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Funding, resource allocation, and performance in higher education systems

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Abstract. This article analyzes forms of resource allocation in university systems and their effects on performance in institutions of higher education. Internationally, higher education systems differ substantially with regard to research and education funding sources and to ways that resources are allocated. European universities receive the majority of their funding from public sources, but private funding plays a more important role in Anglo-American systems of higher education. Many governments use competitive elements in the process of allocating public funds to institutions of higher education. Examples include the implementation of performance measures through "formula funding", or resource allocation on the basis of evaluated project proposals. Corresponding forms of performance-based resource allocation can be found within most higher education institutions. This article analyzes how various forms of funding and resource allocation affect universities at the macro-level and individual behavior at the micro-level. A theoretical approach to this problem suggests that performance-based funding tends to bring about positive changes but is also a factor in unintended side effects. Forms of resource allocation influence the behavior of academics and managers in higher education, particularly their levels of activity as well as the kinds of activities they engage in and their ways of dealing with risks. Empirical analyses partly confirm these hypotheses. It can be shown that changes in resource allocation have an impact on the level and type of activity academics concentrate on but not on the long-term success of universities.

Keywords: funding sources of higher education institutions, national higher education systems, performance of universities, resource allocation in higher education, research universities

Introduction

Burton R. Clark (1983) classified national higher education systems (HES) into systems that are primarily coordinated by market interactions, *"market-oriented systems"*, and systems that are coordinated by governmental planning, *"state-oriented systems"* (Clark 1983, p. 143). Other authors have used similar frameworks to categorize differences between national HES (see for example Massen and van Vught 1994; Trow 1997; McDaniel 1997). Most of them agree on several common features of market-oriented systems (see for example Clark 1983, pp. 161–169; Dill 1997, pp. 168–172; Ewers 1996, pp. 5–11): A high proportion of funding for higher education institutions

is provided by private actors, for example, in the form of tuition and fees, gifts, grants, or research contracts. Their demand drives many activities of universities, faculty, and staff. Competitiveness is necessary for obtaining high levels of funding, and universities have to offer high-quality teaching and research and foster educational and organizational innovations. In traditional state-coordinated systems, programs of teaching and research offered by institutions of higher education are strongly managed by government directives. Moreover, these systems receive funding exclusively from their government (Clark 1983, pp. 125–127; Flitner 1989, pp. 145–158). The government allocates funds on the basis of the previous years' budgets and adds or deducts incremental changes (Ewers 1996, pp. 8–9). State-oriented systems have the tendency to conserve structures and be less innovative and less responsive to changes in demand. The higher education system in the United States is a prototype of a structure in which market-driven competition exists for both education and research. In traditional European systems governmental planning coordinates teaching and research activities as well as organizational structures. However, most national higher education systems employ features of both market-oriented and state-oriented control (Clark 1983, pp. 138–140; Trow 1997).

Over the last three decades public pressure has forced governments in many western countries to look for ways to meet society's needs without spending too much taxpayer-generated money. One way to respond to these pressures is to link funding to performance (Williams 1997; van Vught 1997; Layzell 1998, p. 108). Changes in funding methods, that is, shifts in income sources, or in the forms of resource allocation will likely have a major impact on the behavior of universities as well as their internal process of resource allocation. Research has shown that higher education administrators and institutions respond to changing mechanisms of resource allocation (for example, Mace 1995, pp. 62–69; Wagner 1996, p. 15; Schmidtlein and Taylor 1996, pp. 297–305). But changes in resource allocation also affect individual faculty, who are directly responsible for carrying out teaching and research duties. A detailed examination of approaches to the management of research and teaching, and academics' reactions to those approaches can provide insights into the impacts of performance-based and other methods of university budgeting.

Key research questions of this paper are:

(1) How does resource allocation vary among the higher education systems of several nations?

(2) What methods do universities employ to allocate their internal resources?

(3) How does performance-based budgeting affect individual faculty behavior?

(4) Does the national tradition of funding universities influence the applicability / outcome of performance-based methods of budgeting and the impact of monetary incentives?
(5) Does the method of resource allocation directly affect the long-term success of a university?

The data

The empirical research for this project was conducted at the Department of Economic Geography at the University of Hannover, Germany. The investigation has been funded with the help of the German Science Foundation (DFG). It was based on case studies of universities and in-depth interviews with higher education administrators and professors. The universities selected for the case studies are regarded as prestigious research universities within their national system and are internationally recognized. Because the universities chosen for this study belong to different national systems, a wide spectrum ranging from market-oriented systems to state-oriented systems will be analyzed. The investigation includes universities from the United States (Massachusetts Institute of Technology [MIT], University of Texas at Austin [UT Austin]), Switzerland (Swiss Federal Institute of Technology [ETH Zurich], University of Basel), the Netherlands (University of Twente), and Great Britain (University of Bristol). In order to avoid the problem of defining and measuring "success" with respect to research universities, institutions generally acknowledged as having an outstanding reputation were chosen. The achievements in education and research of these selected institutions are widely recognized, and they serve as role models for other higher education institutions. Analyzing the behavior of these selected universities should provide some insights about how higher education institutions can be managed successfully.

