RESOURCE ALLOCATION WITHIN US PUBLIC RESEARCH UNIVERSITIES: INCOME PRODUCTION FUNCTION AND SOCIAclyy CONSTRUCTED DECISION-MAKING APPROACHES

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UNIVERSITIES: INCOME PRODUCTION FUNCTION AND SOCIA LLY
CONSTRUCTED DECISION-MAKING APPROACHES

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Abstract: In the past 15 years, state financial support for public universities has declined, when measured as a proportion of current-fund revenues while expenditures, in the same time period have risen dramatically. In this mixed methods study, several theories were used to explain patterns of university resource allocation: The economic theory of the firm, resource dependency theory, rational/political and critical/political. The research combines d’Sylva’s (1998) and Volk’s (1995) work and considers, by measuring directly the role of administrators who have budget authority, the impact of the socially constructed production function. The study uses d’Sylva’s work extensively in order to create the baseline econometric analysis by including the relevant variables. In addition, the study adds to the existing body of knowledge by providing a broader understanding of production functions that encompasses the role of the socially constructed production function by key administrators who have budget authority. To test and explore the theories, departmental instructional and research productivity data from the AY 1999 American Association of Universities Data Exchange are examined. The quantitative data sample consisted of 10 major public Research I universities and 152 departments. OLS and GLM regressions, following a semi-log specification were employed to estimate the rate of return to instructional productivity, research productivity, and departmental quality. The qualitative sample consisted of six administrators with budget authority from one Research I university. A thematic analysis technique was employed in order to identify salient themes related to internal resource allocation. Significant findings are that undergraduate instruction and departmental quality yield high returns to departmental earnings. Cross-subsidization exists and some departments within fields enjoy “halo effects” above and beyond their productivity and merit. In describing the socially constructed nature of such difference, one dean is cognizant that his college is very productive and efficient delivering “cheap” instruction, yet it is penalized in the allocation formula. Similarly, another dean is very aware that his college has large numbers of women and minorities that help in the “coloring” of the university, and that disadvantages his college in the allocation formula.
Introduction

The impetus for this study rests in the fact that shifts and mechanisms in the financing of public higher education institutions are becoming increasingly evident. For example, there is a clear trend toward competitive and incentive based budgeting models that have emerged over the last two decades. Coupled with the current financial environment, and projected financial outlook this makes a study of internal resource allocation in public Research I universities particularly important.

Previous work along these lines, such as d’Sylva’s (1998) and Volk’s (1995) work on internal resource allocation using competing models to explain allocation of resources, has aided tremendously in guiding how this study was pursued. Since d’Sylva’s and Volk’s studies, public Research I universities have continued to experience constrained financial times due to 9/11, an economic recession, and two ongoing wars, one in Afghanistan and one in Iraq. These events have thrust many states into structural deficits. As a result, state coffers have suffered tremendously and face deficits that range up to a growing upper bound of 38 billion dollars in California. Such deficits have had substantial impacts on state allocations to public Research I universities, resulting in budget rescissions in fiscal years 2001-02 and 2002-03.

Universities’ responses to such budget crises have ranged from program mergers and buying out faculty to program eliminations. Some universities have proposed initiatives to reorganize their campuses in response to the crisis. Many have responded by raising tuition and exercising widespread tuition price discrimination practices. That is, universities are charging more for graduate students and professional students and charging special fees. In short, universities are shifting, ever increasingly, the costs of higher education to the consumer; to students and their families (Mumper, 1996).

Current budget constraints further underscore the importance of internal resource allocation in universities. Higher education institutions, as always, must manage their scarce resources wisely. The questions posed by d’Sylva in 1998 remains significant: how are state resources allocated within public research universities in the allocation function? That is, which outputs will universities favor in the allocation process given the tighter budget constraints since his study? Will monies be shifted to research intensive units or to teaching intensive units given the increasing monies coming from grant and tuition monies? This study explores this question in the context of public research universities allocation of state monies.

Statement of the Problem

Revenue changes for public universities have been substantial in the course of the last 15 years. An analysis of the revenue streams for public institutions of higher education over the 10 year period from 1985 to 1994 that d’Sylva (1998) reported on and the most recent time period from 1994 to 1999 indicates that the trend described by d’Sylva is continuing, but leveling off somewhat. In his analysis, d’Sylva noted a decline in the proportion of current-fund revenue provided from the state between 1985 and 1994, from 45.1 percent to 35.9 percent, representing an absolute decrease of 20 percent. The trend has leveled off to 35.8 percent in 1999. The
absolute decrease from 1985 to 1999 now represents 21 percent. Conversely, during the same 15 year period, tuition and fees and private gifts, grants and contracts have increased dramatically in order to offset state appropriation decreases. Tuition and fees rose sharply from 14.6 percent in 1985 to 18.5 percent in 1999, an absolute increase of 27 percent while private gifts, grants and contracts rose from 3.1 percent in 1985 to 4.8 percent in 1999, an absolute increase of 55 percent (See Figure 1.1).

Figure 1.1. Percentage Distribution of Current-Fund Revenue of Public Higher Education Institutions, by Source: 1985 to 1999.


Figure 1.1 demonstrates a clear shift in the pattern of funding for public higher education institutions. On the one hand, there is a decline in the proportion of state funding and on the other hand alternative resources led by tuition and fees and private gifts, grants and contracts are increasing. Whether in response to this decline in the proportion of state funding (Slaughter & Leslie, 1997; Ward, 1997), or to satisfy other ends such as personal utility and prestige (James, 1990), universities, and hence, faculty, have sought and will continue to pursue alternative sources of revenue. Mayhew, Ford and Hubbard (1990) document the acceleration in student tuition and fees over the past decade; Kerr (1994) discusses the increased dependency of universities upon stipulated research money provided by government and industry; and Leslie
and Rhoades (1995) and Slaughter and Leslie (1997) discuss the search for new revenues via development and endowment money.

Increases from these alternative revenue sources, plus gradual increases in state support in absolute terms have increased institutional expenditures (e.g., instruction, research, public service academic support, student services operation and maintenance of plan, auxiliary enterprises, and others, See NCES, 2003 p. 391 for complete listing of institutional expenditures) for the public higher education system by 122 percent in current dollars over the fiscal year period from 1986 to 1999. This translates into a 78 billion dollar increase in real terms. This is certainly a sharply and positively increasing slope. However, when measured in 1999 constant dollars using the Higher Education Price Index (HEPI) deflator (See Appendix 1), expenditures increase by 38 billion dollars, from 103 billion dollars in 1986 to 141 billion dollars in 1999. This translates into a 37 percent increase (inflation adjusted). (See Figure 1.2). Such increases would seem to call into question whether the current context is actually one of fiscal stringency and crisis in terms of overall monies.

Figure 1.2. Institutional Expenditures of Current-Fund Revenue in Public Higher Education Institutions in Current Dollars and Institutional Expenditures of Current-fund Revenue in Public Higher Education Institutions, in 1999 Constant Dollars: 1986 to 1999

Government funding (i.e., federal, state and local government) has increased by 91% in current dollars over the fiscal year period from 1986 to 1999. This translates into a 35 billion dollar increase in real terms. This is certainly a positively increasing slope. However, the increase is not at the rate of the slope for increasing institutional expenditures. Moreover, when measured in 1999 constant dollars adjusting for the HEPI government funding increased by 11 billion dollars, from 62 billion dollars in 1986 to 73 billion dollars in 1999. This translates into a 17 percent increase (inflation adjusted) (See Figure 1.3).

**Figure 1.3.** Federal, State, and Local Government Current-Fund Revenue to Public Higher Education Institutions in Current Dollars and Federal, State, and Local Government Current-Fund Revenue, in 1999 Constant Dollars: 1986 to 1999


Both trends overlaid, measured in 1999 constant dollars, paint a complete picture of the sharp increase in institutional expenditures relative to government funding (See Figure 1.4). In the time period between 1986 and 1999, institutional expenditures have increased by 37 percent while government funding has increased by only 17 percent. That is, institutional expenditures have outpaced government funding by a two-to-one margin. The fact that institutional expenditures are rising faster than government funding can keep up with such expenditures.
indicates that higher education institutions have sought alternative funding to support these activities.

**Figure 1.4.** Federal, State, and Local Government Current-Fund Revenue to Public Higher Education Institutions and Institutional Expenditures of Current-fund Revenue in Public Higher Education Institutions, in 1999 Constant Dollars: 1986 to 1999

![Graph showing trends in government revenue and institutional expenditures from 1986 to 1999.](image)


Furthermore, despite the declining rate of state government support to higher education, the magnitude of these current-fund revenues has continued to increase in real terms (inflation adjusted) over this period (See Figure 1.4). Given a set of conditions in which the other revenue sources are fixed, the absolute increases in state support translate into increasing shares of institutional current-fund revenue. However, increases in revenue from alternative sources are not fixed, but rather have outpaced the increases from the state, and therefore, contributed toward the *relative* decline in state government support within the revenue base of these institutions. In short, public universities are becoming increasingly reliant upon revenues other than state current-fund appropriations.

Many authors argue that these funding changes may create an implicit tension between the instructional and research mission of the university (Fairweather, 1996; Slaughter & Leslie, 1997; Volk, 1995; Volk, Slaughter, & Thomas, 2001; Ward, 1997). The connections of this tension to public finance and social expectations can be drawn as follows: Given the economic
assumption from the classical perspective that education is a quasi-public good (Rosen, 2002), higher education should be subsidized by the state to the extent that it provides goods and services that promote the welfare of the state and serves the public interest (Tuckman & Chang, 1990). Put in reverse fashion, public subsidies should not be used if private resources are adequate to satisfy the public need.

Economists such as Thurrow (1990) argue that in the 21st Century human capital will be the primary economic resource able to increase a society’s production possibility curve (PPC). That is, an increase in the PPC raises, in general, living standards. The development of human capital through instruction and training, therefore, is the primary function for which universities will be funded by the state. What is more, James (1990, p. 90), in an attempt to estimate the political demand function of universities, poses the question, “What, then, do members of the legislature care about, what are their priorities?” She argues that if they as politicians want to maximize the political gain from their votes, they will care about the quantity of undergraduate students being educated. Thus, more political stock will be invested in the numbers of undergraduates being educated at universities than in any other function: a completely rational approach to legislative behavior.

One of the major sources of alternative revenues, however, is grants and contracts, which are sponsored primarily by the Federal Government. Therefore, research output, not instruction, is the primary purpose for which grant and contract revenue is provided, and, hence, drives faculty to invest much of their time in research activity. Grant and contract agents may place universities under increasing pressure to choose how they should allocate their competing time between the teaching and research missions.

In contrast to block-grant state funds, the alternative revenue stream of research grants and contracts is often highly restricted. This means that these resources may only be expended to fulfill the purpose for which they were granted, usually specific research or specific research-related tasks. As the relative proportion of funding from these revenue streams increases, the allocation function of the university changes accordingly; the worry is that increased faculty attention towards research comes at the expense of teaching (Slaughter & Leslie, 1997; Ward, 1997).

Another significant source of revenue that is primarily directed towards instruction is tuition and fees. However, these monies, like state revenues, are not generally restricted; thus, the argument is that in their search for more prestige and for more research related revenues, institutions are diverting some of these tuition monies to support research.

Purpose

The purpose of this study is twofold: to conduct an econometric analysis of internal resource allocation and to explore key decision makers’ beliefs about internal resource allocation. That is, like d’Sylva (1998), this study estimates the production (allocation) function of public research universities through modeling the income production function of academic departments; however, it adds an exploratory section through personal interviews with decision-
makers in one institution to develop an understanding of deeply held beliefs of prestige and productivity that are embedded in the thinking of key resource allocators.

In the econometric analysis section, the purpose is to estimate the relative “rate of return” universities assign to teaching productivity and research productivity and to assess whether this return has changed over time. In order to make valid comparisons of work productivity from one time period to the next, the quality of the work was taken into account by including a measure of departmental quality in the model. In the exploratory analysis section, personal interviews with university administrators were used to understand how decision-makers with budget authority conceive of key concepts in making resource allocation decisions.

For the purpose of this study, the allocation function is modeled by the estimation of a revenue function. Revenue functions are part of the family of functions known as Income Production Functions. These functions are commonly found in the human capital theory literature, where they are used to estimate the relative importance of variables in the production of income (Jehle & Reny, 2001; Ramanathan, 1995; Varian, 1992). When income is derived from a central allocation source, the relative importance of variables to the production of income is also a measure of their importance in the allocation of that income. Consider the case where the earnings function is estimated for a population of workers at a single factory. Because all workers are all paid from the same central source (the part of the budget the company sets aside for salaries), the relative importance of the variables that impact upon worker incomes are also by definition a measure of how the company decides salaries should be allocated. Therefore, by modeling the income function for these workers, the allocation function for the company is being modeled also [The terms, “allocation function” and “income (revenue) production function,” heretofore, will be used interchangeably when referring to the university’s goals and the department’s revenue generating endeavors respectively].

By substituting the department for the individual workers and the university for the factory in the example above, the revenue production function, or income function, is estimated as a means of determining the relative importance of teaching and research productivity among these organizations’ allocation priorities (i.e., their missions). Further, departmental expenditures of non-restricted funds are used as a proxy measure for revenues derived from the institution’s current-funds. Thus the relative importance of teaching and research in generating departmental revenues reflects the relative importance each has in the allocation priorities of the institutions. Unlike teaching, the relative importance of research is estimated conservatively in this model because research expenditures, or more accurately, indirect cost recovery monies are not included in non-restricted current-funds in the Delaware Expenditure Study that is part of the American Association of Universities Data Exchange (AAUDE) data set—the primary dataset used for this study.

Departmental income in this study is modeled as a function of teaching productivity, research productivity, and departmental quality. To the extent that institutional resource allocation is measured by departmental expenditures of non-restricted funds, the relative effects of these outputs upon the allocation of resources represents one way of measuring the importance of different variables in the resource allocation decision making process (Dawes, 1971; d’Sylva, 1998; Pfeffer & Salancik, 1974).
The impact of internal decision making on resource allocation for this study is examined with respect to the revenue of academic departments aggregated by academic field of science. In keeping with d’Sylva (1998), this study will use the department as the unit of analysis for its organizational importance in university decision making and resource allocation, an important empirical gap in the literature that d’Sylva addressed and this study will address as well (Fairweather, 1996; James, 1990; Pfeffer & Salancik, 1974; Massy, 1996). Moreover, this study will further address a gap that neither d’Sylva nor Volk (1995) addressed. That is, this study will explore how decisions-makers with budget authority conceive of key elements in the production function for making resource allocation decisions.

Conceptual Framework

How universities are conceived is important in selecting competing decision-making theories that guide resource allocation. Although multiple theories of universities as organizations exist, two sets of theories prove especially useful for this study of resource allocation in public research universities: the first set of theories guide the econometric analysis part of this study and the second set of theories help to frame the exploratory section of this study. The first set of theories consists of the economic theory of the firm and resource dependency theory and the second set of theories consist of rational/political, critical/political theories pursued through a social constructivist interpretive lens for the exploratory section of this study.

The economic theory of the firm conceives of higher education units as rational economic actors. The economic theory of the firm has been extended to include multi-product, not-for-profit organizations, making its application to universities reasonable (e.g., James, 1978). Resource dependency theory lends itself to the study of universities as complex organizations with often diverse constituents and competing goals by emphasizing the political dimension of these organizations and their relationship to the external resource environment (Pfeffer & Salancik, 1978)

Rational/political theory suggests that resource allocation decisions are rational and made by a few key informed individuals. By contrast, critical/political theory conceives of a much more complex set of relationships that are shaped by gender, race, power and service to external constituencies that are dominant external to the university marketplace. Social constructivism focuses on the meaning making of participants—human beings who make resource allocation decisions based on what socially constructed understandings of key issues and concepts. These sets of theories offer alternative, though not mutually exclusive, explanations of the bases for resource allocation within higher education institutions. What follows is a brief account of the sets of theories and their implications.

First Set of Theories

The Economic Theory of the Multi-Product, Not-For-Profit Firm. The economic theory of the firm, heretofore referred to as the “theory of the firm,” is based upon the paradigm that an organization pursues a set of goals to maximize its satisfaction, subject to one or more
constraints (James, 1990; Tuckman & Chang, 1990). In microeconomics this quest to maximize one’s satisfaction or realize one’s preferences is known as utility maximization (Jehle & Reny, 2001; Varian, 1992; Varian, 1999). In the case of not-for-profit organizations, satisfaction is maximized when the organization allocates resources to each goal in such a fashion that no other combination of resources gives rise to a higher level of total utility, given the constraints (James, 1978). The fact that universities are not-for-profit organizations that produce multiple outputs leads to a number of behavioral implications that differ from the traditional microeconomic theory of the firm viewpoint: 1) the objectives of decision-makers matter in determining choices and levels of output; 2) that cost-minimizing factor combinations may not always be chosen; and 3) that cross-subsidization plays an important role (James, 1990).

Universities are not-for-profit “firms” and they are a “special case” within the not-for-profit sector. Unlike profit maximizing organizations that seek to minimize costs, not-for-profit organizations may produce more costly products and services than are optimal from a typical microeconomic profit making perspective, in order to satisfy their own preferences. The major goal sought by universities is “prestige maximization.” Similarly, Garvin (1980) posits that the university’s utility is a function of prestige and a number of other scholars agree (Jencks & Reisman, 1968; Mayhew, 1970; Vladeck, 1976). In fact, Clotfelter (1996), James (1990), and Leslie and Rhoades (1995) argue that universities, as not-for-profit enterprises, maximize revenues rather than profits to serve clients better and to maximize prestige. Clotfelter and Leslie and Rhoades link the dramatic increases in university costs to the pursuit of prestige. In short, prestige maximization has been identified in these and other studies as a common goal that yields maximum utility to the university decision-makers.

Consequently, not-for-profit decision-makers have relatively little discretion over the prices, subsidies, or costs associated with the products and services being delivered, instead, they alter the mix of their organizational products and services to emphasize those that best reflect their revealed preferences (James, 1990; Wildavsky, 1988; Winston, 1999).

However, there is a limit in the degree to which these decision-makers can emphasize their preferences, a limit imposed such that the aggregate revenues of the organization must cover its aggregate expenditures known as the budget constraint. Since these decision-makers have preferences of one product or service over another, and because the production of some of the preferred products or services may not cover their own expenditures, these organizations find themselves taking on profit-making activities that cover the deficit incurred by other activities. According to James (1983), this phenomenon is referred to as cross-subsidization.

Overall, the distinguishing characteristic of the theory of the firm, as it may apply to public higher education, is its rooted attributions in rational, direct connection of means to ends, and resource allocation processes to goals achievement (i.e., prestige maximization).

