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The Productivity of Universities

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1. This paper does not attempt to measure the productivity of universities.[1] Its purpose is to clarify concepts and , above all , to argue that there is no such thing as a unique measure of university productivity. Universities serve multiple objectives and their operations can be assessed , in principle at any rate , in terms of the effectiveness with which each of the various objectives is achieved. That is , every objective can be appraised by means of cost-effectiveness analysis. There is no guarantee , however , that different cost-effectiveness ratios will all point in the same direction , in which case we can get no further unless we can distinguish among the objectives in order of their importance. Similarly , to measure the productivity of a university - defined as a ratio of output to inputs - we must somehow evaluate its output , and every type of valuation implies the existence of some objective function that universities are trying to maximize . Since there is certainly more than one objective function , we end up , again at least in principle, with various alternative valuations of output , each one of which yields a different measure of productivity . We search for the productivity of universities.

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1. For one such attempt , see M. Woodhall and M. Blaug , 'Productivity trends in British university education , 1938-62' , Minerva , September 1965, pp.483-98, and 'Comments' by H.G.Johnson and R.Stone, followed by 'A Reply' by M.Woodhall and M.Blaug , ibid. , Autumn 1965 , pp.95-105; see also C.F.Carter , 'Can we get higher education cheaper?' , Manchester Statistical Society , December 1965 , pp. 1-14 (Reading 15 in this volume).

Some Fallacies

2. The discussion of university productivity is beset by a number of popular fallacies. The leading fallacy is that confusing total-factor-productivity with labour productivity , as exemplified by the widespread tendency to use staff-student ratios as a proxy for the productivity of universities. Now itis true that teaching time is the largest single input into universities , but this is not to say that student time , the services of buildings and equipment, fuel for light and heat and other materials , as well as library and administrative staff , count for nothing ; indeed , taken together , they exceed the input of teaching time , whether measured as a proportion of total costs per student or as a percentage of recurrent expenditures on universities. Secondly , unless we take it for granted that present levels of research in British universities are just optimal from the point of view of providing effective teaching , student-staff ratios may measure the productivity of teaching, but they certainly do not measure the productivity of university teachers. More to the point , however, the appeal to student staff ratios tacitly assumes the output of universities is simply student numbers. This,in turn , assumes that university research can only be evaluated in so far as it contributes to better teaching. If, on the other hand, university teaching serves to create new knowledge as well as to disseminate existing knowledge, student-staff ratios leave out of account a possibly significant portion of the output of universities.

3. Many academics instinctively recoil from the use of student-staff ratios as a proxy for university productivity on the grounds that what is characteristically called "an improvement in staff-student ratios" then implies a decline in productivity. But this dilemma is created by the belief that "more necessarily means worse" and that smaller classes always improve the quality of teaching. Unfortunately, this assumes, as in the case of the contribution of research to teaching, that there is a well-attested body of knowledge about the virtue of small-group teaching and about the effectiveness of certain methods of teaching in different subjects and at various levels of difficulty. In point of fact,

there is very little evidence about teaching and teacher effectiveness in universities, and what evidence there is gives little support to the popular belief in the value of smaller classes (more on this anon). For all we know, reductions in student-staff ratios may lead to a decline in a meaningfully defined productivity of labour in universities. Nevertheless, so long as there are other inputs into universities than teachers, there is no reason to be concerned about labour productivity as such. A fall in the productivity of labour would be nothing to worry about if it were accompanied by a more than proportionate rise in the productivity of buildings and equipment, and vice versa.

4. Another popular fallacy is that of regarding the total-factor-productivity of universities as simply the reciprocal of the money costs per student. No one is surprised to hear that the unit costs of universities have risen over time, either because of the general inflation of prices or because of a commendable urge to improve the quality of the output as time passes, and this implies that a measurement of the productivity trend of universities would show a downward tendency. However, productivity properly measured is a relationship of physical inputs to physical output and, hence, is not the reciprocal of unit costs. The whole point of measuring productivity is that of removing the influence of prices so as to discover whether inputs are becoming truly more capable over time of producing output. It is true that in combining the various inputs to form a composite unit for purposes of comparison to out put, economists frequently resort to money measures suitably deflated by price indices. The reason for this is simply that there is no way of adding so many people to so many tons of concrete or to so many pounds of library books unless they are all expressed in terms of a common denominator. Nevertheless, once we have adjusted the money values of inputs for changes in prices, the resulting productivity measure becomes insensitive to anything except changes in real output per unit of real inputs. There are many good reasons for calculating unit costs, but such figures can never reveal whether the activity in question is becoming more or less productive.