The case studies were carried out between July 1998 and October 1999 and included visits, varying from two to four weeks, to each university campus. During the visits documents and publications were gathered, and in-depth interviews were conducted. At each campus administrators as well as experienced professors from the major academic disciplines were interviewed. The data provide distinct pictures of the selected universities but are not necessarily representative of national higher education systems in these four countries. However, the large number of interviews conducted (117) in these case studies allows descriptive methods of analysis to be applied. A detailed description of the data and methods can be found in Liefner (2001).

Concept

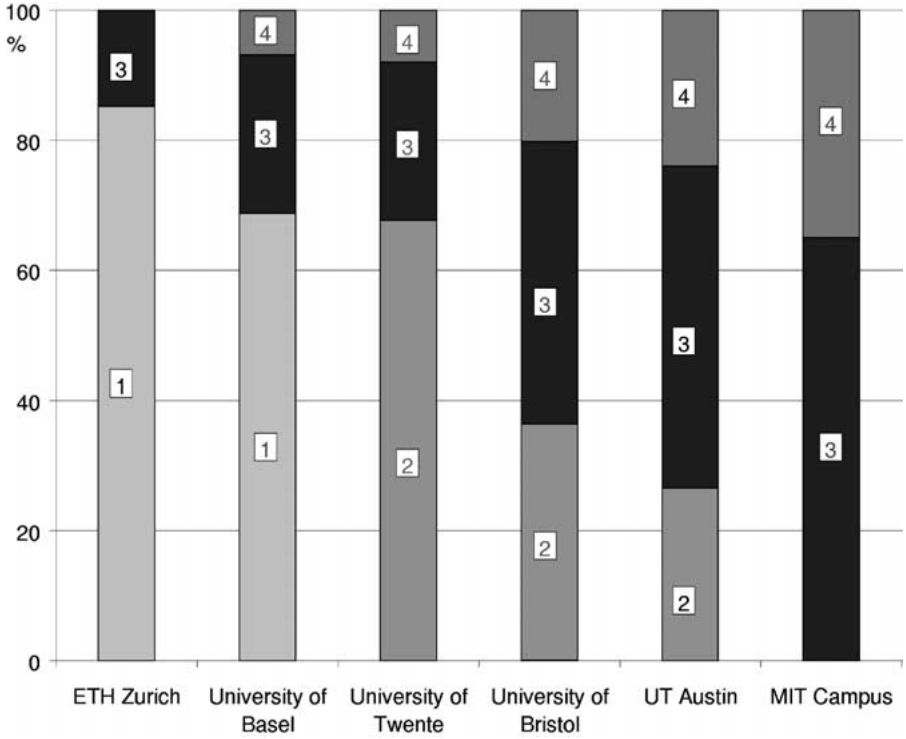
The article is divided into three sections. First the sources of funding and the internal budget allocation of the six universities are described to demonstrate international differences in funding and resource allocation. This section is followed by a discussion of the principal-agent theory, a concept that leads to hypotheses about the effects of performance-based budgeting on individual behavior. The theoretical hypotheses are then compared with empirical findings. The final section examines additional factors that may influence the long-term success of universities and ends with a brief discussion of implications relevant to university administrators.

International differences in funding sources and resource allocation

The following description of the funding regimes of the universities analyzed concentrates on monetary sources that support these universities, allocation of public funds to universities, and internal resource allocation. The goals are (1) to demonstrate the enormous differences in how universities obtain funds from external sources (see Figure 1) and (2) to show how these differences are reflected in the internal budgeting and allocation process. Figure 1 shows that the importance of private funding and market-driven or performance-based public funding varies to a great extent.

(1) Swiss universities: ETH Zurich and University of Basel

The Swiss Federal Institute of Technology in Zurich (ETH Zurich) is the largest and most prominent higher education institution for engineering and science in Switzerland. It has an annual budget of 1 billion Swiss francs, equivalent to 690 million US dollars[1] (ETH Zurich 1998a, pp. 48–64). Among the sources of income the federal government plays a dominant role as about 85 percent of the university's budget stems from it. This dominant income flow is not linked to performance. The federal government decides upon incremental changes from year to year. The administration of the ETH views the high and relatively stable funding from public sources as a factor ensuring academic freedom. Such freedom itself is regarded as a precondition for curiosity-driven research and successful long-term development (ETH Zurich 1998a, p. 32). This philosophy is reflected in the internal budget allocation. The driving force of this allocation is the number of professorships and faculty positions in the departments. A professorship is generally endowed with an average of nearly 13 faculty slots (ETH Zurich 1998b). The initial number of slots allocated to a full professor generally does not change.