The External Control of Organizations: Resource Dependency Theory. The importance of goals as a defining characteristic of organizations has been criticized on several grounds: Goals presume a singularity of purpose (Pfeffer & Salancik, 1978); organizations assume that goal setting and choice have an influence over outcomes (Bollinger, 1990; Chaffee, 1983; Doris &
Loizier, 1990; Drohan, 1997; Hardy, 1991; Liff, 1997; Migliore, 1991; Mintzberg, 1994; Morgan, 1984; Myers, 1996; Redding & Catalanello, 1994; Swenk, 1999; Weimer & Jonas, 1995) and the importance of forces external to the organization are neglected (Pfeffer & Salancik, 1978). Resource dependency theory conceives of organizations as coalitions that “alter their purposes and domains to accommodate new interests, sloughing off part of themselves to avoid some interests, and when necessary, becoming involved in activities far a field from their stated central purposes” (Pfeffer & Salancik, 1978, p. 24). Pfeffer and Salancik see the relationship between resource providers and the organization as a political relationship, because the resource provider holds great power, if not formal authority, over the organization. Recognizing the plurality of goals that exists within organizations, this framework allows for the incidence of conflict and bargaining when goals are divergent.

The process of competing for resources and determining who secures them is central to this framework. As Pfeffer and Salancik (1978, p. 44) state, generally, “Organizations will tend to be influenced by those who control the resources they require.” Or as Slaughter and Leslie (1997, p. 68) put it “He who pays the piper calls the tune.” Two factors are important in determining the level of dependence of one organization over another: the relative magnitude of the exchange and the criticality of the resource.

The relative magnitude of the exchange can be assessed by measuring the proportion of resource shares provided. Organizations with a narrow resource base are more susceptible to inter-organizational control than those with diversified resources. Criticality of a resource to an organization is measured by the organization's ability to keep functioning in the absence of the resource. Resource importance as defined by this measure is independent of its magnitude.

Pfeffer and Salancik (1978) argue that the importance of a resource to organizational functioning, as such, is not problematic. Rather, vulnerability is derived from the possibility of changes in resource supply. To ensure the survival of the organization, it is the compulsory responsibility of the production units to minimize the possibility of resources becoming scarce given that scarcity is central to driving economic behavior in any economic theory. That is, according to Pfeffer and Salancik (1978, p. 2), “The key to organizational survival is the ability to acquire and maintain resources.” In the case of public universities in the present era, the rational response to the declining rate of state funds has been to increase the share of other revenues in their base, and in so doing, protect their revenue supply.

Whereas the theory of the firm is a relatively straightforward connection of means to ends, resource dependency theory conceives of a much more complex set of relationships. And, in fairness, the theory of the firm has been employed and will be employed in this study more as an analytical tool than as a fully encompassing theory that explains organizational behavior. Most analysts who have utilized the theory as a basis for testing production functions would never argue that the theory is a complete description of allocation behaviors (Rothschild & White, 1995; Winston, 1999). Instead, most would acknowledge, for example, the role of the political behaviors inherent in the resource dependency theory of Pfeffer and Salancik (1978). Nonetheless, the theory of the firm does offer an alternative conception of universities as organizations and specifies a set of alternative resource allocation patterns (d’Sylva, 1998).
Second Set of Theories

Rational/Political. The rational/political theoretical perspective is grounded in functionalist theory from sociology. The bedrock of this school of thought is that resource allocation decisions are rational decisions made by a few key informed individuals in the organization. The rational approach follows from the belief that there exists a functional importance to how resources are allocated. Efficiency and effectiveness are the drivers behind internal goal setting and decision making (Morgan, 1983). In this paradigm, decisions are made by developing general goals and principles for the organization. Once goal setting has been accomplished, specific planning, budgeting, and resource decisions can be made.

The political dimension in this theoretical perspective suggests that resource allocation decisions are made through a process of interest-group bargaining. That is, the power of academic units and individuals or coalitions within these units has a direct influence on the resource allocations the unit receives. The one exception of course is that of resource dependency theory that is in play (Pfeffer & Salancik, 1978). That is, the academic units and individuals can benefit from powerful attributes by securing external resources. While academic units and individuals accrue power by bringing in external funding that is highly valued by the organization, Hackman (1985) and Ashar and Shapiro (1990) argue that this process does not disrupt the economy and efficiency of the institution.

Typical variables that are analyzed in this conceptual framework are variables that follow from the functionalist framework surrounding the notion of meritocracy such as centrality, workflow, productivity, quality, and external funds. These variables suggest that if a unit rates very high in these various dimensions then the unit merits or deserves large resource monies. That is, those units who are central to the organization, highly productive, and high quality units that bring in large external funding deserve increased resource allocation.

The literature paints the picture that the rational/political, by all accounts, is a functional approach to the analysis of resource allocation. Workflow, centrality to mission, and quality of particular units are seen as key explanatory variables accounting for patterns of resource allocation.

Critical/Political. The critical/political perspective is grounded in critical theory. According to this perspective, resource allocation is shaped by variables such as race, gender, power, and service to external constituencies dominant in the broader political economy. It follows that administrators of the organization have socially constructed an idea of higher education and its relationship to the corporate marketplace that privileges certain social groups and their connection to large corporations. According to Slaughter (1993), units able to claim a position that is close to this market are highly favored. Units with more male, Anglo faculty and/or students may also tend to be favored in the resource allocation process. Moreover, resource allocation decisions are made by those individuals in power often in conflict with the alleged goals of the organization. In fact, such decisions may even undermine institutional goals of equity, meritocracy, economy, and efficiency.
It should be noted that resource dependency is also a component of the critical/political framework. In the rational/political framework, the institution may privilege units garnering external resources, but not to the point of inefficiency. In the critical/political framework, external dollars may be pursued even to the point of inefficiency. That is, departments with fewer students, fewer women, and minorities may be favored if they are generating valuable external dollars to the institution.

Typical variables that are analyzed in this conceptual framework are variables such as perceived closeness to the corporate market, gender, ethnicity, and external funds. The thrust behind a critical/political perspective is one that purports to explain resource allocation for various units using such variables. This approach suggests that those units that are considered to be close to the market would receive a greater share of resources. Units that are comprised of relatively large numbers of women and minorities are expected to be under funded with respect to their productivity and quality. From this argument one could expect that units with faculty of large concentrations of women and minorities are undervalued in terms of salaries compared to other units with faculty of smaller concentrations of the same (Bellas, 1994). Moreover, powerful units, proxied by external funding dollars, should benefit from increased resource allocation.

*Social Constructivism.* Social constructivism is used in this study as an interpretive lens in understanding how decision-makers formulate resource allocation decisions rather than a theory of decision-making. That is, in the end, human beings make decisions based on some conceived understanding of how things are or should be, what a productive department is and what it is not, and the like. The central tenet of social constructivism is that "social problems are the definitional activities of people around conditions and conduct they find troublesome, including others' definitional activities. In short, social problems are socially constructed in terms of the particular acts and interactions problem participants pursue and in terms of the process of such activities through time" (Schneider, 1985, p. 209). According to Neumann (1995), social constructivism views the world as a human creation. That is, human beings construct it, personally and in interaction with each other. Neumann points out that discovery in the constructivist view, proceeds from individual and communal self-reflection. Moreover, Slaughter (1993) argues that the market within the university setting is an idea that is socially constructed by faculty and administrators. In particular, those who have budgeting authority may have a socially constructed idea of the production function of the university, and of which departments are meeting this function.

*Both Sets of Theories Combined*

The theory of the firm suggests a fairly linear connection of means to ends while resource dependency theory conceives of a much more complex set of relationships. Rational/political theory suggests that resource allocation decisions are rational and made by a few key informed individuals whereas critical/political theory conceives of a much more complex set of relationships that are shaped by gender, race, power and service to external constituencies that are dominant external to the university marketplace. And, social constructivism addresses the participants—human beings who make resource allocation decisions based on what is socially constructed.
Economic theory, resource dependency theory, rational/political, critical/political and social constructivism are used to examine resource allocation in the proposed study for three reasons:

1. They offer alternative approaches to derive different testable propositions for the allocation function of universities.
2. They offer reasonable and often times complementary interpretations of decision-makers’ behavior based on how they conceive of what are important factors in resource allocation decisions.
3. The need exists for more empirical studies of resource allocation from both sets of theories and a social constructivist perspective (d’Sylva, 1998; James, 1990; Slaughter, 1993; Slaughter & Leslie, 1997; Volk, 1995; Volk, Slaughter, & Thomas, 2001).

Moreover, it should be noted that the theories are not mutually exclusive or that those who have employed the theory of the firm as a basis for estimating university production functions have assumed that economic theory fully describes organizational behavior as asserted by Winston (1999). In this study, the researcher recognizes that the sets of theories in combination with each other aid in explaining the production function inherent in resource allocation decisions as applied in practice. Moreover, the theories can be contrasted and the exploratory section offers a rich understanding as to how they mesh together in such explanation.

Research Questions and Hypotheses

In keeping with d’Sylva (1998) and a variation of his original research questions, the research questions for the present study may be posed as follows:

1. Does the relative weight of research productivity exceed that of teaching productivity in the income production function of academic departments in public Research I universities?
2. What is the impact of departmental quality upon the production of departmental income in public Research I universities?
3. Do structural differences exist across the various fields of science: Computing and Mathematics, Life Science, Engineering, Social Science, and Physical Science?
4. How do decision makers conceive of productivity, university and the external world, diversity, efficiency?
5. To what extent do these socially constructed concepts converge with the two sets of theories?

Econometric Framework

Theory of the Firm

Under this framework, the first priority of not-for-profit, multi-product firms, such as universities, is to find a break-even point product mix, so that revenues cover costs; however, this break-even constraint need not apply to each product taken separately. Under the theory, the
survival priority of public universities is to find a set of profitable activities that attract a clientele and that the faculty is willing to carry out, using a low cost technology. Undergraduate teaching, especially lower-division undergraduate teaching, has traditionally served as the profitable activity of U.S. higher education institutions, along with any low-cost programs, undergraduate or graduate, in fields such as business, humanities, social sciences, and some vocationally-oriented programs (James 1990). Thus, the relative importance (as measured by the rate-of-return) of those low-cost, profit producing fields will diminish further within the institution’s allocation function, as “profits” in these fields are used to subsidize the high-cost, deficit producing fields.

If profit-making undergraduate education is, in fact, increasingly cross-subsidizing research in public universities, then one would expect a relative decline in the “profit” associated with the production of undergraduate teaching in the revenue function of the department. That is, the university will become more prone to taking money from the production of undergraduate education and giving it to the loss-making endeavors, which may include graduate education and research. Furthermore, because research as is claimed, in general, has greater utility for faculty (given the research-tilted incentive structure such as more prestige and financial rewards of most Research I universities) than does teaching and because it is far easier to measure than teaching, faculty will be inclined to do more research (James, 1990). Accordingly, universities will increasingly cross-subsidize research from undergraduate teaching, and hence, lower the relative rate of return of undergraduate teaching in the institutions allocation function.

As a corollary to this, the relative rate of return for research will increase as the subsidies to it from undergraduate education increase. As graduate students are often used as inputs into the production of research and hence have a complementary effect on research, the relative rate of return attached to graduate instruction will also increase.

**Resource Dependency Theory**

Increasing the share of alternative revenues within the base of public universities has created a greater reliance upon them. This reliance has facilitated an increase in the criticality of these alternative resources to the organization, and furthermore, increased organizational vulnerability to the providers of these resources. With tuition and fees and research grants and contracts being the most significant and fastest growing of these alternative revenue sources, their criticality to the organization has increased also. Rather than research advancing in importance at the expense of teaching, an alternative conceptualization of resource dependency theory suggests that both research and teaching will increase in importance in the production of departmental revenues.

Pfeffer and Salancik (1974) show that departmental power has a sizable and significant effect upon departmental income production, even greater, in fact, than the effect of the quality of the department. Extending this to the level of the field, those fields that are traditionally powerful will be able to extend their advantage through the internal bargaining process, as suggested by the rational/political theory and secure more internal resources. Following this rationale, the importance of departmental quality will be to decline, relative to power, in the
quest for internal resources, and hence, will have a diminishing rate of return over time within the departmental income production function.

*Exploratory Framework*

*Rational/Political and Critical/Political*

These two sets of theories have been combined because they set the stage for how the exploratory section was developed. That is, in this study it is important to ask questions directly pertaining to key aspects of the theories.

For example, do resource allocators base decisions on rational thinking? As the rational/political theory suggests, are resource allocation decisions, in fact, made by a key set of individuals? With respect to this framework, are efficiency and effectiveness the compelling forces behind internal goals and decision making? Once goals are determined, does specific planning and budgeting take place in order to make effective resource decisions? Do units that acquire large amounts of external funding also earn power within the organization? These are all important questions that were explored within this framework. Moreover, what is the role of key variables such as centrality, workflow, productivity, quality, and external funds? In short, this section was designed to uncover any elements pertaining to this theoretical framework from resource allocators themselves.

In the critical/political framework, it was important to tease out the effects of race, gender, power, and service to external constituencies dominant in the broader political economy. That is, what have administrators with budget authority socially constructed about higher education and its relationship to the corporate marketplace that is believed to privilege certain social groups and their connections to large corporations? As argued by Slaughter (1993), departments with a greater proportion of White male faculty and/or students may also tend to be favored the resource allocation process. Put another way, departments with higher numbers of women and ethnic faculty face a premium penalty (Bellas, 1994) and a penalty in power status in the organization oftentimes at the expense of effectiveness, efficiency, equity, meritocracy and other stated goals.

Under this framework for both theories certain exploratory hypotheses arise:

1. As the rational/political theory suggests, resource allocation decisions, in fact, are made by a key set of individuals.
2. Efficiency and effectiveness are the compelling forces behind internal goals and decision making.
3. Effective resource decisions are made based on goal setting and specific planning and budgeting.
4. Units that acquire large amounts of external funding acquire power within the organization.
5. Centrality of the department’s product, work flow, productivity of the department, quality of the department, and external funds generated by the department are important determinants in the resource allocation function.
6. Administrators with budget authority conceive of the university in ways that benefit certain groups that are closely aligned with the corporate marketplace, and, as a result, those units are privileged based on their corporate connections.
7. Departments with a large proportion of women and ethnic faculty face a power penalty in the organization, oftentimes, at the expense of effectiveness, efficiency, equity, meritocracy and other stated goals.

Ideally, the econometric section of this study would include a comprehensive set of measures that directly tests the explanatory power of each theory combining all theoretical frameworks in one compact mathematical model. In addition to the measures used in this study, these might include direct measures of departmental power, efficiency, faculty utility, gender, race, and resource criticality. However, due to the limitations of the data available and the harmony of the effects as hypothesized under both sets of theories, the relative explanatory power of each theory is premised upon the outcomes related to two sets of variables: undergraduate and graduate credit hours and sponsored research expenditures and departmental standing. The exploratory section serves to broaden our understanding of key elements that do not fit neatly in a mathematical model yet powerfully explain constructs that are not precisely measurable.

Design

Following d’Sylvia’s (1998) econometric approach, an ordinary least squares multiple regression model is employed, relating institutional resource allocation (departmental earnings) to measures of departmental output. Departments in the fields of science, engineering and mathematics (National Science Foundation, 1993) are chosen as the units of analysis.

Model Specification

A semi-log relationship is obtained between departmental earnings and student credit hours. The same relationship holds true for research. In the present model, lower and upper division student credit hours were collapsed into one variable of undergraduate student credit hours, master’s and doctorate student credit hours were collapsed into graduate student credit hours, and faculty quality and program effectiveness were averaged (a mean value consisting of both variables was computed) into departmental standing. Thus, the generalized model is given by

\[ \ln(E) = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 \]

where,
- \( X_1 \) = Undergraduate Student Credit Hours
- \( X_2 \) = Graduate Student Credit Hours
- \( X_3 \) = Sponsored Research Expenditures
- \( X_4 \) = Departmental Standing
This generalized model is extended to include departments for all field groups under investigation in this study: computing and mathematics, engineering, life science, physical science, and social science. The full discussion is provided in the data analysis section.

Higher education institutions must make choices in the allocation of their finite resources across their missions of teaching, research, and public service while being constrained by scarcity of traditional resources and unforeseeable events like 9/11 and others. Changes in the sources and levels of funds available to universities may affect their allocation functions. In the past 15 years, state financial support for public universities has declined, when measured as a proportion of current-fund revenues. Whether in response to this decline or to satisfy other ends such as personal utility and prestige, universities, and hence faculty, have sought alternative sources of revenue to offset this decline, mostly though increased tuition and fees and grants and contracts. The effects of these revenue changes manifest themselves in academic departments, which serve as the primary unit of analysis in this study.

In this study, two sets of theories were used to explain patterns of university resource allocation in such a way that combines d’Sylva’s (1998) and Volk’s (1995) work and considers, by measuring directly the role of administrators who have budget authority, the impact of the socially constructed production function. The economic theory of the firm, resource dependency theory, rational/political and critical/political, combined, help to frame the conversation around resource allocation and how it is done in practice. The study uses d’Sylva’s work extensively in order to create the baseline econometric analysis by including the relevant variables. In addition, and most importantly, the present study adds to the existing body of knowledge by providing a broader understanding of production functions that encompasses the role of the socially constructed production function by key administrators who have budget authority. The implications of such study are practical and very relevant in the current economic climate most states and public research institutions find themselves in.

**Methodology**

The purpose of this study is to use a variation of d’Sylva’s (1998) methodological (econometric) approach to resource allocation by estimating the return for research productivity, teaching productivity, and departmental quality in the allocation function of public research universities for a more recent time period. In addition, this study uniquely explores deep seeded beliefs about resource allocation by interviewing (qualitative exploration) administrators with budget authority. The exploration portion of this study adds to both d’Sylva’s study and Volk’s (1995) study.

The mixed methods model was employed in order to complement and inform the discussion on resource allocation provided by d’Sylva (1998) and Volk (1995). Rather than impose an extreme position on either technique, the study takes on a equilibrium approach to empirically test the secondary dataset with multivariate techniques and to generate primary data intended to capture the perspectives of those with budget authority in ways that only interviews could yield. Cognizant however, that this approach is not absent of its imperfections, it is a
powerful approach in providing a fuller picture of resource allocation (Strauss & Corbin, 1998). Because this study follows a mixed methods approach, the following section is organized into nested parts for both methodological approaches. For example, when the variables and data are discussed there will be two subheadings consisting of *Econometric Methods* and *Exploratory Methods*.

As d’Sylva (1998) noted, “if changes in the institutions resource dependencies drive internal resource allocations, then the rate of return for these variables should reflect the priorities of those upon whom the universities are dependent.” And, alternatively, “if internal factors drive this process, then the optimization of inputs with respect to the utility function of the institutions will dictate the relative return for the outputs of teaching, research, and departmental quality.”

The relative importance of the research and teaching outputs within the allocation function of public research universities is of primary concern. And so, the question becomes how to measure the relative importance of both. One measure of the importance of the inputs is assessing how faculty allocates their time among the various inputs, including public service. However, such measures used in previous workload studies have failed to take into account the role of the department in influencing faculty time allocation. Other studies of resource allocation within higher education (Berg & Hoernack, 1987; Verry & Davies, 1976) have found that the relative weight attached to outputs differs materially across academic departments and disciplines. Since aggregating institutional outputs may lead to unreliable conclusions, Tierney (1980), and others have called for separate analyses to be conducted by department. d’Sylva did just that by examining departments and then aggregating such departments into fields. That is, he moved beyond most other studies by using the primary university organizational unit, the department, as the unit of analysis across a range of public research universities. This study follows suit.

