United States Government Accountability Office

Report to Congressional Requesters

August 2022

# NATIONAL SCIENCE FOUNDATION

# Better Reporting Could Give More Visibility into Gains in States' Research Competitiveness

GAO-22-105043

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## Better Reporting Could Give More Visibility into Gains in States' Research Competitiveness

GAO Highlights

Highlights of GAO-22-105043, a report to congressional requesters

## Why GAO Did This Study

Differences among jurisdictions in the number and competitiveness of proposals that their research institutions submit to NSF can result in some jurisdictions consistently receiving small quantities of research funding. In response to congressional concerns over such funding disparities, in 1979 NSF initiated and Congress later codified the Established Program to Stimulate Competitive Research. The program aims to enhance eligible jurisdictions' ability to compete for federal research funding. The program provided more than $194 million in fiscal year 2021 to various projects in 28 jurisdictions.

This report examines (1) the effects of the program on jurisdictions' competiveness in obtaining NSF and other federal research funding, (2) jurisdiction officials' perspectives on the program's effects, and (3) NSF's efforts to assess the effects of the program and identify opportunities for improvement.

GAO conducted a detailed econometric analysis; conducted 14 semi-structured interviews with officials from seven selected jurisdictions; and reviewed agency documents, reports, and related laws.

## What GAO Recommends

GAO is making one recommendation that NSF enhance its annual reporting to Congress on the Established Program to Stimulate Competitive Research. NSF concurred with GAO's recommendation.

View GAO-22-105043. For more information, contact Candice N. Wright at (202) 512-6888 or wrightc@gao.gov.

## What GAO Found

The National Science Foundation (NSF) funds research and education across all fields of fundamental science and engineering. Its Established Program to Stimulate Competitive Research aims to enhance the ability of eligible U.S. states and territories (known as jurisdictions) to compete for research funding from NSF and other federal agencies. GAO's econometric analysis of the program suggested that participating jurisdictions received more federal research funding after joining the program. In addition, the jurisdictions that joined during the program's early growth—between fiscal years 1980 and 1992—had statistically significant increases in their research funding. However, those that joined later—between fiscal year 2000 and 2012—did not, which may be partly because they have not participated as long. The early participants also had larger increases in the success rates of their NSF research proposals.

**Changes in Jurisdictions' Research Funding and Proposal Success Rates**

| Jurisdictions | Program's effect on research funding from NSF and other federal agencies | Trend in research proposal success rates from fiscal year 2011 to 2020 |
|---|---|---|
| All participating jurisdictions | Statistically significant increase | 7 percentage point increase |
| Jurisdictions joining between fiscal years 1980 and 1992 | Statistically significant increase | 9 percentage point increase |
| Jurisdictions joining in fiscal year 2000 or later | No statistically significant change | 4 percentage point increase |

Source: GAO analysis of data from the National Science Foundation (NSF) on U.S. states and territories (jurisdictions) participating in the Established Program to Stimulate Competitive Research. | GAO-22-105043

Note: For more details, see table 2 in GAO-22-105043.

Officials from seven participating jurisdictions described ways in which the program helped increase research competitiveness or met other program goals, like broadening participation. Most officials stated that this funding has helped them hire or retain faculty. For example, one jurisdiction official said their jurisdiction used the funding to hire researchers with expertise that its research team lacked, including for scientific research.

NSF has made several recent efforts to assess contributions made by the program to increasing academic research competitiveness in participating jurisdictions. The agency plans to build on these efforts by including questions about the program in its agency-wide evaluation plan for fiscal years 2022 through 2026. In addition, NSF reports annually to Congress on the gains made by the program. However, these reports provide limited information on jurisdictions' success in broadening participation of diverse individuals and organizations in research and promoting economic development—goals that are part of the program's mission to enhance research competitiveness. NSF officials said they have such information but have not included it in their reports to Congress because the information is not required. However, the American Innovation and Competitiveness Act requires an analysis of the gains made by the program. Including information relevant to the goals for broadening participation and promoting economic development in its annual reports would allow NSF to communicate more transparently with Congress and other external entities, enabling more effective congressional oversight and public knowledge of the program's impact.

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## Abbreviations

| | |
|---|---|
| EPSCoR | Established Program to Stimulate Competitive Research |
| NSF | National Science Foundation |
| R&D | research and development |
| RII | research infrastructure improvement |
| STEM | science, technology, engineering, and mathematics |

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August 11, 2022

The Honorable Roger F. Wicker
Ranking Member
Committee on Commerce, Science, and Transportation
United States Senate

The Honorable Eddie Bernice Johnson
Chairwoman
The Honorable Frank D. Lucas
Ranking Member
Committee on Science, Space, and Technology
House of Representatives

The National Science Foundation (NSF) supports U.S. scientific advancement and economic growth by funding research and education across all fields of fundamental science and engineering. Specifically, NSF provides about 25 percent of the total federal budget for basic research conducted at U.S. colleges and universities. In fiscal year 2021, NSF obligated $8.3 billion for merit-based awards in its research and education programs. The agency issues about 12,000 new awards each year to principal investigators, small groups of investigators, and research centers for an average duration of 3 years.

NSF's mission includes strengthening research and education in the sciences and engineering throughout the United States and avoiding undue concentration of such research and education. NSF uses a merit-based review of proposals submitted by research institutions. Various factors, can result in an uneven geographic distribution of funding among the nation's states and territories (known as jurisdictions), including differences in the number and competitiveness of proposals submitted to NSF.[1]

In response to congressional concerns over the geographic distribution of its awards, NSF initiated a pilot program in 1979 designed to help jurisdictions that consistently receive a relatively small share of research funding build infrastructure and develop capabilities in science, technology, engineering, and mathematics (STEM). These benefits are

[1]Jurisdictions include all 50 states as well as the District of Columbia, Guam, Puerto Rico, and the U.S. Virgin Islands.

intended to enhance a jurisdiction's ability to compete for federal research funding, which is a measure of research competitiveness, according to NSF. Now known as the Established Program to Stimulate Competitive Research (EPSCoR), the pilot initially awarded five jurisdictions approximately $1 million (in nominal dollars) based on their research potential and their ability to obtain funding.[2] Since then, changes in the EPSCoR eligibility criteria resulted in the program's growth, with NSF EPSCoR providing more than $194 million to 28 jurisdictions in fiscal year 2021.

You asked us to review the effects that EPSCoR has had on eligible jurisdictions' research competitiveness. This report examines (1) the effects that EPSCoR has had on jurisdictions' competitiveness in obtaining NSF and other federal research funding, (2) jurisdiction officials' perspectives on the program's effects, and (3) NSF's efforts to assess the effects of the program and identify opportunities for improvement.

To examine the effects that EPSCoR has had on jurisdictions' research competitiveness, we performed an econometric analysis of jurisdictions' data between fiscal years 1972 through 2019 to determine if EPSCoR jurisdictions differed significantly from non-EPSCoR jurisdictions in their research funding provided by NSF and other federal agencies. We included data for years prior to EPSCoR's inception in 1979 to establish a baseline for measuring changes in jurisdictions' research funding. To examine jurisdiction officials' perspectives on the program's effects, we selected a non-generalizable sample of seven EPSCoR jurisdictions to include those that had both relatively short and long histories of participation in the program. We then conducted 14 semistructured interviews with officials who had participated in the program (two from each of the seven jurisdictions we selected). To examine NSF's efforts to assess the effects of the program and identify opportunities for improvement, we reviewed agency documents, interviewed agency officials, and compared NSF's efforts against GAO's Standards for Internal Control in the Federal Government.[3] For more information about our scope and methodology, see appendix I. For more detailed information regarding our econometric analysis, see appendix II.

[2]Nominal dollars (also referred to as current dollars) represents the actual amount of money spent or earned over a period of time.

[3]GAO, *Standards for Internal Control in the Federal Government*, GAO-14-704G (Washington, D.C.: Sept. 10, 2014).

We conducted this performance audit from March 2021 to August 2022 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

## Background

The National Science Foundation Authorization Act of 1988 formally established EPSCoR with the purpose of assisting those jurisdictions that (1) historically have received little federal research and development funding and (2) have demonstrated a commitment to developing their research institutions and improving science engineering research and education programs at their universities and colleges.[4]

In accordance with direction from Congress and NSF's mission statement for the program to enhance the research competitiveness of targeted jurisdictions, NSF set several goals for EPSCoR. These include (1) developing jurisdictions' research capabilities; (2) establishing jurisdictions' STEM education and professional development pathways; (3) broadening participation of diverse individuals, institutions, and organizations in research and education initiatives; (4) effecting engagement in STEM at national and global levels; and (5) promoting jurisdictions' economic development.

A jurisdiction can compete for EPSCoR funding if (1) it has a commitment to develop its research capacity and improve the quality of STEM research and (2) its 5-year portion of NSF funding equals or falls below 0.75 percent of the total 5-year NSF budget. In 2019, NSF revised the eligibility criteria to prevent year-to-year fluctuations in a jurisdiction's eligibility and to provide greater transparency, simplicity, fairness, and stability.[5] NSF implemented several changes to achieve these goals:

- Previously, NSF calculated eligibility by using 3 years of funding data to determine whether a jurisdiction's percentage of funding was equal

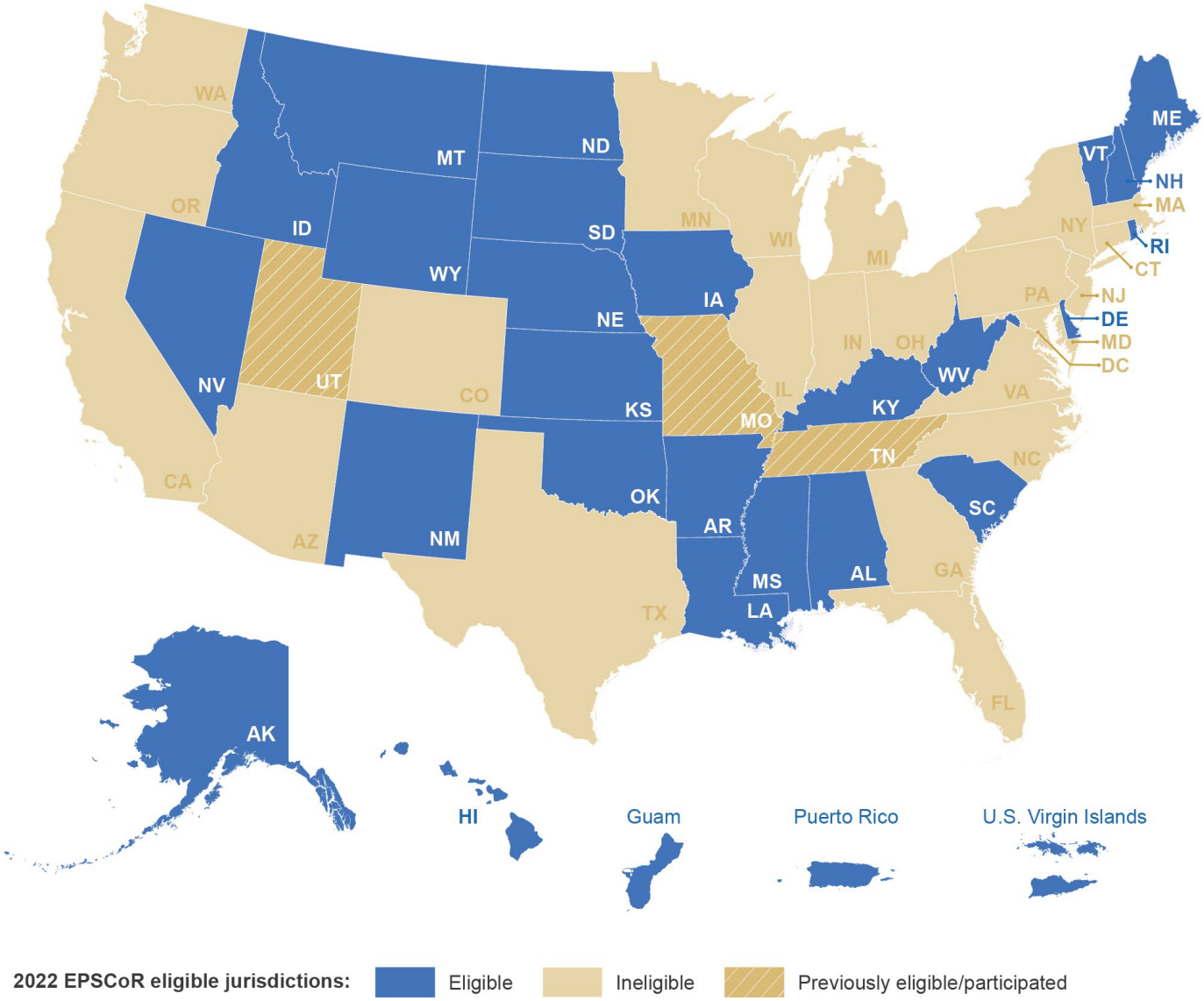
[4]Pub. L. No. 100-570, 102 Stat. 2865.