1) direct public funding, not performance-based
2) direct public funding, partly performance-based
3) private and public research grants and contracts, tuition
4) endowment income, gifts and other income, not classified
Source: ETH Zurich 1998a; University of Basel 1998; University of Twente 1998a; University of Bristol 1998b; MIT 1998; UT Austin 1998

Figure 1. Differences in funding sources of the six universities.

Hence, the resource allocation to the departments is stable, and incremental changes only occur when professors retire and their positions no longer seem necessary.

The University of Basel has a budget of 300 million Swiss francs, equivalent to 210 million US dollars[1] (University of Basel 1998, pp. 76–77, 106–110). Two regional governments jointly fund the institution and provide annual funding of 160 million francs. Some additional funds come from the federal government (35 million francs) and from other regional governments as a payment for the education of students residing in their regions (18 million francs). Despite this last portion of public income a link between performance indicators and public funding does not exist. The university's budget is a part of the legislature, and changes occur incrementally on an annual basis.

The internal allocation of financial resources reflects the way the funds are obtained from the outside (University of Basel 1998, pp. 74–77). The allocation to the departments is largely stable and changes only marginally from year to year. Long-term changes are not driven by performance but by the decision of the board on how the organization should develop and fulfill its role as an innovative stimulator for regional development (University of Basel 1999).

(2) University of Twente, The Netherlands, and University of Bristol, Great Britain

The University of Twente views itself as an "Entrepreneurial University" that emphasizes organizational restructuring as well as active participation in industrial activities (Clark 1998, pp. 39–51). The annual budget of the university is 350 million Dutch guilders, equivalent to 180 million US dollars[1] (University of Twente 1998a, pp. 10, 45). The university receives direct funding from the Dutch government through the so-called "first income stream", which quantitatively dominates two-thirds of the budget and is partly related to performance (University of Twente 1998b, pp. 1–12). Under the current system of resource allocation, one-third of the funds of the first stream is labeled "teaching money". These funds are calculated on the basis of entering students and graduates and some historically fixed portions. The remaining two-thirds of the first income stream is called "research money". This part of the allocation is calculated on the basis of the number of Ph.D. dissertations, engineering certificates, recognized research schools at the universities, and again historically fixed portions. With regard to the large fixed portions in the calculation of "first income stream", 33.5 percent of the university's direct allocation of public funds to the university is linked to performance, 66.5 percent is fixed. Internal distribution is similar to the allocation of the first income stream from the government. Differences between external and internal resource allocation reflect the university's aim to act more business-like than most European universities do (University of Twente 1998b, p. 32). It uses additional factors for the calculation of budgets (numbers of exams passed after the second year, employees funded through research grants and contracts, employees funded through programs of the European Union) and reduces the fixed share of allocation in favor of performance-driven shares. Half of the institution's resources are allocated due to performance; the other half are allocated in fixed portions (see also Schutte 1998, pp. 3–5).

The University of Bristol belongs to a small group of successful British universities that combine high-quality teaching with high-quality research throughout the whole spectrum of the university's academic disciplines. It

has a budget of 150 million pounds, equivalent to 245 million US dollars[1] (University of Bristol 1999). The University of Bristol receives 36 percent of its annual budget directly from the government through governmental organizations, so-called funding councils. Three fifths of that budget is spent on teaching, and two fifths on research. Other important sources of income are public and private research grants and contracts, and tuition (University of Bristol 1998a, pp. 8–14; 1999). The funding councils allocate funds for teaching depending on the number of students at a university as agreed upon with the national ministry. Research activities are funded on the basis of the result of a nationwide evaluation process (HEFCE 1998, pp. 4–16). Therefore, direct public funding involves competition in the fields of education and research. Competition is also a driving force behind all other sources of income as these involve private or public money that is paid in exchange for a specialized service or on the basis of reviewed project proposals. Internally the university does not alter this allocation system (University of Bristol 1998b). Instead it allocates all money to the departments that have "earned" the money through teaching, enrollment figures, project proposals, or high-quality research. The re-allocation of funds between departments is very moderate.

(3) Universities in the United States: MIT and UT Austin

MIT is one of the most prestigious private universities in the United States. For many years its engineering programs have been rated number one in the rankings published by *US News* (*US News* 2000a). The MIT campus has an annual budget of 920 million US dollars (MIT 1998, p. 20). As a private university, MIT does not receive direct public funding, but rather it relies on research grants and contracts (430 million US dollars per year), tuition and fees (235 million US dollars per year), and endowment income of up to 300 million US dollars per year as its principle sources of income (MIT 1998, p. 20). Competitiveness is a necessary precondition for obtaining these funds. Internally, resources that are allocated to the schools, as well as to departments and laboratories are not linked to performance indicators but to the previous year's budgets and the number of faculty slots in each department. Hence, there is no internal allocation of university funds due to performance. But the decisive function of grants and contracts as well as tuition income forces faculty, researchers, and staff to be active in obtaining external funding. Therefore the stable and incremental allocation of institutional funds complements the uncertainties connected with external funding.

