The federal government has been the most important source of funds for academic research since the 1950s. Nearly a third of this support takes the form of indirect cost recovery (overhead). Long a source of conflict between universities and the government, in recent years the indirect cost controversy has escalated, with most research universities intensively investigated for alleged abuses. This essay examines the nature of indirect costs and the sources of the conflicts about them. The main argument is that the types of costs that are covered by overhead charges must be paid for the research intensity of universities to be retained; however, the existing system for reimbursing these costs creates unnecessary distortions in the operation of universities and has very high transactions costs. Instead, both universities and the federal government would be better off if the existing indirect cost reimbursement system were replaced by a system of fixed reimbursement rates that were not related to a university’s actual indirect costs.
The purpose of this essay is to explore the nature and causes of the increasingly fractious relationship between universities and the federal government regarding the reimbursement of indirect costs, or overhead, in federally sponsored research, and to propose some new ways to think about and, perhaps, ameliorate this problem. On the basis of the analysis in this chapter, we have concluded that the source of the friction between universities and the government is the method that the federal government uses for paying for university research, not the intentions or integrity of either party. In particular, the methods used by the government to pay for indirect costs distort the incentives of both universities and federal agencies, and lead to wasteful expenditures by both. To solve this problem requires fundamentally changing the form of federal research grants to universities.

The federal government pays for university research grants through cost-based contracts that are similar to the procedures that are used to pay defense contractors for weapons system development. The amount awarded is based on projected costs, and the university can keep only that portion of the award for which it can document that these costs were incurred. Thus, federal research grants are essentially contracts under which the university promises to undertake a project and to monitor the expenses incurred in doing so, and the federal government agrees to pay the estimated cost of the project when work is initiated and to let the university keep the appropriately documented expenses of the project. This method of funding is often called, inaccurately,
"full cost reimbursement" because, in principle, it is based on the idea that the government pays for all of the cost of research it supports. ²

To support cost-based contracting, the federal government requires universities to establish elaborate government-approved and government-audited accounting systems for calculating the cost of research projects for the purpose of determining federal reimbursement. The incentive for principal investigators and universities to perform high quality research is generated by the process of competitive awards that are based on peer review. Simply put, the prospect of being awarded future grants and obtaining other reputational benefits are the sources of the incentive to perform high quality research.

On average, approximately seventy percent³ of a federal research grant to a university consists of so-called "direct costs:" costs that can be easily and nonarbitrarily associated with performing a single research project, such as the salaries of the personnel and the cost of the lab equipment and supplies that are used in the project. The other thirty percent of grant awards is for "indirect costs." In theory, indirect costs are joint costs of numerous university activities that can not be attributed to any particular project. The largest components of overhead costs are administration and the depreciation, operation and maintenance of buildings and equipment.⁴

Although indirect costs account for much less than half of the total cost of federal research grants, they are the source of a great deal of public controversy. The most visible controversies have swirled around the issue of whether universities include inappropriate expenses in federal overhead costs, such as the president's expenses for entertaining university trustees or depreciation of the university's yacht. More generally, overhead expenditures are widely regarded as "too high," in part because the cost-based contracting system encourages universities to add unnecessary expenses to their overhead accounts. Of course, university indirect costs are not high compared to other
kinds of federal R&D contracts. For example, in the aerospace industry, indirect costs accounted for 58 percent of total contract costs, roughly double the fraction at universities. Nevertheless, the anecdotal improprieties have created both a perception of inefficiency and pressures to undertake reforms.

Thus far, the main response to the indirect cost controversy has been for government and universities to devote increasing resources to calculating and auditing overhead costs. This process itself is a major cause of the increase in overhead expenses because running and administering the accounting system is itself treated as an overhead cost! More fundamentally, in times of declining federal budgets, some have questioned whether government ought to be paying any overhead expenses at all. The rationale for this position is that the government has no obligation to pay indirect costs because the university would have to incur most of these expenditures even if no federal research were performed.

We believe that the fundamental cause of controversies regarding indirect cost recovery is neither inadequate effort in implementing accounting and auditing systems, nor mismanagement on the part of either universities or granting agencies. Instead, the fundamental problem is the very concept of using a system of retrospective cost reimbursement to calculate indirect cost rates. In particular, we propose that federal grants pay for university overhead cost through a prospective standards-based reimbursement system in which overhead rates for all universities are determined through periodic audits of a small sample of similar universities. In particular, a university's reimbursement for indirect costs would not depend on its own accounting estimates of its overhead costs. A prospective reimbursement system of this sort would sharpen the incentive to manage overhead costs efficiently, remove a number of other distortions that are created by the current cost-based system, and drastically lower the cost of accounting for and administering federal grants, while still providing adequate support for
high quality research.

Our proposal is similar in spirit to regulatory reforms that are currently sweeping through a wide variety of regulated industries and to the changes underway in paying for health services. The idea is that when many firms are producing similar products, one can base reimbursement for any particular firm on the average cost of all of the firms. This severs the link between a firm's costs and its reimbursement, and thus creates incentives for individual firms to manage their costs efficiently. This idea motivated the prospective payment DRG system for Medicare payments to hospitals, and has been applied by state and federal regulators in electricity, transportation, and telecommunications.

This essay proceeds as follows. The next section describes the contracting problem that the government faces in supporting university research. Next, we describe the general approach that the government has taken to solve this problem through its cost-based reimbursement system. We then explain why this system works so poorly when applied to overhead costs, and why prospective reimbursement would work much better.

THE NATURE OF THE R&D CONTRACTING PROBLEM

A university can be viewed as a firm producing several outputs, including education and research. Neither of these outputs can be measured very accurately. Educational output is measured by years of study, scores on tests, and numbers of various degrees, but these measures do not capture educational quality. Research is even more complex. New ideas can not be measured or weighed. Furthermore, in addition to new ideas, an output of research is improved capabilities and competencies in the faculty and students performing the research. Thus, providing objectively verifiable measures of a university's educational output is difficult, and objectively measuring a university's research output is essentially impossible.
The key consequence of the difficulty of measuring output is that the federal government and universities cannot write research contracts that are based on measured output. This point is extremely significant. When the output of the activity can be adequately measured in some objectively verifiable fashion, the contracting problem is easy to solve. Firms can offer proposals describing the output that they will produce and the price that they will charge. Government can select the offer that provides best value. A simple competitive bidding process for a well-defined product creates no need for retrospective cost-based contracting.

The problem with R&D procurement is that the parties cannot base their contract on outputs. About the only aspect of a research program that can be measured objectively is the university's expenditures on inputs. Therefore, not surprisingly, R&D contracts are essentially contracts over inputs instead of outputs. That is, in a research contract, a university promises to make certain types of expenditures and the federal government makes payments on the basis of cost estimates that are secured by an offer of proof that the university did spend the funds in the way that was promised. The purpose of the accounting system that the government requires is to provide objectively verifiable measures of these expenditures.

Two features of this process are worth noting.

First, by contractually specifying what sorts of expenditures the university will make, the federal government gains a fair measure of control over the nature and type of research that will be done. Clearly, a principal investigator cannot spend funds for performing experiments on a particle accelerator to study yak breeding in Nepal without running a serious danger of being detected. Therefore, contracting over inputs provides the government with some contractual control over the variable that it is truly concerned about, which is the output of research. Consequently, cost-based reimbursement is a natural and logical approach to R&D contracting.

Second, a contract over expenditures provides no direct incentive for a
principal investigator or a university to conduct high quality research. In the present system, the incentives for high quality research operate primarily through the reputation-building effects of high quality research. To the individual investigator, reputation is acquired by establishing priority in findings, and thereby having one's name associated with new ideas, which in turn facilitates obtaining more financial support for research that will finance producing still more results and gaining even greater reputation. Similarly, high quality research is useful to a university in attracting students, gifts from private donors, and future federal grants.

The importance of the reputational value of good research is enhanced by using competition and peer review to award federal grants. A major factor affecting peer judgement is the principal investigator's performance on previous projects and the university's reputation for providing a supportive and productive research environment. This reputational mechanism neatly finesses the problem of objectively measuring research outputs. It may not be possible to base legally enforceable contracts for a particular project on experts' informal evaluations of the worth of the research, but it is possible to base next period's award on these judgements.