[5]Iowa lost eligibility in 2013 and New Mexico lost eligibility in 2018. Both jurisdictions regained eligibility based on NSF's fiscal year 2019 eligibility publication. However, there was not an official policy in place to determine how jurisdictions could re-establish EPSCoR eligibility after exiting the program.

to or less than 0.75 percent of the budget. The revised criteria are based on 5 years of funding data.

- NSF changed the criteria used to calculate a jurisdiction's percentage to include funding for education and human resources and major research equipment and facilities construction and exclude most EPSCoR funding and NSF funding to other federal agencies.
- Under the previous criteria, a jurisdiction lost eligibility after its funding exceeded the eligibility threshold of 0.75 percent. The new eligibility methodology allows a jurisdiction to remain in the program for up to 5 years if its funding exceeds the 0.75 percent threshold but remains less than 0.8 percent. See figure 1 for a map of eligible EPSCoR jurisdictions as of January 2022.

**Figure 1: Twenty-eight Jurisdictions Eligible for NSF EPSCoR Funding, as of January 2022**




Source: GAO analysis of National Science Foundation (NSF) eligibility information. | GAO−22−105043

Note: A jurisdiction is eligible to participate in the NSF Established Program to Stimulate Competitive Research (EPSCoR) if its most recent 5-year level of total NSF funding (excluding EPSCoR funding and NSF funding to other federal agencies) is equal to or less than 0.75 percent of the total NSF budget. Three jurisdictions—Missouri, Tennessee, and Utah—participated in NSF's EPSCoR program in the past but lost eligibility after exceeding eligibility criteria.

The EPSCoR program uses three investment strategies to strengthen research and development (R&D) competitiveness among participating jurisdictions: research infrastructure improvement (RII), co-funding, and workshops and outreach (see table 1).

**Table 1: NSF Established Program to Stimulate Competitive Research (EPSCoR) Investment Strategies**

| Investment strategy | Purpose | Funding amount |
|---|---|---|
| Research infrastructure improvement (RII) funding | | |
| Track 1: Jurisdiction-wide research and capacity building awards | Support improvements to physical and cyber infrastructure and human capital development in topical areas selected by a jurisdiction's EPSCoR steering committee and aligned with its approved science and technology plan | One award per jurisdiction for up to $20 million over 5 years |
| Track 2: Collaborative awards among jurisdictions | Build collaborative teams across EPSCoR jurisdictions to facilitate projects in focus areas that neither party could address individually as well or as rapidly | Collaborations between two EPSCoR jurisdictions: Up to $1 million per year for up to 4 years ($4 million maximum)<br>Collaborations among three or more EPSCoR jurisdictions: Up to $1.5 million per year for up to 4 years ($6 million maximum) |
| Track 3: Awards to broaden participation of underrepresented groups in STEM (Paused)[a] | Broaden the participation of underrepresented groups—including minorities, women, the disabled, and underserved rural regions—in STEM fields | Up to $750,000 with an award duration of up to 5 years |
| Track 4: Research fellowship awards | Develop the research potential of principal investigators through extended collaborative visits to the nation's premier private, governmental, or academic research centers | Up to $300,000 with a project duration not to exceed 24 months |
| Co-funding | Support proposals that have been merit reviewed and recommended for award by another NSF directorate or office but that could not be funded without the combined, leveraged support of EPSCoR | Up to 50 percent for proposals of $300,000 or less, and less than 50 percent for proposals of more than $300,000, or as determined by NSF EPSCoR |
| Workshops and outreach | Support workshops, conferences, and other community-based activities designed to explore opportunities in emerging areas of science and engineering and to share best practices in areas of importance to EPSCoR jurisdictions | Up to $100,000 for a project period not to exceed 1 year |

Source: GAO analysis of National Science Foundation (NSF) information. | GAO-22-105043

[a]NSF issued a 10 Track 3 awards in fiscal year 2013. In 2016, NSF paused further solicitations after launching a similar NSF-wide funding opportunity open to both EPSCoR and non-EPSCoR jurisdictions.

For more information on NSF's EPSCoR funding for fiscal years 2012 through 2021, see appendix III. For jurisdictions' EPSCoR eligibility status as calculated by NSF based on jurisdictions' share of total NSF funding for fiscal years 2017 to 2021, see appendix IV.

## EPSCoR Had Varying Effects on Research Competitiveness of Participating Jurisdictions

According to our multivariate regression analysis, jurisdictions that participated in EPSCoR for all or part of the time since the program's inception were better able to compete for NSF funding and research funding from other federal agencies after joining the program.[6] In addition, according to data from NSF, EPSCoR jurisdictions increased their success rates of research proposals submitted to and funded by NSF. However, jurisdictions had distinct trends in these measures of research competitiveness depending on when they joined the program.

In particular, jurisdictions that joined the program before fiscal year 2000 (known as the early cohort) had statistically significant increases in research funding from NSF and other federal agencies after joining EPSCoR.[7] In contrast, jurisdictions that joined the program in fiscal year 2000 or later (known as the late cohort) did not. Similarly, the early cohort had a larger increase in the success rate of research proposals to NSF than the late cohort (see table 2).

[6]This could also include increased funding from other agencies' EPSCOR-like programs.

[7]In statistics, a cohort is a group of subjects that share a characteristic. In our analysis of EPSCoR, we assigned jurisdictions to cohorts based on when they joined the program. We used fiscal year 2000 as a break point between jurisdictions joining during the program's early growth between fiscal years 1980 and 1992 and those joining later, between fiscal years 2000 and 2012.

**Table 2: Estimated Effects of NSF EPSCoR on Jurisdictions' Research Funding and Proposal Success Rates**

| EPSCoR jurisdictions | Estimated effect on an average jurisdiction's research funding from NSF and other federal agencies from program entry through fiscal year 2019 | Observed increase in success rates of research proposals to NSF, fiscal years 2011 to 2020 |
|---|---|---|
| All EPSCoR jurisdictions (31 total)[a] | Statistically significant increase | 7 percentage point increase (from 20 to 27 percent) |
| Early cohort (19 total)[b] | Statistically significant increase | 9 percentage point increase (from 17 to 26 percent) |
| Late cohort (12 total)[c] | No statistically significant change | 4 percentage point increase (from 25 to 29 percent) |

Source: GAO analysis of data from the National Science Foundation (NSF). | GAO-22-105043

[a]A total of 31 jurisdictions have participated in the National Science Foundation's (NSF) Established Program to Stimulate Competitive Research (EPSCoR). We did not include three jurisdictions—Guam, Puerto Rico, and the U.S. Virgin Islands—in our regression analysis because we did not have complete data on their federal funding for research and development (R&D), population, and personal income from 1972 to 2019.

[b]The 19 jurisdictions that joined EPSCoR before fiscal year 2000 were Arkansas, Maine, Montana, South Carolina, and West Virginia (1980); Alabama, Kentucky, Nevada, North Dakota, Oklahoma, Puerto Rico, Vermont, and Wyoming (1985); Idaho, Louisiana, Mississippi, and South Dakota (1987); and Kansas and Nebraska (1992). Puerto Rico is not included in our regression analysis of the program's effect on NSF and other federal funding because we did not have complete series of data on the outcome and explanatory variables over the entire study period. In statistics, a cohort is a group of subjects that share a characteristic.

[c]The 12 jurisdictions that joined EPSCoR in fiscal year 2000 or later (and their fiscal year of entering the program) were Alaska (2000); Hawaii and New Mexico (2001); U.S. Virgin Islands (2002); Delaware (2003); New Hampshire, Rhode Island, and Tennessee (2004); Iowa and Utah (2009); and Guam and Missouri (2012). Guam and the U.S. Virgin Islands are not included in our regression analysis of the program's effect on NSF and other federal funding because we did not have complete series of data on the outcome and explanatory variables over the entire study period.

## Effects on NSF Funding

Jurisdictions that participated in EPSCoR increased their share of NSF funding since the program's inception. Our regression analysis suggested that EPSCoR participation contributed to this increased competitiveness. In particular, according to data from NSF, EPSCoR jurisdictions increased their total share of NSF funding from 14.6 percent in fiscal year 1979 (the year before the program's inception) to 16 percent in fiscal year 2019.[8]

[8]Our regression analysis and analysis of EPSCoR jurisdictions' share of NSF funding included 28 of the 31 jurisdictions that participated in EPSCoR for all or part of the time since the program's inception. We did not include three jurisdictions in our analysis—Guam, Puerto Rico, and the U.S. Virgin Islands—because we did not have complete data on their federal funding for R&D, population, and personal income from 1972 to 2019. Data on NSF funding was downloaded from the Survey of Federal Science and Engineering Support to Universities, Colleges, and Nonprofit Institutions.

This increase was equivalent to $84.8 million in fiscal year 2019.[9] In our multivariate regression analysis of jurisdiction-level data from 1972 to 2019, which included other economic and demographic factors that can influence jurisdiction-level research funding, we found that participation in EPSCoR accounted for part of this increase. However, the positive effect of the program was limited to the early cohort. The effects on the two cohorts was as follows:

- **Early cohort**. On average, EPSCoR jurisdictions in the early cohort experienced a greater percentage increase in NSF research funding after joining the program relative to non-EPSCoR jurisdictions, a difference that was statistically significant.[10] We found that the size of the early cohort's increases fluctuated over time and that the increases were statistically significant in every 5-year increment since the program's inception except the increment from 1985 to 1989. However, the increases were small relative to jurisdictions' total NSF funding. We estimated that an average jurisdiction in the early cohort increased its annual NSF funding by about $1.2 million as a result of participation in EPSCoR. For context, an average early cohort jurisdiction's total NSF funding in fiscal year 2019 was $28 million.[11]
- **Late cohort**. On average, EPSCoR jurisdictions in the late cohort did not have a significantly higher percentage increase in NSF research funding after joining the program relative to non-EPSCoR jurisdictions. Several factors may account for our regression analysis not showing a statistically significant benefit of the program. For example, the late cohort had fewer years of participating in the program than the early cohort, including one jurisdiction (Missouri) with 3 years of eligibility, another (Utah) with 4 years, and two jurisdictions (Iowa and New Mexico) having a gap in eligibility of 1 or more years.

[9]According to NSF data, NSF obligated $6,057.6 million for science and engineering to universities and colleges in fiscal year 2019. EPSCoR jurisdictions' share of this amount was $966.8 million (15.96 percent of NSF funding). Had these jurisdictions' share remained at the 1979 level (14.63 percent), it would have been $886.2 million in fiscal year 2019, or about $80.6 million less than the actual amount.

[10]NSF research funding for all jurisdictions increased over the period we examined. Therefore, we examined relative increases in EPSCoR and non-EPSCoR jurisdictions' funding in our regression analysis.

[11]Dollar figures are adjusted for inflation to 2020 constant dollars.

## Effects on Other Federal Research Funding

As with our findings on NSF funding, our regression analysis suggested that EPSCoR jurisdictions increased their research funding from other federal agencies after joining the program. However, the program's positive effect was again limited to the early cohort. In particular, the early cohort began to show a statistically significant increase between 1990 and 1994, and the positive trend continued through 2019. In contrast, the late cohort did not have a statistically significant change in its research funding from other federal agencies between 2000 and 2009 and had a statistically significant decrease between 2010 and 2019.