5. Perhaps the most frequently encountered fallacy in this entire field is that of treating "productivity" as a synonym for "efficiency". Efficiency refers to the optimal combination of inputs to produce a given output, that is to say, producing that output at least cost. The reference to costs shows that efficiency depends critically on the relative prices of inputs: every change in relative prices involves a different efficient combination of inputs. Efficiency can be defined at one point in time, in the context of the existing level of technicalknowledge, whereas productivity is almost always measured between two calendar dates. In principle, it is possible to measure absolute productivity at one point in time, but in practice it is easier and usually more relevant to measure changes of productivity over a period of time. Now, it is perfectly conceivable that an activity that is conducted inefficiently at every point in time nevertheless enjoys productivity improvements as time passes. Much depends on the technical availability of innovations in that particular field of endeavour. Similarly, an activity may be conducted efficiently at every point in time and yet reveal no technical dynamism in the sense of dramatic reductions in the inputs required to produce a unit of output. In other words, one cannot conclude that the steel industry is efficiently organized simply because total-factory-productivity in the making of steel rises 2-3 per cent per annum year in and year out, nor can one demonstrate that the hair-dressing industry is inefficient simply because the productivity of barbers has remained virtually stationary for a century or more. What we can say is that a decline in productivity is an almost certain sign of inefficiency, and that the failure of an industry to improve its productivity at a rate comparable to the rest of the economy must result in a steady upward pressure on its costs.[2]

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2. For a rigorous proof of the last proposition, and its application to the performing arts, see W. J. Baumol, "Macroeconomics of unbalanced growth", American Economic Review, June 1967, pp. 415-26.

The fact remains, however, that efficiency and productivity are distinct concepts that must be judged by different criteria. Even if we showed that the productivity of universities has not increased in the recent past, we would still be far from the conclusion that they could be more efficient.

6. Measurements of productivity are meaningless unless both inputs and output are measured in terms of constant quality. This can be a vexing problem in measuring the productivity of an industry - witness the related argument that most cost-of-living indices exaggerate the degree of inflation that has taken place because they ignore improvements in the quality of products - but it is a much greater problem in measuring the productivity of universities. Take, for example, the output of students completing a course, a significant aspect of general output of universities. If we are going to assess secular trends in the productivity of universities, we must somehow allow for gradual improvements in the quality of students. Most academics are quite convinced from their own experience that the quality of university teaching has been rising in the recent past: they might point to the fact that their subject is now taught to a standard that would have been unimaginable ten years ago, not to mention the fact that the subject itself is improving all the time and that better textbooks are constantly becoming available. What this argument neglects, however, is the consideration that students are both output and input. It is the fallacy of forgetting that university teaching can only be appraised in terms of "value added" to students between the time of entry and the time of graduation. The impression that it is becoming easier all the time to carry university students to the frontiers of a subject may simply reflect the improved quality of primary and secondary education, rather than a rise in the "value added" by universities. Clearly, if we are serious about measuring university productivity, we must standardize the quality of student time, both as an input and as an output, for example by comparing their achievements on a series of attainment tests given at the time of entering universities and again at the time of graduation. Be that as it may, casual impression is very likely to deceive

us. This is true not only of the quality of student inputs but, as the teacher of today was the student of yesterday, also of the quality of teachers. The measurement of educational quality is, indeed, at the bottom of all controversies over university productivity.

The Evaluation of Output

7. If the output of universities was sold in the market place, we would normally evaluate output in terms of money prices, so that a student who fetched a higher than average starting salary would be treated as more than average output. In a sense, the output of universities is sold in a labour market, except that the returns accrue to students rather than to universities. However, universities are not conducted for the purpose of maximizing the life time earnings of its graduates. Their purpose is - and now the arguments begin - to select the most able for leadership in industry and government, to cultivate talent for the sake of self-enrichment, to promote scholarship and scientific research, to preserve and disseminate cultural values, and so on, and so on. Each of these goals can serve as a standard for productivity measurement, of cost-effectiveness analysis if you like, provided they can be expressed in terms of a numerical index or scale with which to evaluate output. For example, the vocational objectives of universities may be approximated by an index of the expected earnings of different types of graduates, on the assumption that present earnings differentials by subjects willcontinue into the future; such a weighting will, of course, favour those reading science and technology. In contrast, the cultural objectives may be converted into an index that assigns more weight to arts than to science graduates. Similarly, it has been proposed that "as a first shot, research output might be measured in terms of publications".[3] A corresponding