The specification of an income production function for departments, of course, is not independent of the allocation function for the institution as a whole. That is, the importance departments attach to teaching productivity in order to capture departmental revenue also reflects the importance attributed to teaching productivity by those who allocate resources at the institutional level. Consequently, actual expenditure data are used as a proxy for institutional allocations.

The empirically derived relative weights that were generated by d’Sylva’s work and generated by this study will yield assumptive beliefs about what priorities are operative in the allocation function. That is, it is believed by many scholars that research outputs yield higher values of prestige than do teaching and public service outputs. But what happens when the returns on investment are much greater for teaching outputs than research outputs as was found in d’Sylva’s work? And it is believed that such returns hold stable over time. How does one reconcile the divergence in such phenomenon between what yields the greatest returns (teaching inputs) and revealed preferences that value research inputs more? In order to understand this phenomenon further it is necessary to explore how decision makers construct certain key elements that go into making resource allocation decisions.
Econometric Method

Variables

The dependent variable for the income production model is the departmental expenditures that include all wages paid to support the instructional function; includes faculty, clerical support, and professional and graduate student stipends. In addition, it includes expenditures for benefits associated with the personnel for whom salaries were reported.

Input Variables

The expenditures of departmental inputs are specified as follows:

\[ y = \sum_{i=1}^{2} C_i \]

\( y \) = total departmental annual expenditures
\( C_1 \) = salary expenditures, and
\( C_2 \) = benefits expenditures.

Output Variables

This portion of the study focuses on the teaching and research outputs of higher education. Although the importance of public service as an institutional output is recognized, and a measure of public service exists for this dataset, it proved to be an unreliable measure; thus, public service was excluded from the study, and it almost always is eliminated from production function analyses. In keeping with d’Sylva, student credit hours (SCH) at two teaching levels, undergraduate SCH and graduate SCH are used as proxies for teaching output. This utilization of SCH as teaching output proxies is noteworthy because the SCH is produced by each department and clearly reflects more accurately the teaching outputs of departments (Dundar & Lewis, 1995).

Research outputs usually are specified as the number of articles published, number of patents granted, or the number of technological innovations developed (Gander, 1995; Dundar & Lewis, 1995); however, no such outputs are available in the AAUDE. Instead, total research expenditures are taken as a measure of research output.

The five outputs for the income function of this study are specified as

\( X_1 \) = Annual departmental undergraduate level SCH,
\( X_2 \) = Annual departmental graduate level SCH,
\( X_3 \) = Annual departmental research expenditures,
\( X_4 \) = Faculty Quality, and
\( X_5 \) = Effectiveness of the Program.
Quality of output variables

In keeping with d’Sylva (1998), it is believed that output quality should be considered in examining departmental production. As d’Sylva, two measures of quality were selected: scholarly quality of the program faculty and effectiveness of the program in educating research scholars. The measures captured elements of both teaching and research outputs of the department although the first related more to research outcomes and the second more to teaching. These measures were obtained from a national study by the National Research Council (NRC) at 3,600 research doctoral programs at over 279 institutions in 41 fields of study (Goldberger et al., 1995). Each program was evaluated by an average of 50 faculty respondents from the same field. The assessment of the “scholarly quality of program faculty” was based on measures of scholarly publication and peer review. Effectively, then, quality is a proxy for research. The assessment of the “program effectiveness in educating research scholars and scientists” was based on measures of faculty accessibility, the department curricula, the instructional and research facilities, the quality of graduate students, the performance of graduates, and other departmental factors that were believed to contribute to a program’s effectiveness. The values for “scholarly quality of program faculty” and “program effectiveness in educating research scholars and scientists” ranged from zero to five, with zero signifying “not sufficient for doctoral education” and five signifying “distinguished”. Raters were required to designate no more than five programs as “distinguished”. For each program a mean rating was calculated; programs were then rank-ordered within fields on each of these two measures (Goldberger et al., 1995). In this study the 1993 NRC rankings were used because the 2003 NRC rankings have not yet been released.

Data

The major data source for this study was the American Association of Universities Data Exchange (AAUDE). Data on expenditures (income) and teaching output (student credit hours at the two instructional levels) were drawn from the latest complete AAUDE set, Delaware Expenditure Data, academic year 1998-1999. Heretofore, the data set is simply referred to as AAUDE data from academic year (AY) 1999. Dundar and Lewis (1995) hold that the AAUDE departmental data are valid and reliable estimates of expenditures and enrollments for the leading research and doctoral granting universities in the nation.

The sub-sample of institutions selected from the AAUDE for this study was limited to those public research universities and departments for which complete data were available for AY 1999. Missing data yielded a sub-sample of 10 major public research universities and 152 departments.

Expenditures and student credit hour production data were taken from 53 types of constituent departments across five departmental fields: Computing and Mathematics, Engineering, Life Sciences, Physical Science, and Social Science. The various departments that were included are in table 3.1

Data Analysis

A multiple regression model relating institutional resource allocation to measures of departmental output for academic units in the sciences was employed. As noted in the
introduction section, the semi-log model is widely used in human capital literature in which theory suggests that the logarithm of earnings or wages be used as the dependent variable. When this model is applied to the field of higher education in the present study, the department is substituted for the individual as the unit of analysis and the earnings of the department are measured by its expenditures of non-restricted research money. The generalized model taken from d’Sylva (1998) is given by

\[ \ln(E) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \epsilon \]

where,

- \( E \) = Departmental Earnings
- \( X_1 \) = Undergraduate SCH
- \( X_2 \) = Graduate SCH
- \( X_3 \) = Research Expenditures
- \( X_4 \) = NRC Faculty Quality
- \( X_5 \) = NRC Program Effectiveness

Data Transformation

The data have been transformed in a number of different ways to meet the specification of the different models. An overview of these transformations is discussed in order to facilitate an accurate interpretation of the results.

Transformation 1: semi-log transformation. In keeping with d’Sylva (1998), the semi-log relationship is obtained between departmental earnings and student credit hours. The same relationship holds true for research. The coefficients in this model may be interpreted as the marginal effects of the independent variables \( X \) upon \( \ln E \) (natural log of earnings). Differentiating both sides with respect to \( n \) yields

\[ \beta_2 = \frac{d(\ln E)}{dX} = \frac{1}{E} \frac{dE}{dX} \]

The term \( (dE/E) \) can be interpreted as the change in \( E \) divided by \( E \). When multiplied by 100, this gives the percentage change in \( E \) per unit change in \( X \). Therefore, \( \beta_2 \) multiplied by 100, gives the rate of return in earnings for a one unit increase in \( X \).

Transformation 2: per full-time equivalent (FTE) instructional faculty member. Brinkman (1981) delineates 3 categories of higher education cost factors, namely, environment, decision and volume factors. Operationalized as input prices, input levels and output levels, these factors alone may account for the variation in non-restricted expenditures. Controlling for these measures across departments, therefore, is necessary to delimit the potential confounding effect. For example, if outputs to the production process vary, they will account for a greater share of the variance in the dependent variable to the degree the levels of those outputs differ. Output
levels are controlled for in this model in two ways, thereby creating two models. In the first model, all quantitative measures were scaled by a factor of (1/FTE). Unlike d’Sylva (1998), it was not necessary to create an estimated measure for FTE as the AAUDE dataset contained FTE. In the second model, FTE was included as an independent variable in the model. In the first case, dividing all quantitative measures by a factor of (1/FTE) strives to eliminate the potentially confounding results from differing output levels. Thus, the coefficients of the independent variables should be interpreted as the rate of return per FTE instructional faculty member. The resulting models are as follows:

Model 1:

\[ \ln(E) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \varepsilon \]

where,

- \( E \) = Departmental Earnings
- \( X_1 \) = Undergraduate SCH per FTE
- \( X_2 \) = Graduate SCH per FTE
- \( X_3 \) = Research Expenditures per FTE
- \( X_4 \) = NRC Faculty Quality
- \( X_5 \) = NRC Program Effectiveness

and

Model 2:

\[ \ln(E) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \varepsilon \]

where,

- \( E \) = Departmental Earnings
- \( X_1 \) = Undergraduate SCH
- \( X_2 \) = Graduate SCH
- \( X_3 \) = Research Expenditures
- \( X_4 \) = NRC Faculty Quality
- \( X_5 \) = NRC Program Effectiveness
- \( X_6 \) = Faculty FTE

**Transformation 3: variable transformations.** Based on d’Sylva’s (1998) methodology, the decision was made to sum the various levels of SCH into two levels: undergraduate and graduate levels. Variables such as Lower Division Organized Credit Hours (LDOCH), Upper Division Organized Credit Hours (UDOCH), and Undergraduate Individual Credit Hours (UICH) were aggregated to create the new variable Undergraduate Productivity (UGPROD). Variables such as Graduate Organized Credit Hours (GOCH) and Graduate Instruction Student Credit Hours (GISCH) were aggregated to create Graduate Productivity (GPROD). The National Research Council’s (NRC) rankings measures were also transformed per d’Sylva’ methodology. Per d’Sylva, the mean of NRC’s Faculty Scholarly Quality (NRCFQ) and NRC’s Program Effectiveness Ratings (NRCER) was computed to create a new variable called Quality (QUALITY). The resulting effects per model are as follows. Model 1 consists of five...
independent variables, including the constant term. Model 2 consists of six independent variables, including the constant term, instead of the seven independent variables initially proposed. Moreover, with respect to the various Fields of Science (FIELDS), Math and Computing was collapsed into Physical Science and the field of Life Sciences was omitted from the study in its entirety because there were insufficient NRC ranking measures for the various disciplines in that field. Consequently, only three fields of study are examined in this study: (a) Engineering; (b) Social Science; and (c) Physical Science. (see Appendices 8 and 9 for old and new variable definitions).

Transformation 4: general linear model (GLM) to test between fields of science effects. In order to test the between field effects of the various Fields of Science (FIELDS), a general linear model technique was used in SPSS version 12.0. In order to carry out the proper analysis it was important to recode the various values in (FIELDS) in order to test the individual coefficients per field of science. For example, in the first run the various fields of science (the fixed factor) were coded in the following manner: 1 = “Engineering”; 2 = “Social Science”; and 3 = “Physical Science”. “Physical Science” in this case was the control group for which the other two coefficients were contrasted against. For example, \( \alpha_{\text{physicalScience}} - \beta_{\text{SocialScience}} \) yields the difference between the two coefficients, and such difference is tested for statistical significance. In short, separate regressions were run comparing the various fields using the GLM approach.

In summary, the semi-log model employed in this study is widely used in the human capital theory literature to specify the earning functions of individuals, commonplace in cost studies; in this study the department was substituted for the individual, and the income production function for the department was estimated. A system of three equations was generated and remained because Life Sciences was excluded from the analysis that generated parameter estimates that were best linear unbiased estimates of the coefficients. Two OLS models were specified in order to identify the best model specification for treating the size of an institution with respect to its FTE instructional faculty members. These models allowed for the hypothesis testing of significance for the individual independent variables using two-tailed t-tests. Moreover, tests that examined the effects between fields of science were employed using the general linear model (GLM) technique.

Exploratory Method

Data Analysis and Variables

This study sought depth vs. breadth in determining who and where to interview participants. As a result, the sample for this section strived for ten administrators but yielded six administrators from one public Research I university who had or have had budget authority. The participants included one former president, one former provost, one former college dean, and three active college deans. They are of various ethnic backgrounds but were all males. The participants took part in an approximately one hour interview. A thematic analysis technique was employed in order to identify salient themes related to internal resource allocation. Particular attention was placed on key areas with respect to productivity, market, diversity, and efficiency. Through this social constructivist framework, it was imperative to identify ways that these administrators made meaning of certain key concepts with respect to internal resource allocation. Moreover, in
this analysis, key vernacular was identified and key concepts for which exact vernacular was not used but the concept can be readily identified.

Limitations

As was the case with d’Sylva (1998), a number of caveats emerged that should be stated with respect to the data and to the design of the models used in the study.

For the econometric method, the AUDE dataset that was used has some limitations. There were multiple cases and records that had to be excluded from the analysis due to incomplete data on the critical variables used in this study. For example, Life Sciences had a very small set of departments that reported complete information in order to make it useful for the study. Also, a field of Humanities was desirable in order to pick up on d’Sylva’s (1998) recommendation for future research that would include such field. However, it was not feasible to include this field in this study due to incompleteness in the dataset. Consequently, the critical questions were not fully answered because the study did not include other fields outside of science, math and engineering.

The indirect costs that are not captured in this dataset comprise a large amount of the research dollars and constrain the dependent variable to a conservative estimate. The research measures are perhaps too conservative because they do not factor in indirect costs as well. Moreover, the measure may, in fact, underestimate research output because articles have been steadily decreasing while patents have been increasing. This limitation is attributed to the data source and the difficulty in capturing patents in a reliable and valid way.

For the exploratory method, only six administrators with budget authority were interviewed at one public research one university. Given the competitive nature of research one public universities, it might be assumed that this sample adequately represents administrators’ beliefs across institutions due to institutions’ isomorphism behaviors. Nonetheless, it would be useful to interview a broader cross section of administrators with budget authority across higher education institutions. That is, the critical questions would be best served by including a larger selection of women and minorities.

In the econometric analysis, no attempt is made to control for different costs of inputs to the different departments within or across institutions due to the limitation of the dataset employed. This potential biasing effect has been noted by De Groot et al. (1991) and is as follows: the main resources for departmental production in public universities are the faculty and administrative staff, and these costs do vary across departments. However, it can be assumed that wages are constant across this sample of institutions because the labor markets for faculty and administrators at major public research universities for comparable fields of science are very competitive.

Dundar and Lewis (1995) note that there are no absolute measures of quality or quantity of educational outcomes. Although value-added measures of teaching and research are probably the best measures of quality, it is very difficult to obtain such direct measures across institutions. Accordingly, in the present study proxies for quality by way of NRC rankings were employed, as
were the proxy variables of SCH and research expenditures in the case of quantity. But the quality proxies employed here have other limitations. Many public universities have considerable differentiation in the quality of their undergraduate and graduate programs (Jones et al., 1982; Dundar & Lewis, 1995). For example, some institutions may have an open access policy at the undergraduate level, while being highly selective at the graduate level in order to obtain the best and most able graduate students. Further, the reputation measures of the NRC are subjective and subject to variability in inter-rater agreement. While there tends to be strong agreement among raters about which programs are the strongest and which are the weakest, there is considerably less agreement about programs in the middle range. Another limitation is noteworthy; the relative effect of other expenditures, core to the mission of public Research I universities, on departmental earnings may be underestimated due to the fact that public service was excluded from the study. Such omission may bias the estimators for research and teaching.

Two distinct OLS regression models were employed. Although using the two models, per se, is not a limitation in and of itself, what may be cited as a limitation is not determining what the best way to treat faculty instructional FTE. Moreover, a central limitation to this study is that in attempting to control for size through faculty instructional FTE there was no attempt to control for the type of instructional faculty (e.g., full time, part-time, ranked faculty, adjuncts, and the like).

In general, this study builds upon the work of others (d’Sylva, 1998; Hasbrouck, 1997; James, 1990; Pfeffer & Salancik, 1978; Slaughter & Leslie, 1997; Volk, 1995; Volk, Slaughter, & Thomas; 2000; Ward, 1997) who have sought to identify the factors driving resource allocation in U.S. public higher education. A number of hypotheses were derived from two sets of theoretical frameworks: the theory of the firm, resource dependency theory, rational/political, and critical/political. These hypotheses pertained to the relative importance of teaching productivity, research productivity, and measures of quality within the resource allocation function of public research one universities. To estimate the relative effects of these variables upon the departments’ income production function, two generalized semi-log models were developed. When applied to the three field groups examined in this study, this model yielded a system of three equations. These equations were tested in order to determine if a statistical difference exist in the production of teaching, research, and quality between fields of science. Moreover, employing a social constructivist framework, six administrators with budget authority from one public Research I University were interviewed in order to explore any deep-seated beliefs about key elements within the internal resource allocation function.

Further, in focusing on institutional faculty, and on units that generate at least some undergraduate student credit hours, the study did not include major entrepreneurial and research units such as Centers, Institutes, and programs that do not do undergraduate education.

Results

The study’s results are presented in two major sections: An Econometric Analysis of Internal Resource Allocation in Public Research One Universities and A Qualitative Exploration of Key Decision Makers’ Beliefs. The econometric analysis section utilizes an econometric
framework for examining the relationship between inputs and outputs believed to explain resource allocation by decision makers. The qualitative analysis section complements and adds a richer description of the beliefs of those who have budget authority, shedding light on how decision makers construct key elements such as productivity, the university and the external world, diversity, and efficiency and make resource allocation decisions accordingly. The mixed methods approach offers a broader perspective on resource allocation. Specifically, the qualitative analysis helps make sense of the quantitatively determined patterns that are usually assumptive of decision-makers' cultural values and social behaviors.

*An Econometric Analysis of Internal Resource Allocation in Public Research One Universities*

Two models were used to assess the hypotheses and propositions posed in this study because it was uncertain as to how best to treat the size of FTE instructional faculty at each respective institution and respective discipline. In both models, an OLS regression technique is employed. Model 1 treats FTE as a factor that should be accounted for by every quantitative measure on both sides of the equation. The interpretation of such transformation would yield a per FTE increase in any quantitative measure. For example, a one unit increase in undergraduate productivity per FTE should be interpreted as some percent increase in departmental earnings. Model 2 treated FTE instructional faculty as an independent variable. In this case, FTE is controlled for within the model and, not surprisingly, explains much of the variation in departmental earnings. Model 3 is the GLM technique that was employed in order to test the effects between the three fields of science. The findings are presented by the three fields of science for each of the three models where the overall goodness of fit statistics, significance of the independent variable coefficients, formal tests of multicollinearity using the Variance Inflation Factor (VIF), and the between field of science effects will be examined. Following the presentation of the results by field of science, the results for the overall research questions and hypotheses are examined.

*Model 1: Engineering*

Within this model, Engineering (n=40), $R^2$ was 0.391, indicating fairly good explanatory power of the model (see Table 4.1).

The null hypothesis that all the coefficients in the Engineering equation were jointly equal to zero was rejected $F(4,35)=5.608$, $p<.001$, leading to the conclusion that at least one of the $\beta$s was not zero. The coefficient for undergraduate productivity per FTE was statistically significant $t(39)=1.661$, $p<.106$ and graduate productivity per FTE was statistically significant $t(39)=3.059$, $p<.004$. Research expenditures per Faculty FTE and Quality were not statistically significant (see Table 4.1).

