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In Defense of the NSF Economics Program

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In 1975, Senator William Proxmire of Wisconsin began a series of highly publicized "Golden Fleece" awards for purportedly frivolous federally funded research projects. His first award was to the National Science Foundation for a social science grant of $84,000 to investigate the reasons that people fall in love. Not coincidentally, in 1981, the federal Office of Management and Budget proposed to Congress a 75 percent reduction in the NSF social science budget, with some of that funding being shifted to the natural sciences, because social science research "was of lesser importance to the economy than the support of the natural sciences." While that specific reduction did not pass Congress, the NSF Economics Program budget did fall by 40 percent from about $10 million in fiscal year 1980 to approximately $6 million three years later. The budget did not re-attain its 1980 real value until 1996 but, since then, it has gone through periods of expansion and contraction. By fiscal year 2013, the real Economics Program budget had again fallen below its 1980 value.

The stagnation of the NSF Economics Program budget has not been the result of general fiscal challenges facing the federal government, but rather of a targeted effort to promote other areas of research at NSF. Indeed, the overall NSF budget has grown sevenfold since 1980 while the Economics Program budget has risen only two-and-a-half times. As a result, the Economics Program budget currently constitutes one-half of 1 percent of the total NSF budget, down from a little over 1 percent in 1980.

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In the last several years, reductions in economics and social science research funding have again been proposed. A Congressional study of the National Science Foundation in 2011 argued that there was widespread waste in its funding (Coburn 2011). It cited the Panel Study of Income Dynamics (partly funded by the NSF Economics Program) as one example of waste, and also listed a study of dynamic pricing in a perishable goods market as a second example. The latter study, later published in the *Journal of Political Economy*, involved dynamic pricing of how ticket prices to sporting events change as the time of the event approaches (Sweeting 2012).

In February 2013, Eric Cantor of Virginia, then the Majority Leader of the House of Representatives, stated: "Funds currently spent by the government on social science … will be better spent helping find cures to diseases." He later added that he was strongly in favor of increasing biomedical funding at NSF and "reducing funding for lower-priority programs like social and political science research" (Cantor 2013a, b). In May 2015, the House of Representatives passed authorizing legislation that, breaking with precedent, required specific appropriations for different NSF directorates—rather than letting NSF itself set scientific priorities—and specified a 45 percent reduction in the NSF directorate for social and behavioral sciences. In June 2015, the House of Representatives passed appropriations legislation that would have redirected a substantial amount of the NSF budget for the social and behavioral sciences to the natural sciences and engineering.[1]

Economics research has also been challenged in agencies other than NSF. In July 2012, the House Subcommittee on Labor, Health and Human Services, and Education recommended to the full House Appropriations Committee a prohibition on any funds given to the National Institutes of Health (NIH) to be used "for any economic research programs, projects, or activities" (COSSA 2012). While this legislation did not pass Congress, the NIH announced administrative regulations in November 2015 that singled out economics research for special treatment, explicitly prohibiting several specific areas of health economics from NIH support.

Economists are rarely of a single opinion on any subject, and the value of government support for economic research is no exception. Milton Friedman (1981) argued that the cuts proposed to the Economics Program at NSF should be extended to the natural sciences; indeed, he proposed that the National Science Foundation be abolished. He argued that the peer review process in academic journals does not reward innovative research and that academic institutions, foundations, and donations from private individuals would be better funders of economics research than the government. This led to a lively debate in the pages of this journal, with then

[1] This legislation is still pending in Congress. Social science funding at NSF other than the Economics Program has also been targeted. In March 2013, Congress passed legislation, later signed by President Obama, that directed that NSF could no longer fund any projects in its political science program unless they were certified by the NSF Director as "promoting national security or the economic interests of the United States" (Consolidated and Further Continuing Appropriations Act of 2013, P.L. 113-6, Division B, Title III, Sec. 543, enacted March 26), another interference in the process of peer review by which the merit of scientific investigations is ordinarily determined. This restriction was lifted in legislation passed by Congress in January 2014.

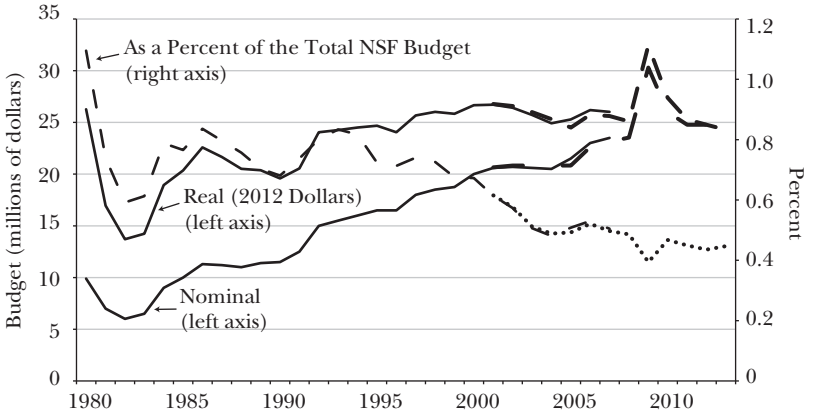
AEA President-Elect Zvi Griliches (1992) arguing in support of NSF funding for economics—citing the importance of peer review in picking the most scientifically worthy studies to fund and bemoaning the public perception that economics funding "is just another barrel of pork"—and Friedman and others (1994), including Merz et al. and Laband et al., taking the opposing side several issues later.