The University of Texas at Austin has an annual budget of 940 million US dollars (UT Austin 1999, pp. 43–44, 95–123; 1998). The university is regarded as a successful research institution, and its growing reputation is

Table 1. Differences in external and internal resource allocation

	ETH Zurich, University of Basel	University of Twente, University of Bristol	MIT, UT Austin
External funding and resource allocation	Public funding dominates, allocation not based on performance	Public funding dominates, allocation partly based on performance	Private funding important, allocation of public funds based on performance
Internal resource allocation	Allocation largely stable, not based on performance	Internal allocation similar to external allocation, partly based on performance	Stable allocation of limited university funds, dominance of other competitive funding sources

shown in national rankings (*US News* 2000b). Grants and contracts, as well as tuition and endowment income make up two-thirds of the budget. About one-quarter is obtained from the state of Texas. This money is allocated according to a formula on the basis of current teaching activities of universities in the UT system (The State of Texas 1998). The determining factor for allocation is the number of semester credit hours weighted by discipline, the number of students, and the level of the courses offered. Therefore all major income sources are either market driven or linked to performance. The internal allocation of funds is organized in a way similar to MIT's. This is true despite the fact that UT Austin receives its public funding depending on its educational activities. The administration of UT Austin allocates money according to needs and not according to performance.

Table 1 summarizes this section. Funding sources and ways of budgeting differ enormously between different higher education systems. The above discussion has also shown that universities – at least the six universities analyzed – tend to react based on the way they receive external resources. This is true for the "traditional European system" represented by the Swiss universities. The bulk of their funding is not directly linked to performance. Internally they allocate most of the funds in the form of fixed budgets. Universities in the Netherlands and Britain both receive a large part of public funding through a system that contains competitive elements. Internally they, too, use a market-like approach. The two US-American universities obtain the majority of their funding in a competitive way. Competition is also a key factor for the amount of money available for individual departments and groups as many activities are directly funded by grants and contracts. Some stability in the allocation of the institutional funds to the schools and colleges is necessary to meet fixed operational costs in the form of faculty salaries and to maintain the university infrastructure.

Despite the fact that pronounced differences in funding sources and resource allocation between these universities exist, all of them are regarded as successful institutions within their national HES. Therefore a close link between the means of funding and success cannot be identified on the university level. Similar results have been discussed by Jongbloed (1998, pp. 12–13) with an analysis of Dutch universities. In order to examine the effects of performance-based resource allocation more closely, the following section analyzes the level of individual behavior.

Resource allocation and behavior

This section analyzes the effects of different forms of resource allocation on individual behavior from a theoretical and an empirical perspective. The analyses in this section are derived from the principal-agent theory that seeks to explain the relationship between a principal and an agent (see for example, Arrow 1991, pp. 37–45; Pratt and Zeckhauser 1991, pp. 15–22). The focus of this theory is to find a payment structure that motivates the agent to work according to the goals of the principal. The following discussion does not use the restrictive and formalized framework of the principal-agent theory but similar arguments (see also Reichwald and Koller 1998). The basic assumptions and arguments of this theory are explained in Laux (1990).

The theory deals with the relationship of a principal who employs an agent or sets up a temporary contract with him/her; this agent can then be paid in different ways. In higher education the principal can be a ministry of science and education, the management board of a university, a president, dean, or department chair. The agents are those actors in higher education who receive assignments, funds, and salaries from the principals. Therefore a number of higher education managers, for example, heads of departments, are simultaneously principals and agents, whereas most of the professors, researchers, and lecturers can be viewed primarily as agents.

In the context of the principal-agent theory, the terms “level of activity”, “success”, and “risk” have to be defined. First, the level of activity means the amount of time and effort an agent puts into activities that are directly related to the goals of the principal. In higher education the achievement of high quality in teaching and research can generally be taken as the central goals of the principals. Second, in the strict sense of the principal-agent theory success has to be expressed in the form of monetary profits. In considering research universities, activities that do not necessarily directly produce monetary income, for example, teaching students or advancing knowledge, also have to be included. Third, risk can be understood as the possibility that some activities in teaching and research may fail to be successful.