For both cohorts, the estimated changes in other federal funding as a result of participation in EPSCoR were small relative to the jurisdictions' total research funding from other federal agencies. For example, we estimated that an average early cohort jurisdiction increased its annual funding from other federal agencies by $3.4 million. For comparison, its average funding from other federal agencies was $156.4 million in fiscal year 2019.[12]

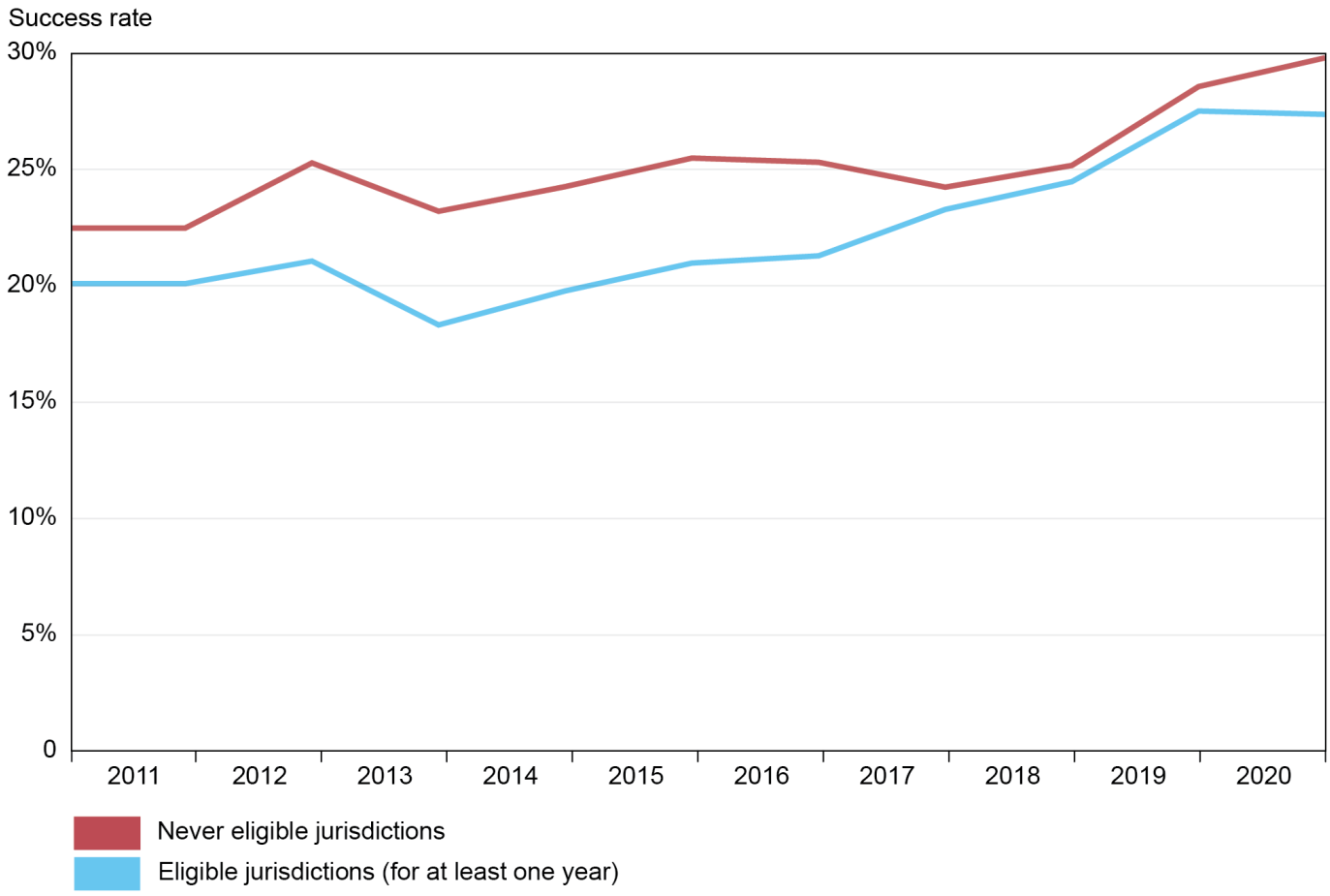
## Trends in Proposal Success Rates

Both EPSCoR and non-EPSCoR jurisdictions increased their success rate of NSF funding their research proposals between fiscal years 2011 and 2020.[13] In particular, the 31 jurisdictions that participated in EPSCoR for all or part of fiscal years 2011 to 2020 increased their success rate from 20 to 27 percent. During the same period, non-EPSCoR jurisdictions increased their success rate from 22 to 30 percent. In every year we analyzed for the 10 year period, EPSCoR jurisdictions had a lower success rate than other jurisdictions, but the difference between the two groups was statistically indistinguishable in fiscal years 2017 through 2019 (see fig. 2).

[12]Dollar figures are adjusted for inflation to 2020 constant dollars.

[13]The proposal success rate is the total number of new awards funded by NSF divided by the total number of proposals submitted.

**Figure 2: Success Rates of Research Proposals Submitted to NSF Among Jurisdictions Participating and Not Participating in NSF's EPSCoR, Fiscal Years 2011-2020**




Source: GAO analysis of data from the National Science Foundation (NSF). | GAO−22−105043

Note: In total, 31 jurisdictions have participated in NSF's Established Program to Stimulate Competitive Research (EPSCoR) for all or part of the time since the program's inception. Our calculation of research proposal success rates of EPSCoR jurisdictions includes six jurisdictions that were not eligible for the program for 1 or more fiscal years during fiscal years 2011 to 2020—Guam, Iowa, Missouri, New Mexico, Tennessee, and Utah.

The early cohort of EPSCoR jurisdictions had a larger increase in their research proposal success rate than the late cohort:

- The early cohort had a 9 percentage point increase in its success rate (from 17 to 26 percent). With this increase, the early cohort narrowed but did not eliminate the gap between its success rate and the higher rate of non-participating jurisdictions.

- The late cohort had a 4 percentage point increase in its success rate (from 25 to 29 percent). The late cohort success rate exceeded or was on par with the success rate of non-participating jurisdictions for 8 of the 10 fiscal years we analyzed.

## Comparison to Other Studies

The results of our regression analysis on the effect of NSF's EPSCoR on jurisdictions' research competitiveness are similar to the results from other quantitative analyses we reviewed. For example, a December 2014 study funded by NSF found that EPSCoR played a substantial role in increasing NSF funding to the early cohort, but not to the late cohort.[14] The report provided evidence that the recent nature of EPSCoR funding for the late cohort could account for the smaller effect of the program on the participants' NSF funding. An earlier study from 2010 found that a jurisdiction's share of federal research funding increased significantly after it became eligible to participate in EPSCoR, but that the increase was quite small.[15]

## Jurisdiction Officials Described EPSCoR's Impacts and Potential Improvements

Jurisdiction officials we interviewed described ways in which EPSCoR helped increase research competitiveness or met other program goals like broadening participation.[16] They also offered suggestions for improving the program.

**Increased research competitiveness**. Jurisdiction officials we interviewed, including researchers and university administrators, described several ways that EPSCoR funding helped increase their jurisdictions' competitiveness for research funding. Most officials told us that EPSCoR funding has helped them hire or retain faculty, including

[14]IDA Science and Technology Policy Institute, *Evaluation of the National Science Foundation's Experimental Program to Stimulate Competitive Research (EPSCoR): Final Report* (Washington, D.C.: Institute for Defense Analyses, 2015).

[15]Yonghong Wu, "Tackling Undue Concentration of Federal Research Funding: An Empirical Assessment on NSF's Experimental Program to Stimulate Competitive Research (EPSCoR)," *Research Policy*, vol. 39, no. 6 (2010): 835-841.

[16]"Jurisdiction officials" refers to principal investigators on EPSCoR Track 1 or Track 2 Research Infrastructure Improvement projects or to vice presidents of research or similar officials at research universities in EPSCoR-eligible jurisdictions.

early career faculty.[17] One official mentioned upgraded facilities as a significant draw for faculty at their institutions.

The following are more detailed examples officials gave of how EPSCoR funding helped increase their jurisdictions' competiveness:

- An official from a university in South Dakota said they used EPSCoR funding to hire researchers with expertise that it lacked for a project on biofilms, including new faculty in the area of scientific and infrastructure research.
- An official from Alaska said that EPSCoR co-funding helped start his career and the careers of others.
- Another official from Alaska said the jurisdiction has leveraged EPSCoR funding to obtain more than $170 million in additional outside funding, and to hire 37 new faculty. Alaska also used EPSCoR to support seed grants to faculty and graduate students to pursue innovative research projects related to EPSCoR themes. EPSCoR funding has enabled the program to distribute 16 faculty awards of up to $20,000 each and 17 student awards of up to $4,000 each since 2020.
- A South Dakota official said that the current Track 1 jurisdiction-wide award has allowed the state's research universities to hire seven new faculty and that EPSCoR has made the researchers it supports more competitive for other research funding. South Dakota's state-supported Governor's Research Centers held a competition in 2021 to fund research proposals, and three of the five winning proposals were led by faculty who received EPSCoR support during South Dakota's previous Track 1 award. The same official told us that graduate students at South Dakota universities have become more successful in receiving NSF research traineeship awards.
- An Iowa official said that the jurisdiction used EPSCoR funding to purchase x-ray fluorescence core scanners to search for groundwater and attract researchers for a Track 2 cross-jurisdiction collaborative award with Kansas that supports inter-jurisdictional research collaboration.

[17]With a population of 14 respondents, we used "most" to characterize responses given by eight or more respondents; "some" for those given by four to seven respondents; and "a few" for those given by two or three respondents.

- Two officials from West Virginia stated that EPSCoR-supported research projects and investment in facilities helped two universities in the state increase their rankings as research institutions.
- An official from Nevada described a proposed Track 1 jurisdiction-wide award to use drones to collect data and model the spread of wildfire, and said that Nevada was seeking to build on its existing capabilities to become a national leader in the use of drones for wildfire data collection and research.

Officials cited a variety of metrics to measure the success of EPSCoR in their jurisdictions. The most common metrics used by the jurisdictions we interviewed were the numbers of undergraduate and graduate degrees awarded in STEM fields and the numbers of articles published by EPSCoR-supported researchers in scientific journals. Other officials stated their jurisdictions tracked the number of spin-off research projects that resulted from EPSCoR awards, successful grant applications, and various measures of increased participation in STEM by underrepresented groups.

**Broadening participation by underrepresented groups**. The 14 researchers and university administrators we spoke with described ways their jurisdictions used EPSCoR funding to target outreach to students and faculty from underrepresented groups with research and job opportunities. Three officials from jurisdictions with large Native American populations emphasized the importance of involving local communities, including Native American communities, in EPSCoR awards. For example, one official we interviewed said researchers on a project drew on Tribal knowledge and tradition of the history of the region's ecosystem. Another official told us Idaho has worked with the Columbia River Inter-Tribal Fish Commission on studying organisms' response to environmental change and sought to ensure that Tribes participated in and benefited from the research. An official in North Dakota told us about a Native American student who received a PhD partially supported by EPSCoR funding, became a teacher at the local tribal college, and served as a mentor for other students in the community.

Jurisdiction officials also told us how they sought to increase participation from first-generation college students, and rural students through outreach efforts. Some of these officials said that their small populations of some underrepresented groups made it difficult to boost participation among these groups. The officials suggested that the EPSCoR program should focus on tailoring efforts at inclusion to each state's demographic

profile—for example, by boosting participation among women, rural students, and first-generation college students.

**Suggested changes to the EPSCoR program**: Jurisdiction officials offered two main suggestions to NSF for improving the EPSCoR program.[18]

- Of the 11 officials who responded to our questions about jurisdiction-wide Track 1 awards, seven said that the $20 million cap in funding for Track 1 projects was insufficient—for example, because inflation has reduced the real value of the funding over time and consequently limited the amount of research investments jurisdictions could make.[19] In addition, Track 1 projects have jurisdiction-wide scope, with funding shared among multiple educational institutions in the jurisdiction. Four other officials said the funding level was sufficient, with one individual expressing doubt that their jurisdiction would be able to use additional funding because of its small university system and the small number of researchers and students.
- Nine out of the 11 officials who responded to our interview follow-up questions stated that administrative workload or compliance costs—including those related to data collection, annual reports, and site visits—were higher for EPSCoR than for other federally funded research programs. An official suggested reducing reporting requirements and making them less burdensome—for example, by allowing research teams to choose the dates of their project meetings with NSF so that research and other academic duties are not disrupted. Two officials expressed support for NSF streamlining its data collection by, for example, developing a common data platform for collecting information from grant recipients.

In addition, each of the following changes was suggested by at least two jurisdiction officials:

[18]NSF officials said that they plan to consider changes to EPSCoR as part of an effort, discussed further below, to assess the program and identify ways to achieve the program's mission more effectively. NSF did not describe particular changes they were considering because their effort was ongoing at the time of our review.

[19]We emailed the 14 jurisdiction officials we interviewed to ask follow-up questions about the size of Track 1 awards and the associated administrative workload and costs. Eleven of the 14 officials responded to these questions.

- Allow successful Track 1 jurisdiction-wide projects to apply for a 5-year extension of their initial award to expand upon their research without reapplying and completing the administrative process again.
- Allow jurisdictions to receive funding for multiple Track 1 projects at the same time.
- Provide more assistance to researchers and jurisdiction officials in navigating the proposal-writing process, such as online sessions that provide discussion opportunities or written guidance.