For this reputational mechanism to provide a significant incentive to universities, the university must regard obtaining future grants as important. That is, some sort of prize must be attached to the award of a research grant, and a larger prize will create a greater incentive to provide an environment which nurtures and supports high quality research.

**Overhead Costs in Contractual Relationships**

Recall that approximately thirty percent of the costs incurred by universities are indirect or overhead costs, and that most indirect costs are central administration and the depreciation, operation and maintenance of buildings and equipment. The distinction between indirect and direct costs is
closely related to the concept of incremental or marginal cost, which is the additional cost of undertaking an activity, given that all of the other activities of the organization still will be undertaken.

Overhead costs have two defining characteristics: invariance and opacity.

First, for the most part indirect costs are not incremental or marginal with respect to any single activity of the university. That is, a particular research project were cancelled, total overhead expenditures would be almost completely unaffected. Indeed, even if the university scaled back its research efforts substantially, it would still need to incur a large part of its overhead expenditures to operate its educational activities. Similarly, if the university scaled back its education efforts, much of the overhead costs would still be needed to support its research activities.

Second, even if an indirect cost element is partially incremental with respect to a particular activity, the precise extent to which it is incremental is almost impossible to measure in a way that could be implemented through an accounting system. Accounting systems are not able to conduct the thought experiment of estimating the long-run effect of a change in university activities on overhead costs.

Because federal research grants are essentially cost-based contracts, one issue that arises is whether and to what extent federal research grants ought to pay for overhead expenditures. To the extent that indirect costs are not incremental for any particular activity, the university would still incur them to accomplish its remaining activities, even if the federal government supported no research at the university. However, if these costs are not paid by someone, the university will be unable to accomplish any of its activities because it will become financially unviable. The fact that indirect costs are not incremental does not make them any less real, and paying them any less necessary to the institutional survival of the university.

A second issue pertaining to indirect cost recovery concerns monitoring
and reviewing these costs to determine if they are "reasonable." For direct costs this function is largely performed in the process of reviewing proposals. In a proposal the principal investigator lists in some detail the direct costs that will be incurred by a research project. Before the proposal is submitted university administrators check these costs to assure that specific cost items (including indirect costs) are accurate and that the proposal does not commit the university to perform a project that will cost far more than the amount of funds requested. Upon submission the awarding agency makes a broad assessment as to whether the proposed costs seems appropriate and necessary. Because indirect costs are not directly associated with any particular research project, the granting agency can not make such a determination with respect to overhead costs. We argue below that the best policy response to this problem is to create incentives for universities to manage overhead costs themselves, rather than to devote substantial resources to measuring whether the costs that are incurred are necessary and reasonable.

**Government and University Objectives**

To design an effective contracting mechanism between universities and the federal agencies that support research, one must first understand the objectives of each party in contracting for research. In this case, specifying with precision the goals of both parties is quite difficult. Both government agencies and universities are nonprofit institutions, so that their objectives can not be reduced to simple measures of financial performance, as is the case for businesses. Whereas the goals of nonprofit institutions are not thoroughly understood, Chapter One suggests some plausible motivations: (1) growing as large as possible; (2) accomplishing certain social goals that managers view as desirable; and (3) maximizing managerial status, recognition, perquisites, and benefits. Because universities are managed in large measure by senior faculty, the latter goals can be interpreted as
serving social objectives that are widely shared among faculty and maximizing the status and welfare of faculty.

To obtain the funds necessary to achieve these objectives, both agencies and universities must satisfy certain external constituencies. Consequently, to attain their core objectives, nonprofit organizations must orient their behavior to serve these groups. Because both government agencies and universities serve numerous constituencies, they can be regarded as pursuing complex, multidimensional objectives that are partially, but not completely, overlapping. Differences in objectives are at the heart of the controversies about federal grants to universities, and create the contracting problem that must be overcome to make federally sponsored university research as efficient as possible.

Federal grant programs for sponsoring university research presumably serve three purposes: (1) to achieve the specific research objectives that are promised in a successful proposal; (2) to accomplish more general objectives concerning the strength and topical breadth of the research capabilities of the nation; and (3) to strengthen the educational system for students in technical disciplines. Whereas these objectives are to some extent complementary, they are also distinct enough to require separate attention if each is to be attained efficiently.

For the purposes of this chapter, the main implication of the multiplicity of government goals is that the federal government arguably has a fairly large interest in supporting university indirect costs because overhead supports other valued activities in addition to federally sponsored research projects. More generally, the federal government must explicitly identify and design into the grant system mechanisms to assure that the broader purposes of support for research universities are taken into account.

An important feature of the implementation of federal R&D policy through numerous sponsoring agencies is that in an agency that supports university research a balance among government's objectives is unlikely to arise. Each
agency will be held accountable for achieving the narrow goals that are embodied in its project grants, but each agency will bear less of a responsibility for the overall health of U.S. academic research and education because the latter objectives derive support from many agencies. Consequently, proactive participation in overall academic research policy by the centralized agencies in the Executive Office of the President, like the Office of Management and Budget (OMB), or the one diverse source of academic research support, the National Science Foundation (NSF), is necessary to balance the more narrow focus that is likely to predominate in the more focused agencies. Thus, placing responsibility for making indirect cost recovery policy in more focused agencies, like the Department of Defense, is likely to lead to less generous reimbursement and a weaker university system than giving the responsibility to NSF.

For research universities, attaining the objectives of growth and prestige requires obtaining support from numerous constituencies other than the federal government: students and their parents, private donors (including industry), state and local government, and consumers of other university services, such as health care and sporting events. Universities derive additional direction from the fact that they are largely democratic, in that faculty play an important role in university governance. Two qualitative properties of the preferences of research universities can be deduced from these observations.

First, and perhaps most importantly, because grants are a major source of funds for research universities, federal research policy has an enormous effect on the behavior of universities. Universities do not naturally and altruistically seek to attain research excellence independently of federal grants, as witnessed by the fact that most universities in the U.S., and nearly all universities elsewhere in the world, do not support extensive research. Federal spending on high quality research in science and engineering allows some universities to grow and to prosper by becoming strong
in these areas; however, there is no reason to believe that universities are inherently more predisposed to foster high quality technical research than to produce high quality football.

Second, to the extent that pressures created by students, private donors, and faculty cause universities to value research, universities are likely to prefer more diversity in research and balance across fields than the federal government displays in grant policies. Universities and the federal government have overlapping goals only with respect to the health of research in areas that the government supports, but even in these areas there are two primary sources of conflict: (1) each university seeks to maximize its own standing as a research institution (Harvard is unlikely to make sacrifices to assure that Princeton remains strong); and (2) universities are willing to sacrifice some strength in a strong field that receives federal support in order to improve the quality of a weak field that the government does not support because other university constituencies value it.

The main conclusion that follows from the discussion of goals is simply that universities and the federal government do not have the same objectives. In particular, the correct way to view the federal government's problem is that it is truly an incentive contracting problem in which the government must seek to design institutions and contracts that create incentives for universities to act more in the way the government prefers, and less in the way that universities would prefer if federal money came with no strings attached.

In ordinary market transactions with for-profit firms, the federal government creates incentives by allowing firms to earn a profit if desired results are achieved. The fact that defense contractors must earn a profit is a reality that must be taken into account in designing the defense contracting system.7 Analogously, in transactions with universities the federal government must permit something like profits on activities that it wants to encourage, knowing full well that the university will then use these funds to
pay for activities that the federal government does not value so highly. This analog to profits provides the university with the incentive to undertake the activities that the government prefers. Therefore, for incentive-based reasons, the government usually will find it desirable to pay more than cost. Economic actors that are always paid cost and nothing more have no incentive to spend efficiently or to produce results that the sponsor wants.

The second conclusion that follows from these observations is that the net cost to the federal government of allowing universities to earn a profit on sponsored research is much less than the gross amount of the profit for three reasons. First, some of the profit will be used to support activities that the federal government values but does not support directly. Second, the possibility for profit, if properly designed, will increase the incentive of the university to undertake its work more efficiently than would be the case under a cost-reimbursement contract. Third, the prospect for profit will give the entire university, not just the grant recipient, a stake in maintaining the quality of federally sponsored research, thereby increasing output per dollar of effort.