Universities are complex organizations in which the agents have specialized knowledge about their activities that administrators do not share (Clark 1983, p. 25). Therefore activity is difficult to monitor, particularly on the level of research groups and individual scholars but also on the level of institutions. In order to avoid a situation where agents take advantage of the fact that their effort is hard to control and reduce their activity, a principal can link funding to performance (success). Examples include governments that allocate money to universities according to how successfully they meet certain goals, such as producing a certain number of graduates or publications per year (Williams 1997, pp. 276–279). Corresponding ways of performance-based budgeting can be observed within universities. The creation of incentives to work hard and according to the principal's assignments goes hand-in-hand with this form of funding. If universities or departments or individual academics perform well, they will enlarge their future budgets. If they are less successful, they will receive a lower level of funding. The many different forms of performance-based resource allocation like formula funding, funding through review processes, contracts, etc., employ this mechanism to maximize performance.

The effects of a change in the principal's behavior can be described as follows (see also Laux and Liermann 1993, p. 583): In a HES without private funding or performance-based budget allocation, the institution bears the risk of unsuccessful projects because it guarantees funding and salaries regardless of performance. All agents enjoy the flexibility to operate in any manner they wish because they need not be concerned about possible failure. Some departments or individuals will take advantage of this situation and be rather inactive or concentrate on activities that do not meet the interest of the principal. With the introduction of performance-based resource allocation, less-motivated agents must work harder and according to the given criteria. The motivated agents, too, will have to bear the risk of failure and lose some flexibility (see also Jongbloed and Vossensteyn 1999, p. 3). Therefore they will either reduce activities that have a high chance of failure or put away some funds as a reserve in the event of a future funding loss. Table 2 summarizes these effects.

Hence, the effect of introducing competitive elements or performance-based funding into HES depends on the motivation of individuals and their way of dealing with risks. The main hypotheses that can be drawn from the theory are:

(1) Agents that have been rather inactive before the introduction of performance-based resource allocation will have to work harder.

(2) With performance-based resource allocation agents will tend to avoid projects with a high chance of failure. Departments and individuals will

Table 2. Theoretical effects of different forms of resource allocation on behavior

Form of resource allocation	Effects on level of activity	Effects on type of activity
Non-competitive conditions of allocation:	– Levels of activity depend on motivation of actors	– Types of activity depend on motivation and interest of agents
Fixed budgets or stable allocation not linked to performance	– Low level of activity and low performance possible	– Mismatch between interests of university and academics possible
		– High flexibility to carry out projects with high risk of failure
Competitive conditions of allocation: Performance-based allocation or allocation through markets	– Levels of activity depend on incentives connected with resource allocation system	– Types of activity have to be consistent with interests of university or meet market demand
	– High level of activity necessary to maintain level of funding	– Projects that have a higher possibility of failure will not be carried out

concentrate on activities where success can be expected because they will have to meet a formula's criteria or market demand.

The theory relies on the assumption of uniform human behavior, and it disregards the national systems and traditions of funding universities. In order to analyze whether the theory can predict the real impact of competition and performance-based budgeting on behavior, the theoretical hypotheses mentioned above will be contrasted with empirical results. This part of the article summarizes findings from interviews conducted with 53 professors, who are active in teaching and research, from the selected universities. The study covered all major academic departments of the six universities in order to get a complete view on the institutions and to avoid a bias towards certain academic disciplines. The interviewees were all very familiar with their departments, mostly being either active or former chairpersons. They were asked to comment on the impact of the current resource allocation system expressing their faculty's view wherever possible. But of course, their answers also reflect individual preferences and experience as well as their national and cultural backgrounds. Thus, the sample reveals the influence of national traditions and culture, but it is not representative for national higher education systems. Nevertheless, the study was designed to differentiate between nations and universities as well as between disciplines (see Liefner 2001). A detailed analysis of national differences is only applied when the arguments underlying the answers given show that differences are not random but based on national characteristics and tendencies. The following section

summarizes (1) comments on reactions to different systems of funding, (2) comments on the likely effects of a funding arrangement based solely on competition and (3) differences in the interviewees opinions due their national or university culture.

(1) The answers concerning the effects of performance-based funding can be summarized as follows: Sixteen professors state that the link between funding and performance leads to increased activity among their colleagues. "People work harder" was the most frequent reply of professors whose departments had undergone a shift towards performance-based resource allocation in recent years. The majority of the interviewees attribute this result to the fact that with performance-based funding an open discussion about the performance of groups and individuals emerges. This seems to be stimulating activity as poor performance becomes obvious and threatens to lead to a loss of funding, reputation, income, and prestige. Fewer of the scholars who are familiar with competitive bidding for funds or performance-based allocation point out that a shift in the manner of resource allocation changed people's attitude toward risks. Ten of them have experienced that people tend to stay within their academic fields and avoid projects with uncertain outcome. A professor illustrates his statement with the example of the scientific indicators: "publications" and "citations". The use of both indicators for the evaluation of research puts pressure on scholars to publish frequently in prestigious journals. Once they have established a reputation within a certain scientific field, their knowledge in this field and about the prospective developments within this field enables them to acquire funding for research projects, to produce new knowledge, and to get access to the top journals in the future. Hence, if continuous publication is crucial for sustaining the funding base, scholars are unlikely to take the risk of changing their fields of research.