In this essay, I reconsider the case for government funding of economic research, with the NSF Economics Program as the leading example. I first set the stage with some background and statistics concerning the NSF Economics Program, and I present some examples of how NSF-supported economic research has made major contributions to a more informed discussion of policy tradeoffs and alternatives. I then tackle the more difficult question of whether the type of economics research funded by NSF would be supported by other agents and institutions in the absence of NSF with a detailed discussion of the issue. It is of course impossible to know what would happen in the counterfactual world where the NSF did not exist or was much smaller than it is now. I use the traditional public goods argument for governmental support for research that is in the general societal interest to argue that neither private firms, universities (at least those without large endowments), foundations, nor private individuals would likely provide comprehensive support for basic economics research across all areas in the discipline in the way that the NSF Economics Program does, although there are several specific areas of economics research where nongovernment funders have been important. Finally, I briefly review the small empirical literature examining the impact of research on outcomes related to scientific productivity, a literature which is weak and inconclusive and, in fact, virtually nonexistent for government economics funding specifically. Despite the weakness of this empirical evidence, I argue that the a priori case for government funding of comprehensive, general-purpose basic economics research is very strong. Further, the NSF Economics Program has an excellent record of funding research in areas that have made major contributions to the discipline and to public policy.

Overview of the NSF Economics Program

The NSF Economics Program was created in 1960 and funds basic research in economics across all subfields in the discipline (the definition of "basic research" is a little fuzzy and will be discussed further below). The Program currently receives proposals twice a year, proposals which are first evaluated by a set of outside reviewers drawn from the profession and then by a committee of NSF-appointed economists with rotating terms. The committee members read the outside reviews, add their own critical evaluations, and then rank the proposals. The NSF program officers then fund proposals based on the rankings and on available funds. The average size of an award currently is approximately $75,000 per year (although there is considerable variation around that average) including indirect costs and with a typical duration of three years. In recent years, the Program receives about 200–300 proposals per year and approximately 20–30 percent of proposals are funded, hence

Figure 1
NSF Economics Program Budget, 1980–2013



Source: The series from 1980–2007 are from Plott (2010, figure 3). The series from 2001–2013 are from personal correspondence with Dr. Nancy Lutz. The increase in 2009 is from the American Recovery and Reinvestment Act.

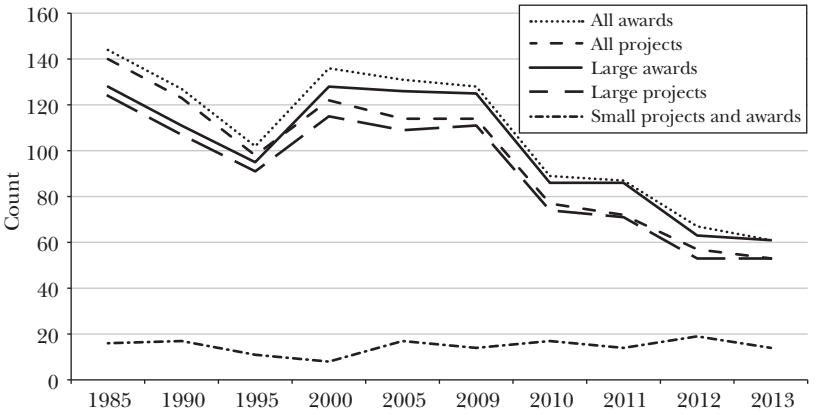
making about 60 grants per year. Approximately one-quarter of funded proposals go to young investigators rather than senior and established researchers.

Figure 1 shows the size of the NSF Economics Program budget in real and nominal terms from 1980 to 2013 as well as its value relative to the total NSF research budget. In the last few years, total spending of the Economics Program has been about $25 million. As noted, its real value was lower in 2013 than in 1980 (the one-shot infusion of additional funds a few years ago was part of the American Recovery and Reinvestment Act of 2009). Figure 2 shows trends in the number of Projects and Awards since 1985. Separate awards are often made to two or more researchers who are located at different institutions but their research constitutes only one project, so there are always more awards than projects. But both have generally declined over time, especially since 2009, and the decline in projects and awards has mainly occurred in the funding of large grants (note that, for small grants, there is no distinction between awards and projects since they are always made to only one institution). Figure 3 shows trends in the median size of awards and projects, both for all grants as well as for small and large ones separately. Award and project sizes in aggregate grew significantly in the early 1990s, then grew more modestly after that.[2]

NSF Economics makes awards with budgets that cover faculty salary, research assistant expenses, lab experiment and capital expenses, field experiment expenses,

[2]The drop in 2012 was for idiosyncratic reasons, as applications with multiple Principal Investigators declined, NSF program staff made an effort to reduce the size of many awards, and some funds in that year were used to pay off awards made in earlier years.

Figure 2
Number of NSF Economics Awards and Projects, 1985–2013



Source: Personal communication with Dr. Nancy Lutz. Small awards are those of $50,000 or less (2012 dollars) and large awards are those of more than $50,000.