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3. Stone, op, cit., p. 99.

index of the amount and frequency of publications in different departments might then be combined with an index of student output of the departments, possibly weighted by the length of different courses. Alternatively, if it were possible to separate the inputs into teaching and research, such as the proportions of the working time of staff and the use of office and laboratory space devoted to the two activities, we might consider the productivity of teaching separately from the productivity of research. Nothing but lack of ingenuity prevents us from mentioning other objectives of universities and different ways of measuring these.

8. Every different weighting system for the evaluation of output yields a different measure of productivity. But what of those goals or functions of universities that cannot be quantified and reduced to a scale? These, I would argue, should be ignored for purposes of measuring productivity and, for that matter, for purposes of assessing efficiency. We measure university productivity presumably to throw light on the underlying causes of the trend in university costs and, perhaps, in order to justify pay claims. To say that universities perfom all kinds of useful functions does not help to account for a certain increase in costs over a period of time - did universities not perform these functions previously? Nor is it of much assistance in claiming 20 per cent more pay rather than 10 per cent. To be sure, such things as the personal satisfaction and cultural awareness of students is part of the output of universities, but this makes no differnece whatsoever to any conclusions about trends in university productivity unless, of course, these factors are more significant today than they were in the past. If anyone asserts that they are indeed more significant now, they have already implied that they are measurable quantities. It is logically impossible to argue both that the objectives of universities are non-quantifiable and that the universites are now achieving these objectives more successfully. This is not to assert that

"what is not measurable is not significant", but rather that when decisions have to be taken in terms of "more of less", resort to the unspecified social, ethical and spiritual contributions that universities make to society is simply designed to take the question out the realm of rational discourse.

9. When the output of universities ha s been evaluated with a variety of weighting systems and compared to a weighted bundle of inputs, the problem remains of choosing between the resulting productivity measures. Needless to say, choice between them depends on the relative importance assigned to different university objectives, a matter on which there is no consensus even among university academics. Nevertheless, the effort to measure and the resulting differences in numbers can clarify the controversy about objectives. Perhaps the greatest value of productivity studies is precisely to spell out the implications of different views about the functions of universities. When a colleague and I attempted a few years ago to measure productivity trends in British university teaching between 1938 and 1962, employing three different weighting systems to evaluate the out put of studentes completing a course, we were much surprised to find that all three productivity trends steadily decline over the period, with the sharpest drop occurring in the last ten years. We made use of whatever evidence there was to remove changes in the quality of both input and output, but we were only too conscious that the evidence was far from satisfactory. Still, our aim was to demonstrate a method of investigation and to throw the burden of proff on those who have claimed that university productivity obviously increased in the 1940s and 1950s.[4] If our results can be believed, they show that widely different concepts of the objectives of universities none the less may lead to identical conclusions about productivity. This illustrates the need to quantify objectives: the results are sometimes enexpected. Comparisons of productivity between universities or between subjects across al universities,

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4. As we said at the time: "We realize that much of the increases in expenditure on teaching staff and educational euqipment per student over the period in

an idea which awaits future research, might reveal that some universities accomplish certain objectives more effectively than obthers, demonstrating that we already have particular "centres of excellence" that we should or should not encourage.

Suggestions for Future Work

10. If we want seriously to consider university productivity - this is not an editorial we; I speak as a fellow academic - there is much work to be done. In the past, the fear that such notions as "productivity", "efficiency", or anything that smacked of rationalized management, would undermine traditional academic values has effectively prevented scientific evaluation of university activity. As Sir Eric Ashby once said of British academics:

> All over the country these groups of scholars, who would not make a decision about the shape of a leaf or the derivation of a word or the author of a manuscript without painstakingly assembling the evidence, make decisions about admissions policy, size of universities, staff-student ratios, content of courses, and similar issues, based on dubious assumptions, scrappy data and mere hunch ... although dedicated to the pursuit of knowledge, they have until recently resolutely declined to pursue knowledge about themselves.[5]

The Hale Committe Report on University Teaching Methods showed that some British universities are at long last beginning to take a critical

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question was intended to increase the quality of education. But how do we know that they did? Our object was to attempt to quantify such changes in the quality of university education and to challenge those who claim that quality has, in fact, improved but that the magnitude of the ot the improvment cannot possibly be measured. What we hoped to show was that, in principle, quality improvments can be measured, but that, in practice, little data have been furnished to measure it adequately". Woodhall and Blaug, op. cit., Minerva, Autumn, 1965, p. 103.