## NSF Is Exploring Changes to EPSCoR to Better Achieve Its Goals

NSF has engaged in several recent efforts to assess EPSCoR's contributions to increasing academic research competitiveness in participating jurisdictions. The agency plans to build on these efforts by including questions about EPSCoR in its agency-wide evaluation plan for fiscal years 2022 through 2026. NSF reports annually to Congress on the gains made by EPSCoR in academic research quality and competitiveness. However, these reports provide limited information on jurisdictions' success in broadening STEM participation and promoting economic development.

### NSF Has Taken Steps to Assess and Improve EPSCoR and Additional Efforts Are Underway

NSF has engaged in several recent efforts to assess EPSCoR's contributions to increasing academic research competitiveness in participating jurisdictions. These efforts included a 2020 review of program management by a committee of external experts, a 2020 exploratory study to develop a framework for academic research competitiveness, and engagement with external stakeholders to explore ideas for future direction begun in 2021 (see table 3).

**Table 3: NSF Efforts to Assess Contributions of the Established Program to Stimulate Competitive Research (EPSCoR) to Increasing Research Competitiveness among Program Participants**

| Assessment effort | Objective | Status |
|---|---|---|
| Committee of Visitors review | Provide NSF with external expert judgments on program management, including performance in meeting EPSCoR's goals and objectives | Report issued in 2020 |
| NSF-funded exploratory study | Develop a framework for academic research competitiveness, knowledge of key factors that contribute to competitiveness, and knowledge of variability of these factors among EPSCoR jurisdictions | Report issued in 2020 |
| Committee on the Future of NSF EPSCoR | Convene a committee of experts to gather stakeholder input on and examine the effectiveness of EPSCoR's investment strategies and changes to achieve its mission more effectively | Initial findings presented to NSF in February and May 2022; NSF expected to post a final version on a publicly-available platform by early August 2022 |

Source: GAO analysis of National Science Foundation (NSF) information. | GAO-22-105043

Reports on the first two assessment efforts—the Committee of Visitors review and NSF-funded exploratory study—included findings and recommendations on EPSCoR's contributions to academic research competitiveness.[20] The third effort—the Committee on the Future of NSF EPSCoR—is intended to do the same.

- **Committee of Visitors review**. Through periodic Committee of Visitors reviews, NSF relies on external experts to provide advice for improving the performance of its programs. The 2020 report on the review of EPSCoR commended NSF for its efforts to engage with stakeholders and develop a framework for academic research competitiveness. The report also noted that NSF had undertaken extensive planning activities that strengthened the program—for example, by restructuring and creating new funding tracks. The report recommended that NSF (1) continue to identify program innovations to increase EPSCoR's ability to address its goals, and (2) begin its ongoing process for envisioning the future of EPSCoR in part as a response to this feedback.
- **NSF-funded exploratory study**. NSF commissioned a study in 2017 to develop a framework for academic research competitiveness that

[20]The Committee of Visitors advises NSF on the management and performance of its programs. The committee periodically assesses EPSCoR with a focus on (1) the quality and integrity of program operations and (2) program-level technical and managerial matters pertaining to proposal decisions.

NSF could apply to EPSCoR. The study's purpose was to develop a framework for future evaluations and knowledge of key factors that contribute to competitiveness, and the variability of those factors among EPSCoR jurisdictions. The study recommended that NSF refine and implement the framework for EPSCoR and take steps to aid future evaluations, such as creating a common data repository to provide a more complete understanding of the research capacities and complexities within jurisdictions. As of July 2022, NSF was establishing the data repository.

- **Committee on the Future of NSF EPSCoR**. NSF announced plans in May 2021 to engage with its external stakeholder community to guide the future of EPSCoR. NSF formed an external committee drawn from the academic community to lead the effort.[21] As directed by NSF, the committee addressed two main questions: (1) What does the available evidence tell us about the effectiveness of NSF EPSCoR's current investment strategies (both individually and collectively), in advancing scalable, jurisdiction-wide solutions and best practices to achieve the program's goals and (2) are there novel strategies or changes to the current strategies that would enable NSF and its EPSCoR jurisdictions to achieve the program's mission more effectively?

  According to the committee co-chairs, between September 2021 and November 2021, the committee gathered public comments and held six listening sessions with 123 participants from six stakeholder groups: economic development experts; minority-serving institutions; undergraduate institutions; principal investigators for EPSCoR projects; university administrators; and other stakeholders such as members of state EPSCoR steering committees. The committee organized itself into four task forces: (1) broadening participation in STEM, (2) education and workforce development, (3) economic development, and (4) research infrastructure and capacity. These task forces focused on developing recommendations for their specific areas to be included in the committee's final report. The committee presented its initial findings in February and May 2022; NSF expected to post a final version on a publicly-available platform by early August 2022.

NSF plans to build on these three evaluation efforts through an internal evaluation of EPSCoR. In particular, NSF included EPSCoR as a priority

[21]NSF formed the Committee on the Future of NSF EPSCoR to focus only on EPSCoR, whereas the Committee of Visitors reviews all of NSF's programs.

area in its Learning Agenda for fiscal years 2022 to 2026, which was issued in March 2022 in response to the Foundations for Evidence-Based Policymaking Act of 2018.[22] In addition, NSF will conduct a study that will address how EPSCoR's funding strategies contribute to increasing academic research competitiveness and how the program could better achieve its mission. According to the Learning Agenda, this study will rely on a data monitoring system developed for EPSCoR and may involve a descriptive analysis of participating jurisdictions; a longitudinal analysis to establish associations between outcomes and program participation; and case studies of participating jurisdictions. NSF anticipates completing the study by fiscal year 2025.

EPSCoR is also included in two other priority areas in NSF's Learning Agenda looking at (1) how NSF can help grow STEM talent and opportunities for all Americans most equitably, and (2) what outputs and outcomes are associated with NSF's partnership programs, such as EPSCoR, and what improvements could make these programs more effective or easier to implement. According to NSF officials, EPSCoR's inclusion in the Learning Agenda reflects the high priority and level of interest that NSF leadership has placed on the program.

## NSF's Annual EPSCoR Reports to Congress Are Limited in Their Analysis of Gains Made

The American Innovation and Competitiveness Act requires NSF to submit an annual report to Congress on EPSCoR as part of the agency's annual budget submission.[23] The report is to include descriptions of the program's strategy, objectives, and awards made in the previous fiscal year, and an analysis of the gains that the program achieved over the prior 5 fiscal years in academic research quality and competitiveness and in science and technology human resource development. NSF submitted its first annual report with its fiscal year 2018 budget request and

[22]The Foundations For Evidence-Based Policymaking Act of 2018 requires heads of federal agencies to establish "a systematic plan for identifying and addressing policy questions relevant to the programs, policies, and regulations of the agency." Pub. L. No. 115-435, § 312, 132 Stat. 5529, 5530 (2019). Agencies are also to develop "an evaluation plan describing activities the agency plans to conduct pursuant to subsection (a) of this section during the fiscal year following the year in which the performance plan is submitted." The NSF Learning Agenda is NSF's evidence-building plan for the upcoming five fiscal years in accordance with the requirements of the Act and following guidance from the White House Office of Management and Budget.

[23]Pub. L. No. 114-329, § 103(d), 130 Stat. 2969, 2974 (2017) (amending 42 U.S.C. § 1862p–9).

submitted the most recent report with its fiscal year 2023 budget request.[24]

NSF's annual reports provide descriptions of the program strategy and objectives and of awards made in the previous fiscal year. The annual reports also include some information on gains made by the program. In particular, the reports provide information on quantifiable measures, such as the average annual percentage of NSF research funds that EPSCoR jurisdictions receive and the number of faculty and students supported by EPSCoR awards. For example, according to the report for fiscal year 2021, almost every participating jurisdiction increased its average annual percentage of NSF research funds in fiscal years 2017 to 2021 compared to the participants' initial 5 years in the program.[25]

However, NSF's reports are limited in their analysis of gains made by the program, such as jurisdictions' success in broadening participating in STEM and promoting economic development. For example, the reports include information on the demographics of reviewers who evaluated EPSCoR proposals or the program in fiscal year 2021, such as the percent of underrepresented minorities, but do not provide a similar breakdown of faculty and students supported by EPSCoR awards. Similarly, the annual reports include anecdotes and examples of efforts to broaden participation. However, they do include not quantitative measures or an analysis of the outcomes of these efforts. For example, NSF's latest report did not include detailed data on the demographic characteristics of researchers who received supplemental funding or an analysis of researchers' ability to use the supplemental funding to maintain or enhance their projects during the pandemic.

NSF officials told us that although they collect demographic information on award recipients, they do not include that information in the agency's annual reports because the American Innovation and Competitiveness Act does not specifically require this information. However, the act does require an analysis of the gains in academic research quality and competitiveness and in science and technology human resource development achieved by the program. In addition, NSF's longstanding

[24]NSF's reports include program data through the most recent complete fiscal year (through fiscal year 2021 in the report submitted with the fiscal year 2023 budget request).

[25]Rhode Island and Guam saw decreases in their share of NSF awards while Maine and New Hampshire remained constant. Among the other jurisdictions, improvements ranged from 0.02 percentage points (Wyoming) to 0.41 percentage points (Alabama).

goals for the program, which are linked to its overall mission to enhance research competitiveness, include broadening participation of diverse individuals, institutions, and organizations in research and education initiatives and promoting jurisdictions' economic development. By including information related to these goals it its annual reports, NSF could show how gains in these areas also contribute to gains in academic research quality and competitiveness, and better meet the reporting requirement of the American Innovation and Competitiveness Act.

The 2020 independent study that NSF commissioned also noted the need for more than a single metric to support strategic program planning and portfolio management for EPSCoR. Metrics on broadening participation and promoting economic development could help meet this need. NSF's use of such metrics in its annual reports would also be consistent with standards for internal control in the federal government, which state that management should externally communicate the necessary quality information to achieve the entity's objectives. By analyzing and communicating a wider range of metrics for EPSCoR, NSF could provide Congress and others with greater visibility about the program's effectiveness to meet its STEM participation and economic development goals as well as its overall mission to enhance research competitiveness.

## Conclusions

Our multivariate regression analysis and interviews with officials in eligible jurisdictions provided evidence that NSF's EPSCoR has had positive effects. In particular, our regression analysis suggested that jurisdictions in the early cohort had increases in their NSF funding and research funding from other federal agencies. In addition, jurisdiction officials we interviewed described multiple ways in which EPSCoR helped increase research competitiveness or meet other program goals, such as broadening participation. NSF has also engaged in several recent efforts to assess EPSCoR's contributions to increasing academic research competitiveness and plans to use the results of these assessments to consider improvements to the program.

However, the reports on EPSCoR that NSF is required to submit to Congress as part of the agency's annual budget submission are limited in their analysis of gains made by the program. For example, the reports include information on the demographics of proposal reviewers but do not provide a similar breakdown for recipients of EPSCoR awards. By including such information, NSF could provide a fuller analysis of the program for congressional oversight. Moreover, through its current efforts to assess EPSCoR's contributions, NSF may identify additional quantitative and qualitative measures of the program's effects on

increasing academic research competitiveness in participating jurisdictions. Including these measures after they are developed in its annual reports would be another way that NSF could provide greater visibility into the effectiveness of EPSCoR in meeting the program's objectives.

## Recommendation for Executive Action

The Director of the NSF should direct EPSCoR to enhance its annual reports to Congress to more fully convey the program's gains. For example, the reports could include measures of jurisdictions' success in broadening participation in STEM. (Recommendation 1)

## Agency Comments

We provided a draft of this report to NSF for review and comment. In its comments, reproduced in appendix V, NSF stated that it concurred with our recommendation for additional actions the agency should take to enhance its annual reports to Congress. In addition, NSF stated that it is in the process of identifying data that will improve its annual congressional reports to more fully convey the program's gains. NSF also provided technical comments, which we incorporated as appropriate.

We are sending copies of this report to the appropriate congressional committees, the Director of the National Science Foundation, and other interested parties. In addition, the report is available at no charge on the GAO website at https://www.gao.gov.

If you or your staff have any questions about this report, please contact Candice Wright at (202) 512-6888 or wrightc@gao.gov. Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this report. GAO staff who made key contributions to this report are listed in appendix VI.

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Director
Science, Technology Assessment, and Analytics

# Appendix I: Objectives, Scope, and Methodology

This report examines (1) the effects that the Established Program to Stimulate Competitive Research (EPSCoR) has had on jurisdictions' competiveness in obtaining National Science Foundation (NSF) and other federal research funding, (2) jurisdiction officials' perspectives on the program's effects, and (3) NSF's efforts to assess the effects of the program and identify opportunities for improvement.