Figure 3
Median Size of Awards and Projects, 1985–2013
(in real 2012 dollars)

Source: Personal communication with Dr. Nancy Lutz. Small awards are those of $50,000 or less (2012 dollars) and large awards are those of more than $50,000. Figures are in real 2012 CPI-U-RS (Consumer Price Index for Urban Consumers, Research Series) dollars.

the cost of data acquisition, travel, and other items. The current average breakdown of budgets across these categories is approximately 30 percent for the salary of the Principal Investigator(s), 25 percent for graduate student support, 32 percent for indirect costs, and 13 percent for everything else.[3] In addition, while the official NSF position on salary support is that it will pay up to two months of summer salary, at a rate of two-ninths of the faculty member's nine-month salary, it reserves the right to negotiate the amount and, in practice, it has generally limited the total amount to $25,000 per year since 2009. That amount is currently about 15 percent of the mean salary of full professors in economics at PhD-granting institutions (Scott and Siegfried 2014) and hence less than two-ninths. NSF funding cannot be used to pay for a lighter teaching load (although much NIH funding does so).

NSF reviews and ranks proposals on two criteria: Intellectual Merit and Broader Impacts. The former basically covers the scientific merit of the project, including the importance of the question and the validity and quality of the research design. It is important to note that NSF tries not to take a position on the relative importance of different subfields within economics, different methodological approaches, or theory versus empirical work. It accepts proposals, and appoints review committee members, who represent all the major fields in economics, from pure theory to applied microeconomics, and from econometric theory to macroeconomics. It is fair to say that it makes an attempt to fund the highest-quality proposals in each major subfield of the discipline.

The Broader Impacts criterion, at least in Economics, refers in many cases to the promise of the project to bear on some issue of public policy or guidance for future policy decisions. A substantive emphasis on the criteria used in the Broader Impacts has been present for most of the NSF's history (Rothenberg 2010), but the term was made official in its current form only in 1996. Over time, reviewers have been encouraged to give it more weight in their rankings. For economics proposals, however, almost any topic can be argued to affect knowledge of the real world, however tangentially, and hence to have some bearing on policy at least in some indirect way. In addition, NSF sees its role as supporting basic research, which includes research that is relevant to policy only indirectly. So-called line agencies of the federal government, which administer specific government programs and fund research on those programs, have a different goal than basic research.

The Broader Impacts criterion also includes whether the project benefits teaching, training, and learning of students; whether underrepresented minorities are likely to benefit; and whether research infrastructure is enhanced by the project. These criteria presumably reflect social goals that NSF, either by itself or from the

[3] These percentages are from the budgets as presented in the proposals at the time of initial awards, but differ from the actual allocations because NSF allows considerable freedom to principal investigators to shift funds across categories during the later periods of the award. Like all government agencies, NSF pays average cost, not marginal cost, thereby subsidizing some of the activities of the organizations receiving the funding.

direction of the legislative or executive branches, have judged to be in the society's best interest.

Examples of NSF-Supported Research on Policy Issues

The NSF Economics program provides support to basic research, although that term differs from its common usage in economics. Economists distinguish between "pure theory" and "applied theory," between "pure econometrics" and "applied econometrics," and between "microeconomic theory" and "applied microeconomics," for example. But all these fields are basic in the sense used in government research funding, for even applied research in economics often does not concern specific programs (think of the vast literature on estimating the rate of return to education, for example, or the estimation of wage elasticities of labor supply). Nevertheless, much of the "basic" research funded by NSF has indeed concerned policy issues, which is not surprising since so much of the research in the discipline in general is policy-oriented and has become more so over time. Although most of that research has been empirical, there have been significant theoretical developments in policy areas like optimal taxation, market structure and antitrust, and school choice designs, to name only three.

The argument here will be that the economic research on policy issues that NSF has funded represents a major intellectual achievement and has greatly informed public discussions of policy issues in a large number of areas. However, whether economic research on policy issues has had a significant impact on policy itself is a separate question and one on which the views of economists differ. Plott (2010), for example, offers a lengthy discussion of the fundamental contributions of economic research in general to policy, ranging across a vast number of areas, and his discussion overlaps heavily with the types of projects funded by NSF since NSF tries to support general economic research. Indeed, the volume in which Plott's essay appears is devoted to the demonstration of the impact of economic research on policy in a variety of areas. On the other hand, many economists are quick to point out the failure of economic principles to affect policy, citing examples like the failure to enact a carbon tax, the existence of a seriously inefficient tax system, and the failure of economic research on welfare programs to have any effect on welfare reform policy.

Table 1 lists a (decidedly nonexhaustive) sampling of topics that NSF has supported over the years that have had a major impact on policy discussions, and sometimes on policy itself, together with just one or two illustrative citations for each. For example, the Economics Program has supported many studies in the area of environmental economics, cap-and-trade systems, carbon taxation, and related issues, including supporting the work of Nordhaus, Oates, and other economists working in the area.[4] The early promotion of emissions trading systems by

[4]All the topics noted in Table 1, and all economists who are named in this section, can be found in the NSF list of past awards at http://www.nsf.gov/awardsearch/.