5. Sir Eric Ashby, "Introduction: decision-making int the academic world", Sociological Studes in British University Education, Monograph No. 7, The Sociological Review, University of Keele, 1963, p. 6.

interest in their own efficiency as teaching institutions,[6] and a recent comprehensive survey of research on teaching methods in British universities noted that of the 105 references, only 5 dated from before 1950, 15 were published between 1950 and 1959, and the remaining 85 all appeared since 1960.[7] Nevertheless, We are still a long Way from American efforts in this field,[8] and the suggestion that We should become more productivity-minded than we have been is still too frequently waived aside With ad hoc arguments[9].

6. U.G.C., Report of the Committe on University Teaching Methods, H.M.S.O., 1964, pp. 105-12.

7. R.M. Beard, Research Into Teaching Methods in Higher Education, Society for Research into Higher Education. 1967, p. 42.

8. See, for example, F. E. Rourke and G. E. Brooks, The Managerial Revolution in Higher Education, Johns Hopkins, 1966, Which reviews the growth of "programme budgeting","cost-effectiveness analysis", and "institutional research" in American state colleges and universities.

9. For example, C.F. Carter has made a number of useful suggestions about the finance of universities so as to provide automatic incentives to encourage efficiency, namely, to separate teaching grants from research grants, and to give universities power to borrow on capital account While charging interest and amortization to current account: (With B. R. Williams) "Proposals for reform in university finance", The Manchester School, September 1963, pp. 255-61; The economics of higher education", ibid, January 1965, pp. 1-16; and Carter, op. cit., p. 12. But in considering changes in university teaching methods, he argues: "It is just not true ... that "the possibilities of substituting capital for labour in education or economizing on the time of teachers are persistently ignored". These matters are being actively pursued in many places: but one often finds that new techniques, though possibly improving the quality or interest of teaching, yield little or no economy in staff, so that one ends up by paying a higher price and justifying it by a supposed improvement in

the final product. Universities are anxious, perhaps on occasion dangerously anxious, to be "With it" by installing closed circuit television, programmed learning systems and the like. It is desirable that this should be done for the sake of experiment, but it is a mistake to suppose that the economic justification for such methods is already known "(ibid, pp. 7-8 (p.332 in this volume)). The upshot of this paragraph is to belittle attempts to explore teacher-saving methods in higher education. By way of contrast, and it is a contrast, see B.R. Williams, "Capacity and output of universities", The Manchester School, May 1963, pp. 185-202, Which canvasses the possibilities of raising university productivity by (1) increasing the plant load, (2) rearranging the time-table and increasing supporting staff, and (3) lengthening the academic year.

Productivity and Efficiency of Education.

11. In my opinion, the first item on the agenda of future research should be student attainment tests given at the time of admission to universities and repeated at the time of graduation. I do not see how we can begin to settle the question of the changing quality of university education Without them. There is no need to jump straightway into nationwide testing. Appropriate tests could be developed and administered at individual universities and gradually built up until they comprise an entire cohort of university students. Alternatively, one might begin to measure the changing standards of O-level A-level passes over time, accompanied by the introduction of something like the American Graduate Record Examination for all students completing a university course. This Would soon generate virtually the same data as standard tests at lhe points of admission and of graduation.

12. More studies of teaching methods and teacher effectiveness, particularly comparisons of the effectiveness of tutorials versus lectures, and small lecture classes versus large lecture classes accompanied by seminars, are the next items on the research agenda. This is the kind of research that must be conducted by educational psychologists or at least in consultation With educational psychologists. Further, studies of the average and marginal costs of undergraduate and postgraduate students in different subjects, on the lines of the L.S.E. investigation,[10] Will throw up evidence that bears on both "efficiency" and "productivity". There is grist here for the economists" mill.