Alternatives to Contracting

Given the problems with contracting for R&D, the question that naturally arises is whether the federal government could better respond to these problems by avoiding contracting altogether and conducting more R&D in government research labs. Reflecting the problems of contracting for research, private companies typically undertake virtually all research in their own research divisions. In other nations a far larger fraction of government-supported research is undertaken in government-operated laboratories, rather than companies or universities. Indeed, in many countries both universities and industries that undertake government-sponsored research are nationalized.
Undertaking work within the same organization facilitates controlling the quality and quantity of resources that are devoted to a project, monitoring the effort of research personnel, and practicing flexible project management that changes the character of research activities as work proceeds and new information is acquired. In addition, internal systems of reward and punishment can be based on cumulative measures of career performance by researchers and research managers, rather than the success or failure of any particular project, and can be tied to the long-term success of the organization.

Three rationales for the U. S. approach can be offered.

First, the U. S. approach probably has in part a purely political origin. Decentralization serves the ideological preference for less direct government control, and the political interest of members of congress to spread federal spending over many states and districts.

Second, because the U. S. approach is highly decentralized, it offers the compensating advantage of diversity. Because the value of research is inherently uncertain, the most effective national research policy may be to attack numerous problems, and each significant problem in many different ways, to take advantage of the specialized knowledge of different researchers in different institutional settings. This strategy maximizes the chance that the most important research results will be found. Because fundamental research is very inexpensive compared to most attempts to apply new knowledge at commercial scale, a diverse set of initial projects may pay for itself by focusing more expensive subsequent activities on projects with the highest expected return. In the public sector, diversity cannot be attained if a central authority (ultimately, congress and the president) directly manages all federally sponsored research.

Third, even if research is centralized, many of the same incentive problems occur within the organization. In a very large, centralized research organization, top managers would face the difficult problem of
measuring the productivity of their researchers and providing them with sharp incentives to do the work that is most valuable to managers rather than projects that are most appealing to researchers.

For some combination of these reasons, the federal government supports a relatively decentralized R&D program through contracting with universities. For the purposes of this chapter, we simply take this decision as given. The relevant question, then, is how contracting methods might be improved.

THE MECHANICS OF COST-BASED REIMBURSEMENT

Because of the inherent difficulties in writing performance contracts for R&D, the federal government has chosen to use cost-reimbursement according to a set of government-mandated accounting principles and negotiated accounting and auditing methods. Although the federal government has always used a system of cost reimbursement, based on accounting records, to pay the direct costs of sponsored research projects in universities, the present system of paying for indirect costs is relatively recent. In 1946, NIH decided not to pay for any indirect costs. In the wake of negative reactions by universities, it grudgingly changed its policy to allow indirect cost recovery, but to cap the payments at eight percent of direct costs, which matched the maximum rate that was permitted by the Office of Naval Research (ONR). (Virtually all universities negotiate their cost reimbursement methods with either NIH or ONR.)

Shortly thereafter, ONR then set forth a set of principles for calculating allowable indirect costs. In 1958, these principles evolved into the first version of Circular A-21, the general guidelines for university cost accounting that were promulgated then by the Bureau of the Budget and that continue to be managed by its successor agency, OMB.

Congress became directly involved in setting indirect cost rates in 1958 by passing legislation that capped the indirect cost rate at 15 percent. In
1963, congress raised the cap to twenty percent. In 1965, a government commission reported that the 20 percent cap was insufficient to cover the costs of research, and recommended that indirect costs, like direct costs, should be reimbursed on the basis of the costs that are actually experienced instead of an arbitrary cap. In 1966, congress passed legislation that removed the cap but that insisted that universities share in the cost of federally sponsored research. A-21 was revised to implement this new policy.

After the new policy was put in place, indirect cost rates began a slow but inexorable climb upwards, reaching an average rate of nearly 50 percent by the 1990s. By 1980, indirect cost rates had resurfaced as a controversial policy issue, and several attempts were made to cap either the overall rate or components of them. All of these proposals were rejected at some point, and indeed in 1986 congress passed legislation that removed mandatory cost sharing by universities. Not until 1991 did OMB finally impose a cap on the indirect cost rate for administrative costs of 26 percent.

Although OMB oversees the cost accounting practices employed by universities, implementation of OMB's policies varies among agencies, and within an agency, among universities. Ultimately, the procedures for estimating and auditing costs are negotiated individually with each university through its "lead agency" (NIH or ONR). Hence, no general description can be entirely accurate without resorting to a mind boggling array of details and exceptions. Nevertheless, some basic features are common to almost all cases.12

The basic function of the cost accounting system is to define a set of final cost objectives, or products that the university can be viewed as producing, and then to assign every dollar of cost incurred by the university to one and only one of these cost objectives. Under such a system, the university's total costs equal the sum of its costs of producing individual products. The accounting systems used by universities recognize each federally supported research project as a separate cost objective or product.
Other activities and research projects that are not supported by federal research grants are also recognized as separate final cost objectives. Thus, every dollar of cost is allocated either to a particular federally sponsored research project or to some other final cost objective.

The accounting system is quite different for direct and indirect costs. Direct costs are easily and unambiguously decomposable into components that are used to support only one final cost objective. Indirect costs are grouped into various categories, called pools, and allocated to final cost objectives using some type of formula.

While some costs clearly are either direct or indirect, typically a broad mass of costs could be treated either way, depending upon the standards used to define which costs are easily and unambiguously decomposable into components that support only one objective. In practice, the federal government and universities have developed rather arbitrary distinctions for separating direct and indirect costs. Typically, direct costs include the time of nonfaculty research personnel who work on the project, expendable materials and supplies that are used in carrying out research, clerical and administrative personnel who are assigned primarily to the project, travel and conferences for research personnel, and equipment that is acquired for use on the project, rather than for supporting many projects.

Indirect costs are divided into several general categories: depreciation, operation and maintenance of buildings and equipment; general and departmental administration (including accounting and auditing functions); libraries; and student services (because students work as research assistants on federally sponsored projects). Clerical and administrative personnel who work for several projects usually are treated as part of indirect administrative costs, even though it is technically possible to require them to keep records indicating how they spent their time. Likewise, utility expenses are treated as part of building operation costs, even though it would be feasible to meter usage in research labs.
The amount of overhead allocated to any particular federally sponsored project is determined as follows. Overhead costs are divided into various functional pools. For each pool, detailed studies are performed periodically to determine the fraction of each pool that is allocated to federal research projects. Typically a costing study for a particular pool is undertaken only once every few years, with the results then used for allocating indirect costs until a new study is performed. These studies are often quite expensive and detailed, and involve extensive data collection and complex algebraic calculations, all of which tend to give them a patina of objectivity and technical respectability. In fact, it is difficult to think of a reason for carrying out these calculations other than to give the results this patina of scientific precision. Most of these costs are joint costs of many, if not all, university activities, making a nonarbitrary attribution of these costs among activities impossible. To emphasize our view of the nature of these fractions, we refer to them as the PCBA (Precisely Calculated But Arbitrary) fractions.

For example, the fraction of library costs that is allocated to federal grants is often determined by conducting surveys in which people who enter a library are asked whether they made that particular trip for the purpose of carrying out federally sponsored research. In similar fashion, the fraction of the cost of faculty office space and laboratories that is allocated to federal grants is typically determined by asking a faculty member, or whoever else is present when the surveyor arrives, what fraction of the total activity in the office or lab is devoted to federally sponsored research, as opposed to other research, teaching, or administration.

These questions presuppose that the time spent on federally sponsored research is clearly separable from the time spent on other activities. For example, the concept of a specific federally sponsored research project is frequently arbitrary, as all of the work directed by a faculty member may be closely related and supported by several sources. Likewise, the time a
faculty member spends explaining a research project to a student research assistant, or teaching the student how to use laboratory equipment, is both research and education. Our experience is that the responses to these surveys about the allocation of time and space to federally sponsored research vary widely because of different interpretations that people give to a question that asks them to make arbitrary allocations among joint activities.