Table 1
Areas of Policy Contribution by NSF-Supported Research

Topic	*Description*	*Illustrative Citations*
Emissions trading	Extensive research supported by NSF Economics on emissions trading and cap-and-trade systems was followed by federal legislation for sulfur dioxide trading and by several state-level trading systems	Baumol and Oates (1971)
Monetary policy	Research establishing the importance of expectations, predictable policy rules, and aggressive responses to inflation led to a long period of stability of national GDP	Taylor(1980)
Measurement of inflation	NSF-sponsored research contributed to the discovery of multiple biases in the construction of the Current Price Index that had resulted in an overstatement of inflation by over 1 percentage point per year, affecting COLAs for Social Security	Boskin et al. (1996)
Inflation-indexed bonds	Much research supported by the Program has concerned asset markets and their prices and how inflation-indexed bonds offer investors a more secure asset, contributing to the understanding of such bonds offered by the US Treasury since 1997	Campbell et al. (2009)
Trade liberalization	The NSF program supported numerous studies of the complex relationship between trade liberalization and growth, contributing to the public policy discussions that led to major liberalizations in the 1990s	Grossman and Helpman (1994)
Deregulation	NSF supported a large number of studies of deregulation of the airline industry, electricity markets, financial markets, and the hospital industry, studies which influenced public policy on deregulation over several decades	Bailey and Williams (1988); Rassenti and Smith (1998)
Government auctions	NSF-supported research on auction design led to improvements in government auctions of the radio spectrum yielding a revenue gain of $100 billion. Economic research also informed auction designs for airport slots, offshore oil leases, forests, toxic assets, and mineral rights	Milgrom and Weber (1982); Wilson (1992)
Antitrust	Among many other topics, economic research on cross-price elasticities of demand in differentiated product markets have influenced DoJ and FTC Horizontal Merger Guidelines	Berry, Levinsohn, and Pakes (1995)
Kidney transplantation	Research on methods of overcoming obstacles to kidney exchange among incompatible donors led to new organizations of exchanges that saved thousands of lives	Roth et al. (2005)
Private pensions	Behavioral economics research on undersaving for retirement and passive behavior in the face of default rules led to major 2006 federal legislation changing default rules and other pension characteristics	Choi et al. (2002); Thaler and Benartzi (2004)

economists contributed to the turnaround of opinion on the usefulness of the approach and to both national and state-level policy enactments utilizing variants of the idea. However, once again, it can be argued that economists' ideas on this topic have not influenced policy to nearly the extent they should.

NSF-funded economics research supported the development of macroeconomic theories with model-consistent expectations and associated studies of monetary theories and macroeconomic dynamics, including the work of Kydland, Lucas, Phelps, Prescott, Sargent, and Wallace in the 1970s and 1980s. This work has had fundamental repercussions both on academic theories of the business cycle and economic growth, as well as on thinking about government policy. Some might argue that this work has had more methodological influence on subsequent policy-oriented work in macroeconomics than a direct influence on policy (for example, on monetary neutrality), but Taylor (2010) argues otherwise. One occasionally hears the argument that NSF funding decisions are biased toward research that casts a favorable light on government programs, but much of this research provides a definitive counterexample because much of it suggests the weakness of certain government macroeconomic policies. NSF also supported research by Taylor leading to the well-known Taylor Rule, which has also had a major impact on monetary policy.

Improved price indices and the measurement of inflation provide an example of a topic commonly regarded by the public as an obscure technical problem but which has implications for virtually every area of the discipline and for the application of economics to the real economy. NSF Economics has supported the research of Boskin, Diewert, Gordon, Griliches, Hausman, Jorgensen, Pollak, and Rosen, among many others, on this topic. Much of that NSF-funded research fed into the analysis and recommendations of the well-known Boskin Commission Report (Boskin et al. 1996; discussed in a six-paper "Symposium on Measuring the CPI" in the Winter 1998 issue of this journal). This research had a major impact on price index development in the federal government, especially the development of the Consumer Price Index for Urban Consumers, Research Series (CPI-U-RS), which is now widely preferred to the plain vanilla CPI. Another important policy-related topic in inflation concerns the development and impact of inflation-indexed bonds, which are now being offered by the US Treasury and are a key component of the portfolio of many investors (in this journal, see Wilcox 2008). Economic researchers who work on pricing in asset markets and portfolio decisions have been supported by NSF Economics, and their research has contributed to the understanding of those Treasury bonds, as illustrated by the work of Campbell, Shiller, and Viceira.

Yet another area of NSF Economics support has been in the controversial area of trade liberalization and growth. Particularly in the 1990s, NSF supported the research of Edwards, Grossman, Helpman, Paul Romer, and many others working in the area. The research by economists made major contributions to the complex issues involved in trade liberalizations. More recently, the Program has supported numerous studies of international trade between developed countries as well, both general models of trade as well as of specific trade agreements such as the North

American Free Trade Agreement (see Kehoe and Ruhl 2013, for one of many possible examples). Again, however, the politics of trade barriers has proved to be an obstacle to fully incorporating the lessons of economic research in the area.

NSF Economics has supported a large number of studies in the area of industrial organization, including research on estimation of cross-price elasticities of demand in differentiated product markets, which has had a major influence, both theoretically and computationally, on the development of Horizontal Merger Guidelines jointly authored by the US Department of Justice and the Federal Trade Commission (2010). Going farther back, the extensive theoretical and empirical literature on resale price maintenance, which dates at least back to influential economic research in the 1960s (for example, Telser 1960), has been supported by the NSF Economics Program. Another major area of NSF support in the area of industrial organization has been support of economic research on deregulation, applied to many different industries including airlines, electricity, banking, and hospitals (in addition to the illustrative citations in the table, see Kahn 1971; Bailey, Graham, and Kaplan 1985). Legislative actions and decisions in both the executive branch and the courts have used this research to make major changes in public policy toward regulation.

