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**Towards the estimation of the economic value of the outputs
of Scottish Higher Education Institutions**

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1 Introduction: Towards the estimation of the economic value of the outputs of Scottish Higher Education Institutions

“ A serious assessment is important. To be serious one finds that this normally requires a quantitative look. Otherwise one just gets poetry. This is not to say that everything can be reduced to numbers, certainly not. But one can do a lot with numbers, including getting a sense of what the critical trade-offs are, where additionality may lie and a sense of what is and is not important....”

Frank Lysy , 2002 ¹

“Thinking about how to finance universities, like financing the arts, has been distorted by a certain kind of high mindedness. Where truth and beauty are concerned it is easy to pull off a rhetorical trick that casts concern with money in a rather Philistine light...it is correct to say that truth, understanding and learning cannot be given numerical values. It does not follow however that their value cannot be assessed, or that the assessment of this value cannot be conducted along the ordinary lines of what is and is not worth spending money on.....” Gordon Graham 2002²

1.1 This report is the outcome of a preliminary scoping study undertaken for the Scottish Higher Education Funding Council and Universities Scotland Knowledge Transfer Taskforce during the three month period April – June 2005. The study focussed on the feasibility of developing an economically meaningful approach to measurement of Scottish higher education institutional outputs in monetary terms.

¹ From *What drives investment within Countries?* F.J. Lysy 2002

² From *Universities – The Recovery Of An Idea* Gordon Graham 2002

1.2 The study was undertaken by a team from the University of Strathclyde, comprising two economists (Emeritus Professor Iain McNicoll and Donald McLellan) and a senior university manager (Ursula Kelly).

1.3 The study was able to draw on previous pilot research undertaken by the team, which had received support from the Nuffield Foundation. Indeed, without the pilot research the team would not have been able to contemplate addressing this feasibility study within the timescale and resources available.

Background to the study

1.4 One of the key issues facing the Scottish Higher Education Funding Council and Universities Scotland Knowledge Transfer Taskforce has been how to assess the contribution made to the Scottish Economy by Scotland's higher education sector. It is widely thought (in Scotland, in the UK and internationally) that higher education has a pivotal role to play in economic development, particularly through the transfer of knowledge to its host region, with higher education institutions being "key components of an innovative and competitive knowledge-driven economy."³

1.5 Current UK government policy is strongly focussed on encouraging universities and other higher education institutions to engage with their host regions, and seeks to maximise the benefits to the economy that may be gained from universities' activities.⁴ The SHEFC itself has explicitly stated: "Knowledge Transfer is an important issue for HE in Scotland over the next five to 10 years, as Government looks to it as a means to support, stimulate and develop the economy."⁵

1.6 However, while the belief that higher education is important to economic growth underpins the policy approach to much of the higher education sector's activity, there is very little hard quantitative *evidence* against which related resource allocation decisions aimed at encouraging economically valuable activity can be made.

³ *Research and Knowledge Transfer in Scotland*: Report of the Scottish Higher Education Funding Council and Scottish Enterprise Joint Task Group 2001

⁴ See, for example, the Lambert Review, the White paper on Higher education as well as the Scottish Executive *Framework for Higher Education in Scotland*

⁵ From *Higher Education in Scotland: A Baseline Report* 2004

1.7 Higher education's impact on the economy can be, and has been, estimated in terms of jobs and output generated through the operation of the HEIs as businesses, both directly and in terms of 'knock-on' multiplier effects.⁶ However in measuring the economic impact of a university in this way, no explicit value is placed on the actual activity in which HEIs engage. Conventional economic multiplier studies continue to prove useful to both HEIs and policy makers in that they give a quantitative handle on the *expenditure* impact of a university, particularly within a given region.⁷

1.8 Nonetheless, the growing policy emphasis on higher education's role in the economy has led to an increasing need for quantitative analysis of the value to the economy of *what* a HEI does (that is, as a producer of specifically educational goods) – over and above the economic benefits that arise from the mere fact of the HEI doing *something* (that is, as a producer of general unspecified goods).