Given the PCBA fractions that are determined as described above, overhead costs are allocated to federal research projects according to the following procedure. The PCBA fraction for a particular overhead pool is multiplied by the total costs in that pool. The costs that are so allocated from each pool are added to determine the total amount of overhead costs that are allocated to federal research grants. This total is allocated across federal grants in proportion to the direct costs (excluding equipment costs) that are charged to each grant.

Note that grant awards are based on projected accounting costs. In order to project overhead costs on government grants, the university, in conjunction with the federal government, must estimate the university’s total overhead costs and the direct costs that will be charged to federal grants. The ratio of estimated total overhead costs for federal research to estimated direct costs of government grants, after some exclusions, is than calculated to create a projected overhead rate. When submitting individual federal grants, the university multiplies the eligible direct costs by the projected overhead rate to determine a projected overhead cost for the contract.

An important characteristic of the reimbursement process for both direct and indirect costs is that while award amounts are based on projected accounting costs, the university is ultimately allowed to keep this money only if audited accounting costs are equal to or greater than the amounts awarded. Thus, federal contract awards are ultimately based on ex-post accounting costs.

The university and its principal investigators have very close control
over direct costs, and have considerable latitude to transfer expenditures among categories of direct costs, so that typically there is no large discrepancy between the amount awarded and the amount spent. Any discrepancies that do occur are settled on a grant-by-grant basis. The university and principal investigator have much less control over whether actual overhead accounting costs equal the amount of indirect cost recovery because indirect cost recovery depends on factors such as the university's over-all level of government research awards and the over-all level of overhead costs. In the case of indirect costs, discrepancies are settled on an aggregate basis for an entire year's contracts. Discrepancies in any one year usually are corrected by adjusting aggregate overhead payments in subsequent years, although occasionally the government insists that the university pay its excess collections immediately.

For both direct and indirect costs, the federal government classifies certain types of costs as unallowable. These items must not be included in cost calculations for purposes of determining federal reimbursement. Unallowable costs fall into four categories.

The first category, which receives all of the public attention because it can be interpreted with the delicious prose of scandal, consists of costs that are viewed as being extravagant or unnecessary. Examples would include certain types of entertainment expenses, first-class airfares, etc. Whereas the detection of these types of unallowable costs has fostered a great deal of public controversy, in reality these rules prevent the reimbursement of only a handful of easily identifiable types of expenditures, and are financially insignificant. As long as the expenditure is not one of these forbidden types, it is allowable. For example, the cost of a new research facility may be extravagant due to an unnecessarily expensive architectural design or the use of very expensive building materials, or a library may buy many obscure journals that are not read, but the rules on allowability of costs are not designed to discover this type of waste. Thus, in practice, the requirement
that expenditures be allowable is a very minimal and rather unimportant restriction.

The second category of unallowable costs consists of facilities that have been paid for by the federal government. For example, if a university receives a government grant to construct a building, the depreciation of that building is not included in the indirect cost pool. In addition, state universities are generally less aggressive in collecting indirect costs. These practices are financially far more significant than the disallowances of the first type. Average indirect cost rates are about ten percentage points lower for public than for private universities.

Third, many federal agencies, including some programs in the NSF, will not pay any fraction of the academic-year salaries of full-time faculty performing the research, although these agencies will pay summer salary supplements. The inaccuracy of the term "full cost reimbursement" to describe the federal system of paying for university research is most clearly exemplified by the exclusion of faculty salaries from many research grants.

Fourth, beginning in about 1990, the federal government began to adopt a new approach for disallowing costs, in response to a substantial increase in indirect cost rates during the 1970s and, especially, the 1980s. In general, the government has increased the stringency of many accounting and audit procedures, and agencies have become more forceful in bilateral negotiations about both the methods for allocating indirect cost pools and the final rate, especially with the large private universities that charge the highest rates. The end result is that an increasing fraction of the accounting costs that are derived from the procedures authorized by the government are not reimbursed even though they are, in principle and by prior agreement, reimbursable. Two significant examples of tougher policies that override the detailed rules for calculating indirect costs are the cap on the component of the indirect cost rate that covers administrative costs, and the termination recovery of automatic carry-forward of the under recovery of authorized
indirect costs through increments to indirect costs rates in subsequent years.

THE EFFECTS OF THE PRESENT SYSTEM

The cost-reimbursement approach to R&D grants begins with adapting tools that were invented for other purposes to the problem of establishing mutual obligations between contracting parties. Accounting was invented to assist firms in monitoring their own performance, and is nontrivial and interesting only because firms typically are sufficiently complex that managers are uncertain about precisely how their resources are used, and whether a particular use is profitable. Only then is a formal, costly method of systematically measuring the use of these resources is useful to managers. The original and still primary purpose of accounting systems is to assist managers of an organization in carrying out their job effectively.

Because an accounting system must incorporate fundamentally arbitrary methods of allocating the unallocatable and measuring the unmeasurable, it is an inherently imperfect mechanism to measure progress toward the goals of the organization. If managers use accounting system to make decisions, employees have an incentive to alter their behavior in ways that enhance their performance strictly as measured by the accounting system. Hence, managers use accounting systems as only one of many tools to measure employee productivity and to sharpen the incentives of employees to maximize their contribution to the objectives of the organization.

To use accounting and auditing procedures to govern transactions between organizations creates new incentive problems of this same general type. Now the managers of the organization have an incentive to adjust their operations so as to maximize the amount of reimbursement that they receive under the accounting rules, which in turn are only imperfectly aligned with the goals of the sponsor. In principle, government contract officers could respond to this problem by creating additional methods for monitoring contractors and
sharpening their incentives, but they are handicapped in doing so for two reasons.

First, government does not have available bonuses, stock options, regular performance reviews, and other techniques for creating incentives for managers. Indeed, if it had such tools, the managers would be government workers, not managers of an independent organization, and the point of decentralized procurement would be defeated.

Second, because universities derive revenue from many sources other than a government agency that sponsors research, the contract officer can not influence the form of contracts and other transaction arrangements between the university and other entities. Thus, the government can not control distorting incentives that are created by differences in the formal relationships between a university and each of its customers. Hence, accounting procedures that might be minimally distorting if they were uniformly applied to all sources of revenue can become uncorrectably distorting if different accounting methods are used for governing relations with different organizations.¹⁹

This section describes the main incentives that are created by the current system and argue that the general approach taken by the current system is a reasonable response to the nature of the government's contracting problem. Then, it will discuss some of the problems created by the current system. Before doing this, it will be useful to begin by first discussing the notion of incremental cost in greater detail.

**Incremental Cost** Some federal officials have proposed that universities should receive, at most, the incremental cost of a research project to the university, and perhaps that even these costs should be shared.²⁰ To understand the meaning and effect of these proposals requires a detailed understanding of the concept of the incremental and nonincremental costs of
The incremental cost of an activity is the extra cost that is incurred by undertaking it, holding all other activities constant. The significance of incremental cost is that, by definition, the incremental cost of an activity is the minimum amount that an organization would have to be paid to be willing to do it if no funds were available from other sources. Two particular features of the concept of incremental cost and how it applies to research projects undertaken by universities are especially important: the relevant time horizon, and the confounding effect of synergies (or complementarities).

First, the incremental cost of a research project generally depends on the planning horizon being considered. In general, incremental cost is larger for longer time horizons. For a short planning horizon the university may have sunk resources in productive facilities that have no alternate uses, while for long planning horizons fewer of these decisions will have been made. Thus, economists often speak of two notional time horizons: the short run, in which significant sunk expenditures have been incurred, and the long run, in which investments in all sunk expenditures must be replaced.

For research projects, we might think of the short run as lasting a few years, and the long run as lasting a decade or more. Thus, the short-run incremental cost of a research project would include costs for some equipment, materials and supplies not yet purchased, and some salaries. However, some salaries would not be part of short-run incremental cost because the university would not fire personnel immediately if the loss of grant support was perceived to be temporary, or if long-term employment contracts (such as academic tenure) prevent it from doing so. Similarly, the university may have purchased certain equipment that would be used on the project, trained certain personnel, and built and recently refurbished the building that would house the project. Finally, the administrative superstructure may have been designed to support a certain anticipated level of grant activity, and might not be able to adjust its size instantaneously.
To the extent that administrative costs can not vary with the level of grant activity, they would not be included in short-run incremental cost.