The Economics Program has also given major support to research on auction methods. This is an area where there was rapid development of theory starting in the late 1980s, accelerating in the 1990s, and continuing to this day. Research of Ledyard, McMillan, Milgrom, Plott, Roth, Smith, Wilson, and others has been supported. This research had a direct impact on the auctioning of the radio spectrum in 1995 with a revenue gain of $100 billion to the federal government (McAfee, McMillan, and Wilke 2010). In another area of mechanism design, NSF has supported research on the development of kidney exchanges, which has led to important reworking of those exchanges in actual practice. Somewhat similar methods have been used to generate deferred-acceptance algorithms for public schools in New York and Boston that solved serious problems with methods that had been used previously (for a review, see Roth 2010).

Economic research on behavioral economics has also been supported by the NSF Economics program. One example of NSF-support research with a policy impact concerns default rules for saving. Years of research by economists on this issue led to federal legislation in 2006 that changed pension default provisions. More recently, an Executive Order by the White House (2015) directed all agencies to use behavioral economics insights in the design of their programs. The Executive Order also mentioned another recent governmental reform based on NSF-supported research, a reform to simplify and streamline college financial aid application forms as of the 2017–2018 application year. Those forms have been a long-standing source of barriers to application because of their complexity and length. NSF-supported research in this area includes Bettinger, Long, Oreopolous, and Sanbonmatsu (2012), which showed that simplifications in, and streamlining of, the Free Application for Federal Student Aid (FAFSA) application form increased application rates and, ultimately, college attendance rates.

The NSF Economics Program has also supported many individual economists who are widely regarded as having made major contributions to the discipline. The program has supported every Nobel Prize winner in Economics since 1998 and almost every John Bates Clark medal winner since 1961. It has supported the research of ten out of the last eleven chairs of the Council of Economic Advisors, including those serving under both Republican and Democratic administrations, constituting further testimony to the support of economists who engage with real-world policy problems. The Economics Program has provided partial support to the Carnegie-Rochester Public Policy conference and the Brookings Panel on Economic Activity. Datasets like the Panel Study of Income Dynamics (PSID), whose core funding is provided by NSF, and the Health and Retirement Study (HRS), whose core funding is provided by the National Institutes of Health, have generated thousands of published articles in economics journals: for example, a Google Scholar search on the Panel Study of Income Dynamics yields 24,000 hits as well as 12,900 hits for the Health and Retirement Survey.

None of this evidence proves that NSF funds have been solely responsible for the research or that the research would not have been done otherwise. (The next section takes up this question.) In addition, the topics supported by the NSF have also been supported by many other funders and institutions as well. However, the evidence does demonstrate that NSF has successfully identified some of the best research in the discipline and has supported projects in areas of economics that have had a major impact on informed discussions of public policy, and often on policy itself.

Would Economics Research Be Underfunded in the Absence of NSF?

The key question for assessing the value of NSF Economics Program funding is: what is the marginal social benefit of another dollar of funding or, alternatively, the marginal social benefit of the total budget of the Program? A subquestion concerns the marginal social benefit of funding different types of research (theory versus empirical, for example). In principle, these should be empirical questions to be answered with data but, perhaps unsurprisingly, determining the answers is difficult and there is essentially no credible existing evidence addressing these questions. In the absence of determining evidence, circumstantial and indirect reasoning must be brought to bear.

First, I should make one general point: it is important to recognize the small size of the NSF Economics Program. It funds only 60 new grants per year, spread out over all subfields in economics, and each grant lasts about three years, which means that about 180 are in place in any given year. There are about 12,000 AEA members at academic institutions in about 800 departments of economics, and if NSF were to fund only the 180 best research projects from those members, a very large number of meritorious proposals would obviously go unfunded. In addition, given its tiny

size, it is not surprising that the aggregate impact of NSF on research in the entire discipline of economics is small and that most papers published in economics journals are not NSF-supported. But this is irrelevant to the question of whether the marginal benefit of another dollar of NSF spending is large or small: indeed, it may only demonstrate that the NSF Economics budget should be dramatically increased.

Also, the annual NSF Economics Program budget of $25 million is miniscule by almost any comparison. The NIH spends approximately $194 million per year on a wide range of economics projects, which is about eight times the NSF budget, even though it is focused only on health economics (Schuttinga 2011). Moreover, most NIH economics funding is basic research in the governmental meaning of the word. To believe that the current allocation is an optimal allocation of government expenditure, one also must believe that NSF dollars spent on economics topics like those in Table 1 have a very low marginal social benefit relative to dollars spent on health economics. It is likely that spending within the Federal Reserve System on basic research in macroeconomics (again, just one subset of economics) is also larger than at the National Science Foundation.

Other major funders of economics research also provide support in excess of $25 million or slightly lesser amounts but for much more specialized uses. The National Bureau of Economic Research spends $32 million per year on its research programs and administrative expenses[5] yet concentrates its activities on only a select number of areas, mostly empirical, in the discipline. The Russell Sage Foundation, a small foundation focusing entirely on social policy funding, spends $13 million per year on its activities, more than a half of what NSF Economics spends, despite the relative narrowness of its agenda.[6]

Despite the small scale of the NSF Economics Program, there are those who believe that its marginal social benefit is small, or even negligible. The primary argument in favor of this position is that economists who are funded by NSF would have done the same research without the funding. Cochrane (2012) represents the views of many economists in arguing that academic economists use government funding to conduct the research they would have done otherwise. Milton Friedman, as noted, was of the view that universities, foundations, and private philanthropists should be the funders of economic research instead of the government. A particularly stark way to address this issue is to ask the hypothetical question of whether, if NSF were abolished as Friedman proposed, other institutions would pick up the slack and provide the same funding as NSF currently does or, more generally, whether the same amount of research would take place. If so, then all the NSF research supporting the topics in Table 1 would have been conducted anyway and the marginal social benefit of NSF is effectively zero. While such a counterfactual is inherently speculative, it is worth conducting this thought experiment in some detail because it puts the potential marginal social benefit of NSF into useful

[5] NBER Summary Financial Statement for the fiscal year ended June 30th, 2015; available at http://www.nber.org/info.html (accessed June 28, 2016).