To examine the effects that EPSCoR has had on jurisdictions' research competiveness, we performed an econometric analysis of jurisdictions' data between fiscal years 1972 to 2019 to determine if jurisdictions that received EPSCoR funding differed significantly in their research awards from NSF and other federal agencies from jurisdictions that never received EPSCoR funding. For more detailed information on our econometric analysis, see appendix II.

To examine jurisdiction officials' perspectives on the program's effects, we conducted 14 semistructured interviews with program participants from a nongeneralizable sample of seven EPSCoR jurisdictions (two participants from each jurisdiction). To capture a variety of jurisdiction officials' perspectives on the program's effects—using a random number generator—we selected a non-generalizable sample of seven EPSCoR jurisdictions to include those that had both relatively short and long histories of participation in the program. Out of the 28 eligible jurisdictions in 2022, three of the randomly selected jurisdictions were in the program before 1985 (Nevada, North Dakota, and West Virginia), three jurisdictions started after 1985 (Alaska, Idaho, and South Dakota), and the seventh jurisdiction (Iowa), had graduated out of and rejoined EPSCoR.

Within each jurisdiction, we identified the principal investigator for the jurisdiction's current Track 1 jurisdiction-wide research and capacity building award. In the case of Iowa, we identified the principal investigator for a Track 2 cross-jurisdiction collaborative award since Iowa did not have a Track 1 project at the time we conducted our interviews. We also selected a vice president for research at a research university in each jurisdiction to provide a high-level perspective on how EPSCoR operates across institutions in a jurisdiction.[1]

[1]At the suggestion of the Vice President for Research at the University of Iowa, we interviewed the Senior Associate Vice President for Research because of that official's greater familiarity with Iowa's EPSCoR.

We asked 10 standard questions in our semi-structured interviews. These questions covered the respondent's role in and background with the state's EPSCoR, the types of projects their jurisdiction's EPSCoR supports, examples of increased research competitiveness stemming from EPSCoR in their state, their perspective given their status as either a recently or long-time eligible state, the metrics they use for evaluating their state's EPSCoR and if those have changed over time, the impact of changes to EPSCoR's structure over the past 10 years, examples of EPSCoR projects broadening participation in STEM by members of underrepresented groups, and changes they would make to EPSCoR.

Following our initial 14 semi-structured interviews, we sent a list of follow up questions where we provided a standardized set of response options. These questions asked respondents for their views on the adequacy of $20 million as the funding amount and 5 years as the duration for Track 1 awards. The possible responses were "Too Much," "Not Enough," or "About Right." We also asked how the administrative workload for EPSCoR compared with that of other NSF grant programs. The possible responses for this question were "About the Same," "More," and "Less." For all three follow-up questions, we also provided respondents with an opportunity to suggest changes to each of these aspects of the program. Overall, 11 out of our 14 semi-structured interview respondents completed the follow-up questionnaire, including all seven principal investigators and four out of seven vice presidents for research.

After receiving responses to our follow-up questionnaire, we conducted a content analysis and summarized the information by common response and theme. In addition, we developed a system of terminology for characterizing respondents' views. With a population of 14 respondents, we used "most" to denote responses given by eight or more respondents, "some" for those given by four to seven respondents, and "a few" for those given by two or three respondents.

To examine NSF's efforts to assess the effects of the program and identify opportunities for improvement, we reviewed agency documents, reports, and related laws and conducted a literature search for studies that mentioned EPSCoR for the past 10 years. In addition, we interviewed agency officials and a variety of EPSCoR stakeholders. We reviewed the first six of the annual reports that NSF was required to submit to Congress under the American Innovation and Competitiveness Act to determine the kinds of qualitative and quantitative information NSF was collecting and evaluating in preparing its report to Congress. We also

reviewed the reports to determine the progress of NSF's internal study it commissioned to develop a new evaluation framework for EPSCoR.

In addition, we reviewed a variety of other documents and legislation. Specifically, we reviewed the American Innovation and Competitiveness Act because of the annual reporting requirements it imposes on EPSCoR and the Foundations for Evidence-Based Policymaking Act of 2018 due to the data and evaluative requirements it imposes on federal agencies, including NSF. We also reviewed several previous reports on EPSCoR, including from the Congressional Research Service and the National Academies of Sciences, Engineering, and Medicine.

In addition, we reviewed Standards for Internal Control in the Federal Government because the principles described are directly relevant to NSF EPSCoR's actions.[2] We determined that the information and communication, and control activities components of internal control were significant to this objective, along with the underlying related principles that management should internally and externally communicate necessary quality information to achieve its objectives and that management should design control activities to achieve objectives and respond to risks. We assessed the content of NSF's policies, procedures, and guidance against these principles.

To gain a more thorough understanding of EPSCoR, we interviewed multiple stakeholders related to the program. In February 2022, we interviewed the co-chairs of the Committee on the Future of NSF EPSCoR, and we reviewed the committee's preliminary findings. In addition, we spoke with officials at the EPSCoR/Institutional Development Award Foundation and the EPSCoR/Institutional Development Award Coalition, which according to these officials, function as an information clearinghouse and advocacy body, respectively, for NSF EPSCoR and related programs at other federal agencies. We also interviewed a representative from the National Academies of Sciences, Engineering, and Medicine about its prior evaluation of NSF EPSCoR, including its methodology, findings, and the relevance of their findings in the present day.

For additional perspectives on EPSCoR, we interviewed representatives from Mississippi State University and Jackson State University, which have participated in Mississippi's EPSCoR. Mississippi was not part of

[2]GAO-14-704G.

our sample of jurisdictions. These interviews focused on the administrative workload of EPSCoR and challenges its research institutions faced in leveraging EPSCoR funding effectively. In our interview with Jackson State—a Historically Black University—we also discussed the unique issues facing these schools and other minority-serving institutions in applying for and receiving federal funding, as well as challenges the university faced specific to Mississippi's EPSCoR.

To determine how EPSCoR funding levels changed over the most recent 10 years, we used EPSCoR funding data from fiscal years 2012 through 2021 to analyze the breakdown of funding by research support area and by each jurisdiction that participated in the program between 2012 through 2021.

We conducted this performance audit from March 2021 to August 2022 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

# Appendix II: Econometric Model of EPSCoR Jurisdictions' Research Funding

To examine the effects that the Established Program to Stimulate Competitive Research (EPSCoR) had on jurisdictions' research competitiveness in obtaining National Science Foundation (NSF) and other federal research funding, we used a multivariate regression model to examine whether jurisdictions that were eligible to participate in the program had a statistically significant difference in three outcome variables, before and after eligibility, and from jurisdictions that were never eligible (non-EPSCoR jurisdictions).[1] The three outcomes were science and engineering funding from NSF to academic and nonprofit institutions (NSF funding), science and engineering funding from other federal agencies to academic and nonprofit institutions (other funding), and research and development (R&D) expenditures made by jurisdictions themselves (jurisdiction-level R&D expenditures). We used these three outcome variables because NSF has collected them annually for EPSCoR and non-EPSCoR jurisdictions and they are publicly available from fiscal year 1972 onwards. In addition, previous studies on EPSCoR's effect on jurisdictions' research competitiveness have used the same data.[2] To assess the reliability of the data for the purposes of our econometric analysis, we reviewed relevant documentation about the data, interviewed knowledgeable officials, and examined the data for obvious errors or inconsistencies. We determined the data were reliable enough to use for contextual descriptive statistics and regression analysis, with limitations as noted.

## Sample

Our sample included jurisdiction-level annual data on the three outcome variables and explanatory variables from 51 jurisdictions for 48 years

[1]Eligibility is determined by NSF based a threshold (i.e., 0.75% of total NSF funding over the past 5 years as of fiscal year 2019) determined prior to a jurisdiction's participation to the program. Eligibility does not guarantee proposal acceptance. It allows jurisdictions to submit grant proposals to EPSCoR program under a merit-based review process. Eligible jurisdictions can submit one proposal per jurisdiction on research infrastructure improvement (the largest component of EPScoR) at one funding cycle. Thus eligibility can be considered a pre-determined and exogenous treatment, and measures the "intent-to treat" effect.

[2]For examples, Julia Melkers and Yonghong Wu, "Evaluating the improved research capacity of EPSCoR states: R&D funding and collaborative networks in the NSF EPSCoR program." *Review of Policy Research,* vol. 26, no. 6 (2009): 761-782. Yonghong Wu, "Tackling undue concentration of federal research funding: An empirical assessment on NSF's Experimental Program to Stimulate Competitive Research (EPSCoR)." *Research Policy,* vol. 39, no. 6 (2010): 835-841.

(fiscal years 1972 through 2019).[3] We obtained jurisdiction-level annual eligibility status for EPSCoR from previous reports and studies.[4] Our sample included 28 jurisdictions that have participated in NSF's EPSCoR for all or part of the time since the program's inception and 23 jurisdictions that were never eligible.[5] Out of the 28 EPSCoR jurisdictions, 18 of them became eligible before fiscal year 2000 (early cohort), and 10 of them became eligible in and after fiscal year 2000 (late cohort). For the 51 jurisdictions, we included jurisdiction-level annual data from 1972 to 2019 on population and personal income to control for economic and demographic factors that can influence jurisdiction-level research funding.[6] We included data for years prior to EPSCoR's inception in 1979 to establish a baseline for measuring changes in jurisdictions' research funding and R&D expenditures.

In calculating descriptive statistics on outcome variables, we found that relative to non-EPSCoR jurisdictions, EPSCoR jurisdictions increased their average shares of NSF and other funding between fiscal years 1979—the year that NSF initiated EPSCoR as a pilot program—and 2019. For example, in fiscal year 1979, the average NSF funding for the early cohort, late cohort, and non-EPSCoR jurisdictions were $9.1 million, $17.6 million, and $86.4 million, respectively, and increased to $28.0, $51.6, and $233.5 million, respectively, in fiscal year 2019.[7] In total, the 28 EPSCoR jurisdictions' share of NSF funding increased from 14.63 percent in fiscal year 1979 to 15.96 percent in fiscal year 2019. The

[3]We downloaded the three outcome variables from NSF National Center for Science and Engineering Statistics in the fall of 2021, and at that time, the most recent observations were up to fiscal year 2019. Data on NSF funding and other funding were from the Survey of Federal Science and Engineering Support to Universities, Colleges, and Nonprofit Institutions; data on jurisdiction-level R&D expenditures were from the Higher Education Research and Development Survey

[4]For example, IDA Science and Technology Policy Institute, *Evaluation of the National Science Foundation's Experimental Program to Stimulate Competitive Research (EPSCoR): Final Report* (Washington, D.C.: Institute for Defense Analyses, 2014).

[5]In total, there are 2,448 observations from 51 jurisdictions from 1972 to 2019. Guam, U.S. Virgin Islands, and Puerto Rico are EPSCoR jurisdictions but were not included in the regression analysis because we did not have complete series of data on the outcome and explanatory variables over the entire study period.

[6]We downloaded annual jurisdiction-level data on population and personal income from Bureau of Economic Analysis from 1972 to 2019 in October 2021.

[7]All dollar are inflation adjusted to 2020 constant dollars.

average share of NSF funding per EPSCoR jurisdiction increased from 0.52 percent in fiscal year 1979 to 0.57 percent in fiscal year 2019.

## Econometric Model

We developed a panel data[8] econometric model to examine the extent to which the changes we observed in EPSCoR jurisdictions' NSF and other funding were associated with their participation in the program and to examine the differing effect of the program on early and late cohorts over time. We based the model on a general econometric framework for examining the differing effects of a staggered treatment in which cohorts entered the program at different times.[9] A previous study indicated that the impact of EPSCoR differed among jurisdictions that joined the program before 2000 and those that joined in or after 2000.[10] One may expect that on the one hand, having longer involvement with EPSCoR would slowly increase a jurisdiction's research capacity and know-how to obtain extramural funding over time. On the other hand, the size of the incremental effect on capacity building may diminish over time, as shown in a previous study.[11]

In the model below, we used the natural logarithm transformation of the outcome variable $\log(y_{it})$ for jurisdiction $i$ and year $t$ as the dependent variable to reduce skewness resulting from some jurisdictions having a high level of the outcome variable and others having a low level of the outcome variable.[12] Jurisdiction-level annual explanatory variables on the right-hand side are described in table 4. Our model was as follows:

[8]Panel data or longitudinal data consist of repeated observations on the same units over time. In this case, we have repeated observations on jurisdictions over fiscal years.