In the long run, most of costs become part of incremental costs to the extent that they would adjust to changes in the level of activity. If the loss of research grants was permanent, the university might not replace or renovate an obsolete building that houses research facilities, and might make long term adjustments in the size of its faculty and administration. Thus, some of these costs are incremental in the long run.

The second feature of incremental cost is that, for any organization pursuing multiple activities, the incremental cost of a group of activities considered as a whole is likely to be larger than the sum of the incremental cost of each activity, considered separately. The reason is that when productive synergies exist between activities (such synergies are called economies of scale or scope), these activities will have joint costs. These joint costs are not incremental with respect to any single activity, but nonetheless are incremental with respect to all joint activities considered together.

To illustrate this point and to show its significance, suppose that we calculate the incremental cost of each of a university's federally funded research projects. That is, for each project, we determine the costs that could be avoided if that project were not undertaken (but all other activities of the university, including all other federally funded research projects, were undertaken). Now add all of these costs together, and call it the sum of the incremental costs of federally funded research projects. Now perform the following calculation. View all of the university’s federally funded research projects as a single activity and calculate the incremental cost of this activity. Call this the incremental cost of all federally funded research. The latter number is virtually always larger than the former. That is, the sum of the incremental cost of all federally funded projects is less than the incremental costs of all federally sponsored research.
The reason for this difference is that federally sponsored research projects have synergies. A university can take advantage of the fact that it has multiple research projects to lower its costs of conducting each project. For example, the university may use a piece of equipment on several projects. If only one project were canceled, the university would still need to purchase the equipment to conduct the remaining projects. Thus, the cost of the equipment is not an incremental cost of any specific project. If the university canceled all projects, it would then no longer need to purchase the equipment. Thus, the equipment cost is incremental to all projects considered together. One can make similar arguments about buildings, graduate research assistants, libraries and university administration.

To guarantee that a university is paid enough to be willing to undertake federally sponsored research, the university must receive at least the long-run incremental cost of all federal research. If the government only pays short-run marginal cost, the university can maintain its research level for a few years, but it can not do so in the long run unless it finds additional funds to maintain the university's capital investments, research faculty, and administrative support system. Even paying long-run incremental cost for each project will be insufficient to maintain the ability of the university to undertake such projects, because the shared costs will not be reimbursed. The incremental cost of a single project may be low because many costs are joint with other federally sponsored activities; however, these joint costs must be paid by someone in order to enable a university to undertake federal research.

Just as it is folly to pretend that indirect costs do not have to be paid because they are not incremental with respect to any specific project, it is equally foolish to pretend that a particular project is a financial albatross if it does not pay as high an indirect cost rate as other projects. From a financial standpoint, the university's financial status and the viability of its other activities are unaffected by the presence or absence of an activity for which the university is paid its long-run incremental cost.
Consequently, a university is unambiguously better off financially if it accepts a grant that pays more than the long-run incremental cost of the new research that the grant supports, and that does not substitute for a grant that pays a higher indirect cost rate.

Moreover, if the university accepts a new grant that pays a lower indirect cost rate than is paid by the federal government, the federal government also benefits! The reason is that if a new research activity that is supported by a grant makes any contribution, however small, to pay for the fixed indirect costs of the university, the amount of overhead that will be charged to the government in the future will be less. Thus, whereas some claim that a project is being subsidized if it generates less indirect cost recovery than the federal rate, in reality all research sponsors are better off (and no project is subsidized) if every grant includes some payment in excess of the incremental cost of the project.

Desirable Features of the Current System

The general approach of the current system is a reasonable response to the nature of the government's contracting problem. It responds to the measurement problems of contracting for research, and, by overcompensating universities for federally sponsored research, it gives universities an incentive to become strong research institutions. The complete argument has four parts: (1) cost-based contracts make sense for direct costs but not indirect costs; (2) the accounting costs of federally sponsored research probably exceed the long-run incremental cost of this research; (3) payments in excess of long-run incremental costs serve a useful function for the federal government as well as benefit the university; and the present mark-up in grant awards over long-run incremental cost is a relatively inexpensive way to achieve these benefits.

(1) As discussed above, because output is intangible and uncertain,
government uses direct costs as the best available description of the research project that the university and government are agreeing will be undertaken. Because direct costs do bear a close relationship to the nature of the research that is undertaken, they are not seriously misleading as an indicator of the product emanating from a research grant. Moreover, because direct costs are closely associated with the research that is undertaken, government program officers and peer reviewers can exercise at least some crude monitoring of the reasonableness of the expenditures, given the proposed research. Thus, with respect to direct costs, there seems to be no real alternative to cost-based contracting.

For indirect costs, the amount charged to a project bears no close relationship to the proposed research, and its reasonableness can not be monitored easily. Hence, cost-based contracting for indirect costs is substantially more of a problem than cost-based contracts for direct costs.

(2) The accounting cost of all federally funded research at a university probably exceeds the long-run incremental cost of performing all federally funded research. That is, universities have been earning a mark-up over the incremental cost on federally funded research. Most direct costs are probably incremental in the long run and the government has largely reimbursed nearly all of these. However, in some cases the indirect costs that are charged to federally sponsored research are clearly not incremental with respect to these projects, and thus, by reimbursing these costs, the federal government has provided reimbursement greater than incremental cost.

Some indirect costs that are charged to the government are not incremental with respect to federally sponsored research because of complementarities among federally funded research projects, other research, education, and other university activities, most notably health care services, as discussed in Chapter Five. Complementarities cause these indirect costs not to be incremental to any activity. Bear in mind that the incremental cost concept here is based on retaining the quantity and quality of all other
activities, including education, research, and health care. To retain the same quality of these activities, universities still would be required to have extensive laboratory facilities, to involve students in research, and to have accounting procedures in place that enabled them to account for expenditures from other grants and contracts.

How much of federal indirect cost is incremental is difficult to say. For most research universities, most expenditures on plant and equipment are financed by private donors and state governments. For libraries and administration, a considerable part of physical investment and personnel would need to present in any case to support other activities of the university. Thus, a substantial portion of building depreciation, library costs, and administrative expenses are not incremental to federally sponsored research. For private research universities these categories account for at least one third (frequently more) of all overhead costs, and about thirty percent of total grant awards is for recovery of indirect costs. Hence, private research universities receive a mark-up at least ten percent, and perhaps more, over the total incremental costs of federal research.

(3) Retaining a mark-up over incremental costs performs a desirable and necessary function. A mark-up on numerous grants creates a prize that rewards a university for maintaining a strong research environment. As we have argued, it is naive to think that universities are somehow automatically programmed to want to produce high-quality scientific research. The prospect of a large prize that can be used to support other university activities creates a substantial incentive to undertake high-quality research. Many faculty, students and administrators have no direct interest in the science and engineering fields that account for virtually all federal support for university research. In the absence of a broader university stake in federal grants, these members of the university community have no reason to nurture these fields. The mark-up on grants gives the entire community an incentive to keep its scientists and engineers competitive for future research grants.
Seemingly the more difficult part of the argument is to explain why paying a mark-up of ten percent does not cost the federal government very much. One reason that the mark-up is not very expensive is that the federal government probably values the other outputs of the university (and so wants to retain the quality and scope of university activities). Consequently, the mark-up is simply an indirect form of procurement. Undoubtedly some of the mark-up goes to pay for projects that the university values highly but that the federal government does not; however, a university's preferences are not likely to be completely in conflict with those of the federal government. Thus, the research, education, and health care arising from the mark-up are also of some value to the federal government, which reduces the net effective cost of the mark-up to government.

In addition, if the federal government did not include some payment for the non-incremental indirect costs of the university in the overhead rate on grants, it eventually would have to find another way to pay for them if it wanted research universities to survive at their present quality and quantity of research. Although some indirect costs may not be incremental with respect to any single activity, they somehow must be paid. If no one pays for them, and if universities are not leaving significant opportunities for revenue unexploited, then the university must generate the funds to pay these costs by eliminating or reducing the quality of other activities. Thus, some of the mark-up on federal research grants simply goes to support overhead costs that the government would have to find some other way to pay for if it did not pay mark-ups on federal research grants.