1.9 Assuming that higher education is indeed an essential contributor to economic development and growth,⁸ the question then arises: how can one assess which part of the wide range of 'higher education' activity is most important in this regard? If there is a desire on the part of policy-makers to focus resources on the most economically valuable higher education activity, on what basis can such resource allocation decisions be made?

1.10 Reviews of the extant literature on higher education and the economy (for example Gemmel 1997, Chevalier et al 2002) highlight that there is a growing body of theoretical work which focuses on higher education's contribution to the stock of human capital, and continuing analysis of private and social rates of return to graduation. Some work has been conducted on very specific aspects of higher education – such as the returns to investment in basic research.⁹ However, in the UK

⁶ The current project authors have undertaken a significant number of studies of this aspect of higher education at national, regional and local economy level.

⁷ Indeed, the only hard evidence cited by Lambert and in the White Paper related to figures produced by the current authors in *The impact of higher education institutions on the UK economy* UUK 2002

⁸ And there remain a body of sceptics as to the ultimate truth of this assumption – see, for example, Wolf 2003 *The myths about Education and Economic Growth*

⁹ See, *The Economic Returns to Basic Research and the Benefits of University-Industry Relationships: A literature review and update of findings*, (2000,) Scott et al, SPRU.Report for the Office of Science and Technology, DTI

at least, few attempts have so far been made to identify and quantify the value of *all* HEI outputs (eg including teaching/research/advisory work, cultural/community engagement) in monetary terms – which would be an essential prerequisite for a comprehensive cost-benefit analysis of higher education institutions.

1.11 The SFC have invested considerable effort into identifying aspects of higher education institutional work which could be defined as being primarily concerned with ‘Knowledge Transfer’ and have sought to encourage and support such activity. However there remains no effective, methodologically valid, practical way to analyse the actual economic value of the activity supported, nor indeed to compare the ‘value’ thus created with that generated by other aspects of higher education work.

1.12 During 2004 , with support from the Nuffield Foundation, the current report authors had begun to examine new and different ways of approaching the problem of assessing the economic value of HEI outputs. This had been undertaken essentially as a small pilot project, taking a single higher education institution as a case study. The aim had been to examine whether it was possible to identify all the outputs of an HEI (including the ‘intangibles’ such as cultural engagement), to quantify these in natural units and to examine the feasibility of applying monetary values to these outputs. The team concluded that the development of volume and value output measures for this particular HEI was possible and were able to make preliminary suggestions on ways of deriving these.

1.13 The team was commissioned to build on this initial research and explore this approach further in the context of all higher education institutions in Scotland . This commission took the form of the current project - i.e. to conduct a study of the feasibility of measuring the outputs of all Scottish HEIs in monetary terms, whether this is realistically possible and whether such an approach could yield meaningful insights into the economic value of all Scottish higher education institution activity. The outcome of this work is presented in the current report.

Scottish Higher Education

1.14 To give a flavour of the size and shape of the Scottish higher education sector as contextual background to the report, it is worth noting some basic facts. According to

the latest statistics from the SHEFC,¹⁰ there were nearly 257,000 higher education students in Scotland in 2002/03, with around 77% of these registered at Scottish higher education institutions. The remaining 23% were studying for higher education qualifications at Further Education Colleges. There are 21 higher education institutions operating in Scotland, 20 of which receive funding from the Scottish Higher Education Funding Council.¹¹ The total revenue of the Scottish HEIs in 2002/03 amounted to nearly £1.8 billion.¹²

1.15 Scottish higher education institutions cover a diverse range of types and origins, with 14 universities (including four ‘ancient’ universities founded in the 15th and 16th centuries), two art colleges, one university college, one college of higher education, one conservatoire and a university institute (the University of the Highlands and Islands Institute), as well as an agricultural college. They range in size from an institution with around 700 students to ones with nearly 25000 students. In addition to this the Open University (its head office based in Milton Keynes) operates extensively in Scotland.