Whereas these comments on effects of performance-based budgeting are mainly from US-American, British or Dutch professors, the following comments on the effects of stable funding arrangements draw basically on the experiences of Swiss interviewees. According to their comments, the main negative effect of a stable budget that grows incrementally and that is not linked to performance is the opportunity to be relatively inactive. Eighteen of the scholars who are familiar with the effects of fixed budgets report that they have observed this kind of behavior among their colleagues. The main positive aspect of fixed budgets is flexibility to follow new ideas and concentrate on pure research. Fourteen scholars explicitly state that a guaranteed basic budget that covers the costs of infrastructure and the salaries of some faculty and staff provides favorable conditions for curiosity-driven research.

Hence the theoretically expected effects of different ways of funding can be shown empirically. Performance-based funding produces incentives to work hard but also to concentrate on fields in which the scholar's expertise is well known. The absence of performance orientation allows scholars to work on projects that might have a high chance of failure. On the other hand it allows them to be rather inactive (for similar results see for example, Williams 1997, p. 288). If these statements of the interviewees not only reflect individual experiences but also effects that are generally connected with the different forms of funding – if the theoretically derived hypotheses are correct – performance-based funding should have specific effects on the activities of scholars.

(2) In order to confirm this result and get a more detailed impression of likely changes connected with performance-based funding, the professors were asked their opinions about the possible effects of a funding regime completely based on market forces and performance-driven allocation. Table 3 summarizes the results. The expectations are transformed into scores from "1" to "5", with a "5" indicating that professors expect a strong positive impact of completely performance-based allocation, a "3" indicating that no changes are likely, and a "1" indicating the expectation of a strong negative impact. Table 3 shows arithmetic means of the marks given by the interviewees who generally favor performance-based resource allocation (group 1 [n = 9]), those who oppose a high degree of performance-orientation and competition (group 2 [n = 19]), and those who are undecided (group 3 [n = 17]). The table concentrates on activities that should be affected.

If the hypotheses are correct, a shift to completely performance-oriented funding and resource allocation should be connected with a reduction of pure research as this type of research has a relatively high chance of failure. Applied research in which the prospective outcome can be clearly defined in advance should increase. The table shows that all interviewees expect a large increase in the quantity of applied research carried out. They also expect the quality of these projects to be higher although professors who favor performance-oriented funding (group 1) are generally more optimistic than the others. In contrast, the quantity of pure research carried out would slightly decrease or remain stable. The opinions about likely changes in the quality of pure research differ. The scholars generally opposing a high degree of performance orientation (group 2) as well as the undecided ones (group 3) expect decreasing quality, whereas group 1 expects increasing quality.

A high degree of performance orientation should theoretically lead to increasing numbers of publications as this is an indicator of scientific performance which is easy to monitor. The quality of publications is not directly

Table 3. Effects of completely performance-based resource allocation

Impact of completely performance-based resource allocation on . . .	Expectations of interviewees . . .		
	who favor performance-based allocation	who oppose performance-based allocation	who are undecided
Quantity of pure research activities	3.1	2.6	2.7
Quality of pure research activities	3.6	2.1	2.3
Quantity of applied research activities	3.9	3.9	3.9
Quality of applied research activities	4.0	3.1	3.4
Number of scientific publications	3.8	3.1	3.4
Quality of scientific publications	3.8	1.9	2.6
Proximity to market application	4.5	4.0	4.1
Public acceptance of universities	4.1	3.8	4.0
Efficiency of internal organization	4.0	1.8	2.8
Motivation of faculty and staff	4.0	1.8	2.8

measurable; therefore, the quality of publications should go down. Again, the interviewees widely agree about changes in quantity but disagree about effects on quality. With performance orientation publishing activities will rise. In the view of group 1 positive changes in the quality of publications can be expected, yet the majority of the interviewees expect a negative influence.

Another aspect of scientific activity that should be affected by a completely competitive funding system is the transformation of new knowledge into marketable products. An additional benefit of accelerated technology transfer could be growing public acceptance of universities. The interviewees agree that the transformation of new knowledge into products will dramatically increase. Public opinion about universities will change positively as well. Furthermore the efficiency of universities and the motivation of personnel could be affected. Efficiency should be improved by the use of market coordination, whereas the effects on motivation depend on the individuals' attitudes toward competition. In these respects the expectations are totally split. Depending on their general attitude towards competition and performance orientation, the professors expect dramatic increases or decreases in efficiency and motivation.