13. With reference to the vocational objectives of universities, it is high time that the U.G.C. reported, not simply the first employment of university graduates, but also their starting salaries in their first employment. The sort of study that the P.E.P. carried out over ten years ago [11] should be repeated from time to time. It is all very well for the Swann Committe to complain of the extent to which universities are consuming their own output; if we knew more about the employment prospects of young graduates and postgraduates, however, We might see that the root of the trouble is not their own ignorance about the allegedly splendid opportunities in private industry but simply differences in earnings connected with age and educational qualifications. Sometimes it is said that the vocational objetctive of universities rightly understood is to maximize the occupational and industrial mobility of the labour force. This is an assertion that could be quantified if we had data on labour mobility cross-classified by educational qualifications. Perhaps academics should take a more active role in urging the Ministry of Labour or the Registrar-General to collect such evidence.

14. "Equalization of educational opportunities" is frequently advanced as one of the objectives of universities. I take this to mean that universities should encourage everyone with the required aptitude and ability to take up university education, regardless of family origins or financial means. Now this objective is largely a sham, inasmuch as half of all those who achieve two A-level passes do not gain admission to universities at the present time. However, if we look at higher education in the Robbins sense and not merely at universities, and keep in mind the British system of students' grants, the objective of equalizing educational opportunities

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10. H. Glennerster, The Graduate School: A Study of Graduate Work at the London School of Economics, Oliver and Boyd, 1966.

11. P.E.P., Graduate Employment: A Sample Survey, P.E.P., 1956; P.E.P., Graduates in Industry. The Second Report on the Study of Industry and the University Graduate, P.E.P., 1957.

might be said to come near to being fulfilled. However, as soon as we remember the "fall out" between the ages of 15 and 18, when students rely almost entirely on their own means to satisfy admission requirements into universities, we begin to doubt whether universities and even all of higher education succeed in equalizing educational opportunities. What we need to know here is the income, occupation, and education of the parents of university students, and indeed of those students who go elsewhere to the teacher training and technical colleges to obtains higher education. This information is readily available in the United States and Canada but is is simply unobtainable at present in Great Britain.[12] There has been much discussion about appropriate levels of university fees, about fifth and sixth form grants, and loans to replace student grants at the university level. All of the questions require the type of information that we have just mentioned. We could look at university productivity in terms of the objective of equalizing educational opportunities. But we cannot do so until we know much more about the socio-economic characteristics of students than we do.

15. One could go on almost indefinitely in this vein. I shall draw to a close, however, by returning to the subject of university research. There can be no doubt that, however difficult it is to evaluate the output of university teaching, these difficulties are as nothing compared to those of evaluating the output of research, not to mention the effectivennes of research in contributing to better teaching. I have new suggestions to make that would help to measure research as part of the output of universities. It is

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12. The Robbins survey on the social background of students collected information only on the education and "social class", crudely defined, of fathers.

13. As Carter put it: "There is a justification (of university research) which appears to me to be (unhappily) valid: and that is that the nation will persistently undervalue the search for knowledge, and can only be persuaded to pay for this contribution to its own state of civilization by slipping in research as an unnoticed by-product of university teaching", op. cit., p. 10.

clear, however, that long before we tackle the output problem, we have yet to settle the much simpler problem of measuring the inputs into university research. Such things as laboratory equipment, full-time research workers, and use of libraries are easy to deal with. The real difficulty is the proportion of staff time devoted to research. In principle, this is a measurable item, but in practice it can be difficult to devise an adequate scheme for measuring it. The recent U.G.C. effort in this area was deservedly attacked by many academics as a meaningless exercise. This is not to say, however, that we should not do better, unless of course we believe, as we so often do, that it would not be in our best interest to reveal the quantity and quality of university research.[13] A perfectly practical idea would be to distribute "calendars" in a random week to a random sample of staff in different institutions, asking them to note down their principal activity in each hour, distributed among such categories as (1) "teaching", (2) "preparation for teaching and marking of papers", (3) "administration", (4) "general reading in one's subject and in related fields", and (5) "personal research, papers, and projects". One can see objections even to this scheme, but something like it must come sooner or later. If we continue to deny that teaching and research can somehow be distinguished, at least on the side of inputs if not on the side of output, we have no business to pretend that we can say anything about the productivity and efficiency of universities.