1.16 This particular study primarily considers the issues involved in regard to the 20 Scottish higher education institutions in receipt of SHEFC funds. All of these institutions are legally independent entities and are classified as NPISH (Non Profit Institutions Serving Households) in the UK National Accounts.

1.17 The higher education institutions under study are complex, multifaceted organisations, which engage in an extremely wide variety of activities which produce a spectrum of ‘private good’, ‘public good’, ‘merit good’ and even ‘hobby good’ outputs. They operate in regulated and unregulated markets and provide a very wide variety of services to a wide range of local, national and international clients – including government, charities and private businesses as well as to individuals.

1.18 The present authors have undertaken many studies of higher and further education in the UK and were more aware than most of the complexities surrounding

¹⁰ Higher Education in Scotland: 1st Update Report March 2005

¹¹ The exception is the Scottish Agricultural College, which receives funding support through the Scottish Executive Environment and Rural Affairs Department

¹² From HESA *Resources of Higher Education Institutions* 2002/03

higher education institution operations. However even the authors were surprised at the volume and variety of activities that began to be revealed in the course of the research, as well as by the layers of regulations governing almost every aspect of those activities.

1.19 It is worth noting that there is still sometimes psychological resistance among some parts of the higher education sector to the very concept of higher education institutions being assessed in economic terms.

1.20 This may be partly based on an anxiety that outputs of cultural activities or other ‘socially valuable’ work which do not appear to be ‘commercially useful’ or which are not necessarily ‘sold’ will be overlooked or treated as unimportant. However, as is highlighted later in this report, simply because something does not have an obvious or observable price does not mean there is no associated economic value.

1.21 For example, in relation to assessing the economic value of cultural outputs the authors have considered a very wide range of potential techniques that could be applied¹³ and have identified a measure that is frequently used in the evaluation of transport projects but which can very feasibly be applied to the economic evaluation of a range of cultural outputs.

Key points to note about the report structure and content

1.14 The approach adopted in this report towards estimating the economic value of Scottish higher education institutions is extremely new. That is not to say that the principles adopted are new – on the contrary, the approach is entirely rooted in fundamental economic theory and consistent with national and international best practice as outlined by the UK Treasury, the Office of National Statistics, Eurostat and the World Bank.¹⁴ The innovation lies in the application of this approach, for possibly the first time in the UK (and certainly in Scotland), to assessment of higher education institution outputs.

¹³ See *Economics and Culture* David Throsby 2001 for a comprehensive discussion of issues affecting the economic valuation of culture and *Arts and Economics* Bruno Frey 2003

¹⁴ Including, for example the *Green Book*, the *World Bank Handbook on Economic Analysis of Investment Operations*, the UK ONS *Atkinson Review* and the Eurostat manual

1.15 The innovative nature of the study has inevitably compelled a large part of the project and the project report to be devoted to explaining the complex economic principles involved and exploring how these would apply to Scottish higher education institutions. The report also sets the measurement of Scottish higher education institutional outputs into the context of the most recent ‘best recommended practice’ for the measurement of Government and NPISH outputs, as exemplified by the 2005 Atkinson Review. The project team viewed this as essential for the credibility of this new approach to higher education and indeed for the SHEFC Taskforce to be able to repose confidence in any insights yielded.

1.16 Therefore the prospective reader must be prepared for a lengthy, detailed and at times technical report. To assist the reader, each section is preceded by an ‘abstract’, which outlines the content covered in that section. The report also includes a number of substantial appendices, including an extremely important summary of the relevant fundamental economic principles (Appendix A), which the main report both draws on and refers to where necessary. Another appendix with content central to the report is Appendix B, which comprises a full table of identified output variables for the University of Strathclyde, which is used as an illustrative case study for discussion in detail in Section 5 of the report. Other appendices include an extensive bibliography, an overview of some of the relevant key literature together with notes on issues arising in the shadow-pricing of staff inputs and on the pricing of research journal outputs, primarily for information purposes.