Problems in the Present System

The main undesirable feature of the current cost reimbursement system is that it adds to the total cost of federally sponsored research in at least three ways. First, implementing the system is expensive, but the benefits of dealing separately with each
university are small. Second, the system actually discourages efficient management. Third, the system distorts the incentives of university managers in ways that make universities less effective in serving both federal objectives and their own goals. We explore each of these issues separately.

The System is Unnecessarily Costly. Maintaining the system of accounts and audits to implement cost reimbursement is itself a costly procedure, but the product of this process is indirect cost recovery rates that are broadly similar across categories of universities. Table 1 contains the indirect cost rates at about 70 universities. Because the sample is based on the universities that are most successful in obtaining grants from NIH, a few otherwise strong institutions that have no medical school and are not leaders in biology (e.g., Princeton) are excluded, whereas a few state universities that are not research universities but have a strong medical school are included.

As is apparent from Table 1, indirect cost rates do differ among universities, but are quite similar in peer groups. For example, ten leading private research universities (Caltech, Chicago, Columbia, Cornell, Harvard, Johns Hopkins, MIT, Pennsylvania, Stanford, Yale), based on amounts of support and general prestige, had an average indirect cost rate of 67 percent in 1992, excluding separate rates for medical schools. Six of the ten had rates within three percentage points of the average. Likewise, twelve leading public universities (five University of California campuses except San Francisco [essentially a medical school], Illinois, Michigan, Minnesota, Penn State, Texas, Washington and Wisconsin) had an average indirect cost rate of 48 percent. These universities are somewhat more dispersed, with six of twelve being within three percentage points of the average.

Of course, small differences in indirect costs can make a difference in grant revenues. For the top 25 research universities, annual revenues from the direct costs of sponsored research (excluding the items that are not
eligible for indirect cost recovery) were in the range of one to two hundred million dollars in 1994, the last year for which complete data are available. If eligible direct cost revenue is $100-200 million, a swing of five percentage points in the indirect cost rate would produce a swing in revenues of $5-10 million; however, a university with this volume of research would have total revenues of several times the amount of its federal research support, so this change in most cases would be much less than a year's growth in income.

Despite producing broadly similar results, research-intensive
TABLE 1:
INDIRECT COST RATES AT SELECTED UNIVERSITIES, 1992

<table>
<thead>
<tr>
<th>University</th>
<th>Rate</th>
<th>University</th>
<th>Rate</th>
<th>University</th>
<th>Rate</th>
</tr>
</thead>
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<td>G. Wash.</td>
<td>.48</td>
<td>North Car.</td>
<td>.445</td>
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<tr>
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<td>.484</td>
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<td>.60</td>
<td>Northwest.</td>
<td>.51</td>
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<tr>
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<td>Georgetown</td>
<td>.59</td>
<td>Ohio State.</td>
<td>.45</td>
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<tr>
<td>Boston U.</td>
<td>.73</td>
<td>Harvard</td>
<td>.68</td>
<td>Penn.</td>
<td>.65</td>
</tr>
<tr>
<td>Brandeis</td>
<td>.59</td>
<td>Medical</td>
<td>.77</td>
<td>Penn. State.</td>
<td>.444</td>
</tr>
<tr>
<td>Brown</td>
<td>.68</td>
<td>Pub.Hth.</td>
<td>.54</td>
<td>Pittsburgh.</td>
<td>.43</td>
</tr>
<tr>
<td>Caltech</td>
<td>.58</td>
<td>Ill.-Chi.</td>
<td>.56</td>
<td>Purdue</td>
<td>.49</td>
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<tr>
<td>Calif. Berk.</td>
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<td>Ill.-Urb.</td>
<td>.517</td>
<td>Rochester</td>
<td>.57</td>
</tr>
<tr>
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<td>.412</td>
<td>Indiana</td>
<td>.68</td>
<td>Rockefeller</td>
<td>.68</td>
</tr>
<tr>
<td>Calif. Irv.</td>
<td>.475</td>
<td>Ind./Purdue</td>
<td>.49</td>
<td>Rutgers</td>
<td>.64</td>
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<td>.64</td>
<td>So. Cal.</td>
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<tr>
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<tr>
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<td>Texas-Aus.</td>
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</tr>
<tr>
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<td>Mass. Med.</td>
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<td>Utah</td>
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<td>Vanderbilt</td>
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<tr>
<td>Private</td>
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<tr>
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<td>.50</td>
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<tr>
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<td>Washington</td>
<td>.51</td>
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<tr>
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<td>NYU</td>
<td>.51</td>
<td>Wash. U.</td>
<td>.60</td>
</tr>
<tr>
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<td>.45</td>
<td>Medical</td>
<td>.635</td>
<td>Wisconsin</td>
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<td></td>
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<td></td>
<td>Yale</td>
<td>.68</td>
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</table>

universities spend substantial sums on the administrative apparatus that supports accounting and auditing indirect costs. We do not know precisely how much administrative cost is associated with estimating indirect costs. What is know is that indirect costs account for about 30 percent (about $3 billion) of sponsored research payments from the federal government, and that about twenty percent of indirect costs, running to more than a half-billion dollars, is accounted for by the administrative categories that include accounting, auditing, and monitoring grants.\textsuperscript{23} Our experience at our own universities is that the proportion of administrative effort associated with the indirect costs of sponsored research is very high. A large part of the negotiations with the government about accounting and auditing practices deal with indirect costs, and some "special studies" to document particular components of indirect costs run in the millions of dollars.

\textbf{The System Does Not Reward Efficiency.} Cost reimbursement contracting provides little direct incentive for universities to manage indirect costs efficiently. Of course, an indirect incentive to manage costs efficiently is created by the fact that universities compete for grants, and the cost of performing the research is one factor that sponsoring agencies consider. Furthermore, at least for direct costs, agencies and peer review panels attempt to make some broad determination of whether costs are reasonable. However, these factors do not provide as strong an incentives to minimize indirect costs because program officers and peer reviewers have no way of knowing whether indirect costs are reasonable, and no means of controlling these costs even if they believe the rates are too high. Moreover, negotiations over rates and auditing systems do not focus on whether expenditures were efficient -- just on whether they were made for the purpose alleged.

\textbf{The System Distorts University Management.} The particular practice of basing overhead reimbursement on a university’s own accounting estimates of
overhead costs creates serious and systematic incentives for universities to
distort the way they conduct their activities in order to maximize the amount
of overhead that is allocated to government contracts, and, thus, that
government grants will pay for. Some examples are as follows.

Suppose that one type of research requires facilities that are more
expensive than classrooms, while another type of research requires only the
least expensive type of facility. In this case, the university can maximize
indirect cost recovery by bundling low-cost research with classrooms and
separating high-cost research from educational spaces, even if this
arrangement is inefficient. The high-cost research facilities then will be
fully reimbursed, while the reimbursement for low-cost research facilities
will be a weighted average of the true costs and the (higher) cost of
classrooms. Typically, research labs do have higher construction, maintenance
and operating costs than most other space, so indirect cost accounting creates
an incentive for universities physically to separate high-cost facilities with
a substantial volume of federally sponsored research. This practice reduces
the efficiency of university operations by inhibiting collaborative
interaction across these physical boundaries and creating unnatural barriers
between research and other activities, notably education, health care, and
other community service activities. For example, indirect cost recovery
procedures provide a disincentive for universities to make educational uses of
research facilities that are used for federally sponsored projects, and to
allow students to work in labs for academic credit rather than as research
assistants.

Another example of a socially destructive distortion is the incentive
that indirect cost recovery creates for the university to wall itself off from
its surrounding community. Consider the case of a research library. Research
universities subscribe to a long list of arcane, and very expensive, technical
journals. If a university adopts the socially desirable policy of allowing
members of the surrounding community to use its library, the indirect cost
audit will measure that a lower fraction of use is accounted for by sponsored research, and so cut the fraction of library costs that can be recovered as part of overhead. Quite rationally, the university is likely to make its research library off-limits to outsiders in order to increase its total grant payments from the government.