The rate of return on departmental earnings for an extra credit hour of graduate instruction per instructional faculty member (45.4%) was greater than the rate of return for an extra credit hour of undergraduate instruction per instructional faculty member (24.3%). The difference in this case was substantial; an additional unit of graduate teaching per faculty FTE
yields 21.1% more departmental earnings than an additional unit of undergraduate teaching per faculty FTE (see Table 4.1).

The model was tested for multicollinearity using the formal test of Variance Inflation Factor (VIF). The null hypothesis for multicollinearity is as follows:

\[ H_0: \text{Multicollinearity exists if } VIF = \frac{1}{R^2} > 10 \]

The VIF for all coefficients were less than the threshold of ten; therefore, the null hypothesis was rejected and it was determined that there is no multicollinearity in the model (see Table 4.1).

Table 4.1. Model 1 Results for Engineering.

<table>
<thead>
<tr>
<th>Coefficients*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
</tr>
<tr>
<td>-------</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>I</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

* Dependent Variable: (ln) of Total Departmental Annual Expenditures per Faculty FTE

Model 1: Social Science

Next we turn to the field of Social Science. In this field (n=40), R^2 was 0.374, once again indicating fairly good explanatory power of the model (see Table 4.2).

The null hypothesis that all the coefficients in the Social Science equation were jointly equal to zero was rejected F(4,55)=8.226, p<.001, leading to the conclusion that at least one of the βs was not zero. All coefficients were statistically significant save research expenditures per faculty FTE. Undergraduate productivity per FTE, graduate productivity per FTE, and Quality were statistically significant t(59)=2.947, p<.005; t(39)=3.202, p<.002; and t(39)=4.128, p<.0001, respectively. Although research expenditures per faculty FTE was not found to be statistically significant, the direction of the coefficient is negative (see Table 4.2).

The rate of return on departmental earnings for an additional unit increase of quality (45.6%) was greater than both the returns for an extra credit hour of graduate instruction per instructional faculty member (34.2%) and the rate of return for an extra credit hour of undergraduate instruction per instructional faculty member (32.8%). The differences in this case
were not substantial at all; an additional unit of quality yields 11.4% and 12.8% more departmental earnings than an additional unit of graduate teaching per faculty FTE and an additional unit of undergraduate teaching per faculty FTE, respectively. An additional unit of graduate teaching per faculty FTE yields 1.4% more departmental earnings an additional unit of undergraduate teaching per faculty FTE. The independent variables were found to be orthogonal to each other; therefore, the null hypothesis that multicollinearity is present was rejected (see Table 4.2).

Table 4.2. Model 1 Results for Social Science.

<table>
<thead>
<tr>
<th>Model</th>
<th>Coefficients</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Unstandardized Coefficients</td>
</tr>
<tr>
<td></td>
<td>B</td>
</tr>
<tr>
<td>1 (Constant)</td>
<td>10.426</td>
</tr>
<tr>
<td>Undergrad Productivity per Faculty FTE</td>
<td>.001</td>
</tr>
<tr>
<td>Graduate Productivity per Faculty FTE</td>
<td>.008</td>
</tr>
<tr>
<td>Research Expenditures per Faculty FTE</td>
<td>.000</td>
</tr>
<tr>
<td>Quality</td>
<td>.130</td>
</tr>
</tbody>
</table>

* Dependent Variable: (b) of Total Departmental Annual Expenditures per Faculty FTE

Model 1: Physical Science

For the field of Physical Sciences (n=52), \(R^2\) was 0.270, once again indicating fairly good explanatory power of the model (see Table 4.3).

The null hypothesis that all the coefficients in the Physical Science equation were jointly equal to zero was rejected \(F(4,47)=4.340, p<.005\), leading to the conclusion that at least one of the \(\beta_s\) was not zero. The coefficient for graduate productivity per faculty FTE was statistically significant \(t(51)=2.240, p<.030\) and quality was statistically significant \(t(51)=2.090, p<.042\). Undergraduate productivity per faculty FTE and research expenditures per Faculty FTE were not statistically significant. Although undergraduate productivity per faculty FTE was not statistically significant, the magnitude coefficient is very small approaching zero (see Table 4.3).

The rate of return on departmental earnings for an additional unit increase of graduate instruction per instructional faculty member (29.1%) was slightly greater than the return for an additional unit increase in quality (27.8%). Again, the differences in this case were not substantial; an additional unit of graduate instruction per instructional faculty member yields 1.3% more departmental earnings than an additional unit of quality. Using the VIF statistic, it can be asserted that the independent variables meet the OLS assumption of orthogonally and, hence, determined that multicollinearity is not present in the model (see Table 4.3).

Table 4.3. Model 1 Results for Physical Science.
Model 2: Engineering

Unlike model 1, this model appears to explain substantially more of the variance in departmental earnings. Within this model, Engineering (n=40), $R^2$ was 0.860, indicative of strong explanatory power of the model (see Table 4.4).

The null hypothesis that all the coefficients in the Engineering equation were jointly equal to zero was rejected $F(5,34)=41.633$, $p<.001$, leading to the conclusion that at least one of the $\beta$s was not zero. Three of the coefficients were statistically significant and undergraduate productivity per FTE and research expenditures per faculty FTE were not found to be statistically significant. Faculty FTE, Quality, and Graduate productivity per FTE were statistically significant $t(39)=3.728$, $p<.001$; $t(39)=3.811$, $p<.001$; and $t(39)=1.548$, $p<.131$, respectively. Again, research expenditures per faculty FTE was not found to be statistically significant, and in this model undergraduate productivity per FTE was also found to be statistically nonsignificant. As was the case in Model 1, the direction of the coefficient for research expenditures is negative. As for undergraduate productivity per FTE, the magnitude is small approaching zero (see Table 4.4).

The rate of return on departmental earnings for an additional unit increase in instructional faculty FTE (62.1%) was greater than the rate of return for an additional unit in quality (31.5), and an extra credit hour of graduate instruction per instructional faculty member (16.9%). The difference in this case was substantial; an additional unit of instructional faculty FTE yields 30.6% more departmental earnings than an additional unit increase in quality and 45.2% more departmental earnings than an additional unit of graduate teaching per faculty FTE. Per the VIF statistic, the null hypothesis that multicollinearity is present was rejected. Although there does not appear to be multicollinearity, for all independent variables except quality, the VIF statistic is larger than in Model 1 (see Table 4.4).

Table 4.4.  Model 2 Results for Engineering.
Model 2: Social Science

Once again, unlike model 1, this model appears to explain substantially more of the variance in departmental earnings. Within this model, Social Science (n=60), R^2 was 0.852, suggestive of strong explanatory power of the model (see Table 4.5).

The null hypothesis that all the coefficients in the Engineering equation were jointly equal to zero was rejected F(5,54)=61.965, p<.001, leading to the conclusion that at least one of the βs was not zero. All coefficients were statistically significant except for research expenditures. Faculty FTE, Quality, Undergraduate productivity per FTE, and Graduate productivity per FTE were statistically significant t(59)=4.295, p<.001; t(59)=4.235, p<.001; t(39)=2.605, p<.012; and t(59)=2.217, p<.031, respectively. Of particular interest is how the order of magnitude remains stable from Model 1 to Model 2. And, again, research expenditures per faculty FTE was not found to be statistically significant. In this model, the direction of the coefficient for research expenditures is no longer negative; however, it is of a small magnitude approaching zero (see Table 4.5).

The rate of return on departmental earnings for an additional unit increase in instructional faculty FTE (44.3%) was greater than the rate of return for an additional unit increase in quality (25.2), an extra credit hour of undergraduate instruction per instructional faculty member (25.0%), and an extra credit hour of graduate instruction per instructional faculty member (16.1%). The difference in this case was substantial; an additional unit of instructional faculty FTE yields 19.1% more departmental earnings than an additional unit increase in quality, 19.3% more departmental earnings than an additional unit of undergraduate teaching per faculty FTE, and 28.2% more departmental earnings than an additional unit of graduate teaching per faculty FTE. According to the VIF statistic, the null hypothesis that multicollinearity is present was rejected. Once again the VIF statistic for each coefficient appears to be slightly larger than those in Model 1 (see Table 4.5).

Table 4.5. Model 2 Results for Social Science.
Model 2: Physical Science

Once again, unlike model 1, this model appears to explain substantially more of the variance in departmental earnings. Within this model, Social Science \( (n=52) \), \( R^2 \) was 0.773, once again, indicating fairly strong explanatory power of the model (see Table 4.6).

The null hypothesis that all the coefficients in the Engineering equation were jointly equal to zero was rejected \( F(5,46)=31.320, p<.001 \), leading to the conclusion that at least one of the \( \beta \)'s was not zero. Three of the coefficients were statistically significant and undergraduate productivity per FTE and research expenditures per faculty FTE were not found to be statistically significant. Faculty FTE, Graduate productivity per FTE, and Quality were statistically significant \( t(51)=4.755, p<.001; t(51)=3.146, p<.001; \) and \( t(51)=1.690, p<.098 \), respectively.

Of particular interest is how including faculty FTE as an independent variable made faculty FTE the strongest predictor of departmental earnings; however, the next order of influence on departmental earnings remained consistent with Model 1. That is, graduate productivity per faculty FTE still yields a better return on departmental earnings than quality. Remarkably, both research expenditures per faculty FTE and undergraduate productivity per faculty FTE were found to be statistically nonsignificant. In this model, the direction and magnitude of the coefficient for research expenditures is fairly stable and consistent with the results yielded in Model 1. However, that was not the case for undergraduate productivity per faculty FTE. In this model, the coefficient for undergraduate productivity per faculty FTE is now in the negative direction and slightly larger in magnitude (see Table 4.6).

The rate of return on departmental earnings for an additional unit increase in instructional faculty FTE (72.8%) was greater than the rate of return for an extra credit hour of graduate instruction per instructional faculty member (28.0%), and an additional unit increase in quality (14.8%). The difference in this case was substantial; an additional unit of instructional faculty FTE yields 44.8% more departmental earnings than an additional unit increase of undergraduate teaching per faculty FTE, 58% more departmental earnings for an additional unit increase in quality. The independent variables were found to be orthogonal to each other; therefore, the null hypothesis that multicollinearity is present was rejected. Once again the VIF statistic for each coefficient appears to be larger than those in Model 1, particularly in the case of undergraduate productivity and faculty FTE (see Table 4.6).
Table 4.6. Model 2 Results for Physical Science.

<table>
<thead>
<tr>
<th>Coefficients^</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
<th>Collinearity Statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
<td>B</td>
<td>Std Error</td>
<td>Beta</td>
</tr>
<tr>
<td>1 (Constant)</td>
<td>13.750</td>
<td>.299</td>
<td></td>
</tr>
<tr>
<td>Undergraduate Productivity</td>
<td>.000</td>
<td>.000</td>
<td>-.105</td>
</tr>
<tr>
<td>Graduate Productivity</td>
<td>.000</td>
<td>.000</td>
<td>-.280</td>
</tr>
<tr>
<td>Research Expenditure</td>
<td>.000</td>
<td>.000</td>
<td>.022</td>
</tr>
<tr>
<td>Quality</td>
<td>.182</td>
<td>.108</td>
<td>.148</td>
</tr>
<tr>
<td>Faculty FTE</td>
<td>.013</td>
<td>.003</td>
<td>.728</td>
</tr>
</tbody>
</table>

^ Dependent Variable: (in) Total Departmental Expenditures

**Between Effects for the Fields of Science Using Models 1 and 2**

In this model GLM is employed. The GLM Univariate procedure provides regression analysis and analysis of variance for one dependent variable by one or more factors and/or variables. GLM uses a dummy variable approach that treats the three fields of science as the factor and the independent variables as the covariates in the model. The data were pooled in order to model the effects in the joint production of departmental earnings across the three various fields of science. The parameter estimates for the individual fields of science coefficients were varied given the different estimation procedure. That is, in Model 1, all quantitative variables are scaled by 1/FTE whereas in Model 2, faculty FTE is included in the model as an independent variable.

The change in significance for the various contrasts between coefficients from Model 1 to Model 2 was pronounced and can be attributed to the model specification. For example, in Model 1, it was found that there was a statistical significant difference between Physical Science and Social Science. The null hypothesis for all fields is as follows:

\[ H_0 : \beta_{\text{PhysicalScience}} = \beta_{\text{SocialScience}} = \beta_{\text{Engineering}} \]

In Model 1 Physical Science (Fields = 3) was the control, therefore, the difference between the coefficients for Social Science (Fields = 2) and Engineering (Fields = 1) were with respect to the coefficient of Physical Science, that is, \( \beta_{\text{PhysicalScience}} - \beta_{\text{SocialScience}} \) and \( \beta_{\text{PhysicalScience}} - \beta_{\text{Engineering}} \). The difference between the coefficient of Physical Science and Social Science is statistically significant. Therefore the null hypothesis that \( \beta_{\text{PhysicalScience}} = \beta_{\text{SocialScience}} \) is rejected, \( \beta_{\text{PhysicalScience}} - \beta_{\text{SocialScience}} = -.225 \), \( p < .001 \) (see Table 4.7).

Table 4.7. Model 1 Between Fields of Science Effects where Physical Science is the Control.
Parameter Estimates

Dependent Variable: (ln) of Total Departmental Annual Expenditures per Faculty FTE

<table>
<thead>
<tr>
<th>Parameter</th>
<th>B</th>
<th>Std. Error</th>
<th>t</th>
<th>Sig.</th>
<th>95% Confidence Interval</th>
<th>Partial Eta Squared</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>10.759</td>
<td>.130</td>
<td>82.460</td>
<td>.000</td>
<td>10.492 – 11.008</td>
<td>.979</td>
</tr>
<tr>
<td>ugpgrad_per_fte</td>
<td>.001</td>
<td>.000</td>
<td>2.049</td>
<td>.042</td>
<td>.000 – .001</td>
<td>.028</td>
</tr>
<tr>
<td>gradprod_per_fte</td>
<td>.007</td>
<td>.001</td>
<td>4.925</td>
<td>.000</td>
<td>.004 – .010</td>
<td>.143</td>
</tr>
<tr>
<td>resexp_per_fte</td>
<td>.000</td>
<td>.000</td>
<td>1.824</td>
<td>.070</td>
<td>.000 – .000</td>
<td>.022</td>
</tr>
<tr>
<td>quality</td>
<td>.135</td>
<td>.032</td>
<td>4.159</td>
<td>.000</td>
<td>.071 – .199</td>
<td>.107</td>
</tr>
<tr>
<td>[Fields=1.00]</td>
<td>.167</td>
<td>.065</td>
<td>2.590</td>
<td>.011</td>
<td>.040 – .295</td>
<td>.044</td>
</tr>
<tr>
<td>[Fields=2.00]</td>
<td>-.223</td>
<td>.045</td>
<td>-4.969</td>
<td>.000</td>
<td>-.314 – -.133</td>
<td>.146</td>
</tr>
<tr>
<td>[Fields=3.00]</td>
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<td>.</td>
<td>.</td>
<td>.</td>
<td>.</td>
<td>.</td>
</tr>
</tbody>
</table>

*a This parameter is set to zero because it is redundant.

In a new GLM, Model 1, Social Science (Fields = 3) is now the control, therefore, the difference between the coefficients for Engineering (Fields = 2), and Physical Science (Fields = 1) were, now, with respect to the coefficient of Social Science, that is, \( \beta_{\text{SocialScience}} - \beta_{\text{Engineering}} \) and \( \beta_{\text{SocialScience}} - \beta_{\text{PhysicalScience}} \). The difference between the coefficients of Social Science and Physical Science is already known from Table 4.7. The difference between the coefficient of Social Science and Engineering is statistically significant. Therefore, the null hypothesis that \( \beta_{\text{SocialScience}} = \beta_{\text{Engineering}} \) is rejected, \( \beta_{\text{SocialScience}} - \beta_{\text{Engineering}} = -.392 \), p < .001 (see Table 4.8).

Table 4.8. Model 1 Between Fields of Science Effects where Social Science is the Control.

Parameter Estimates

Dependent Variable: (ln) of Total Departmental Annual Expenditures per Faculty FTE

<table>
<thead>
<tr>
<th>Parameter</th>
<th>B</th>
<th>Std. Error</th>
<th>t</th>
<th>Sig.</th>
<th>95% Confidence Interval</th>
<th>Partial Eta Squared</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>10.525</td>
<td>.137</td>
<td>77.103</td>
<td>.000</td>
<td>10.255 – 10.795</td>
<td>.976</td>
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<tr>
<td>ugpgrad_per_fte</td>
<td>.001</td>
<td>.000</td>
<td>2.049</td>
<td>.042</td>
<td>.000 – .001</td>
<td>.028</td>
</tr>
<tr>
<td>gradprod_per_fte</td>
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<td>.001</td>
<td>4.925</td>
<td>.000</td>
<td>.004 – .010</td>
<td>.143</td>
</tr>
<tr>
<td>resexp_per_fte</td>
<td>.000</td>
<td>.000</td>
<td>1.824</td>
<td>.070</td>
<td>.000 – .000</td>
<td>.022</td>
</tr>
<tr>
<td>quality</td>
<td>.135</td>
<td>.032</td>
<td>4.159</td>
<td>.000</td>
<td>.071 – .199</td>
<td>.107</td>
</tr>
<tr>
<td>[Fields=betw_effect=1.00]</td>
<td>.225</td>
<td>.045</td>
<td>4.969</td>
<td>.000</td>
<td>.135 – .314</td>
<td>.146</td>
</tr>
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<td>[Fields=betw_effect=2.00]</td>
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<td>5.473</td>
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<td>.250 – .534</td>
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<td>.</td>
</tr>
</tbody>
</table>

*a This parameter is set to zero because it is redundant.

In Model 1 Physical Science (Fields = 3) was the control, therefore, the difference between the coefficients for Social Science (Fields = 2) and Engineering (Fields = 1) were with respect to the coefficient of Physical Science, that is, \( \beta_{\text{PhysicalScience}} - \beta_{\text{SocialScience}} \).
and \( \beta_{\text{PhysicalScience}} - \beta_{\text{Engineering}} \). The difference between the coefficient of Physical Science and Social Science is statistically significant. Therefore the null hypothesis that \( \beta_{\text{PhysicalScience}} = \beta_{\text{SocialScience}} \) is rejected, \( \beta_{\text{PhysicalScience}} - \beta_{\text{SocialScience}} = -.152, p < .001 \) (see Table 4.9).

Table 4.9. Model 2 Between Fields of Science Effects where Physical Science is the Control.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>B</th>
<th>Std. Error</th>
<th>t</th>
<th>Sig.</th>
<th>Lower Bound</th>
<th>Upper Bound</th>
<th>Partial Eta Squared</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>13.567</td>
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<td>.000</td>
<td>.000</td>
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<td>13.814</td>
<td>988</td>
</tr>
<tr>
<td>upgrad</td>
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<td>.687</td>
<td>.000</td>
<td>.000</td>
<td>.001</td>
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<td>6.078</td>
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<td>.000</td>
<td>.002</td>
</tr>
<tr>
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<td>5.092</td>
<td>.000</td>
<td>.133</td>
<td>.303</td>
<td>.153</td>
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<td>.052</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* This parameter is set to zero because it is redundant.