1.17 The reader is encouraged to follow the complete report through in the order in which it is presented rather than being tempted to move to sections that might appear of most immediate interest. The complex nature of the subject matter has meant that the report required to be written and ordered sequentially, with understanding of later discussion of empirical estimates being reliant on the reader having at least taken an overview of the preceding sections.

1.18 The authors are aware that at times the report content may challenge current thinking and practice in relation to Scottish higher education institutions. The report is not deliberately intended to be controversial; where a particular conclusion is drawn

that may question current practice, the reasons are fully referenced to the relevant economic theory which compels the conclusion.

1.19 Indeed the authors appreciate the Knowledge Transfer Taskforce requesting the study in a spirit of genuine enquiry and from a desire to more fully understand the relationship between higher education and the economy. The authors accepted the project brief in the same spirit.

1.20 It must also be emphasised that this report is preliminary; it is the outcome of a 3 month project intended as a feasibility study. It does not provide all the answers, nor did the team have the resources to engage in widespread data collection. Indeed, it was only possible to cover as much ground within the resources available as a result of the previous research undertaken by the team, together with their combined tacit knowledge, experience and expertise of both the economic issues and knowledge of the higher education sector.¹⁵

1.19. The conclusions therefore of this preliminary investigation are far from the ‘final word’. However the project team feel that the work undertaken has moved knowledge of this aspect of Scottish higher education significantly further forward, laying solid ground and a ‘route map’ for more extensive and full scale analysis of Scottish higher education institutional economic value. A number of recommendations are made as to the next steps, where further resources would be best targeted should the Taskforce wish to proceed further, together with a summary outline of where further investigation could be of practical use for policy decisions.

¹⁵ For example, Emeritus Professor McNicoll is one of the few economists in the UK to combine expert knowledge of national accounts, economic statistics and cost-benefit analysis together with knowledge of the economics of education. The small project team are currently among the very small number of people in Scottish universities conducting any applied research at all into the economics of *higher* education.

2 The Range and Scope of the Study

This chapter presents an overview of the range and scope of the study. The study is orientated toward an economic analysis of the outputs of the 20 Scottish HEIs in receipt of SHEFC funding. A detailed framework is developed in later chapters but the range and scope are first outlined here.

Measurement of the economic value of Scottish Higher Education Institutions (HEIs) is the objective of this study. Both economic theory and practice demonstrate that, in order to address all of the issues concerned with resource allocation and use, analysis of outputs (and inputs) in monetary terms is essential. There are, however, many difficulties in even defining HEI outputs as a coherent set of variables and problems in the measurement of these outputs are likely since universities are unlikely to collect or process all of the data required. In fact, the establishment of overall price levels is a challenging exercise since there is virtually no observable information on the “correct” prices applicable to the output of HEIs. However, although difficult, estimation of correct prices and values for Scottish HEIs is not impossible in principle.

The focus of this study is on HEI outputs rather than on inputs or outcomes – this is in line with both the UK Treasury Green Book and the recent Atkinson Report. Our definition of HEI output in the present study is entirely consistent with existing and forthcoming UK and EU requirements: that is, the measure required is HEI direct output. “Inputs” are not acceptable; “activities” should only be utilised when there are no alternatives present and “outcomes” should be used primarily to derive “weights” applicable to various direct outputs. A discussion of what is meant by these various measures is included in the chapter. Two essential conditions which are necessary, albeit difficult, must be also be addressed. Firstly that everything which should be included is included and everything else excluded where possible. Secondly, that everything which should be included is included once and once only (the no double counting condition). Following these guiding principles this chapter then presents an in-depth analysis of specific definitions and issues which the remainder of the study then seeks to address.