[9]A staggered treatment refers to the situation that once a participant entered the program it remained in the program for the rest of the study period. For further information on the features and properties of the generalized model, see Wooldridge (2021), *Two-Way Fixed Effects, the Two-Way Mundlak Regression, and Difference-in-Differences Estimators* (Michigan State University, Sept. 2021).

[10]IDA Science and Technology Policy Institute, *Final Report*.

[11]IDA Science and Technology Policy Institute, *Final Report.*

[12]We estimated the model for each of the three outcomes (see further details in Wu "Tackling undue concentration of federal research funding"). We prefer NSF funding over share as the outcome, because jurisdictions shares correlated across jurisdictions and add up to one. Our empirical results on NSF awards remain qualitatively similar using either log or share of NSF awards.

$$\log(y_{it}) = \sum_{s=1}^{8} \beta_{early,s} * D_{i,early} * post_{it} * ls_t + \sum_{s=5}^{8} \beta_{late,s} * D_{i,late} * post_{it} * ls_t + D_{i,early} * t + D_{i,early} * t^2 + D_{i,late} * t + D_{i,late} * t^2 + \vartheta_1 D_{i,early} + \vartheta_1 D_{i,late} + q'_{it-1} \emptyset + \alpha_i + \gamma_t + \varepsilon_{it}$$

**Table 4. Explanatory Variables and Description**

| Explanatory variable | Description |
|---|---|
| $post_{it}$ | Dummy variable representing a jurisdiction's eligibility to the program. $post_{is} = 1$ for jurisdiction $i$ that became eligible in year $t = s$ and $post_{it} = 1$ for $t \geq s$ for the rest of the period |
| $D_i$,early and $D_i$,late | Dummy (indicator) variables for the early cohort jurisdictions eligible for EPSCoR prior to 2000 and for the late cohort jurisdictions eligible in and after 2000 |
| $\sum_{s=1} D_{i,early} * post_{it} * ls_t$ | Eight interactions of cohort dummy variable($D_{i,early}$, ), post program dummy variable ($post_{it}$), and dummy variables for each of the eight 5-year intervals from 1980 through 2019 ($l1_t - l8_t$) |
| $\sum_{s=5} D_{i,late} * post_{it} * ls_t$ | Four interactions of cohort dummy variable ($D_{i,late}$), post program dummy variable ($post_{it}$), and dummy variables ($l5_t - l8_t$) representing each of the four 5-year intervals from 2000 through 2019 |
| $q'_{it-1}$ | One-year lagged population and personal income to control for the size and economic strength of a jurisdiction |
| $\alpha_i$, $\gamma_t$ | Jurisdiction-level fixed effects ($\alpha_i$) controlling for time-invariant jurisdiction-level characteristics, such as location; year fixed effects ($\gamma_t$ ) controlling for macroeconomic cycles affecting all jurisdictions for each year, such as economic recession |
| $D_{i,early} * t, D_{i,early} * t^2, D_{i,late} * t, D_{i,late} * t^2$ | Inherent linear and quadratic time trends for early and late EPSCoR cohorts to control for cohort-specific, time-varying, unobservable characteristics that may influence a jurisdiction's research competitiveness, such as jurisdiction-level investments in higher education and EPSCoR-like programs initiated by other federal agencies |

Source: GAO analysis. | GAO-22-105043

Note: $\varepsilon_{it}$ denotes the idiosyncratic errors that change across time and across jurisdiction and are not captured by the model. We considered the Established Program to Stimulate Competitive Research (EPSCoR) to be a staggered program in our analysis, even though a few EPSCoR jurisdictions exceeded the eligibility threshold recently, since they remained for co-funding during the study period. Given our long analysis period, we used both linear and quadratic trends in order to allow the rate of change in outcomes to vary over time.

The parameters of interest are the 12 $\beta$ coefficients (i.e., $\beta_{early,s}$, where $s = 1,2,3, \ldots 8$ ; $\beta_{late,s}$, where $s = 5,6,7,8$), and they represent the changes in outcomes before and after an EPSCoR jurisdiction's entry to the program compared to changes in the outcomes of non-EPSCoR jurisdictions over the same period. For example, $\beta_{early,s}$ $(where\ s = 1,2,3, \ldots 8)$ measure the program's estimated effect for eight 5-year intervals for the early cohort covering fiscal years 1980 through 2019, and $\beta_{late,s}$ $(where\ s = 5,6,7,8\ )$ measure the program's estimated effect for four 5-year intervals for the late cohort covering fiscal years 2000 through 2019. Because the outcome variables are in log form, the coefficients approximate the differences between EPSCoR and non-EPSCoR jurisdictions in their percentage changes in the outcome variables.[13] For example, $\widehat{\beta_1} * D_{i,early} * post_{it} * l1_t$ represents the percent change in the outcome for an early EPSCoR jurisdiction after it became eligible for the program between 1980 and 1984. Similarly, $\widehat{\beta_5} * D_{i,late} * post_{it} * l5_t$ measures the percentage change in the outcome for a late EPSCoR jurisdiction between 2000 and 2004.

Based on the estimated coefficients, we can further test whether the overall percentage changes for early, late, and all EPSCoR cohorts from fiscal years 1980 through 2019 were statistically different from zero. For example, the linear combination of the eight coefficients$(\sum_{s=1}^{8} \hat{\beta}_{early,s})$ approximates the overall percentage increase in outcome over 1980 to 2019 for early cohorts, and the overall percentage increase for an ESPCoR jurisdiction over the period between 1980 and 2019 is $(\sum_{s=1}^{8} \hat{\beta}_{early,s} + \sum_{s=5}^{8} \hat{\beta}_{late,s})$.

We used two-way fixed effects estimation (i.e., controlling for jurisdiction-level and year fixed effects) as well as pooled ordinary least squares estimation to estimate the model. Two-way fixed effects regression is a technique on panel data to isolate the effects of time-varying factors on the change in outcome from jurisdiction-level time-invariant factors and annual factors affecting all jurisdictions. For example, by controlling jurisdiction-level and year fixed effects, we were able to isolate the effect of a change in a jurisdiction's eligibility status on change in a jurisdiction's

[13]The point estimates of the beta coefficients can be interpreted approximately as percent change on outcome. The precise percent change can be calculated as $100 * (\exp(\hat{\beta}) - 1)$. For further information, see Robert Halvorsen and Raymond Palmquist. "The interpretation of dummy variables in semilogarithmic equations." *American Economic Review*, vol. 70, no. 3 (1980): 474-475.

funding from time-invariant factors and macroeconomic shocks, such as a jurisdiction's location and economic recession.

## Regression Results

We report the mean, standard deviation, and number of observations for the variables included in the regression in table 5, and the estimated coefficients and standard errors of above model in table 6.

**Table 5: Mean and Standard Deviation of Variables Used in Regression Analysis of Impacts of the Established Program to Stimulate Competitive Research on NSF Funding, Other Funding, and Jurisdiction-Level R&D Expenditures**

| | Variables | Early cohort | Late cohort | Non-EPSCoR |
|---|---|---|---|---|
| log NSF funding | Mean | 9.31 | 10.16 | 11.58 |
| | Standard deviation | 1.02 | 0.65 | 0.83 |
| log other funding | Mean | 11.23 | 11.99 | 13.45 |
| | Standard deviation | 0.85 | 1.03 | 0.9 |
| log jurisdiction-level R&D expenditures | Mean | 9.71 | 9.63 | 10.87 |
| | Standard deviation | 1.26 | 1.05 | 1.15 |
| Post program dummy variable ($\boldsymbol{post_{it}}$) | Mean | 0.73 | 0.32 | 0 |
| | Standard deviation | 0.44 | 0.47 | 0 |
| log population | Mean | 14.35 | 14.32 | 15.74 |
| | Standard deviation | 0.73 | 0.76 | 0.79 |
| log personal income | Mean | 10.93 | 11.01 | 12.51 |
| | Standard deviation | 0.77 | 0.77 | 0.85 |
| Number of observations | | 864 | 480 | 1104 |

Source: GAO analysis of NSF data. | GAO-22-105043

Notes: National Science Foundation (NSF) funding, other funding, state research and development (R&D) expenditures, and personal income have been adjusted to 2020 constant dollars. Variables that are interactions between post program dummy variable and 5-year period dummy variables were not included in this table for brevity.

As a key result of our model, we found that participation in EPSCoR was associated with greater increases in jurisdictions' NSF and federal funding after they become eligible to participate in the program as compared to non-EPSCoR jurisdictions. These increases included a statistically positive effect for the early cohort and a statistically insignificant effect for the late cohort. For example, for the early cohort, participation in EPSCoR was associated with statistically significant increases in NSF funding in every 5-year interval ranging from 0.615 to 0.854 (in log points) except for fiscal years 1985 through 1989. In contrast, for the late cohort, participation in the program was associated

initially with increases and then with reductions in their NSF funding, but those changes were not statistically different from zero compared to changes that non-EPSCoR jurisdictions experienced.

**Table 6: Estimated Impacts of the Established Program to Stimulate Competitive Research on NSF funding, Other Federal funding, and Jurisdiction-Level R&D Expenditures**

| | NSF funding | | Other Federal Funding | | Jurisdiction-Level R&D expenditures | |
|---|---|---|---|---|---|---|
| **Variables** | **Early cohort** | **Late cohort** | **Early cohort** | **Late cohort** | **Early cohort** | **Late cohort** |
| Post program Fiscal Year 1980-1984 | 0.615** | — | -0.160*** | — | 0.474* | — |
| Standard error | [0.301] | — | [0.050] | — | [0.244] | — |
| Post program Fiscal Year 1985-1989 | 0.339 | — | 0.032 | — | -0.064 | — |
| Standard error | [0.210] | — | [0.045] | — | [0.215] | — |
| Post program Fiscal Year1990-1994 | 0.696*** | — | 0.168** | — | -0.014 | — |
| Standard error | [0.242] | — | [0.073] | — | [0.288] | — |
| Post program Fiscal Year1995-1999 | 0.854*** | — | 0.283*** | — | 0.067 | — |
| Standard error | [0.243] | — | [0.076] | — | [0.343] | — |
| Post program Fiscal Year 2000-2004 | 0.807*** | 0.105 | 0.578*** | -0.064 | -0.042 | -0.327*** |
| Standard error | [0.239] | [0.097] | [0.102] | [0.334] | [0.381] | [0.094] |
| Post program Fiscal Year 2005- 2009 | 0.759*** | 0.101 | 0.652*** | -0.095 | -0.105 | -0.074 |
| Standard error | [0.250] | [0.087] | [0.128] | [0.167] | [0.394] | [0.170] |
| Post program Fiscal Year 2010-2014 | 0.641** | -0.100 | 0.521*** | -0.280** | -0.230 | 0.033 |
| Standard error | [0.267] | [0.100] | [0.153] | [0.129] | [0.404] | [0.210] |
| Post program Fiscal Year 2015- 2019 | 0.542* | -0.201 | 0.487*** | -0.434** | -0.120 | 0.176 |
| Standard error | [0.280] | [0.144] | [0.172] | [0.167] | [0.436] | [0.318] |
| Cohort year trend | -3.113** | -1.860** | 0.100 | -1.450 | -3.652 | 3.550* |
| Standard error | [1.447] | [0.868] | [0.846] | [1.052] | [2.452] | [1.935] |
| Cohort year trend squared | 0.001** | 0.000** | -0.000 | 0.000 | 0.001 | -0.001* |
| Standard error | [0.000] | [0.000] | [0.000] | [0.000] | [0.001] | [0.000] |
| Lagged log population | 0.184 | | 0.183 | | -1.156 | |
| Standard error | [0.427] | | [0.285] | | [0.747] | |
| Lagged log personal income | 0.677 | | 0.155 | | 1.296 | |
| Standard error | [0.487] | | [0.291] | | [0.788] | |
| Constant | 1464.905** | | 259.980 | | 607.077 | |
| Standard error | [584.606] | | [422.982] | | [1,041.439] | |
| R-squared | 0.929 | | 0.961 | | 0.814 | |

| Variables | NSF funding | | Other Federal Funding | | Jurisdiction-Level R&D expenditures | |
|---|---|---|---|---|---|---|
| | Early cohort | Late cohort | Early cohort | Late cohort | Early cohort | Late cohort |
| Post estimation-summation of estimated post program effects[a] | 5.159*** | | 1.688** | | -0.227 | |
| Standard error | [1.768] | | [0.739] | | [2.404] | |

Legend: * = p<0.1, ** = p<0.05, *** = p<0.01; — = no data.