In Model 2 where Social Science is the control, the difference between the coefficients of Social Science and Engineering is statistically nonsignificant. Therefore, the null hypothesis that \( \beta_{\text{SocialScience}} = \beta_{\text{Engineering}} \) is not rejected.

A Qualitative Exploration of Key Decision Makers' Beliefs

This section reports data from exploratory interviews designed to elucidate how key decision-makers from RI University who have budget authority conceive of central concepts used to allocate resources in the allocation function, and how such construction of key concepts shapes resource allocation decision making. It is organized into four separate parts consisting of themes that framed and emerged from the interviews: productivity, the university and the external world, diversity, and efficiency.

Productivity

This section explores how decision makers conceive of productivity. It helps to explain deep seated structures of prestige that shape decision making about resource allocation in universities. Moreover, it enables us to sort out unacknowledged assumptions about productivity.
The former president of RI University readily identifies “Sciences, Anthropology and Philosophy in [the] Social & Behavioral Sciences” as the most productive units on campus. Interestingly, he generalizes the “Sciences” but does not generalize the Social Sciences, and is very specific about two units in that field. This can be attributed to the fact that these two departments are ranked. Moreover, when asked about how he conceives of “productivity,” he responds in the following manner:

“I’m thinking about it, primarily in terms of the quality of teaching that they did, the amount of writing, published research that was done. And the contributions to both, the academic and economic world.”

Quality of teaching, research, academic reputation, and economic returns to the academic community and to the business community seem to be benchmarks of productivity. What is interesting in the president’s response is that he mentions teaching as an important element of “productivity”; however, research publications and economic returns based on research that can be loosely interpreted as economic rewards based on research productivity is a larger portion of the response. The respondent suggests that a productive unit is also one of high quality—great national reputation. The respondent revealed a very important political dimension to discerning productive and high quality units. He indicated that his administration tried to eliminate a not so productive and not so high quality unit but were unable to do so due to external political constraints. Instead, his administration moved the unproductive department to another college within the university. Moreover, the president does consider external funding to play a vital role in which units are productive. That is, the respondent believes that external funding is very important—leads to excellence, and without it the university would not be as excellent.

“External funding is what provides the extra funding for that level of excellence that the university aspires to. The regular funding that the universities get simply isn’t adequate for that.”

This response goes to the heart of an embedded assumption of prestige in the marketplace for research one universities. The assumption is that more dollars should yield more productivity that in turn generates more excellence. It is believed that more excellence should yield prestige—the academic currency of research one universities. For the president, money is a means to an end. For others it may become almost an end in and of itself, driving decisions more rather than, in contrast, to considerations of quality.

A key unit that deserves mention is the College of Humanities at RI University. The president indicated that the college serves a very important function—a general education function that is neither central nor funded. As a result, this college is of lesser priority than graduate education and research, and is, in fact, generally underfunded. The respondent also acknowledges the potential for it to be “great”; however, he also recognizes the futility in the College’s ability to be of high productivity and quality due to underfunding and general lack of support:

“It was very difficult for them to reach that level of excellence, first of all, because it did not have…the humanities did not have the support, of the university in general. It was kind of a, what do I call it, a lost cousin (laughs).”

It is noteworthy to point out that the undergraduate education function is important at least in the case of the College of Arts and Sciences. The administration funneled some monies to arts and
sciences in order to serve the undergraduate education function of the University. That decision was made in the context of much external criticism of the university for ignoring undergraduates. It also reflects in part a recognition that the College plays an important role in general education, and an effort to some extent to make up for the underfunding of the past.

"The arts and sciences received some extra funding in the early years of my being there, and that was primarily to take care of the backlog of, that students needed to have taken, professional level courses and were, in their senior year, or in some cases and still taking, still trying to take care of general education requirements. And so extra funding was provided not because it was gonna provide better quality, but just simply because it was gonna provide access to undergraduates with the courses that they needed."

Significantly, an investment in Arts and Sciences and general education is not viewed as an investment in productivity and quality, hence, excellence or prestige. It is instead an investment in troubleshooting, in an area of activity for which the university had been politically criticized.

The former provost of RI University was much more detailed in his responses about productivity. In fact, he was very cautious at the beginning and thought that the question about productivity itself was a "shotgun question." The provost seemed to believe that productivity was not measured solely on number of publications but the quality of the publications as measured by the quality of the journals or the quality of the publishing company.

"In general, we would be looking at quality issues related to the services to students. That is, whether or not adequate number of courses are being offered so that students can fill their schedules. We look at output of faculty in terms of publications, where publications occur, if it’s in the science side then you are looking at the quality of the journals that they are publishing in. If it is say in the Humanities side you are looking at the reputation of the publishing house that is publishing the book or monograph. Also, looking at recognitions and prizes on the part of the faculty.... Also, we would be looking on the science side, particularly, I guess it includes the social sciences, grants awarded or grants won, since in most of those areas it is very difficult to carry out scholarship without receiving grant funds to do that. I would also look at the participation of faculty in, campus government, and in other activities on the campus, including service to the central administration since we appointed large numbers of committees....So productivity is not simply a numbers game how many students pass through or, but you have to make a quality assessment as well as a numbers."

The provost thought of quality much like the president did; however, he was much more detailed once again about specific units within colleges. For example, he believed that Astronomy, Optics, and Chemistry were of exceptional quality. He pointed out some up and coming units that deserved mention such as Cognitive Sciences, Psychology, and Women’s Studies. All were gaining in national prestige.

However, the crux of the provost’s understanding of quality and productivity rests on the fact that he seems to conflate the two. This is important because he also suggests that money equals quality because he believes that without grants and contracts (money) you will not have scholarship. Put another way, it is difficult to carry out quality scholarship without money.

"Well, it just happened that at the [RI University] and, largely no effort of my own, that the units that were at the highest quality, were in the sciences, certainly, Astronomy, the Optics Center, then, some up and coming departments such as, oh, I guess we have to put Chemistry close there
and in the College of Engineering, the Hydrology department, in the College of Agriculture, the activities, and this occurred in several units that involved insect research, Entomology, and several other departments that were involved with insect research. Let’s see, outside of the sciences, maybe still in the sciences, Geosciences very strong, outstanding, they’re [a] nationally recognized department. Outside of the sciences, I think probably our Philosophy department was one of the most outstanding departments. Up and coming departments were the program in Cognitive Science, another up and coming department in terms of stature, activities of faculty and so on, was Psychology. As I was leaving the Provost’s office, the program in Women’s Studies had gained national recognition. That’s really saying something for the program of Women’s Studies since they started so far behind, it actually became a department at the time that I was Provost.”

The provost conceives of productivity much the same as he conceives of quality (i.e., stature of the faculty, faculty’s national reputation, faculty’s effort in undergraduate education, and the quality of the faculty’s graduate program as judged by external evaluations). He seems to believe that high quality units are also high productivity units. This might not always be the case—for example, some high quality units in the sciences do not generate many student credit hours as was found the econometric analysis section with respect to the Physical Science field in this study. Moreover, it is interesting that the provost readily ascribes the highest quality marks to departments in the sciences, although RI University has several units outside the sciences that are highly ranked, even top ten fields, nationally, as in Anthropology, Linguistics, Management & Information Systems, and, Sociology at RI University. The connection to grant monies is clear. When asked about the role that external funding plays in whether or not a unit is productive, the provost indicated that external funding played a crucial role in units, “particularly in the technology, science, social science areas.”

What is interesting about the provost’s perspective on how and why certain resources were infused into specific units is that the where and why was remarkably similar to the president’s responses. That is, there was a strong and positive relationship with respect to infusing monies into the general/undergraduate education function of the university. The time period here is important. The early to mid 1990s was a time when state legislators were particularly critical of public research universities’ lack of attention to undergraduate education. As it turns out, resources were infused into particular areas as a reactionary measure much more than a proactive measure. For example, the provost indicated that monies were appropriated into undergraduate education consistent with comments the president made about infusing monies into the general education function. The fact that this is where they poured money into suggests that such infusion was due to an external press and not due to any strategic planning or any internal commitment. What is more, is that the money was poured into particular science units that had increasingly heavy undergraduate responsibilities. Here, there is no mention of the units from other colleges that were doing a great job serving this central university function.

“During the 90s there was substantial unrest about the quality of the undergraduate experience. I think particularly, the availability of courses, the availability of advisors, the large size of classes, the role of senior faculty in teaching at the lower division level. And, so I started infusing more money into those departments that were willing to step up and take the challenge offering more 100 and 200 level courses and putting their senior faculty in those courses. There were a couple of other places where I thought we needed to infuse money where the departments had essentially been starved and the departments
were taking on more and more undergraduate responsibilities, and that would be Chemistry, Mathematics...huge teaching loads.”

Thus, even in the case of undergraduate education, Science was favored and targeted for support. The dean of science offered, by far, the most detailed description of how he conceives of productivity. Moreover, some of the criteria he uses to assess productivity are quantitative in nature (i.e., student credit hours) with the exception of qualitative exit interviews he conducts of every student that leaves his college for the purpose of assessing teaching in each department. He understands that productivity can be a complex construct to measure. He defines productivity in terms of a matrix of four components that are rank-ordered on a scale of one to four (a lower number suggests a favorable score) per department in order to get a handle on it. On close examination of the responses, all four components were not evident even though he mentions that four exist. As a result, here are the three components that he explicitly speaks to in the matrix consisting of (1) Quality of the program; (2) Teaching; and (3) Funding capacity.

Interestingly, despite the quantitative nature of some of his criteria, he links productivity to reputation. That is, he believes that if a department has a great reputation then it is producing, specifically, that they have “the best graduate program.” In turn, if they have a great graduate program then that says something about the quality of the department. Thus, an important thread that is consistent with the perceptions of the president and the provost is the conflating of merit and productivity.

Teaching is measured in a traditional quantitative way that takes into account student credit hours per department. However, the dean also values student input with respect to teaching by conducting student exit interviews for every student that leaves the college.

Funding capacity was somewhat less unclear. Yet it is believed that a department is rated for its funding capacity external to the university with some explicit internal funding benchmarks that are already in place.

The dean describes in great detail how he measures productivity in his departments. He describes the already mentioned matrix approach and he briefly describes a shortcut approach that is not as good as his matrix approach; however, in his estimation, yields a high degree of correlation with the matrix approach with “some variations, but they’re not extreme.” Below are summary illustrations that capture the essence of the two approaches:

**Matrix Approach to Measuring Productivity**

<table>
<thead>
<tr>
<th></th>
<th>Quality of the Program</th>
<th>Teaching</th>
<th>Funding Capacity</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Department A</td>
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<td>Department B</td>
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<tr>
<td>Department C</td>
<td></td>
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</tbody>
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Scale: 1-4, lower score better

**Shortcut Approach to Measuring Productivity**
The algorithm can be specified as follows:

\[ X = SCR + ICR \quad \text{then,} \quad \frac{X}{Y} = Z \]

where,

- \( X \) = Percent Total
- \( SCR \) = Percent Student Credit Hours
- \( ICR \) = Percent Indirect Cost Recovery
- \( Y \) = Percent of the Budget
- \( Z \) = Unitless Efficiency Measure

"I usually create a matrix, which has just four components in it. The first component is quality of the program. So what is its reputation? And its reputation is a summary of productivity to the outside community. So any way you cut it, if a department has a huge reputation [then] that means that its producers are producing. Those departments that have a very high reputation, typically also have the best graduate program...summarized into the quality of the department.

The second thing that I worry about is what I call teaching. And, so I look at those numbers very carefully...and I look at the exit interviews of the department, of the students that leave the college, to see which departments they consider to have the best classes. That I take into account in addition to the number of student credits hours that they teach. Then it's funding capacity I take into account. Those are basically, the values that I use, and, and then I rank the departments from one to four in each one of those, and the lower the number, the better.

And there's another way of measuring efficiency, but efficiency is not as, good as what I've just mentioned. Efficiency [is] truly an algorithm, in which you can take the percentage of the student credit hours taught by a department, and add to that a percentage of the indirect cost recovery. And divide that by the percent of the budget, and that gives you a unitless efficiency number."

Keeping in mind that these rather detailed approaches “doesn’t give you at all a sense of, of where you should be investing future monies.” Although, the detail in such a response supports a rational approach to decision-making, the question remains how does the dean make such determinations for future resource allocation decisions? Everything seems to get lost in the detail of the process, yet know explicit linkages are made in the dean’s measure that would point to a one to one correlation between high productivity and high quality. It is believed that future decision-making involves the blending of the rational/political approach. The very essence of resource allocation gets lost in the details. He points out that there is a concise mathematical way to calculate efficiency but chooses to use a strict accounting approach with no weighting involved. This is a very interesting point because it suggests that even the most detailed of responses does not take into account the variations inherent in capturing teaching inputs and research inputs in such a way that is non-linear. More importantly, the linear approach will always favor a unit that is producing more of the desired input, in this case, the research input.

Quality of a department seems to consist of the typical prestige maximization principles widely held. For example, the dean believes that those departments that are distinguished by virtue of “number of National Academy Members, and, and its rankings...” are of high quality. Yet, he did not believe that external funding providers played an important role in what units are more or less productive or of high quality. He used the example of Biology whereby, he
believed that such department was underfunded with respect to the external funding potential, yet doing very well. Also, he believed that his college was doing extremely well, considering it captures more external funding than the College of Medicine. The dean believes that productivity and quality are “not measured by the capacity to acquire funds at all.” However, it should be noted that there appears to be a contradiction in this conception with the way the dean actually measures productivity in his matrix.

The dean of humanities offered a perspective that was much more in line with the university’s policy on promotion and tenure that evaluates faculty based on research, teaching, and service. The dean uses language such as active scholars, effective classroom teachers, service to the community and outreach to the community--this latter component is more specific than the university’s policy. More importantly, is the descriptive language ascribed to teachers. That is, the dean values “effective” teachers; he does not use the language of and thereby, “efficient.” His measure of efficiency consists of effectively using human capital talent in the classroom. This formation is perhaps not surprising coming from a unit that is much more aligned with the general education function, and, thereby, perceived to be undervalued, less prestigious, and less powerful in the university environment. He could talk about efficiency in quantitative terms particularly for teaching, because his College generates so many student credit hours. Instead, he focuses on effective teaching. The dean indicated that he uses various instruments to assess student input such as surveys, exit interviews, and an annual evaluation of every department.

“There are different measures of productivity. One measure is the effective use of faculty talent. Is faculty active as scholars? Are they effective as classroom teachers? Are they participating in the Department and College’s larger mission of service to the community, and in general outreach? Are they using their budgets effectively? Are they using them wisely? Are they receiving positive feedback from graduate students, undergraduate students? Is staff reasonably content? These are all factors.”

The dean also conceives, much like the provost, of quality synonymous to productivity, but in this case it relates to teaching undergraduate education. Again, we find deep seeded assumptions about prestige such as national rankings, awards and recognition. When it comes to research, not surprisingly, in the College of Humanities, external funding does not seem to be a very important factor in unit productivity. The reason is simple, “external funding is not readily available.” As a result the dean does not use that as a criterion for assessing productivity.

The dean’s response for which units he believed had potential is an interesting one because it captures the essence of market segmentation and comparative advantage in the field of microeconomics, although the dean does not use economic jargon to describe what is going on. That is, he describes one unit as having potential to be a nationally ranked department because it has decided where its comparative advantage exists in the university marketplace. More importantly, it is cognizant of such advantage and is actively expending resources to improve on its advantage and solidify such advantage for the purpose of increasing national rankings. That is the implicit goal. On the other hand, the dean describes another unit that cannot decide where its comparative advantage rests or at least is not ready to actively pursue its advantage without offloading other functions within the unit.
“I think the Department [Language] has the potential to become a top ten department, within the next 10 years probably a top 20 department within the next five years simply because of the quality of the faculty that’s been hired in the past ten years. And the focus of the department, it’s under very capable leadership, of the department head. They’ve been able to focus on what they want to do and what they want to do well, and then they have hired accordingly, to bring people who are not senior faculty, but junior faculty, and associate professors who are real dynamos—so really focused and really good at what they can do. I think the [“Humanities”] Department, if it were able to decide, among the many things that they do, and what they really want to become excellent, truly excellent, they could become a top 20 department, but that remains to be seen.”

The dean of education did not define productivity specifically but did provide some productivity measures that are again based on deep seeded assumptions of productivity such as, national rankings through US News and World Report, publications, national and international reputation, reputation in the school districts, faculty recognition, faculty editorial involvement for major journals and major foundations, and fundraising. Most of these had little to do with quantity. Also, he mentioned some general areas as to how he conceives of productivity. For example, the dean believed that productivity could be thought of in terms of economics and student enrollment. When describing the economics of the college he spoke directly to grants and contracts as a measure of productivity—departments that were generating revenue for the College. In the case of enrollment he spoke to the diversity and selectivity of his college and how it both helps and hurts the college as a measure of productivity for the college as a whole. So again, we find that a productive unit is one of high quality. Hence, productive units equal high quality units.

“If you’re talking about economics, that’s one level of productivity in which departments or the college will get more funds than the State allocation. And the way that occurs would be through grants and contracts, in particular. In the College of Education, there are [several] departments, and one of the departments, the entire time I was the dean, was the most active and the most successful in obtaining external funding. And that was the Department of [“Education”]. So you are looking at it from external funding that are beyond the state monies that help the faculty members do their research, that supported graduate students, almost with full funding, doing their graduate work that helped the faculty members in their own travel, and it helped them in terms of their publications and presentations around the country. Those monies that they generated had multiple effects on the way in which they did their job, and therefore, the money part was high productivity and, and how that resulted in them performing their duties, taking care of their students, advancing their careers, was another high productivity area.

Another level of productivity would be student enrollment. Although in this university, or at least while I was the dean, perhaps the best way to say it—the money didn’t follow the students. So, when you look at what we had in terms of our undergraduate population, it was approximately 800, and the graduate population approximately 800, the college as a whole, was among colleges on campus in that particular regards.”

The dean’s response is really divergent from the other respondents. He has a solid grasp on how money is generated in his college, yet, he astutely points out that the money generated in his college by way of student credit hours is not commensurate with how his college is funded. In short, his college does not reap the financial rewards generated from high generation of student credit hours. Moreover, he is keenly aware that generating external monies is a productive activity that generates productive outcomes for students and faculty. In addition, much like the dean of humanities, the dean of education points to an important factor in the resource allocation formulae that both are aware of, that is, both colleges serve a tremendous general education
purpose providing “cheap instruction” with no corresponding economic or other return to such investment or service.