2.1 Of course, it is necessary to delimit the range and scope of any project, if for no other reason than satisfying resource and time constraints. However, in the case of higher education the issues involved are so complex that clarity of scope and purpose is particularly essential. In the first instance, “higher education” itself is an umbrella term covering a very large range of activities in a wide variety of dimensions, including, teaching, research, knowledge transfer, etc. Furthermore, the numbers of agents or “stakeholders” interested or involved in HE is uncommonly large, and includes not only parents, students, and HEI staff, but also businesses, government

agencies, charities and others. In fact, if HE externalities are significant (see discussion in pages 48 - 66), then arguably most members of Scottish society are affected by HE, wittingly or unwittingly.

2.2 These complexities can, and do, create great problems in any analysis of the role and purpose of higher education. Two fundamental problems of particular relevance to the present project can be mentioned: (i) it is necessary, but difficult, to ensure that everything which should be included *is* included, and that everything else is excluded; (ii) it is necessary, but difficult, to ensure that everything included is counted once *and only once* (i.e. no double-counting).

2.3 Turning specifically to the range and scope of the present study, the key words/phrases are “Scottish HEIs”, “outputs”, and “economic value”. Considering each of these in turn, the project is orientated towards the economic analysis of the 20 Scottish Higher Education Institutions in receipt of funds from the Scottish Higher Education Funding Council (SHEFC). These institutions clearly play a central and pivotal role in *the Scottish higher education sector*, but they by no means comprise the totality of it. On the supply side, HE courses are provided by Scottish FE colleges, and the Open University¹⁶ and other distance learning providers are active in Scotland. More broadly still, *Scottish customers* for HE services can and do utilise providers outside Scotland. On the demand side, certainly students and the funding/research councils would be included in any sensible definition of the HE sector. As suggested in the opening paragraph, plausible cases could be made for including other members of society.

2.4 The focus is on HEI *outputs*, rather than *inputs*. Given resource availability, this is readily justified by the fact that there is so much more pre-existing data and information available on the input and cost structures of the Scottish HEIs. Of rather more importance, it is necessary to define what, generically, should and should not be classified as an HEI “output”. Given fundamental similarities in the nature of the goods and services produced by HEIs to those in areas of the UK public sector (non-tertiary education, health and others), it is useful to begin by examining what is said in

¹⁶ The Open University head office is based in Milton Keynes but it receives some funding from the SHEFC in relation to its operations in Scotland.

two recent UK government publications concerning the definition of public sector outputs.¹⁷

2.5 Firstly, the UK Treasury “Green Book”¹⁸, which is the government’s manual for public sector project appraisal and cost-benefit analysis, distinguishes between *objectives, outcomes, outputs and targets*. Of these, for the present study the important definitions are those relating to “outcomes” and “outputs”. The Green Book states the following:

“There is usually a hierarchy of outcomes, outputs, and targets that should be clearly set out in an appraisal. *Outcomes are the eventual benefits to society that proposals are intended to achieve*. Often, objectives will be expressed in terms of the outcomes that are desired. But outcomes sometimes cannot be directly measured, in which case it will often be appropriate to specify outputs, as intermediate steps along the way. *Outputs are the results of activities that can be clearly stated or measured and which relate in some way to the outcomes desired*” (Green Book, para 4.3, present authors’ italics)

2.6 Some additional clarification is provided in Box 6 of the Green Book, which is replicated here.

¹⁷ Though it should be noted that Scottish HEIs are not public sector bodies, but rather are formally Non-Profit making Institutions Serving Households (NPISH). As will be seen later, this is actually non-trivial in the present context, since it has implications for the “market structure” of the Scottish HE sector. It may also be noted that Atkinson, in his report to be referred to in the text, indicates that much of discussion is relevant to NPISHs.

¹⁸ *The Green Book: appraisal and evaluation in central government 2003* (HM Treasury)

Green Book Box 6: Examples of Outputs and Outcomes.

Policy Area	Outputs	Outcomes
Job search/job Matching	number of job seekers assisted	value of extra output, or improvement in efficiency Job search
Development of Skills	number of training places and/or numbers completing training	value of extra human capital and/or earnings capacity.
social outputs: schools; health centres	exam results (schools) people treated (health centres)	Improvements in human capital (schools) measures of health gain (health centres)
Environmental Improvement	hectares of derelict land freed of pollution	improvement to the productivity of the land.