[6] Audited financial statement for fiscal year 2015, http://www.russellsage.org/about/financial-statements.

perspective. The rest of this section discusses, therefore, whether private firms, universities, foundations, or private philanthropists would fund economic research to the same degree as NSF.

Private firms fit the classic public goods model, where the free rider problem would lead to underprovision of a public good by a private firm. Research that produces public knowledge fits the two conditions for a pure public good: public knowledge is nonrival, because one person's consumption of it does not diminish another person's consumption, and it is nonexcludable because, once published, no one can be denied access to it (Nelson 1959; Arrow 1962).[7] Private actors acting in their own self-interest would not support the optimal level of the good or service because they would not be able to capture all of the societal benefits.

The failure of private firms to conduct basic research is particularly likely since such research has major impacts only after cumulative years of collective effort and research. In economics, the linkage from research to public policy can be long, diffuse, and uncertain. The scholarly achievements on the topics delineated in Table 1 took years of research from a large number of economists, building on each other's work, and the outcome of the full body of work could not have been anticipated in advance nor could the marginal contributions of any single study or even small group of studies be identified sufficiently in advance to warrant private investment.

Having said this, some large firms do hire staff economists to conduct research that is academic in nature or hire consultants to conduct research on topics that have value as basic research. The field of auctions is a prominent example, and many of the most fundamental contributions to the field were the result of private consulting contracts. More recently, firms like Microsoft, Amazon, Google, and other web-based firms have sponsored economic research that has led to publications on basic research topics published in the leading journals. In addition, research in many other areas of economics published in the journals is a result of consulting agreements, which can be verified by the recent enactment of disclosure statements for papers published in the *American Economic Review*.

Nevertheless, these examples are the exception rather than the rule. Most economic research sponsored by private firms must ultimately be seen as benefitting the bottom line of the firm, and the research that is sponsored has to obey boundaries where at least some such benefit can be established. Private firms rarely sponsor research on most types of pure theory, theoretical econometrics, or fundamental foundations of the macroeconomy. Even when firms occasionally support basic research, such efforts often are eventually closed down, as the example of the celebrated Bell Labs research shop in the 1970s and early 1980s demonstrates.

Research universities are more likely candidates for picking up the slack since they are nonprofit institutions for whom a primary goal is basic research. But it is

[7]Here I ignore the fact that most prominent journals charge prices for their product and that many individuals do not have access to journals through institutional subscriptions and would have to pay to gain access.

worth parsing this possibility in detail by considering the research university environment in the United States: that is, what the goals of universities are, along with their business model and level of financial resources. For example, public universities are funded by state legislatures whose goals are only partly to establish nationwide research excellence and whose main interest is in providing education to the residents of the state. Recent trends in reduced funding of state universities reveal that university research is a declining priority. State universities typically also do not have sufficient funds to hire graduate research assistants for their faculty, to pay for data acquisition above a nominal level, to establish research centers entirely supported by state funds, or to pay for the expenses associated with building an experimental lab and running lab experiments. NSF funding does support all of those expenses.

Private universities have a greater financial potential for research support, but it is only the top 20 or so universities with large endowments that have the funds to support research expenses other than faculty time. Most private research universities in the United States have modest endowments at best and are unable to support hiring of research assistants or expenses for data acquisition, experimental labs, or research centers.

Salary payments for faculty time is a separate issue, for the business model of most research universities is to pay salary for only nine months of the year, so that summer research must be funded by outside sources solicited by the researcher. This is widely regarded as an accounting fiction, as most academic economists continue to do research out of intellectual interest or for career incentives year-round whether they find extra funding or not; they simply make their "9-month" salary last 12 months. If they do the same summer research with NSF funding that they would do without it, NSF funding is simply a transfer from the taxpayer to the researcher.[8] However, the elasticity of substitution probably differs by the type of research—for example, whether the research has empirical content. Further, it should be recalled that salary support constitutes only 30 percent of the average research grant, which therefore constitutes an upper bound on the transfer. But ultimately the question of whether a faculty member would work at a faster pace or more intensively in the summer with a grant than without it is again an empirical question that is not possible to determine with current data and on the basis of current research. Further, even if it could be established that the average elasticity of substitution is nonzero, or it could be established that certain fields have a higher elasticity than others, it is difficult to imagine how NSF could incorporate this information into its review and award process. Asking the NSF staff or NSF review committees or reviewers to make a judgement on how much of a proposed project would be conducted without NSF funding would be an impossible task and lead to

[8] If the funds were granted for the researcher's paid research time during the nine months of the year, the university would reduce its salary payment by the amount of the time spent on the project and then the university, not the researcher, would be the recipient of the transfer, but still with no change in aggregate research output. But if the funds were granted for the researcher's teaching time, and the university used the released salary funds to hire another teacher, teaching output would remain unchanged but aggregate research output would rise (there is of course an opportunity cost to the other teacher's time).

discretionary judgments that would be unpopular and fraught with error. It is also unlikely that NSF should simply rule out entire fields of research on the grounds that the average elasticity in those fields is high. This is why NSF instead ignores this issue and just uses the criteria discussed above—Intellectual Merit and Broader Impacts—to make its awards.