On the one hand, the dean celebrates the fact that his college is very diverse in gender, ethnicity, socio-economic status (SES), and the like. On the other hand he describes his diverse college as incurring a penalty for having such a diverse, and above all, high numbers of low SES student body. It is celebrated when the central administration needs to cite diversity, usually that translates into getting “patted on the back.” However, that does not translate into resources in recognition for the contribution and the need that such student body demands. The dean succinctly describes his college as the college that “helps the coloring of the University,” and how that affects his resource allocation opportunities. To sum it up in his words, “…our students are from, in some instances, lower class, and low SES…the College is low SES within the University, and, that poses certain kinds of problems. What I mean by that is, in terms of our budget as compared to other people’s budget, State budget.” This reality of educating a very diverse student body, specifically low SES, and drawing the parallel to being a low SES college with respect to other colleges’ budget is powerful and supports the critical/political framework. Moreover, this conception points to a very important fact: this is the only dean who makes this very important connection between serving a diverse student body and the relative lack of resources that follows.

This situation and a pejorative view of colleges of education served as the impetus for the dean to begin a capital campaign to raise external monies. That campaign became a measure of productivity—ability to fundraise or “friend-raise” as the dean put it. That campaign was successful by raising $10 M from zero when he became dean of the college. The success of the campaign was corroborated by the president by making mention that the College had succeeded in raising external monies.

Productivity was synonymous with high quality in that departments that were highly recognized and produced quality publications were of high quality. Of interest was how he mentioned that certain departments meet some but not all the criteria of high quality (i.e., productivity in many respects) because they are not bringing in much external monies but they are the best in taking care of their students “…so the tradeoff might be, might be equal in that regard. If you, in fact, students are your main thing, as opposed to the buck.”

The way the dean was able to infuse resources into the college was by infusing resources into faculty positions. He was able to successfully reallocate lines and resources for the purpose of bringing in new and sometimes younger faculty to aid in transforming what he called a “cottage industry” into the information age economy. Even with the reallocation of resources it was very difficult to compete in the marketplace for new faculty because competitors offered better “packages” that included start-up monies, space, graduate assistants, and research money.

The dean of agriculture also conceives of productivity as a construct that consists of grants and contracts, membership to the National Academy of Sciences, and quickly moves to the concept of comparative advantage much like the dean of humanities pointed out. For example, he points out that his college has a comparative advantage in irrigation science and plant genomics. Again, the dean focuses on quality. He also points out that he is cognizant of
the fact that there is a danger in simply measuring productivity and quality in terms of an “input model as opposed to an output model.” That is, he makes key distinctions about the differences that exist in each department’s input/output model and comprehensively describes how it is inherently difficult to capture outputs between various departments. But he neither mentions nor alludes to investing state dollars in his calculations to generate research grants.

“I shared with you that our Plant Sciences department, those guys operate on half a million dollars of faculty member per year, in extra mural grants, and that’s from the National Science Foundation... they are very good at that. But the key is, is that’s what it takes to have a successful program in Plant Genomics. I’m a biochemist... it took in the neighborhood of a hundred to a hundred and fifty thousand dollars a year to run my lab. Now, the output was what I published, where my students went, and all this sort of stuff... an agricultural economist... they can work on a research budget of let’s say... $20,000 bucks a year... The inputs are easy to quantitate—dollars in. The harder part is to quantitate what comes out. ‘Cause yet what comes out is what counts.

We do it at the University level, we do it at the college level, we do it, we do it all the way through. And it’s OK, but I think it’s OK only if you always remember that it’s an input—not an output model. So again, you know, as you go into University Administration, make darn sure you measure what’s coming out, and say to yourself, well, you know, that guy needs so much coming in to have this much coming out. And he needs more funds—we need to work like hell to make sure he gets more. Don’t evaluate them just based on the number of grants you get, because again, it just takes more money. I shouldn’t say more grants... the value of your grants, I guess would be the best way to put it. We try to balance it as best we can, and lots of times it’s a little harder to do because the output is not always a smooth linear model.”

The dean of agriculture infused resources into faculty lines much like the dean of education. He directed resources into faculty lines, start-up monies, space and “all the necessary stuff it took to really recruit [and retain] some of the very, very best people”, principally in the plant sciences. However, he did not talk strategically in the same way as the dean of the college of education, relating characteristics of his college and to the allocations of state monies they received.

University and External World

It was important to assess how decision makers with budget authority perceive the university’s external relationships. Of particular interest is how the respondent characterized the relationship between the university and the external world. In general the responses ranged from good to bad. In the case of the deans, the relationships appeared to be much better due to the fact that they self-selected who they interacted with. And, per their own admission, they self-selected and interacted with friends of the college. The dean of the College of Humanities stands out as someone who is much more aware of the responsibility the university has to its community. He believes his college has a strong mission to “develop the programs and outreach efforts” for the community “in whose midst we live.”

The president believed the relationships to be “excellent” and “very poor” in some cases. The relationship appears great with friends of the university and not so great with the critics of the university. The reasons vary from friends that are quite aware of what the university does and how it functions to the critics that continually have the university under a microscope because it is the largest public employer in town.
"I think it was excellent in terms of alumni, in terms of those individuals and foundations who were involved in the professional world, and knew what the quality of the University was. I think that, that there was nothing but positive results from that relationship with—from that part of the external world. The relationship with the community and the city and the media, in my opinion, was extremely poor."

The president continues to describe an administration that is constantly under the microscope and does not benefit from being the largest public employer in town. He describes a university that is reactive to its community critics and takes on a risk aversive identity. This could be a general phenomenon of research one universities or simply a phenomenon that is symptomatic of this particular administration.

"And so that's kind of that scrutiny I think works against the university, and can have the effects of making educational leaders think twice, before the launch into either a controversial or partially risky decisions."

However, when asked about the relationship he had with the university community and community at large he indicated that he had great relationships with those who understood and were in-step with the mission of a research one university. He indicated that it was very good, especially in the business circles. He was part of the business elite—"the Breakfast Club, which is, uh, a gathering of businessmen that gather, that get together every, I don’t know, about once a week, uh, for breakfast. Moreover, he stated that he was a member of very large and powerful not for profits that drive economic development and economic development interests. He describes his fellow members as "movers and shakers" of the community (i.e., prominent business people, and the local and regional economic development groups, prominent business and politically influential organizations. Membership also included the respective alumni foundation and others.

When asked about the influence of such memberships—organizations, individuals, and the like he was careful to point out that they were only one input for decision-making and there were others such as the Faculty Senate. He pointed out that he believed that the Faculty Senate was actually a powerful and influential constituency even if the Senate did not believe the same. As a result, he believed that the Faculty Senate, alumni, and people he associated with were the primary influence on decision-making. One could gather that the "business elite" had influence given the frequency of their meetings.

The president believed that faculty and the administration (i.e., president’s cabinet) decide what the university produces, and the private sector plays a supporting role. The president plays a very important role in bringing everyone together—and ultimately what the direction will be.

"Well, ultimately there's no single individual that does that. It clearly has to be a partnership that consists of faculty representation and certainly the leadership in an institution, and by leadership I mean the president, the vice-president, and certainly the deans. The board is a critical factor in determining what an institution is going to accomplish and what it's not going to accomplish. So it has to be the partnership. The president's role is to try to bring all those varying constituencies together, and to make recommendations as to where the institution should go, taking all those things into account."
As far as students are concerned, he believed that they were marginally powerful—only in matters of student affairs because they were a constituency group that was served. Insofar as units, he believed that the College of Business, College of Engineering, and the College of Sciences were powerful. The College of Business was the only powerful unit that was not characterized as a high quality unit. This is a significant finding because this college neither fits the definition the president provided of productivity or quality nor the definition of other key decision makers. That is, high productivity equals high quality. So here we have a college that does not meet that definition, yet is seen as very powerful. This finding is consistent with Resource Dependency Theory and consistent with critical/political theory. As both theories suggest, powerful units are more closely aligned with external funding agencies and are comprised of few minorities and women. This college is aligned with the corporate sector and leverages power through its business relations. Also, this college has low numbers of minorities and women, particularly, in certain disciplines. Moreover, such close ties with the business sector afford it power internally, leveraged by the key alignments externally that is also consistent with Slaughter & Leslie’s findings (1997).

The provost, on the other hand, spent much more time describing the university’s relationship with the community as great, centered on respective academic units complying with their legally mandated function per the University’s charter (i.e., “outreach, public education, the general public education, transferring technology from the laboratory, and, and from the experimental stage out into the uh, community”). Moreover, the provost characterized his relationship with the community as a good one because he was involved with certain constituencies and “friends” of the university—much like the president.

“I think it was a good relationship. I worked very hard through the, RI Foundation. I had a kind of twice, monthly, breakfast with members of the community that Foundation people, from their long list of people who were friends of the University or should be friends of the University. We would have these breakfast meetings twice a month with 15, 12 to 15 members of the community, both here and in ["Metro"], more so in ["My Region"] than the ["Metro"] area. And I would spend my time after the meal, maybe 15 or 20 minutes, summarizing a number of, outstanding areas in the University: things that we were doing, and I was pretty sure they wouldn’t know about. And then of course, always an appeal for their help in the political arena. During the 90s, we, (laugh) seemed to have a lot of trouble and it looks like we still do.”

The provost talks about similar important external constituencies as the president but succinctly lists them. However, he points out that the state legislature tops the list. The list consists of the state legislature, the Board of Regents, the alumni and the general public, the federal government, and the private donors. The provost provides an excellent and comprehensive view as to how he believes the university generates revenue, functions and the juxtaposition of the two.

“There are several important key external constituencies. I’d have to start with the Legislature because it provided the bedrock, the foundation for everything that went on. The other money, about a third of that $1 B was grant funds, and, you wouldn’t get grant funds if you didn’t have, you know, the basic activities of a University and then, a substantial amount of money that came in the form of gifts and scholarships and so on, and you wouldn’t have that either without that foundation. And I would say next of course is the ["Governing Board"]--the governing body that has no money so, it was necessary always to keep them happy...The other very important constituency out there is the alumni and the general public. You can work your magic with the
Regents and work diligently with legislators. But if it's clear to the legislators that you don't have voters on your side, if you don't have alumni and parents that are proud and happy with the educational successes of the University then, it's a deep pit of trouble that you get into. So that's probably an area of great delicacy and requires constant attention.”

The donors are an interesting external funding constituency because, according to the provost, the private donations look impressive to the community and others; however, the university and the college where the monies were donated still have budgetary commitments that are non-discretionary in nature. However, donations are important because they help in maximizing any given college’s prestige, and hence, the university’s prestige. This is an important finding given that the money will be used as a prestige enhancer because this kind of money is taken into account in the generation of indices for national rankings such as the US News & World Report.

“Also, donors. As you well know we got several very large donors to the University. It's hard to make a campus-wide impact from a donor that wants to give his money entirely to the Law College. It does not relieve any of the budgetary commitments to the Law College and it does kind of distort the picture, but at least it provides us with an opportunity of developing a Law College with a national reputation.”

It was important to learn more and assess how single donors, when making contributions, form or generate any kind of qui pro quo expectations of influence, with respect to their contribution, to the college they make the contribution to. Also, it is important to learn if such expectations are explicit or implicit. In resource dependency theory, there exists the expectation that a private donor will receive some kind of return on such contribution. Therefore, it was important to tease this out further. The provost's response was insightful in learning how it actually works.

“Well, I think that, that any major donor is sophisticated enough to know that they're not going to be able to direct the kinds of courses that are taught or the faculty that are hired...that is never a part of the gift letter as we call it, but, you know, let's be honest, I mean, someone that gives 10 or $12 M to a college is going to have some influence. And they're also intelligent enough to know that they have to wield that influence subtly and carefully. But the bottom line is the faculty really determines the academic programs and the nature of research and so on. If someone wanted to give the University lots of money to study parapsychology or little green men or something......it's going to get turned down. We just wouldn't accept money with any legal commitments about the nature of the academic pursuits.”

Moreover, the provost made it very clear that the faculty decide what is going to be produced at the university. It is faculty who “drive[s] the curricula and the, and certainly that drive the areas of, uh, scholarly investigation.” However, he clearly acknowledges in a tongue and cheek fashion that donors do, in fact, expect something in return for their money. Particularly, if it is big money. This finding is significant and consistent with Resource Dependency Theory in that he who pays the piper can and does, in fact, call the tune. As a result, this exchange between donor and benefactor is not explicit but well understood implicitly—an implicit social contract between the two parties.

With respect to power, the provost’s response was an interesting one: it is in alignment and supports Bolman and Deal’s (1986) key assumptions within the political framework of resource allocation. That is, organizational goals and decisions emerge from ongoing processes of
bargaining, negotiation, and jockeying for position among individuals or groups. The provost points out that individuals and their personalities play an essential role in influencing the president and the provost. Again, the provost ultimately believes that power is generated through quality and adds vision that can catch the attention of a key decision maker like himself. That is, high quality and vision generates power.

“Well, it's interesting, but, at that level, personalities begin to play a very big role in getting the ear of the Provost or the President. And I don’t mean just if they're, you know, buddies or something like that. But it's the vision and devotion to quality that attracts the attention of the central administrators. And there the focus will shift a little bit based on the department head or the dean that's determined to elevate his or her program to the highest levels in the nation. And they're doing it cleverly and with clever recruiting and design of new exciting avenues for investigation and education. So, I would say that what determines power in that case is, the creative abilities, and the ability to communicate those expectations and view of the future, communicate those effectively with central administration.”

The dean of science believes that external relationships are very good. He is quick to point out that the federal legislature is a very good relationship. This is a very different set of constituencies he looks to than do the other administrators. He also believes that the relationship with K-12 is very good because the college is creating a stronger bond with the school districts with respect to the science and mathematics courses taught in the schools. The college is “highly respected by big industry in town, the high-tech industry in town.” Industry has an eye towards the college creating technology transfer and is influential through some big firms in town led by some big names in town.

With respect to power, the dean believes that the highly productive and of high quality department [“Highly Ranked”] is the most powerful department in his college. Its power is realized from and permeates throughout the university because they are “very good, but also because they bring in so much money.” Because they bring in so much money and they are called upon to cross-subsidize many other functions of the university, the department is not always happy for doing so. The dean’s description of the relationship of departmental power and money brought in are best summarized in his own words.

“Theyir whole thing gets all torqued, because all the money that comes into the college, which brings in about half of all the money that comes into the University, so you can just imagine how torqued they are.”

The dean of humanities believes in general that the relationship between the university and the external world is “pretty good.” It is interesting that he immediately points out that the best relationships, not surprisingly, exist between university fund providers, particularly in the area of the sciences. What is critical and of significance is that the worst relationships seem to exist in the community and do not seem to be getting any better. More importantly, he points to a historical fact that the university and the community where it resides have a stressed relationship, particularly as it relates to its largest minority. This response is consistent with the president’s belief that the relationships with friends of the university are great and that they are poor with the critics; however, unlike the president, the dean alludes to a historical context that may explain why the university has a strained relationship in the community it resides.
"I think the university probably has a pretty good, credible, maybe even excellent relationship, in terms of government, agencies, and private foundations, in the area of science, technology, medical school, bio-medical research, some areas of engineering. I don’t think it has a particularly strong or credible record in other areas. And in terms of, talking about the external world in general, I don’t think that. I think the university’s role has been historically questioned within its community, which is, predominantly, Hispanic, Chicano. And I don’t think that relationship is getting any better."

The dean of humanities gives an excellent description of how the interaction among his colleagues might suggest a disparity in university resource allocation. He points to the administration’s inability to bring together the various colleges and various interests in a coordinated way. These facts as he suggest points to a significant finding within the structure of a public research university. That is, he has a grasp of the various types of competitors for funding in the university structure: the traditional academic units vs. the professional units. He seems to believe that it is unfortunate that within this competitive framework, no seemingly, good faith effort is exercised by upper administration to bring the various competitors for some unified institutional goals. This points to some very important questions with respect to bureaucracies and complex organizations like higher education institutions. That is, who benefits from this “divide and conquer” framework? Who benefits from information asymmetries in this seemingly perverse competitive model? Who pays the price given this structure? How does undergraduate education fare in this structure if the units who win out under this model do not serve a critical undergraduate function? And finally, who should pay? The dean’s comments generate quite a bit of additional questions that are outside the scope of this study.

"I think it’s a loose confederation of colleges and auxiliary units that at times seem to have a very tenuous relationship among us. I think this is particularly true for the non liberal arts colleges, and those I would identify as the sciences, the humanities, the fine arts, and the social and behavioral sciences. I think there’s a whole ‘other sphere out there called the professional colleges, and it’s just very little, sometimes, seeming common ground, and I think that’s the nature of a Research I University, and it’s a regretful…and I regret saying that, but I see the sometimes that central administrators fail to bring together those disparate parts in a way that’s functioning in a harmonious whole to bring together those disparate parts in a way that’s functioning in a harmonious whole. And so there’s great discrepancy then, in the allocation of resources across the University, consequently."

According to the dean of education, the relationship with the state legislature was “tenuous…they did not respect at all the research mission of the University.” And the relationship with private donors was “great.” Important constituencies consistent of the Board of Regents, alumni, governor’s office, state department of education, the K-12 system, special interest groups in town, and students.

The dean of agriculture characterizes power in a very descriptive way, but it all comes down to power being “about individual power.” However, he also describes a process that exists in his college that follows the rational/political framework as far as who ultimately makes allocation decisions.

"Well, in most instances, people would have to be on certain committees, and, or they would be a part of the group, like the department heads group. Where, it wouldn’t be so much as, it would be more of a negotiation; they would be in a position to negotiate in regards to the reallocation of
resources. Some faculty members, individual faculty members, are not on committees and all, not in a position to negotiate with the dean or with a committee, unless they're on the committee, and/or they work through their department head, and/or the committees themselves. And it's absolutely imperative that the committee structure exists, because that's where a lot of decisions are made.

It resonated loudly when the dean spoke about his belief that the college and the university should operate more like a business for greater effectiveness and greater public support. He expresses concerns over not having paid more attention to the needs of the "customer." His concerns were warranted because that explains why, as the president and provost noted, the University finally infused monies into the general education/undergraduate function. They infused these monies because the client (e.g., students, their parents, and others) expressed concern about the quality of what they were buying--undergraduate education.

"Your success as a business depends upon being able to charge a fair profit for a high quality product that everybody wants to buy. And so you flourish and everything goes along. A public university has to reach out to customers and say, hey, we have a great product, are you willing to buy it, are you willing to pay tuition? And at the same time, are you willing to say to your elected officials, hey, that's a good place to go, to the University, you really need to support them, or I am not going to vote for you. And there is where, in public education right now, I think we're going through a big-time transition. And I think that had we, perhaps, over the years, followed that idea of the customer a little more carefully, we might not be in the situation that we find ourselves in, where we said, what happened to our public support?"

Interestingly enough, among the rhetoric of the president and the provost, the University has not practiced "quality" principles when delivering a high-level, high-quality level of instruction for its general education function. Instead, most of the high-level and high-quality behaviors have been practiced at the graduate level, relating to prestige and external funding.

Diversity

It is critical to assess diversity and the extent to which a decision maker with budget authority infuses money into diversity initiatives or the extent diversity initiatives are linked with financial capital. There were varying approaches to diversity and money anywhere to not linking any monies due to a belief that good policy would address diversity initiatives to directly linking resources to such initiatives.

