing on unique assignee names (for the institutional types above) linked to $\geq$2 Orange Book drugs. We then reviewed these manually and linked to institution names in NIH grant data, in some cases using inventor location and manual searches to link patents to the correct campus. The institution list in this table combines Tufts University's Boston campus and New England Medical Center (NEMC), retaining ICR rates from NEMC. We present imputed ICR rates in place of negotiated rates where negotiated rates are not available (specifically: for Scripps Research Institute and Eastern Virginia Medical School). The details of the imputation procedure are available in the appendix. Both the effective and the negotiated rate are for FY2024 only. The "Total NIH Funding" column reports institutions' average annual NIH funding between 2005 and 2024, in constant (2023) dollars. The "Change ($)" column reports institutions' counterfactual decline in funding under a 15% ICR rate. The "Change (%)" column expresses this change as a percent of total NIH funding between 2005 and 2024.

Table 4: Indirect cost recovery: Policy alternatives

Institution	Support for Research & Infrastructure Investment	Incentives for Cost Efficiency	Administrative Burden	Transparency	Advantages and Drawbacks
Negotiated rates based on audited F&A costs, with caps (the current system)	High	Low	High	Low-Medium	• Flexibility to scale with costs, provides incentives for growth • Low cost-sensitivity may lead to direct and/or indirect cost inflation • May create incentives to enlarge direct and indirect research investments beyond socially optimal levels • May privilege research qualifying for federal overhead over others • Costly to administer: paradoxically increases overhead
Flat rate: Low (the proposed 2025 change)	Low	High	Low	Low	• High incentives for cost efficiency while simple to administer • Institutions with high infrastructure costs undercompensated • Relative to current system, reduced incentives for research/infrastructure investments • Universities may reallocate away from scientific fields with high fixed costs
Flat rate: High	High	Medium	Low	Low	• Simple to administer while introducing some cost-sensitivity • Institutions with low infrastructure costs overcompensated • May privilege research qualifying for federal overhead over others
Benchmarked rate using peers' F&A	High	Medium	Low-Medium	Low	• Maintains some flexibility of variable rates while reducing burden • Peer choice unclear and potentially subject to gaming • Difficult to account for dynamic institution-specific cost shocks or compensate for institution-specific opportunities • Incorrect peer choice risks inappropriate reimbursement (and in turn, distortions noted in previous two rows)
Reimburse F&A via direct cost accounting only (no ICR)	Medium-High	Medium	High	High	• Transparent, with potential to link reimbursement to value • Allocating joint costs to specific projects complex / not always possible • Uncertainty of future revenue streams may discourage investment in infrastructure or other shared resources

A Supplementary Figures

Figure A.1: Distribution of negotiated and effective ICR rates over time, restricting to institution-years where negotiated rate is available, & calculating effective rates from no-frills R01 grants (with few caps and exclusions)



Notes: Figure presents a variant on Figure 2, showing distribution of NIH grantee institutions' ICR rates in the 1980s, 1990s, 2000s, and 2020s, restricting effective rates to institution-years for which we can measure negotiated rates (left panel), and calculating institutions' effective rates for "no-frills" R01 grants only (middle panel)—which are less likely to be subject to ICR caps and exclusions, such that we expect effective rates to be close to negotiated rates. Data from manually-collected institutional F&A agreements for 1965-2007 and 2024 and NIH RePORTER. The grants in the "no-frills R01" condition are R01-equivalents, with less than $500,000 in direct costs (inflation adjusted), excluding supplements, and with no human subjects (pre-2005) and single-investigator grants with no subawards (post-2005)—where the latter two conditions are period-specific due to data limitations.