Source: GAO analysis of NSF data. | GAO-22-105043

Notes: Number of observations reduced from 2,448 to 2,397 after using one-year lagged data on population and personal income. Year fixed effects and jurisdiction fixed effects are included in all estimations and omitted for reporting. Robust standard errors are clustered at jurisdiction level and in. National Science Foundation (NSF) funding, other funding, state research and development (R&D) expenditures, and state personal income have been adjusted to 2020 constant dollars. Periods refers to the 5 year interval from 1980 to 2019.

[a]This is a post estimation hypothesis test (t-test) on the linear combination of all estimated post program effects of both early and late cohorts.

We found that, compared to non-EPSCoR jurisdictions, the early cohort also increased its other federal funding since fiscal year 1990, and increases persisted until 2019. In contrast, jurisdictions in the late cohort did not receive increased funding from other federal agencies once they became eligible to participate in the program and reduced their other federal awards during the last 10 years of the program significantly (i.e., fiscal years 2010 through 2019). Those changes jointly were not significantly different from zero for the late cohort compared to changes of non-EPSCoR jurisdictions.

We did not find the overall impact of EPSCoR on jurisdiction-level R&D expenditures to be statistically significant, except during the first 5 years after jurisdictions became eligible, when the program was associated with an increase in expenditures among the early cohort and a decrease in expenditures among the late cohort.

We calculated the increase in annual NSF funding associated with EPSCoR participation to be about $1.2 million with a 95 percent confidence interval between $0.4 million and $1.9 million (in fiscal year 2020 dollars) for an early EPSCoR jurisdiction.[14] We calculated this estimate by multiplying the approximate percent increases estimated by our regression analysis with the mean level of NSF funding prior to the EPSCOR program (i.e., an average of $8.8 million in 2020 dollars

[14]This 95 percent confidence interval would contain the population average 95 percent of the samples if we were to draw random samples to calculate the simple average based on the distributions of the beta coefficients from columns 1 and 2 in table 6.

between fiscal year 1972 and 1979 for the early cohort). Specifically, the beta coefficients from columns 1 and 2 in table 6 are used to approximate the percent changes. We obtained the annual average change in percentages by taking the simple average of all percent increases from the eight 5-year intervals and divided by 5 years.[15] To put this increase into context, the observed level of NSF funding for an average early-cohort jurisdiction was $9.5 million in fiscal year 1979 and $28.0 million in fiscal year 2019. The annual impact of ESPCoR was therefore about 6 percent of this increase.

Using the same approach, we estimated that, on average, an early-cohort jurisdiction increased annual funding from other federal agencies by $3.4 million, with a 95 percent confidence interval between $1.7 million and $5.1 million. The observed level of other federal funding for an average early cohort jurisdiction was $59 million in fiscal year 1979 and $156 million in fiscal year 2019.

## Robustness Check

We conducted several robustness checks that confirmed the findings from our main econometric model. In particular, we applied an alternative non-parametric approach in which we used EPSCoR jurisdictions that were not yet eligible in a given year as the comparison group for eligible jurisdictions instead of non-EPSCoR jurisdictions.[16] The estimated percent increases in NSF funding that were associated with EPSCoR are qualitatively the same as our main analysis. In addition, when we estimated a series of variations of the above model, we consistently found a statistically significant and positive effect of EPSCoR on NSF funding. For example, in one variation, we excluded observations after fiscal year 1992, and thus focused on the effect of EPSCoR on the early cohort before the late cohort became eligible. In another variation, we dropped three jurisdictions that had the highest level of NSF funding prior to the inception of EPSCoR from our analysis.

[15]While NSF funding included awards from EPSCoR and other NSF programs, EPSCoR accounted for only 20 percent of the total NSF funding for an early participant in the recent decade. For example, an early participant received an average of $6.1 million per year from EPSCoR since 2010 (including RII grants and co-funding). Our estimated increase of about $1.2 million per year represents the effect of EPSCoR above and beyond the $6.1 million of funding.

[16]For further information on this approach, see Brantly Callaway, and Pedro H.C. Sant'Anna. "Difference-in-differences with multiple time periods." *Journal of Econometrics*, vol. 225, no. 2 (2021): 200-230.

## Limitations of the Regression Analysis

Our analysis had several limitations. First, the type of analysis we conducted cannot explain on its own the mechanisms, such as hiring faculty or making investments in laboratory equipment, through which EPSCoR may have increased a jurisdiction's competitiveness for research funding. Second, we did not have sufficient quantitative information to identify the causes of our differing results for early and late cohorts—for example, whether the recent nature of EPSCoR funding for the late cohort could account for the lack of a statistically significant association with NSF and other funding. Finally, some EPSCoR jurisdictions were also eligible for EPSCoR-like programs of other federal agencies, such as the National Institutes of Health since the 1990s. However, we did not have information on jurisdictions' participation in EPSCoR-like programs of other federal agencies. As a result, we were not able to examine the interactions of these programs with NSF's EPSCoR in enhancing a jurisdiction's research competitiveness for all types of federal research funding. On balance we believe our results reflect the causal impact of EPSCoR on NSF and other research funding, although these limitations collectively suggest that our results should be interpreted with some degree of caution.

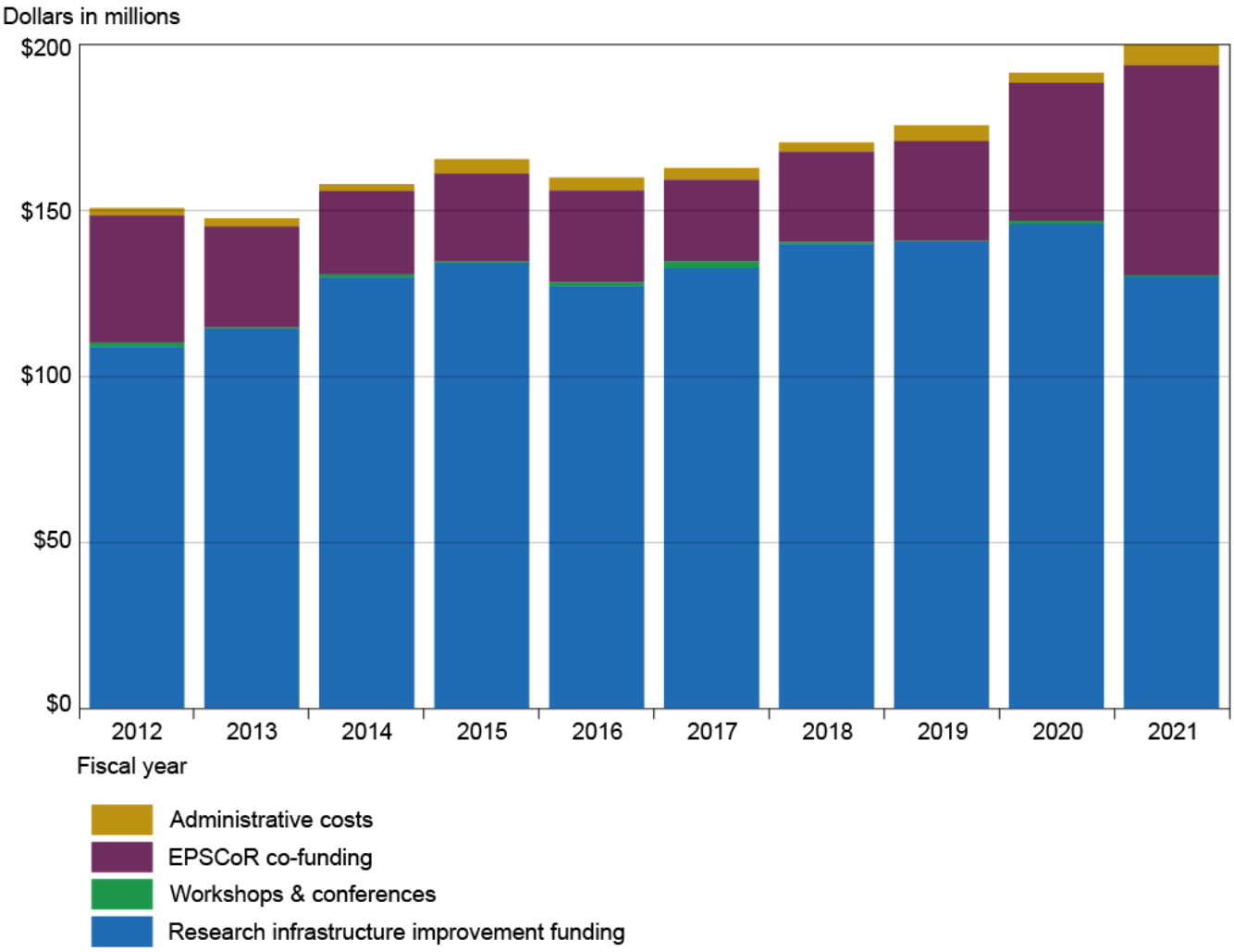
# Appendix III: NSF's EPSCoR Funding for Fiscal Years 2012-2021

The National Science Foundation (NSF) obligated $1,682.7 million for the Established Program to Stimulate Competitive Research (EPSCoR) in fiscal years 2012 through 2021. NSF's annual obligations for the program fluctuated from year to year and had an overall increase of $49.4 million, from $150.8 million in fiscal year 2012 to $200.2 million in fiscal year 2021. Annual obligations for EPSCoR stayed at about 2 percent of NSF's total annual obligations, which also increased over the past 10 fiscal years. The consistent proportion of obligations for EPSCoR was in keeping with a statutory provision for the program to increase as NSF funding increases.[1]

NSF's Research Infrastructure Improvement awards (RII Tracks 1 through 4) consistently made up the largest portion of annual obligations for EPSCoR. On average, awards for this investment strategy made up about 77 percent of NSF's obligations for the program in fiscal years 2012 through 2021. Co-funding, the second largest portion, accounted for almost 20 percent of obligations on average, followed by workshops and outreach at 0.5 percent and NSF administrative expenses at 2.1 percent. For example, fiscal year 2021 co-funding investments included $13 million toward three new Mid-Scale Research Infrastructure projects based in EPSCoR jurisdictions and $5 million toward the new Center for Advanced Radio Sciences and Engineering based in Puerto Rico. Figure 3 shows the trend in NSF's investment strategies and administrative expenses over the past 10 fiscal years.

[1]42 U.S.C. § 1862p–9(b).

**Figure 3: NSF Funding for the Established Program to Stimulate Competitive Research (EPSCoR), Fiscal Years 2012-2021**

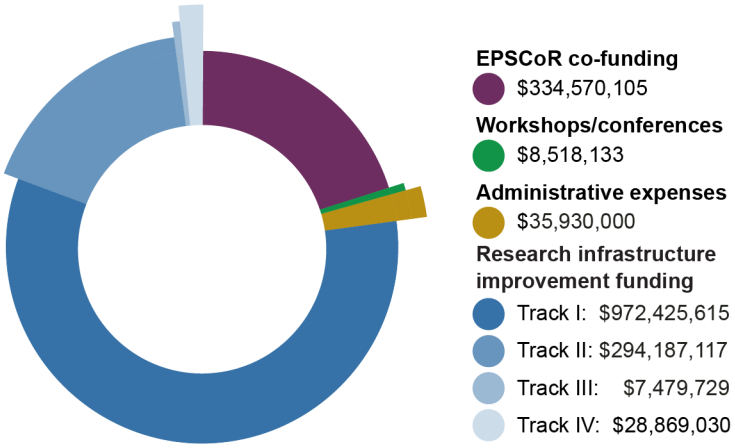



Source: GAO analysis of data from the National Science Foundation (NSF). | GAO–22–105043

Within research infrastructure improvement awards, the $20 million jurisdiction-wide research and capacity building awards (Track 1) made up the largest share of total obligations during 10-year period from fiscal years 2012 through 2021. Collaborative awards among jurisdictions (Track 2) made up the second-largest share, followed by research fellowship awards (Track 4). Awards to broaden participation of underrepresented groups in STEM (Track 3) made up a relatively small part of obligations during the 10-year period because these awards were only distributed during fiscal years 2013 and 2014. Similarly, solicitations

for research fellowship awards (Track 4) were piloted in fiscal year 2017. Figure 2 shows total obligations for EPSCoR for fiscal years 2012 through 2021, broken down by investment strategies and research infrastructure improvement award tracks.

**Figure 4: NSF Established Program to Stimulate Competitive Research (EPSCoR) Total Funding, Fiscal Years 2012-2021**




Source: GAO analysis of data from the National Science Foundation (NSF). | GAO-21-105043.