THE CASE FOR PROSPECTIVE REIMBURSEMENT

The main lesson from the preceding section is that indirect cost recovery for federal research grants is a procedure that allows universities to set a mark-up over the incremental costs of federal research. This mark-up rewards universities for committing resources to areas of research that have high federal priority and for creating an environment that supports and fosters high-quality research. Furthermore, as long as the purposes of federal support for university research extend beyond simply supporting the particular projects that receive awards, providing some excess of revenues over incremental costs is necessary.

Given this understanding of the economic role of overhead reimbursement, the current method of establishing mark-ups is seriously flawed. The goal in choosing a mark-up is to cover all incremental costs and provide an incentive for universities to want to win these awards in order to pay for other activities that universities value and, for the most part, policy-makers want as well. Perhaps a mark-up roughly equal to a university's own overhead rate provides roughly the correct incentive, but no theory predicts that current rates, or any others, are somehow precisely correct. In any case, variation in the magnitude of the mark-up across similar universities appears to have no justification in either economic analysis or public policy. Because overhead rates do not vary dramatically within broad classes of universities (e.g., public vs. private, and rank in the quality of education and research), essentially the same incentive could be created by using prospective benchmark
standards for overhead rates.

The concept of an indirect cost benchmark is to apply to each type of university the same fixed mark-up rate for overhead costs, based on a thorough government audit of overhead at a sample of peer universities. Benchmarks would be established by undertaking intensive, government-financed audits of a few universities. Universities would no longer be required to retain existing accounting systems for allocating indirect cost pools, to justify the amount recovered, and to undertake regular audits to authenticate that their indirect cost recovery was justified. Instead, universities would be required simply to maintain sufficiently transparent records that they could support a federal audit should they be selected as one of universities that would be audited to establish the next benchmark rate. The indirect cost rates derived from these audits would be fixed for several years, requiring the government to conduct only a few infrequent audits and giving universities a stable rate on which to base long-term capital expenditure plans and annual budgeting. The results of the audits would not be used to adjust any past indirect cost recovery for any university, including those that were audited. The total amount of indirect cost recovery by a particular university would bear no relationship to its actual indirect costs, but would instead be determined by the average proportion of indirect costs of all universities and its own success in winning awards.

The procedure for establishing nationwide indirect cost recovery rates must include a method for categorizing universities. One approach, which minimizes the redistribution of indirect cost recovery among universities, would lump together groups of universities that now have similar rates and status. The types of distinctions that would serve this purpose are public versus private, region, and rank in terms of research quality. This approach requires an objective mechanism for classifying universities that allows periodic reclassification to reflect changes in status. The interests of the federal government dictate that if a university undertakes a program to
improve its faculty and research facilities and succeeds in improving its ranking, it should be able to recover the rate given to its new peer group, not the past one.

A second approach would remove some of the rate difference in the present system. For example, the present practice of different reimbursement rates for public and private universities is difficult to defend if the point of indirect cost recovery is to generate a financial incentive to invest in research of interest to the government. The observation that some state governments return indirect cost recovery to the treasury is a superficial reason not to pay these universities the full amount of indirect cost recovery, for to do so will give the state government a greater incentive to invest in university facilities. Moreover, if a state persistently just keeps indirect cost recovery for other purposes, its university will deteriorate and so will see its grant income (and indirect cost recovery decline).

Recent changes in federal policies regarding indirect costs represent a first step in rationalizing indirect cost recovery. The cap on university administrative costs is a ubiquitous rate for one overhead category, and negotiated rates that are not strictly tied to indirect cost accounts move in the direction of simply setting a mark-up over direct costs. Both have the advantage that they attenuate the relationship between incurring a cost and receiving a payment, and so counteract to some extent the incentive not to control costs.

Unfortunately, these changes as implemented have substantial disadvantages. First, they still are based on complex accounting and auditing processes, and universities are still required to provide ex post justification for the costs that they recover, even if actual costs substantially exceed the caps. Second, negotiated rates are determined separately for each university, even though the outcome of the process are roughly similar in each case. These negotiations consume a great deal of administrative effort in universities as well as the government, and serve no
real purpose once one has abandoned the idea that rates are calculated on the basis of the principle of cost reimbursement.

The better way to implement the cap on administrative costs would be to adopt a flat rate for each peer group of universities and to relieve them of the responsibility for auditing these costs. This approach was proposed in 1988 by a panel that was organized by the American Association of Universities, under the leadership of Cornelius J. Pings, then the provost of the University of Southern California and now the head of AAU. The Pings report found that the aggregate rate for all administrative costs exhibited little variation among universities, so that adopting one rate for all would cause little disruption. The report also recommended "threshold" rates for libraries and student services that a university could adopt without providing proof by audit that actual expenditures matched or exceeded the flat rate.

The Pings recommendations remain a far better approach than the current system, and an excellent first step towards eliminating the present system. Certainly a transition period when universities could retain some of the present system would ease the adjustment for schools with unusually high rates for their peer group, although, as explained above, the magnitude of the required adjustment is a small fraction of total revenues for even the outliers. In any case, the government's response to the Pings report -- to cap administrative costs but to retain the auditing requirements and the rate negotiation process -- ignores the single most important feature of the proposal: fixing a benchmark rate that is not likely to be affected by the cost experience of a single university, and so encouraging efficient administration.

Our proposal goes beyond the Pings report to recommend a flat rate for the indirect costs of buildings and equipment within each peer group of universities. Universities have steadfastly opposed this approach on the basis of the argument that, unlike administrative costs, building and equipment costs legitimately can differ substantially among universities
within the same peer group due to differences in the relative amounts of different types of research that each university undertakes. In theory, this observation is correct, but it is not conclusive.

As a practical matter, except for single-purpose medical schools and universities in which only the medical school receives a significant amount of federal research support, research universities tend not to be highly specialized in particular areas of science or engineering. Except for the differences between public and private universities and among regions due to differences in utility and construction costs, the unexplained variance in this component of indirect costs apparently is relatively small. Moreover, if some universities did respond to a ubiquitous flat rate by specializing in fields that require little capital investments, the government could develop a peer group of specialized institutions that had its own rate. Furthermore, if benchmarking were adopted, provisions for special exemptions to retain the old system either permanently or during a transition could be made available for the few hard cases. Thus, the existing variation among universities falls into the category of a moderately interesting problem that can be solved rather than an inequity that is so immense that it makes the proposal unattractive.

Perhaps a more likely reason for resistance to benchmarking for buildings and equipment is that, unlike administrative costs, universities do not want to face an incentive to control these expenditures. Recall that the fundamental problem in keeping these costs reasonable is knowing whether they are necessary and efficient. Universities probably do not serve the objectives of faculty or top management by having a larger staff than they need for accounting and auditing; however, these groups may enjoy gold-plated buildings. Moreover, excessive expenditures on buildings, but not on administration, typically are financed from new and separate university funds (donors, state construction budgets), enabling the university to collect twice for building costs (the second time through indirect cost recovery). By
contrast, because donors are unlikely to endow administrative costs, universities collect the administrative costs of federal grants only once. Hence, universities have a much stronger incentive to reject benchmarking for facilities costs than for administrative costs.

A benchmark system for all components of indirect cost recovery has five important features that deserve a crisp summary.

First, the proposed system would continue to fulfill its main functions: providing a prize to universities for winning research grants and paying for some of the nonincremental overhead costs that are necessary to support all university activities. Because overhead rates within broad categories of universities do not vary greatly, this objective could be accomplished without a sudden, massive redistribution of grant revenue.

Second, benchmarking indirect costs reduces accounting and auditing requirements, and so provides an opportunity for considerable cost savings. Increasingly stringent accounting rules and intensive audits have caused a dramatic increase in administrative indirect costs. Part of administrative overhead is due to accounting, auditing, negotiating, and even litigating indirect costs.

Third, under a benchmarking system, universities would experience a new and potentially powerful incentive to eliminate excessive overhead expenditures. Under the current system, when a university incurs extra overhead expenditures for any allowable cost, it creates a basis for requesting a higher reimbursement rate from the federal government. Under a benchmark system, universities have an incentive to economize on indirect costs, thereby maximizing the difference between reimbursements and actual costs, which is the mark-up that can be spent on other priorities. Incentive prizes that are created by mark-ups are valuable because they encourage universities to incur overhead expenditures that increase the ability of the university to obtain research grants, but discourage spending on frills.