This analysis shows two lines of argumentation that explain the results shown in Table 3. First, the professors interviewed argue that people will react to changes in the environment of their workplace. This argument –

which is consistent with the theoretical hypotheses – explains the expected changes in quantities as well as an increasing proximity to the market. A shift toward applied research as well as a drive toward the creation of new products would be the likely outcome of increasing the importance of market forces and performance measures in university funding. The interviewees largely agree with this conclusion. Second, the arguments about changes in quality and working conditions depend on the general attitudes of the interviewees toward competition and performance orientation. The professors who favor a highly competitive funding and resource allocation system expect positive impacts on the quality of research and publications as well as positive changes in efficiency and motivation. The opposite is true for the majority of professors interviewed who are skeptical about a high degree of competition at universities.

Empirical studies either confirm these results or provide additional insight. Examples include the studies of Geuna (1999, p. 103), Mace (1995, p. 62) and Slaughter and Leslie (1997, pp. 180–184), who analyze changes in the relation between pure and applied research, or Owlia and Aspinwall, who focus on the application of knowledge to marketable products.

(3) So far, the analysis focused on differences between people favoring or opposing a high degree of competition in the funding of higher education and research. In terms of the large differences between national university systems with respect to the overall coordination and the funding arrangements, the opinions of professors could be influenced by their national backgrounds. This section addresses the question whether national or university culture determines the interviewees' expectations about the likely impact of competition and performance-based funding.

The following analysis looks at relations between the national background of the interviewees and the scores given. A table need not be shown here as there is no evidence for a connection between national background and expectations, except for two cases. First, Swiss professors tend to expect a more negative impact of competition on quantities compared to the other interviewees. They do not agree with the expectations of the majority of the interviewees that competitive funding arrangements will lead to a higher number of publications. Furthermore, they expect a strong negative impact on the number of projects of pure research, whereas the majority expects only a limited negative influence. Second, unlike the majority of the interviewees, British professors expect a positive impact of competitive funding arrangements not only on applied research but also on the quality of pure research and publications. These findings can be explained by the basic arguments underlying the interviewees' expectations. Some of the Swiss professors

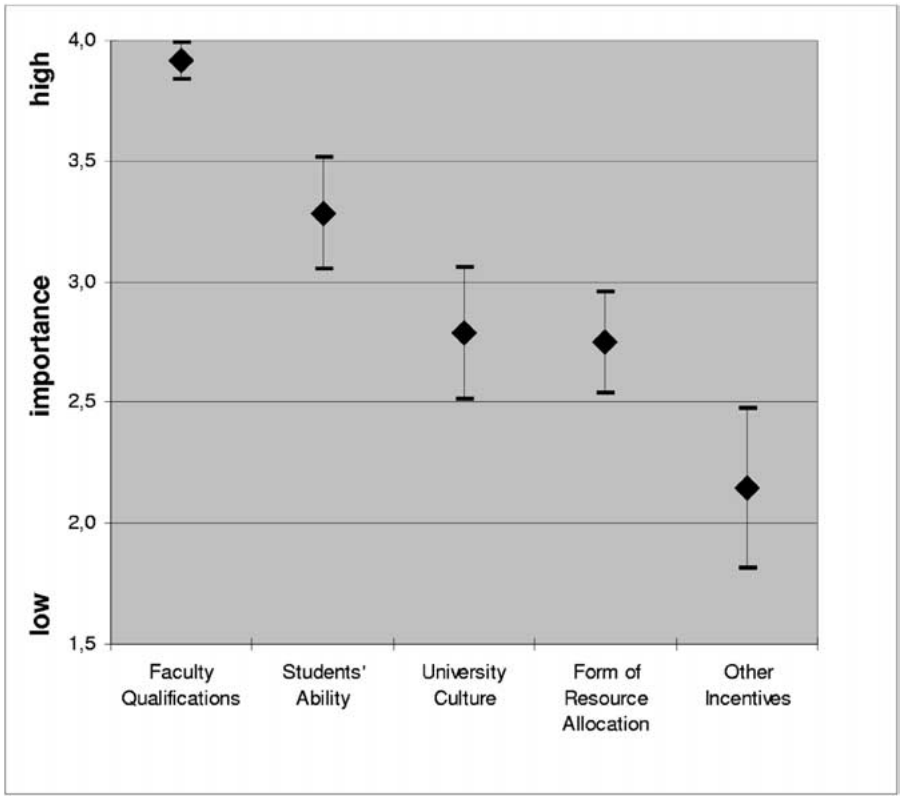
lack personal experience with performance-based funding and competition for resources. This is one factor that explains their skepticism. Some of them mention as a second factor that the Swiss culture is more based on consensus than on competition. This general, not university-specific feature also explains why many Swiss interviewees do not favor a dominant role of competitive elements in university funding. The strong positive expectations of British professors may be due to the recent positive experiences with the introduction of performance-based funding and quality assessments. Furthermore, the British (and Dutch) funding systems that combine stability and competition may also combine the advantages of both ways of funding. The expectations of the US-American professors are neither positively nor negatively pronounced. That may be due to the fact that universities in the United States have a longer tradition of being funded under competitive conditions. The professors know the advantages and the disadvantages of that funding arrangement, but as the system is generally accepted, there is less debate compared to European HES.