The president is on the extreme point of not linking monies explicitly to diversity initiatives. This, indeed, is ironic because usually a president leads an institution in policy-setting initiatives that supposedly will lead the University in some positive direction. He believed that diversity initiatives could be realized through policy. More importantly, it is inconceivable that any such initiatives can have any type of success without some type of policy analysis designed to determine whether or not monies or additional monies are required to carry out the purported initiatives within any given policies. This is a significant finding because it suggests that such diversity initiatives, first of all, are sufficient, not necessarily effective, and neither existing monies nor additional monies are required.

"Well, we made an attempt to add to diversity through the regular policies that we had. We didn't divert special resources for diversity issues, but we tried to build policies that assured that the
resources that were made available were linked to diversity. For example, the evaluation process that we had for the hiring of deans in the various colleges specifies that their evaluation would be on the basis of diversity. So that’s not a direct link to resource allocation, but it certainly had an effect.”

However, the policy and the mechanism used to achieve diversity initiatives had no consequences embedded in the policy. In fact, it was heavily weighted on process and not outcomes by creating new entities that were concerned with diversity initiatives.

“I, we, established a couple of extra councils that went above and beyond what you would normally find within the university for diversity purposes. One was university-wide.”

During the president’s tenure he shifted responsibility and cost centers for diversity to the academic units—a resource allocation shift from a highly centralized one to a decentralized one with no apparent focus on outcomes. Again, this appears to be a process-centered approach rather than an outcomes-based approach. And it involved eliminating offices related to minority student issues. This is a significant and a rather peculiar finding given the president’s minority status. First, the president believed that he was the only one that could take on such a controversial task of dismantling an effective student affairs program designed to ensure academic success of minority students, particularly, disadvantaged minority students because he is a minority. This finding is suggests a phenomenon that should be explored further because it hinges on understanding why a minority senior administrator would have a sense of obligation to eliminate a program that is focused on academic outcomes for minority students. Second, the president believed that by shifting the responsibility from the university as a whole for minority students’ academic success to the respective academic units without any additional incentives or resources appears negligent at best. Third, in so doing, expecting the colleges to pony up the additional resources to ensure academic success without any of the original allocated resources to the program that was dismantled would have had the effect of stressing the colleges even further. Fourth, it did not appear that he and/or his administration considered the academic success of minority students an imperative by not creating “real” and feasible expectations of colleges and attainable outcomes of the same. Unfortunately, what is missing from the former president’s responses is any mention of successes as a result of his policy choices, even after probed further. What is more, he actually cut the diversity centers across campus and diffused their activities and responsibilities.

“Within the institution, I don’t recall that it added resources, but it shifted some resources, when I gave the responsibility for diversity success of minority students through the years, academic units, specifically the colleges, rather than having it centered on the office of student affairs. It was a very controversial move, but I felt that because I was a minority, I was about the only one that could do that. And so I dismantled the office that used to center on academic success for students and charged each of the colleges with establishing their own diversity success units, and so I guess that each of the colleges then would. I don’t recall specifically now, but I guess that the expectation was that the colleges themselves would put some of their resources into that activity.”

The provost follows a similar pattern to the president; however, he cites an important time during his tenure where there were explicit links between diversity initiatives and resources. Moreover, he describes the way the university intended to diversify and retain its faculty. It appears that an unwritten policy is the way to go to circumvent any legal consequences of any policy that can be construed as adverse in nature to any one group. Unfortunately, this policy of
noncommittal can also be viewed as just that--noncommittal to initiatives actively recruiting and retaining minority and women faculty. Such ambiguity is described as a good thing by the provost, but in reality, it may appear as a policy of indifference to diversifying the academic ranks.

"...you don't write up a formal program in that regard [recruitment and hiring of minority and women faculty in various departments], and you just let your deans, department heads know that we can always find the money both to recruit and to retain our outstanding faculty, and that includes minority faculty."

For the dean of science, diversity and his approach can be summed up rather succinctly. He is against any diversity czar and believes that the responsibility for diversity, specifically, hiring diversity should rest with everyone and not the central administration. Moreover, he believes in targeting diversity and not creating diversity policies to do so like the president suggested. He is “interested in targeting targets and not creating huge programs about this and that and the other, but just looking around, that’s the fastest way you can change things.” More importantly, he believes “we don’t need big programs, we just need to go and do it.” That about sums it up.

The dean of humanities on the other hand linked resources to diversity “very, very directly.” He is a seasoned dean and expects an aggressive approach to recruiting and retaining diverse faculty--defined as ‘members of U.S., underrepresented minority groups, and particularly Latinos. Unlike the president, he does believe in directly linking resources to diversity initiatives for hiring and recruiting diverse faculty per his definition. The fact that he defined diversity in a specific way suggests an acute awareness of the issues surrounding social reproduction and other theoretical underpinnings surrounding hiring and retaining faculty. His links are rather fascinating in that he not only expects his faculty to comply with his agenda on diversifying his college but indicates that if faculty are not in compliance with his agenda there are consequences. This approach is surely emblematic of an outcomes centered approach.

“I have ratcheted it up—the linkages between the distribution of resources from the dean’s level to diversity. For example, in the recruitment and retention of diverse faculty, departments will not hire for the next five years while I’m dean unless they can demonstrate to me that they have a credible aggressive, good faith, recruitment plan to bring a diverse faculty to this campus, and retain what few diverse faculty we have. So it’s a very direct correlation. And in my address to the college all college meetings about a month ago, I was very explicit, and I also told departments that, I’m creating a post doc program, I’m creating a graduate fellowship program, and those are targeted for diverse populations, and if departments want to receive those resources from the college, they have to line up on my diversity agenda, the ones that do not, they’re gonna be left out.”

The dean of education links resources to diversity as much as possible through new faculty lines. That is, he tries to assure that the search committee is going to solicit a diverse pool of competitive applicants. However, even the dean recognizes that he cannot guarantee diverse results. So, in effect, he feels that he is hamstrung by the hiring process put in place. In addition, he feels that the minority faculty that exists on these search committees is small to begin with, and might not have the same interests in hiring a diverse faculty member in mind. So, the end result of linking resources to diversity initiatives might yield an undesirable result with respect to diversity. Moreover, what is missing in the dean’s response is any mention of
any effective strategy has been employed or could be employed to achieve greater diversity results.

"When you get down to how that's done...when you have a dearth of minority faculty members, a dean cannot do it by fiat. You want to but you can't. The dean can't run the search, particularly if the person's gonna have the final say-so. In fact, what the dean can basically do is just not approve anything that doesn't come back looking as though people have done what they needed to do to come up with a diverse pool—which is where you start. And then come up with the best candidate for the position. I think this whole thing with hiring and diversity is a lot more complicated than you want it to be. And if you get people not thinking alike on this—it's tough. When I talk about diversity in the college I know I'm talking more about diversity in terms of students than I am faculty."

The dean of agriculture believes in a direct link between resources and diversity initiatives. He provides a concrete example of a woman who was hired and retained based on criteria that do not usually follow the norm of mostly promoting based on research productivity. It is certainly a unique example but one that is illustrative of the direct links a dean can make in his own sphere of influence. More importantly, it is the only evidence from a dean that makes any kind of linkage to affirmative action.

"We hired a woman—one phenomenal teacher [that] really worked with the students—research program minimal. I had to really hold down and say, my God, you know, if I had wanted to hire somebody pushing back the frontiers of science in our area, I wouldn't have hired her. I wanted somebody that would relate to the students, that would do a good job of teaching, a good job of advising, whatever, and she did it. She's now our tenured associate professor, but, man, that was a blooming fight for me all the way through this system, and I finally said to a few important people around here, hey, it's time to walk your talk."

Efficiency

The respondents varied in how they responded to the concept of efficiency anywhere to embracing it to overtly mocking the concept itself in a university setting.

The president believed that the most efficient unit in the university was the Graduate College and believed that the main driver for making them an efficient college was the loss of state appropriated funding—an external press for scarcity. Moreover, its efficiency can be attributed to their division of labor techniques (e.g., the academic units handle graduate admissions, scholarships, and the like instead of the Graduate College itself).

"That was one of the most efficient units, and the reason was that they pushed a lot of their activities down to the constituents and departments rather than trying to insulate the care of admissions and the scholarships and all of that kind of thing."

On the other hand, the provost laughed at the concept of efficiency and academic units. He took a long pause and remarked "if there is such a thing." He believed that efficiency in higher education is a dicey concept and one that is usually turned into a numbers game. The provost simply believed that efficiency is one of many inputs to decision-making about a unit. He does suggest it is central to the discussion of productivity as well for efficiency is very much related to productivity.
"Well, efficiency is in general one of a number of measures in the way the Administration would respond, say, budgetarily to a unit. So, efficiency gets measured with quality and, you know, effect on the overall mission and importance in connection to the community, and, there are a number of measures, and they’re in a continuous circle. You can’t put them in a Venn diagram."

Moreover, he was very insightful for understanding how the budgetary process works at RI. The provost provided a comprehensive view of the process itself, the nature of decision-making, and the political implications of membership in the budgetary process.

Decision-making is carried out through a shared governance structure that is heavily slanted toward the academic side and per the provost the “provost chairs that group—the provost’s vote is a little bigger than everyone else’s.” Therefore, the process begins to look less and less like shared governance in budgetary matters. As for the political implications of membership, the provost notes that at the end of the day, the decision-making comes down to the president and the two senior vice presidents (the provost and the senior vice president for business affairs). Ultimately, “the two senior vice presidents made the final budget recommendations and the president tweak[ed] some numbers here and there to let us know that he was looking at them. But he trusted his two senior vice presidents that the money was going to be spent to meet the objectives that were his.”

The provost describes an inner circle of decision makers that are central and key to the budgetary needs of the institution. One could describe this small group of individuals as a powerful group on campus. This is an important finding, and, per the provost’s description, that leaves a large segment of the university population out of the decision making process. Equally important is who is not included in this elite group of decisions makers. It appears that everything is done under the guise of the shared governance system—a democratic system. However, the provost believes that “those [budgetary] decisions have to be made, as dictatorial as it may sound, by a smaller [group] of people because the University is not a democracy.” As it turns out, the provost describes an extremely hierarchical system of governance and decision making on budgetary matters that is consistent with and supports the rational/political approach, whereby, a small number of individuals make the decisions in a hierarchical organization.

A final point of interest was the provost’s characterization of the role of the president in budgetary matters. He believed that” presidents, however, and unfortunately, often think they’re budgetary officers and get involved at the kind of detail level that they probably should not.” He obviously, has a take on the role of the president or at least the role the president should not have. It sounded much more like the president should be much more of a figure head and not mettle in these very important and powerful matters. So it seems that the president does not have real power per the provost’s description of the role of the president in budgetary matters and would be consistent with Neumann’s (1995) findings of the role of presidents.

“In principle the president divests his authority but not responsibility for budget activities to the provost. So that in RI and most universities the provost, sort of ‘chairs’ the group, the small group of people that begin to look at the needs and then the expected revenues. Then there is a budget process, usually begins as soon as you make one year’s allocation, you begin immediately on the next year, gathering up what the needs are and so you look at the needs, first of all, of debt, meeting legislatively mandated programs, regently mandated faculty salaries. The group is also usually skewed so that the vice president for research, who reports to the provost is on the
committee, the vice president for Health Sciences, who reports on Academic Affairs is on that committee, so, sort of the academic influences begin to be the strongest and begin to outweigh other demands at that table. And in my mind, the priorities were first, the undergraduate experience, secondly, the research agenda, thirdly, the development of people, and then, you know, two other dozen issues that came beyond that."

The dean of humanities readily admits that he is not a manager that looks at efficiency measures or some kind of matrix. I wonder if he knows that his colleague in the college of science uses a matrix to assess productivity and efficiency? The dean is cognizant of his college’s financial contribution to the university. He clearly points out that his college provides “cheap instruction” through its undergraduate mission in the form of adjuncts for many students throughout the university. As a result, he believes that his college is the most efficient college in the university—delivering cheap instruction by hiring cheap labor in the form of a high number of adjuncts and overburdened graduate assistants. He is aware that cheap instruction generates much revenue that his college never sees, hence, this is a source of contention. It is important to note that the dean is critical of efficiency because he understands that efficiency in his college equals "cheap" and that is certainly not good especially in the allocation of resources game. And, as it turns out, efficiency is not rewarded in his college. This is an important finding because here we have a clear case of a unit being seen as efficient because it minimizes costs (delivering cheap instruction) and maximizes revenue (student credit hours) yet it is not rewarded for being productive. After all this unit is a highly productive unit as it relates to teaching inputs (student credit hours), but not as "productive" as it relates to research inputs (securing sizable amounts of external funding).

"Well, I’m not a manager, in the sense that I look at efficiency and efficiency measures on some sort of a matrix. And, I’m willing to cut people slack in the distribution of resources whether they’re human resources or monetary resources. But after some time, I want a return on those. I want a return, specifically. Let's take the example of diversity. I've gone down the road in the past of distributing resources to promote diversity based on good faith on the departments who have made genuine efforts. I've been disappointed, and so, the efficiency is really going to be determined by what I get as a plan before resources are made available to departments. Now, we have a huge undergraduate mission in this college. We've delivered 20,000 seats in freshmen composition, foreign language instruction, mainly Spanish, and general education every year to this university. And we are the most efficient college here in terms of serving freshmen and sophomores, by far. We deliver cheap instruction, 'cause we employ large numbers of graduate assistants. That's got to stop, you know, we've got to get the resources to adequately compensate and to reduce the teaching loads of those graduate students. And not a consequent or corresponding return from central administration."

In short, being efficient is seen as being cheap, not good.

Another key finding with respect to why the college of humanities might not see the resources generated for the university is that the college is not usually at the table where university resource allocation decisions are being made as described by the provost. That is, the college is not represented at university finance committees, strategic planning committees, and other key budgetary decision making committees. Clearly this is a disadvantage to the college and one could conclude that the college, definitively, does not hold a position of power within the university.
“I recognize that Humanities, the faculty in humanities, the students in humanities, and the dean of humanities as having a relatively minor role to play, in terms of setting university priorities, and [the] university’s strategic plan and behaviorally affecting the behavior of the university in terms of distribution of those resources.”

According to the dean of education, efficiency is, simply put, “getting the biggest bang out of a buck.” He describes it further by using some economic terms.

“The unit that is able to, to make whatever resources that they have work for them, leverage their resources, get twofers, threefers, you know, of their resources, and have a plan for how they’re going to increase or maximize their resources over time, realizing to some degree that they may not be able to depend on the central unit, central administration, or someone to provide them with necessary things.”

According to the dean of agriculture, universities “are not famous for being efficient…” However, the dean did sum up rather eloquently, and reminded us as to what business we are in, how and why universities and his college are not efficient in the traditional sense. We are not efficient like a business because “our principal customer is people.” Given this description the dean of agriculture much like the dean of humanities assert that efficiency is not desirable in the allocation formulae.

“By and large, people are not efficient to deal with. It isn’t like can you cut a penny off, making that bloody widget. ‘Cause lots of times, you know, there will be a student sitting there, and you just need to spend, uh, you need to spend another two hours, as opposed to 15 minutes. And it makes all the difference in the world. It might make all the difference in the world, who knows? I mean, that’s the way you got to look at it.”

Summary

In the econometric analysis section of this study, income production functions were estimated for departments in the fields of Engineering, Physical Science, and Social Science for a sample of public, research one universities. Two OLS regression models were employed in order to treat instructional faculty FTE. GLM regressions were employed for the two models as well in order to test for the effects across fields of science. Methodologically, both models in their treatment of instructional FTE were presented in order to assess the convergence of the results and the true specification of the production function further exposing any spurious results in $R^2$.

Discussion of the Research Questions and Hypotheses

What follows is the research questions posed at the beginning of this study and the corresponding responses based on the empirical findings. They are as follows:

Responding to the Research Questions and Hypotheses.

1. Does the relative weight of research productivity exceed that of teaching productivity and in the income production function of academic departments in public Research I universities?

In order to address this research question teaching productivity is disaggregated into undergraduate and graduate productivity. Given both Models 1 and 2, there is no evidence that research exceeds the relative weight of teaching productivity. Instead, it is quite clear that for all fields of science the rate of returns for teaching productivity measures were greater than the rate
of return for research productivity and were statistically significant. (see Table 4.10). In both models, Social Science and Physical Science consistently show statistically significant returns on teaching productivity. However, when teaching productivity is disaggregated there are distinct differences in the relative weight within teaching productivity itself. That is, in both models, Engineering and Physical Science graduate productivity clearly exceeds the weight of undergraduate productivity. Moreover, Social Science shows much more balance in the weights with respect to, both, undergraduate and graduate productivity.

Table 4.10. The Rate of Return to Teaching Productivity versus The Rate of Return to Research Productivity by Fields of Science.

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<th>Field</th>
<th>Model 1</th>
<th>Model 2</th>
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<tr>
<td></td>
<td>% Productivity</td>
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<tr>
<td></td>
<td>Undergrad</td>
<td>Graduate</td>
<td>Research</td>
</tr>
<tr>
<td>Engineering</td>
<td>24.3*</td>
<td>45.4***</td>
<td>19.8</td>
</tr>
<tr>
<td>Social Science</td>
<td>32.8***</td>
<td>34.2***</td>
<td>-0.5</td>
</tr>
<tr>
<td>Physical Science</td>
<td>9.9</td>
<td>29.1**</td>
<td>16.7</td>
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* p < .10; ** p < .05; *** p < .01; **** p < .001.

2. What is the impact of departmental quality upon the production of departmental income in public Research I universities?

Unit increases in departmental quality exhibited a consistent, positive, and statistically significant effect upon the production of departmental income. Departmental quality was statistically significant within both models for all fields of science except for Engineering in Model 1. In Model 1 quality yielded the largest returns (45.6%) to departmental income in Social Science. It exceeded Physical Science by 17.8% and exceeded Engineering by 31%. In Model 2, quality in Social Science remains relatively high but it is now overtaken by Engineering (31.5%) (see Table 4.11).

From these results we may conclude that departmental quality does have a positive and significant effect upon the production of departmental income irrespective of what methodological approach is chosen (i.e., Model 1 or Model 2). In addition, it is important to reiterate that quality is a proxy for research.

Table 4.11. The Rate of Return to Departmental Quality by Fields of Science.

<table>
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<th>Field</th>
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3. Do structural differences exist between the various academic fields of Engineering, Social Science, and Physical Science (Computing and Mathematics was collapsed with Physical Science and Life Science was excluded from the analysis altogether)?