Fourth, the leverage that the federal government can exercise over
universities about how they spend indirect costs is minimal. The government has attempted to control some elements of indirect costs by capping them, by negotiating lower rates than are justified by the accounting procedures that the government requires, and by insisting that some funds from indirect cost recovery be spent in the same cost. But this interventionist approach is procedurally costly. Moreover, direct government oversight is not likely to have much of an effect on the propensity of a university to make extravagant and wasteful expenditures, not because universities are so adeptly managed, but because the government has no effective means for using indirect cost accounting to improve the quality of university management. Benchmarking replaces ineffective auditing procedures with much more effective direct incentives.

Fifth, the current system creates a serious and systematic set of incentives for universities to distort the way they conduct their research and other activities in order to maximize the amount of overhead that government will pay. All of these distortions would vanish under benchmarking.

CONCLUSIONS

The rationale for a system of cost-reimbursement for the direct costs of university research grants is easy to comprehend. Research projects are likely to vary enormously in cost, depending upon the number of personnel involved, the equipment that is needed, etc. One would be hard put to justify a method for reimbursing the direct costs of a research grant that did not explicitly deal with the differences in resources committed to, say, research projects in abstract mathematics versus high-energy physics. To induce universities to strike a proper balance between inexpensive and expensive projects (i.e., not to specialize in mathematics while closing down laboratory sciences), the size of a grant must reflect its direct costs. Insisting that a university must be able to prove that it actually spent the direct cost
award as promised is also prudent, given that the research output from a grant
can not be objectively specified in advance or accurately measured after the
project is completed.

Thus, a cost-reimbursement system for direct costs has considerable
merit. It places restrictions on the uses of the grant by both the university
and investigator, but it does not severely restrict the freedom with which the
investigator manages the project, including selecting the specific research
tasks to be carried out. Even though an elaborate accounting system for
measuring direct costs may be costly to operate, it is likely to have
significant advantages that would be difficult to match under any alternative.

A system of indirect cost reimbursement that is based on a university's
own accounting costs is much more difficult to defend. Indirect cost recovery
is best conceptualized as a procedure for allowing universities to set a mark-
up over direct costs. This mark-up rewards universities for supporting and
fostering high quality research in areas that the federal government wishes to
support, reimburses universities for part of the overhead costs that support
all of their activities, and gives them a little extra for supporting other
activities that do not receive federal grants.

Because actual overhead rates do not vary a great deal within each broad
class of universities, reimbursing overhead according to benchmark rates could
accomplish the same desirable functions. Prospective reimbursement also would
eliminate costly accounting and auditing requirements, provide universities
with much greater incentives to manage their own overhead costs prudently, and
remove a number of other distortions that are caused by retrospective cost-
based reimbursement of overhead. For all these reasons, we recommend that the
federal government develop a system of grant awards for universities that
makes far more extensive use of benchmarking.
1. In addition to project grants, the federal government also supports university research through institutional grants, contracts with universities to manage national labs, and payments to university medical centers for health services that exceed their costs. This chapter focuses exclusively on research grants because they are an extremely important activity for research universities and because they raise quite different contracting problems than the other two forms of federal support.

2. The term "full cost reimbursement" is misleading for two reasons that are discussed more fully in this chapter. First, the federal government makes various costs non-reimbursable, even if they are truly costs of performing the research. Second, in an environment with joint costs, "the" cost of a project can not be defined unambiguously, for reasons explained at length in this chapter. Thus, on a theoretical level, the meaning of the concept of full cost reimbursement is unclear. A recent report on indirect costs by staff of the Department of Health and Human Services accurately states: "Under the cost reimbursement policy, the Federal Government agreed to pay for some portion of the direct and indirect, or overhead, costs of research. However, it has never been clear that full cost reimbursement has been the policy." (HHS Working Group on the Costs of Research, Management of Research Costs: Indirect Costs, Washington: Department of Health and Human Services, May 1992, p. 5.

3. HHS Working Group, supra note 2, p. 23.

4. HHS Working Group, supra note 2, p. 25.


11. For more information about the history of federal policies for contracting with universities for research projects, see the HHS Working Group on the Costs of Research, *supra* note 2.

12. Universities with a very low volume of sponsored research (under $3 million) can use a simpler process for accounting for indirect costs.

13. Equipment is the major category that is excluded from the direct costs that are multiplied by the indirect cost rate to determine indirect cost recovery.

14. Why state universities follow this practice is a matter of some controversy. One plausible explanation is that some state governments require that public universities return indirect cost recovery to the state treasury (see HHS Working Group, *supra* note 2, p. 26), so the university has nothing to lose and possibly something to gain competitively by keeping indirect costs low and so reducing the bottom-line price that it charges the federal
government for research. Another possible explanation is that state universities exclude depreciation of state-financed buildings and equipment because the federal government would force them to do so to maintain parity with the exclusion of federally financed facilities.

15. HHS Working Group, supra note 2, p. 18.

16. Rather than allowing universities to charge a fraction of faculty salaries to federal research grants, and then declaring this cost to be unallowable, federal agencies generally follow the essentially equivalent practice of requiring universities to practice "cost sharing" by paying all or most of the salaries of faculty who have research grants.

17. HHS Working Group, supra note 2, p. 18.


20. For example, the Inspector General of HHS, among possible solutions to the problem of rising indirect cost rates, proposed that the federal government pay no more in indirect costs than the lowest rate offered to any entity and that even this rate be limited to expenditures for items that are incremental to federally sponsored research. U. S. Department of Health and Human Services, Office of the Inspector General, Federal Funding to Colleges and Universities in Support of Research, Washington: HHS, May 1991.

21. Presumably, the existence of these productive synergies is the reason that the activities are taken place within a single organization in the first place.

22. Total federal obligations for science and engineering R&D were $144 million at the 24th leading institution, Arizona, in 1994. If, as estimated
by the HHS Working Group (supra, note 2, p. 23), thirty percent of this revenue were indirect cost recovery, then Arizona collected slightly more than $100 million in direct costs. The leading institution was Johns Hopkins, with $613 million; however, a large part of this support was for a specialized research facility that is nearer a national laboratory than an academic research program. Washington, MIT and Stanford rank below Johns Hopkins, total R&D support of between $250 and $275 million, which translates to direct costs of under $200 million. See U. S. National Science Foundation, Federal Science and Engineering Support to Universities, Colleges, and Nonprofit Institutions, NSF 96-317, Arlington, Virginia: National Science Foundation, 1996, p. 35.

23. In 1994 nearly $12 billion was granted to universities for research and development (not including facilities grants). Some of the latter funds are not for standard research projects, but are allocations to research centers that have different accounting procedures. The government does not separate these allocations from the rest, but the vast majority of support is for ordinary project grants. For example, the National Institutes of Health and the National Science Foundation spent about $8 billion on R&D at universities in 1994, and almost all of the funds from these agencies are for standard project grants. Hence, if 31 percent of grant awards are for indirect cost (supra, Note 13) the estimate of $3 billion for indirect cost recovery is not likely to be substantially in error.

24. The administrative cost cap has two benchmarks: a lower amount (24 percent) that requires less justification, and a higher amount (26 percent) that requires more extensive justification. The thrust of our argument is that once one has set a cap that is roughly equal to average cost under the present system, there is no reason to audit actual expenditures for the purposes of determining whether the university actually spent more than the capped amount.
25. Association of American Universities, *Indirect Costs Associated with Federal Support of Research on University Campuses: Some Suggestions for Change*, Washington: AAU, December 1988. The report also recommended greater rationality in distinguishing direct and indirect costs, proposing that, generally speaking, more costs should be measured in a manner that allowed them to be part of direct costs. A similar but more limited proposal to set a single, unaudited rate for departmental research was proposed by the Comptroller General in *Assuring Reasonableness of Rising Indirect Costs on NIH Research Grants -- A Difficult Problem*, Washington: U. S. Government Accounting Office, March 16, 1984.

26. The HHS Working Group, supra note 2, undertook a regression analysis of the components of indirect cost rates and found that nearly all of the variance among universities could be explained by ownership (private or public), amount of research expenditures (a measure of quality), and region (to reflect differences in wages, utility prices, and construction costs).