Hence, the differences in national or university cultures and funding arrangements are reflected in the expectations connected to performance-based resource allocation. But, these differences in expectations are relatively small compared to the common views of the interviewees on the prospective outcome of a strongly competitive funding system (e.g., more applied research, an increased number of publications, market application).

Discussion: What determines the success of universities?

The analysis of interviews has shown that the impact of performance-based budgeting or at least the expectations about the impact of competition are similar in all six universities investigated; only minor differences exist. Instruments of performance-based budgeting work largely as predicted in theory. The first section of this article has shown that the application of performance-based resource allocation varies to a great extent between universities and national HES. Therefore, the link between performance-based resource allocation and the success of universities must be weak; otherwise, not all of the six universities could be successful institutions.

In order to assess the importance of resource allocation strategies for the long-term success of higher education institutions, the professors were asked which factors determine the educational and scientific potential of universities. “Importance” is expressed with marks ranging from “1” (unimportant) to “4” (extremely important). Figure 2 shows the median marks and the 95-percent confidence interval.



Source: own investigation.

Figure 2. Importance of different factors for the long-term success of universities.

The figure shows that the only factor classified as decisive for long-term success by more than 90 percent of the interviewees is the quality of academics. The majority of the interviewees stress that this factor is far more important than all others. The second factor that has a significant impact on the long-term development prospects of universities is the ability (qualification and motivation) of students. The form of resource allocation is less important. The majority of the interviewees view resource allocation as a means of developing an innovative and performance-oriented culture within systems and institutions of higher education. Its direct effects on success are very limited. This ranking of factors looks exactly the same at all universities in the study.

These findings can help to explain why universities that work under various funding systems and apply different resource allocation mechanisms show considerably fewer differences with respect to their success in teaching

and research. Obviously the six universities examined in this study manage to attract highly qualified faculty. This may be a result of their institutional reputation and/or of the environment they offer for research and education. The majority of interviewees argue that a creative environment and a basic infrastructure are essential for attracting qualified people. Hence, existing reputation and success in the past as well as clear institutional goals will have a positive impact on future development. This explains why all six universities are successful institutions despite the enormous differences in the available budget and the form of resource allocation.

The result that the quality of faculty is a crucial factor for success can also be combined with the results of the hypotheses and the findings of the second empirical section. The majority of the interviewees agree that well-qualified people tend to respond less to monetary incentives. Instead they work according to their individual motivation and scientific interests. As they are confident of their scientific capabilities, they need not avoid risks. Faculty that are less motivated might respond to the pressures created with performance-based budgeting, but as they are not highly qualified, the outcome of rising activity will be small. This can explain why the existing effects of performance-based resource allocation on behavior do not lead to obvious differences on the university level. The hypotheses about changes in individual behavior are correct, but the factor "quality of personnel" is decisive for success and dominates the other effects. Universities with a large number of highly motivated and qualified faculty will be successful regardless of the form of resource allocation.

As the form of resource allocation cannot directly influence the long-term success of universities, what else can its function be? First, it can force institutions and individuals to pay attention to the governments and taxpayers who support the institution. Second it can help to adjust the organizational structures of universities more quickly to emerging needs and opportunities. Third it can be used to re-allocate funds to those groups and scholars that have proved to be successful and to reduce the budgets of those who are not performing in an acceptable way.

Policy implications

This paper has shown that there is obviously no *a priori* superior approach to successful resource allocation in education and research. Furthermore, the culture and tradition of universities and national HES have only limited influence on the peoples' reactions towards performance-based budgeting. Therefore governments should allow universities to look for different and individual ways of managing their institutions. University administrators

should define the basic goals of their institutions and propose how they can fulfill their mission under the given, historically developed, and culturally accepted framework that revolves around the endowment, the reputation, the regional industrial potential, etc. If administrators decide to use market forces or performance measures for the internal allocation of budgets, they should keep in mind that the long-term success of their institution is based on the qualifications and abilities of the people they employ. Therefore the internal forms of allocation should not primarily focus on giving all scholars incentives to work hard. This would lead to higher activity among less-productive or less-motivated scholars. The qualified and motivated faculty would not change their behavior or avoid projects that might be professionally more risky. This form of resource allocation would not produce better results in the long run. Performance-oriented methods of budgeting should make sure that resources could be reallocated to those units and individuals who have been successful in the past or demonstrate excellent promise for the future.

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Note

1. Calculation based on the average 1997 exchange rate of the Frankfurt stock exchange.

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