In order to address this research question, it was useful to examine the difference of the coefficients between all three fields of science. The rate of return for the joint production model of all fields, when Physical Science is the control, suggests that Social Science has an adverse effect on departmental earnings (-22.5%). That is, per one unit increase of a social science department it decreases departmental earnings by 22.5%. Social Sciences revealed a larger but still negative effect when contrasted with Engineering. That is, per one unit increase of a social science department it decreases departmental earnings by 39.2%. This result is indicative of the “halo effects” that Engineering benefits from in perceived quality above and beyond that of Social Science. Moreover, Social Science has a negative and adverse effect on Engineering and Physical Science and typically is disadvantaged in the allocation formula bringing to bear beliefs of some deans in the exploratory section of this study.

Table 4.12. Between Field of Science Effects.

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<th>Model 1</th>
<th>Model 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coefficient Difference</td>
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<table>
<thead>
<tr>
<th>Contrast</th>
<th>Coefficient Difference</th>
<th>Coefficient Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\beta_{\text{Physical Science}} - \beta_{\text{Social Science}}$</td>
<td>-.225**</td>
<td>-.152*</td>
</tr>
<tr>
<td>$\beta_{\text{Physical Science}} - \beta_{\text{Engineering}}$</td>
<td>.167**</td>
<td>-.070</td>
</tr>
<tr>
<td>$\beta_{\text{Social Science}} - \beta_{\text{Engineering}}$</td>
<td>-.392**</td>
<td>.081</td>
</tr>
</tbody>
</table>

* $p<.01$; ** $p<.001$.

4. How do decision makers conceive of productivity, university and the external world, diversity, efficiency?; and

5. To what extent do these socially constructed concepts converge with the two sets of theories?
This set of research questions has been addressed in the presentation of the qualitative exploration findings.

**Discussion**

As was shown, how universities are conceived is important in selecting competing and sometimes complementing decision-making theories that guide internal resource allocation. Although multiple theories of universities as organizations exist, two sets of theories proved especially useful for this study of internal resource allocation in public research one universities: the first set of theories guided the econometric analysis part of this study and the second set of theories helped to frame the exploratory section of this study. The first set of theories consisted of the *economic theory of the firm* and *resource dependency theory* and the second set of theories consisted of *rational/political*, *critical/political* theories pursued through a *social constructivist* interpretive lens for the exploratory section of this study.

A study of internal resource allocation in public research one universities was presented. A mixed design approach was used for this study: an econometric framework guided by d'Sylva's (1998) study and a qualitative exploratory framework guided by d'Sylva and Volk's (1995) studies. In the econometric analysis section, the relative rate of return universities assigned to teaching productivity and research productivity were estimated. In addition, the quality of the work was taken into account in such estimation of returns by including a measure of departmental quality from the NRC rankings in the model. Specifically, this section examined the relative rate of return universities realized from teaching productivity, research productivity, and departmental quality for academic units within fields of science such as Engineering, Social Science, and Physical Science and the difference of such returns between the three fields of science. The allocation function was modeled by the estimation of the department's income production functions. In the exploratory analysis section, personal interviews with university administrators were used to understand how decision-makers with budget authority conceived of key concepts in making internal resource allocation decisions. Specifically, this section explored these key concepts in order to develop an understanding of deeply held beliefs of prestige and productivity that are embedded in the thinking of key resource allocators.

This section is organized in the following manner. First, a discussion of the major findings will be offered. Second, the implications of the study are presented and discussed. Third, suggestions for future and needed research will be presented to culminate this study.

**Major Findings**

Two major approaches were employed in this study: an econometric approach that used quantitative methods such as OLS and GLM regressions and an exploratory approach that used a qualitative method (i.e., personal interviews). On the one hand, the income production function for departments within the fields of Engineering, Social Science, and Physical Science was estimated. On the other hand, key concepts used in internal resource allocation by decision makers with budget authority were explored. A number of interpretations can be made regarding the effects of the variables measuring teaching productivity, research productivity, and departmental quality upon the dependent variable, departmental income, the exploratory
observations, and to what degree these effects fit the various sets of theories employed in this study.

Teaching Productivity

Consistent with d’Sylva’s (1998) findings, instruction has not been displaced by research as the priority in the allocation function of public research universities. Using a different set of data at a more recent time period and a variation of his econometric models, greater returns to teaching productivity versus returns to research productivity were consistently found across all fields of science. However, the effects across fields of science with respect to undergraduate, graduate, and research productivity emerged as an important finding. That is, Social Science (32.8%) had the greatest returns to undergraduate productivity in Model 1, greater than Engineering (24.3%) and substantially greater than Physical Science (.9%). In Model 2, Social Science (25.0%) paralleled the relationship, except, in this model, the returns to undergraduate productivity were substantially higher than both Engineering (4.0%) and Physical Science (-10.5%). This is remarkable, because after controlling for faculty FTE in Model 2, Physical Science shows negative returns on teaching productivity. However, returns to graduate productivity are high and positive.

With respect to Volk’s (1995) work, these findings support her results in that graduate education pays more than undergraduate education. Furthermore, as was clear from the findings in the exploratory section. Colleges with high number of minorities and large amounts of undergraduate student credit hours lose out as well.

So, what pays? Clearly, graduate education pays, quality pays, and Engineering pays. Graduate education has a significant research component. Quality is a proxy for research. Engineering reaps the benefits of “halo effects.” Moreover, Social Science, the unit that has the largest returns to undergraduate education is the one that is treated the worst in the institutional allocation.

So how do these results converge with the alternative theoretical frameworks used in this study? As was reported in the introduction section of this study, during the years between 1988 and 1999 tuition and fees and private gifts, grants and contracts increased dramatically in order to offset the decreases in state appropriations with tuition and fees leading the way. Consequently, public research universities came to rely more heavily on student tuition and fee revenues as the rate of state support declined. As students became a more critical resource provider, a concomitant upward shift in the level of faculty attention towards student instruction was expected. However, this would only occur if the increased resources from students were being allocated to the departments as departmental teaching productivity rose. An alternative hypothesis, derived from the Theory of the Not-for-Profit Firm (James, 1990), suggested utility maximization was what drove the allocation of resources, and that undergraduate education only entered into the utility function of faculty to the degree that the profits that were generated from it could be transferred to support more desirable endeavors such as research. Although undergraduate students became a critical resource provider, as a group, they have yet to realize any sizable influence over internal resource allocation.
The results have shown clearly that teaching does matter within the departments’ revenue production function when aggregated by field type. Therefore, by the transitive property, teaching also matters within the institution’s allocation function. Specifically, undergraduate teaching matters, having yielded a consistently positive effect upon the production of departmental income across fields of science. These results support the resource dependency perspective that teaching is rewarded because resource shares from students and the state are great in relative magnitude.

Engineering and Physical Science were getting significantly less return from the institution for teaching undergraduates, and in the case of Physical Science, negative returns. This result supports the theory of the firm hypothesis that profit-making undergraduate instruction increasingly is being “taxed,” presumably to support other loss making endeavors that yield greater utility to institutional decision-makers. As suggested by the theory of the firm, those endeavors that yield greater utility may be graduate instruction and departmental quality. The results support this notion as the rates of returns for graduate instruction across all levels are statistically significant and fairly large. Furthermore, the rate of return to departmental quality is more pronounced in Social Science and Physical Science and is statistically nonsignificant in Engineering.

These results suggested that for some fields, particularly Engineering and Physical Science, undergraduate instruction, though still important in the revenue production function of departments, was increasingly being “taxed”. As the “return” to undergraduate instruction diminished, the “return” to graduate instruction and departmental quality has increased, at least in some cases. Undergraduate instruction, therefore, may have cross-subsidized graduate instruction and activities that promoted department quality, such as research. Evidence was found to support the argument that undergraduate instruction was being used to cross-subsidize research directly. The between field effects clearly showed that social sciences that was large in undergraduate students cross-subsidizes the physical sciences that was large in graduate students.

Research Productivity

The effect of teaching productivity on departmental earnings was greater than the effect of research productivity for all fields of science. However, this does not suggest that research was not important. Although the returns to research productivity were statistically insignificant across all fields of science, the direction and magnitude with respect to Model 1 and Model 2 are of importance. In Model 1, Social Science (-0.5%) shows a small negative return to departmental earnings and remains small in Model 2. However, this is an important finding because it suggests that, when controlling for FTE in the model, Social Science (1.5%) shows a positive return to departmental earnings. The converse is true for Engineering. That is, in Model 1, Engineering shows a positive (19.8%) return to departmental income and in Model 2 it shows a negative return (-8.7%). This suggests that Engineering, when controlling for instructional FTE in the model, is not generating large amounts of external funding, particularly because it shows the greatest returns to graduate instruction. Again, this corroborates the fact that Engineering is the primary beneficiary of “halo effects.” It is a department that is not generating the kind of revenue that is desired of “productive” departments yet it is reaping all the benefits from its perceived value.
The hypotheses generated from resource dependency theory and the theory of the firm both suggested that research productivity would have a significant positive effect on the generation of departmental income. This was not supported in this study; yet, caution is expressed in completely ruling it out due to the noted limitations of the dataset.

*Departmental Quality*

The most important finding was that Social Science showed statistically significant, substantial, and the greatest returns to quality across fields and in Model 1 and greater returns than Physical Science, but not Engineering. In Model 1, the returns to quality in Social Science (45.6%) were substantially greater than Physical Science (27.8%) and Engineering (14.6%). In Model 2, Social Science (25.0%) returns were substantially larger than Physical Science (14.8%) but less than the returns of Engineering (31.5%). These findings are divergent from d’Sylva’s (1998) findings. Here, it appears that none of the fields of science are being “penalized” for having relatively high national quality rankings. Most importantly, this finding appears to support the theory of the firm’s proposition suggesting that departmental quality is part of the institution’s utility function.

Notwithstanding the finding that the returns to quality may, indeed, support the theory of the firm, the effects of Social Science overall effect when compared to Physical Science and Engineering show that Social Science has an adverse effect on the model. Moreover, a major finding in the exploratory section contradicts this notion. That is, it was found that some units at R1 University are high in quality and high in student credit hour productivity, yet, were, penalized. This is an important phenomenon because it appears that some departments within certain fields are benefiting perceptually. Case in point, Engineering may benefit from a “halo effect” because it is “engineering” while social science suffers from a “pissed on effect” because it is “social science.”

*Exploratory*

Several beliefs and key concepts emerged and significant observations were detected. First and foremost was the preponderance of the former president and former provost reference to “productive” and “high quality” units as mostly coming from the “Sciences.” Another major finding was one that goes to the heart of the assumption of prestige in the university marketplace for public research one universities. The former president makes an assumption that more dollars will yield more productivity that in turn generates more excellence. It follows that more excellent should maximize prestige. What is significant is that for the president, money is a means to an end. Yet, for others it may become almost an end in and of itself, driving decisions more rather than, in contrast, to considerations of quality.

The president pointed out that R1 University funneled monies into its undergraduate education function in the context of much external criticism. What is remarkable is that during his tenure, despite the criticism, the Sciences were favored and targeted for support (i.e., “halo effect”). What is significant is that the president believes that an investment in general education is not viewed as an investment in productivity and quality, hence, excellence or prestige. This is
supported by the econometric analysis that the investments appear to be on the side of departments within fields that are perceived to generate more prestige. Another major finding came from the analysis of the provost’s remarks with respect to productivity. It was found significant that he seemed to conflate productivity and quality. That is, he believes that high quality units are also high productivity units. This belief was contradicted by the findings on return to quality and student credit hour productivity by the econometric analysis for Physical Science.

The Science dean elaborated in extraordinary detail about how he determined which units were productive and of high quality, yet, how he actually made internal resource allocation decisions was lost in the detailed depiction and process. Most significant was the fact that his elaborate linear approach for measuring productivity and quality mathematically favors units that are producing more of the quantifiable desired input, in this case research.

Perhaps the most important finding was how aware the Education dean was of how money is generated in his college and how divergent his response was from the other respondents. He is acutely aware of the fact that his college generates many revenues through student credit hour productivity yet his college is not funded commensurate with its high level of productivity. Again, this finding supports the cross-subsidization concept and we have another clear example of a department within a field that suffers from the “pissed off effect.”

Also, the dean points out that his college is very diverse in gender, ethnicity, socioeconomic status (SES). However, he describes his diverse college as incurring a penalty for having such a diverse, and above all, high numbers of low SES student body. It is celebrated when the central administration needs to cite diversity, usually that translates into getting “patted on the back.” However, that does not translate into resources in recognition for the contribution and the need that such student body demands. In addition, the dean succinctly describes his college as the college that “helps the coloring of the University,” and how that affects his resource allocation opportunities. To sum it up in his words, “…our students are from, in some instances, lower class, and low SES...the College is low SES within the University, and, that poses certain kinds of problems. What I mean by that is, in terms of our budget as compared to other people’s budget, State budget.” This reality of educating a very diverse student body, specifically low SES, and drawing the parallel to being a low SES college with respect to other colleges’ budget is powerful and supports the critical/political framework. Moreover, this conception points to a very important fact: this is the only dean who makes this very important connection between serving a diverse student body and the relative lack of resources that follows.

The Humanities dean is cognizant of his college’s financial contribution to the university. He clearly points out that his college provides “cheap instruction” through its undergraduate mission in the form of adjuncts for many students throughout the university. As a result, he believes that his college is the most efficient college in the university--delivering cheap instruction by hiring cheap labor in the form of a high number of adjuncts and overburdened graduate assistants. He is aware that cheap instruction generates much revenue that his college never sees. It is important to note that the dean is critical of efficiency because he understands that efficiency in his college equals “cheap” and that is certainly not good especially in the
allocation of resources game. And, as it turns out, efficiency is not rewarded in his college. This is a significant finding because here we have a clear case of a unit being seen as efficient because it minimizes costs (delivering cheap instruction) and maximizes revenue (student credit hours) yet it is not rewarded for being productive. After all, this unit is a highly productive unit as it relates to teaching inputs (student credit hours), but not as “productive” as it relates to research inputs (securing sizable amounts of external funding). In short, being efficient is seen as being cheap and this is not good. Moreover, here we have the clearest example of cross subsidization by field. Unfortunately, Humanities, as a field was not tested in the econometric analysis; however, the interview is powerful in illustrating the importance of the existence of cross-subsidization.

Another major finding was that the president had strong alliances with the business community and his alumni foundation that, in turn, has strong ties with the business community. No real mention of community ties with organizations that have local and regional foci? It was clear that the president hung out with some very important and influential people, for certain, prospective donors. Moreover, this certainly seems to support resource dependency theory.

Implications

The results of this study clearly support the blending of the two sets of theories when understanding internal resource allocation. Undergraduate instruction does contribute significantly in the Social Sciences and not as much in Engineering and Physical Science. Departmental quality does contribute positively to the production of departmental income. Returns to research productivity were statistically nonsignificant but proved to be important, with respect to the direction and the magnitude of its contribution, when interpreting the results. Moreover, much caution is suggested when interpreting the returns to departmental earnings on research output because the research measures are conservative and may be underestimating the importance of such measure.

So what exactly are the implications of these results for major public research one universities? If universities and thereby departments are rational economic actors they certainly ought to continue to give major attention to instruction, especially undergraduate instruction given the high returns. However, some departments within the Social Sciences may, in fact, be cross-subsidizing other departments as may be the case in Engineering and Physical Science.

The implications for research productivity are mixed. While research productivity did not prove to be statistically significant in either model employed, it certainly may be helpful. The direction and magnitude of the returns to research productivity shed light on how research is being favored and in what fields and who is being penalized. Clearly, in the case of Physical Science the rewards to research productivity are positive and negative, albeit small, in the Social Science. Moreover, Engineering with respect to research productivity is, in fact, clear. Engineering is found to benefit from “halo effects” at the expense of other units who are not only productive in undergraduate and graduate productivity but also in research productivity as measured by the research measure and quality, acting as a proxy for research. This has serious
implications for how administrators with budget authority fairly or unfairly allocate internal funds.

There seems to be another serious implication that is not captured in this study, yet speaks volumes as to the nature in which research does in fact matter yet is not being counted. And as was demonstrated in this study, such research measures, as a result, are underestimated. There seems to be a burgeoning of research centers and institutes. Such enterprises generate incredible amounts of external revenues that cannot be captured in a dataset such as the one used in this study because they do not fit nicely into traditional academic departments and fields. The implication is simply, underestimation of the incredible importance of research dollars and how such dollars influence in a non-traditional way. Moreover, if this is a trend, then it has significant implications for who is affiliated with such enterprises and to what end.

Quality clearly plays a significant role in increasing departmental earnings and should correspondingly play an important role in the internal resource allocation function. As a result, the universities, departments, faculty, students, and the public at large should strive to improve quality as marginally improving quality will be rewarded significantly. These findings support Bowen’s (1980) and Clotfelter’s (1996) view that institutions of higher education essentially spend the most to be the best, and Leslie’s (1995) findings showing a connection between quality and financial resources.

Perhaps the major implication to the public and universities is that the undergraduate function is believed to be an important function and that universities are, in fact, supporting that function. However, what came through loud and clear from the personal interviews, is that financial support for the undergraduate function may sometimes be an act of serendipity or a response to external criticism, or an act in troubleshooting.

Recommendations for Future Research

The scope of work to be done in fully specifying the production function for higher education is just as colossal now than it was when d’Sylva (1998) examined resource allocation. This study added to the existing literature on internal resource allocation by varying the econometric models employed by d’Sylva and including personal interviews that helped tremendously in further understanding the nuances of internal resource allocation using academic departments in three fields of science within public research one universities.

Although the study attempted to repeat d’Sylva’s analysis with the inclusion of departments from other fields within similar institutions it was not done, and, hence, ought to be considered for future research in order to provide a more comprehensive analysis. Analysis of data from departments from the Humanities would prove to be very insightful given what was learned from the Humanities dean with respect to “cheap” instruction via low cost technologies. Data for professional schools, such as Law and Medicine, would also help to develop a broader depiction of the production function for these institutions. The effects of the interactions between these fields also would be instructive: Does the addition or deletion of certain types of departments significantly impact the overall, university production function? Do complementarities exist, for example between some Physical Science departments and
Engineering departments, between Life Science departments and Medical departments? Also it would be important to understand how the allocation functions of public research one universities compare to the allocation functions of private research universities.

The need exists to include an index for proportion of women and minorities in any given department with field of science in order to test the hypotheses that Volk (1995) tested for one institution. This could be thought of as a diversity index of sorts. Such an index would allow the specification of a single econometric model that estimates these types of parameters along with teaching and research productivity and quality.

It is important to disentangle further the relative importance of undergraduate and graduate levels (i.e., lower division, upper division, masters, and doctorates). Furthermore, to the extent possible, in the case of graduate student labor, it is important to tease out the effect of the extent to which there labor contributes to instruction vs. research output.

Traditional academic departments may no longer be the best way to test external revenue generation or even production functions for that matter, given that so much activity takes place in research centers and institutes whose members are separate from but related to academic departments.

Long after this study, the need to define and understand the complex technologies of instruction and research and how certain revenues such as tuition and fees support the instruction-research nexus will continue to persist. It is expected that as our understanding of such technologies accounting of this very important revenue source improves, all stakeholders in the public research university will be able to make healthier and informed decisions about the allocation of constrained financial resources.

References


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