Large-scale data collection is an area where substitution is least likely to occur. No university would be willing to support a dataset like the Panel Study of Income Dynamics—a dataset that is used by macro- and well as micoeconomists—out of its own private funds, nor would foundations. Other government agencies would not do so because the PSID is insufficiently focused on the programmatic concerns of line agencies (indeed, the PSID was created by the Department of Health and Human Services in the 1960s, but eventually they chose to drop it given its general focus, and NSF picked it up). Nor would other government statistical agencies pick up the PSID; it would be the view of the Census Bureau and the Bureau of Labor Statistics, for example, that the PSID is mainly used by academics to address narrow research questions, whereas they see their mission as to more directly provide descriptive statistics to Congress, and the federal government in general, charting the state of American society and its economy.[9]

General-purpose data collection is one area where a good case can be made for direct salary support for economists. Even with government funding for all the nonpersonnel expenses necessary to collect data, most researchers would prefer not to spend their time being involved in a large-scale data collection exercise for a public-use dataset that will lead to publications mostly by other economists; they would rather work on another research paper of their own. Without salary compensation, most economists would simply not engage in that activity. It is difficult to imagine that universities, even those private universities with the largest endowments, would initiate data collection projects like the Panel Study of Income Dynamics, the Health and Retirement Survey, or many financial datasets purely out of their own private funds.

Finally, private foundations and private philanthropy could pick up much of the research that would be funded by a government research agency like NSF. On the face of it, this outcome seems very unlikely, for foundations typically have specific missions, defined by their founders or donors or board members, which focus on certain public issues of interest. Foundations also typically do not make awards on the basis of peer review or merit review, but instead generally make awards through a private solicitation process. Similarly, individual private philanthropic donors typically have specific research agendas in mind and usually are interested in only very applied research on a particular topics of personal interest. Indeed, major increases

[9] This point is reinforced by the experience of the Survey of Income and Program Participation, which is funded by the Census Bureau, and the National Longitudinal Survey, which is funded by the Bureau of Labor Statistics. Both are most heavily used for research and not for the main missions of their agencies and, as a consequence, these datasets are continually at risk of deep funding cuts within their agencies or complete elimination when agency budgets are tight.

in private support of research have already occurred in the natural sciences, where large donors have picked up some of the slack from reductions in government funding. They have only provided funds for narrowly defined topics of interest, and the consequences for the advance of knowledge in the natural sciences have been problematic (Broad 2014).

If government funding of research did not exist, it is possible that foundation boards and private donors might see their responsibilities differently and might fund some portion of the basic research that would, in the alternative universe, have been government funded. But there would surely be limits to that support, and it almost surely would not support the broad, comprehensive agenda of research in all areas of economics that an agency like NSF supports.

As with private firms, there are exceptions in some areas. A number of private foundations sponsor billions of dollars of research, a slice of which goes to economists: the Gates Foundation, the Rockefeller Foundation, the Ford Foundation, the Hewlett Foundation, and many others. A recent report stated that $52 billion was given by US foundations in 2014 (Foundation Center 2014), and if only a tiny sliver of that went to economists, it would still be vastly greater than the NSF Economics Program budget. Much of the economic research in developing countries is supported by foundations, including many of the randomized controlled trials currently being conducted there. However, this is the exception rather than the rule. Most subfields in economics do not have foundation support of this kind, and it is unlikely that new foundations would spring up to serve other subfields in economics were NSF to be abolished. Further, from a societal point of view, it would again seem to be a distortion of resource allocation to devote disproportionate support to selected fields in this way. In addition, once again, it is difficult to imagine how NSF could deal with this issue, except, for example, by deciding they would no longer support randomized controlled trials in developing countries because these can be funded by other institutions.

The conclusion to be drawn from this discussion is that a significant body of economic research would almost surely be lost if NSF were not to exist. The loss would differ by field and by whether other funds are available, and the loss would be concentrated on research at public universities and less-endowed private universities that do not have the funds to support nonsalary expenses for projects that would require them. The collection of large-scale datasets would be significantly reduced with subsequent damage to the state of scientific knowledge.

Empirical Evidence on the Impact of Government Funding of Research

Very little systematic empirical work has been done to estimate the impact of the NSF Economics Program. In correspondence published in this journal, Laband, Piette, Ralston, and Tollison (1994) regressed citations to papers published in the leading economics journals on whether the author(s) had previously received an NSF award, finding a positive effect of an additional 5.6 percent citations. But as

the authors recognized, those who receive award funding may be those who would have done better research than those who do not receive funding, and the positive correlation they found could have occurred even if the funding had no effect on whether either group did their research. This is a form of the well-known "selection" problem, and in this case, the authors argued that the best interpretation of their findings was that NSF was picking the better proposals. Arora and Gambardella (2005) conducted a similar but more extensive investigation, but again not controlling for selection, and found NSF grants in the late 1980s to have considerably smaller effects, which were present mostly for younger researchers. One possible difference between the two analyses is that Arora and Gambardella did not use total citations but used a quality-weighted index based on journal impact factors. But neither of these analyses can be given much weight given their inability to control for selection. Jaffe (2002) has argued that funding agencies need to build more evaluation structures into their award procedures, possibly by randomization, and this would seem to apply to the NSF Economics Program as well.