Over the past 10 fiscal years, EPSCoR jurisdictions received on average $53.1 million in program awards. The amounts received by individual jurisdictions ranged from a low of $15.6 million for Guam to a high of $86.2 million for Louisiana. Several factors can account for differences in jurisdictions' awards:

- Five jurisdictions—Iowa, Missouri, New Mexico, Tennessee, and Utah—did not meet the program's eligibility requirements in recent years.
- Jurisdictions can vary in the number and quality of research proposals they submit to NSF, which can affect the number of proposals that NSF funds.
- Jurisdictions can have years in which they do not receive funding for a research capacity development (Track 1)—for example, if they submit a Track 1 proposal that NSF does not fund because it does not meet the agency's merit review criteria.

See table 7 for a breakdown of each jurisdiction's EPSCoR funding for fiscal years 2012 through 2021.

**Table 7: Funding for Jurisdictions under NSF EPSCoR, Fiscal Years 2012-2021 (dollars in millions)**

| Jurisdiction | Track 1 funding | Track 2 funding | Track 3 funding | Track 4 funding | Co- funding | Other Funding[a] | Total |
|---|---|---|---|---|---|---|---|
| Alabama | $30.2 | $7.7 | $0.7 | $3.2 | $25.9 | $0.6 | **$68.3** |
| Alaska | 38.1 | 1.9 | 0.8 | 1.6 | 6.1 | 2.1 | **50.7** |
| Arkansas | 40.5 | 8.5 | 0.8 | 0.7 | 17.0 | 0.3 | **67.7** |
| Delaware | 39.7 | 14.4 | — | 1.2 | 14.2 | 0.1 | **69.6** |
| Guam | 15.2 | — | — | — | 0.5 | 0.0[b] | **15.6** |
| Hawaii | 28.9 | 1.0 | — | 1.1 | 9.7 | 0.3 | **40.9** |
| Idaho | 40.1 | 18.7 | 0.7 | 0.9 | 16.3 | 0.2 | **76.9** |
| Iowa | 12.0 | 1.0 | — | 0.3 | 13.2 | 0.2 | **26.8** |
| Kansas | 31.0 | 22.2 | — | 1.6 | 13.2 | 0.0 | **68.0** |
| Kentucky | 35.9 | 11.8 | 0.7 | 1.5 | 15.5 | 0.1 | **65.6** |
| Louisiana | 44.5 | 21.6 | 0.7 | 2.0 | 17.4 | 0.1 | **86.2** |
| Maine | 39.7 | 19.5 | 0.7 | 0.6 | 7.5 | 0.7 | **68.7** |
| Mississippi | 28.7 | 17.2 | — | 1.0 | $12.9 | 0.0 | **59.9** |
| Missouri | 20.4 | 2.8 | — | — | 6.1 | 0.2 | **29.5** |
| Montana | 32.9 | 10.4 | — | 1.2 | 13.5 | 0.8 | **58.7** |
| Nebraska | 38.6 | 13.6 | 0.7 | 0.8 | 12.1 | 0.0 | **65.9** |
| Nevada | 25.4 | 2.0 | 0.7 | 1.0 | 8.8 | 0.1 | **38.0** |
| New Hampshire | 33.8 | 23.5 | 0.8 | 1.0 | 7.7 | 0.5 | **67.2** |
| New Mexico | 39.2 | 7.9 | — | 0.5 | 15.7 | 0.3 | **63.6** |
| North Dakota | 33.7 | 10.2 | — | 0.6 | 9.3 | 0.3 | **54.0** |
| Oklahoma | 32.7 | 6.0 | — | 1.6 | 17.4 | 0.0 | **57.7** |
| Puerto Rico | 17.1 | 7.0 | — | 0.2 | 9.4 | 0.0 | **33.7** |
| Rhode Island | 32.4 | 15.4 | — | 1.3 | 6.2 | 0.1 | **55.4** |
| South Carolina | 28.0 | 21.2 | — | 1.5 | 18.7 | 0.8 | **70.2** |
| South Dakota | 43.9 | 14.3 | — | 1.4 | 6.0 | 0.4 | **66.0** |
| Tennessee | 12.0 | — | — | — | 6.4 | 0.8 | **19.1** |
| Utah | 20.2 | — | — | — | 5.5 | 0.1 | **25.7** |
| Vermont | 32.0 | 8.2 | — | 0.7 | 5.1 | 0.1 | **46.0** |
| Virgin Islands | 33.0 | — | — | 0.2 | 0.3 | 0.2 | **33.7** |
| West Virginia | 32.8 | 6.0 | — | 0.4 | 11.3 | 0.1 | **50.5** |
| Wyoming | 40.0 | — | — | 0.8 | 6.1 | 0.1 | **47.0** |
| **Total** | **972.4** | **294.2** | **7.5** | **28.9** | **334.6** | **9.3** | **1,646.8** |

Legend: — = jurisdiction did not receive funding.

Source: GAO analysis of National Science Foundation (NSF) data. | GAO-22-105043

[a]Other funding includes workshops and conferences, and RII Additional. In 2020, NSF Established Program to Stimulate Competitive Research (EPSCoR) introduced a Collaborative Research

Proposal (RII Additional), also known as Cultivating Indigenous Research Communities for Leadership and Education in Science, Technology, Engineering, and Math (STEM). This proposal falls outside of the traditional RII Tracks and would normally fall under the "Outreach category," but was funded through a different mechanism.

[b]The values in Table 7 are rounded to the nearest million. Jurisdictions that receive less than $50,000 in "[a]Other funding" are assigned "$0.0".

# Appendix IV: Jurisdictions' EPSCoR Eligibility Status and Share of Total NSF Funding

Jurisdictions are eligible to participate in the National Science Foundation's (NSF) Established Program to Stimulate Competitive Research (EPSCoR) if their most recent 5-year level of total NSF funding is equal to or less than 0.75 percent of the total NSF budget (excluding EPSCoR funding and NSF funding to other federal agencies).[1]

Jurisdictions that have been established in the EPSCoR program and whose share of total NSF funding is above 0.75 percent but less than 0.80 percent are allowed to remain EPSCoR-eligible for up to 5 years. See table 8 for detailed eligibility status and share of total NSF funding for the past 5 years.

**Table 8: Status of Jurisdictions' EPSCoR Eligibility and Share of Total NSF Funding**

Dollars in millions

| Jurisdiction | Fiscal years of EPSCoR eligibility[a] | Total adjusted funding, fiscal years 2017 to 2021[b] | Percent of NSF budget, fiscal years 2017 to 2021[c] |
|---|---|---|---|
| Guam | 2012-present | $3.0 | 0.01% |
| Virgin Islands | 2002- present | 13.4 | 0.04 |
| Vermont | 1985- present | 47.8 | 0.13 |
| South Dakota | 1987- present | 49.2 | 0.13 |
| North Dakota | 1985- present | 59.4 | 0.16 |
| West Virginia | 1980- present | 62.7 | 0.17 |
| Puerto Rico | 1985- present | 76.4 | 0.21 |
| Wyoming | 1985- present | 82.1 | 0.22 |
| Mississippi | 1987- present | 96.9 | 0.26 |
| Maine | 1980- present | 97.6 | 0.27 |
| Idaho | 1987- present | 101.7 | 0.28 |
| Arkansas | 1980- present | 102.3 | 0.28 |
| Nevada | 1985- present | 115.7 | 0.32 |
| Kentucky | 1985- present | 145.3 | 0.40 |
| Nebraska | 1992- present | 146.3 | 0.40 |
| Montana | 1980- present | 149.3 | 0.41 |
| Oklahoma | 1985- present | 154.1 | 0.42 |
| New Hampshire | 2004- present | 161.8 | 0.44 |
| Delaware | 2003- present | 169.5 | 0.46 |
| Kansas | 1992- present | 170.4 | 0.46 |

[1]Jurisdictions include all 50 states as well as the District of Columbia, Guam, Puerto Rico, and the U.S. Virgin Islands.

Dollars in millions

| Jurisdiction | Fiscal years of EPSCoR eligibility[a] | Total adjusted funding, fiscal years 2017 to 2021[b] | Percent of NSF budget, fiscal years 2017 to 2021[c] |
|---|---|---|---|
| Louisiana | 1987- present | 192.4 | 0.52 |
| South Carolina | 1980- present | 212.5 | 0.58 |
| Hawaii | 2001- present | 231.8 | 0.63 |
| Rhode Island | 2004- present | 232.4 | 0.63 |
| New Mexico | 2001-2017, 2019-present[d] | 232.6 | 0.63 |
| Alaska | 2000- present | 247.1 | 0.67 |
| Iowa | 2009-2012, 2019- present | 252.3 | 0.69 |
| Alabama | 1985- present | 271.7 | 0.74 |
| Missouri | 2012-2014 | 321.4 | 0.88 |
| Utah | 2009-2012 | 325.9 | 0.89 |
| Tennessee | 2004-2012 | 371.4 | 1.01 |
| Connecticut | - | 383.6 | 1.05 |
| Minnesota | - | 486.6 | 1.33 |
| Wisconsin | - | 596.4 | 1.63 |
| Georgia | - | 773.7 | 2.11 |
| Arizona | - | 778.0 | 2.12 |
| New Jersey | - | 790.5 | 2.15 |
| Oregon | - | 795.4 | 2.17 |
| Washington | - | 804.1 | 2.19 |
| Indiana | - | 825.2 | 2.25 |
| Virginia | - | 853.8 | 2.33 |
| Ohio | - | 977.4 | 2.66 |
| North Carolina | - | 1,016.1 | 2.77 |
| Florida | - | 1,136.0 | 3.10 |
| Michigan | - | 1,147.4 | 3.13 |
| Pennsylvania | - | 1,463.9 | 3.99 |
| Illinois | - | 1,556.4 | 4.24 |
| Colorado | - | 1,693.4 | 4.61 |
| District of Columbia | - | 1,821.1 | 4.96 |
| Maryland | - | 1,870.0 | 5.10 |
| Texas | - | 2,051.7 | 5.59 |
| New York | - | 2,547.9 | 6.94 |
| Massachusetts | - | 2,636.1 | 7.18 |
| California | - | 4,690.4 | 12.78 |

Legend: - = jurisdiction was never eligible for Established Program to Stimulate Competitive Research (EPSCoR).

Source: GAO analysis of National Science Foundation (NSF) data. | GAO-22-105043.

[a]Years of eligibility correspond to years that jurisdictions first received funding or became eligible for funding and years that they lost eligibility because the jurisdictions exceeded the eligibility threshold funding level.

[b]To determine jurisdictions' eligibility for EPSCoR, NSF adjusted jurisdictions' funding amounts to exclude EPSCoR funding and NSF funding to other federal agencies.

[c]Percentages are NSF's calculations based on a total combined budget for fiscal years 2017 through 2021 of $36.7 billion.

[d]New Mexico lost eligibility in fiscal year 2018 but regained it in fiscal year 2019.

# Appendix V: Comments from the National Science Foundation

National Science Foundation
Office of the Director

July 27, 2022

Candice N. Wright
Director
Science, Technology Assessment, and Analytics
U.S. Government Accountability Office
441 G Street, NW
Washington, D.C. 20548

Dear Ms. Wright:

Thank you for the opportunity to review and provide comments on the Government Accountability Office (GAO) draft report, *National Science Foundation: Better Reporting Could Give More Visibility into Gains in States' Research Competitiveness* (GAO-22-105043). The National Science Foundation (NSF) values the GAO staff's professionalism and many constructive interactions during this GAO engagement.

NSF appreciates GAO's acknowledgement of agency efforts to increase STEM capacity and competitiveness in EPSCoR jurisdictions. NSF concurs with the recommendation made by GAO for additional actions the agency should take to enhance its annual reports to Congress. The Foundation is in the process of identifying data that will improve its annual congressional reports to more fully convey the program's gains. In its future congressional reports, NSF intends to include measures of jurisdictions' success in broadening participation in STEM, among other relevant data.

Again, thank you for the opportunity to review and comment on this draft report. Please feel free to contact Veronica Shelley at vshelley@nsf.gov or 703-292-4384 if you have any questions or require additional information. We look forward to working with you again in the future.

Sincerely,

Sethuraman Panchanathan
Director

*2415 Eisenhower Avenue, Suite 19100 Alexandria, VA 22314*

# Appendix VI: GAO Contact and Staff Acknowledgments

## GAO Contact

Candice N. Wright, (202) 512-6888, wrightc@gao.gov

## Staff Acknowledgments

In addition to the contact named above, Joseph Cook (Assistant Director), Summer Lingard-Smith (Analyst-in-Charge), Xiang Bi, Virginia A. Chanley, Eric T. Charles, Louise Fickel, Rebecca M. Gertler, Patrick L. Harner, Abigail M. Loxton, Matty S. Njie, Tim Planert, Joseph Rando, and Jack Wang made key contributions to this report.

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