Although pertaining to a different federal government agency and not restricted to the subject of economics, two recent studies of funding from the National Institutes of Health (NIH) may be relevant. Jacob and Lefgren (2011) used a regression discontinuity design to estimate the effect of winning an NIH grant on subsequent research productivity measured by citations, leveraging the fact that proposals are awarded at NIH on the basis of a well-defined score and looking at scores above or below a particular cutoff. Jacob and Lefgren found very small effects on future productivity, with a winning proposal leading to only one additional publication over the next five years, about a 7 percent increase. The positive effect was also mainly concentrated among younger researchers, consistent with the notion that older researchers are more likely to have alternative sources of funding. As is always the case with regression discontinuity designs, and as acknowledged by the authors, the estimated effects only apply to marginal applicants, and it could be that the effects on inframarginal applicants are larger (or smaller). The authors also discussed at length whether the small effect arose because most marginal proposals that were not funded by NIH obtained funding from some other source. The authors' data were not definitive on this question, but they suggested that other funding for rejected proposals could often be obtained from coauthors who obtained grants from other NIH or from non-NIH sources, from NSF (although these grants could be small in magnitude), or from other sources such as foundations and universities. While this may seem to contravene the arguments in the last section, this result is likely to be heavily influenced by the predominance of biomedical funding at NIH, which may have more alternative funding sources.[10]

Freeman and Van Reenen (2009) studied whether the doubling of the NIH research budget from 1998 to 2003 had positive effects on research activity in the

[10] Li and Agha (2015) also examine the correlation between NIH priority scores and later publication outcomes, but the authors explicitly disavow any attempt to separate selection of better proposals into higher priority scores from a true impact of the funding itself.

biomedical sciences. They stressed that the doubling and a subsequent rapid deceleration created severe problems for biomedical researchers because of adjustment costs incurred in ramping up research facilities and then adjusting downwards. This "stop and go" cycle is a familiar problem in science funding, especially in the case of biomedical researchers. The deceleration has been argued to disadvantage young researchers in particular (Stephan 2012). Freeman and Van Reenen argued that the impact of large increases and decreases in science funding depend on how funding agencies make decisions about how many awards to make, the value of each, and whether they are made to younger rather than older researchers, and they argued that NIH had not paid sufficient attention to this issue. For present purposes, the "stop and go" cycle creates problems of inference for any study that uses the number of awards or amount of funding as a determining variable because it implies there are significant lags in any output response and that short-run and long-run effects are likely to be quite different.

Another, older, literature of possible relevance, albeit even more tangential to NSF Economics funding, takes a "knowledge production function" approach to the effect of research and development on economic growth, productivity, or some other measure of output (as in Griliches 1979). While early papers applied the approach to investigate the effects of industry research and development, other papers studied the effect of academic research on growth and productivity, often using a traditional growth accounting framework. Although there are endogeneity and identification issues in these studies, most find a positive effect (Jaffee 1989; Adams 1990; Mansfield 1991; Adams and Griliches 1996). A more relevant literature for present purposes is that examining whether public funding of research and development in the sciences has positive or negative effects on private research and development—or put differently, whether public and private research and development are complements or substitutes. The relatively large literature on this topic was reviewed by David, Hall, and Toole (2000), who found results all over the map, and very sensitive to specification, level of aggregation, and other issues (see also Diamond 2008). The authors concluded that the evidence, taken as a whole, is ambivalent on the main question of interest. A side note is that much of the research cited in this paragraph was funded by the NSF Economics Program.

Conclusion

The NSF Economics Program is under challenge in Washington. However, the evidential basis for supporting a reduction in its budget is essentially nonexistent. On the contrary, the circumstantial and indirect evidence for the opposite position—that the Program is dramatically underfunded—is strong. The number of grants made is tiny and has been declining over time, and the real budget is no larger than it was in 1980, despite the tremendous growth and productivity of the discipline over the last 35 years. The size of the budget is miniscule compared to that of other federal research funding agencies and as compared to that spent by

some other institutions that fund economics research in specialized areas. Yet the NSF program has supported research in a number of areas related to public policy where that research has had a major impact on the discipline, on thinking about policy problems, and often on policy itself, demonstrating the high value of the program. Finally, while some fraction of the funds expended to support faculty summer research time may merely substitute for time they would have spent on the research even without that funding, this fraction is likely to be small as a percent of the average NSF grant and likely to apply only to certain types of research. Overall, the elimination of NSF support for research expenses, especially those of a nonsalary nature, on a broad range of basic research topics would almost surely lead to the disappearance of much research at universities other than those with large endowments and would not be replaced by funding from other institutions.

The critical missing element in existing discussions of this issue is a strong empirical basis demonstrating the marginal social benefit of NSF spending, either for marginal increases or decreases in its budget or for its spending as a whole. It would be valuable to know that marginal benefit not only for the current mix of NSF spending but also for specific projects such as general purpose data collection and data purchase, expenses for research assistants, the lab, and randomized controlled trials, and for empirical work versus theory, either microeconomic theory or econometric theory, for example. It would be interesting to determine whether the marginal social benefit of NSF support of these types of expenditures differs by whether they are made to economists at well-endowed universities rather than those with modest or small endowments. Conducting such empirical work is challenging because exogenous changes in the NSF budget would not be easy to find, and because it would require working with confidential data inside NSF on rejected proposals and the subsequent funding and research productivity of these projects. Nevertheless, further progress on this important issue for government support of economic research requires that such efforts proceed.

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