2.7 In truth, it would be possible to argue about some of the specific classifications of entries in Box 6. However, the basic distinctions being drawn are reasonably clear. *Outputs* are things that are produced. *Outcomes* are results which are causally derived **at least in part** from the utilisation or consumption of outputs. *Activities* are processes which contribute to the creation of outputs. Hence, there is a causally linked chain as follows:

Activities -----> outputs -----> outcomes.

2.8 For subsequent reference, some other points arising from Box 6 can be noted:

- Outputs seem to relate quite narrowly to the producing organisation or sector, while outcomes seem to have a broader, societal, orientation.
- *Alternative* measures are suggested for both outputs and outcomes.
- Both “natural” and monetary units of measurement are suggested.

2.9 A very recent report for the Office of National Statistics by Sir Tony Atkinson¹⁹, henceforth “the Atkinson Report”, is focussed explicitly on providing a detailed and critical review of the measurement of output in the UK public sector. Atkinson’s focus is on the National Accounts, with an emphasis on (a) estimating *real* growth in public output, and (b) providing robust output data for the estimation of public sector *productivity*. Although these ultimate objectives differ from those of the present study, there is a considerable degree of overlap in many areas.

2.10 Atkinson consistently emphasises the need for UK practice to reflect existing and forthcoming EU regulation and legislation regarding economic statistics. As such, in defining the concept of public sector output, he draws initially on the Eurostat (2001) *Handbook on Price and Volume Measures in the National Accounts*. He notes that the Handbook distinguishes between activities, outputs and outcomes as follows:

“*Activity* is, for example, the number of operations in hospitals or the number of patrols carried out by police.Activity indicators reflect what the non-market units are actually doing with their inputs and are therefore closer to the output.....Using activity indicators often does not lead to reasonable productivity numbers. However, for some collective services, activity indicators may be the only indicators that can be found.”

“*Output* is the preferred approach. However, it is not always easy to define exactly what the unit of output is. For individual goods and services it is in principle possible to define the output, since an actual delivery of that output takes place from the producer to the consumer...For example, for education, the output is the amount of teaching consumed by a pupil. For hospital services, the output is the amount of care received by a patient. For cultural services, the output is the amount of theatre plays

¹⁹ Atkinson Review: Final Report *Measurement of Government Output and Productivity for the National Accounts* 2005

consumed. For collective services, however, there is no transaction between producer and consumer since these are provided simultaneously to the society as a whole. It becomes therefore very difficult to define the output.”

“*Outcomes* are for example indicators of the level of education of the population, life expectancy, or levels of crime. Such indicators might be influenced by factors that are unrelated to the activity, and therefore are generally not representative of the output. In some cases, however, outcome indicators can be used as indicators for the quality of the output”

(All the above from Atkinson, pages 31-31, quoting the Eurostat handbook Paragraph 3.1.2.1).

2.11 The above quotes say a great deal, and also leave scope for further clarification. Like Atkinson, we discuss the latter further subsequently. In the meantime, the following highlights can be drawn from the Eurostat approach as summarised above.

- *Inputs* are not acceptable as a proxy measure of output. This will be discussed further in the context of the HEIs, but here it can be noted that these are “grade C” measures and will be invalid under EU regulations from 2006. Thus, numbers of lecturers, doctors, policemen, etc cannot be used as proxies for their sectoral outputs.
- *Activities* (essentially as in the Green Book) are the processes which lead to the creation of outputs. We could say that they represent the ***production functions*** by which inputs are transformed into outputs. Thus, “number of lecturers” is an input, but “number of teaching hours delivered” is an activity. Again, only in particular circumstances would activity measures be acceptable as proxies for outputs.
- The Eurostat *output* measure can at least be read as being somewhat different from that in the Green Book, seeming as it does to imply an element of consumption, which in Green Book terms would seem to be tending towards an outcome. In some cases these can probably be reconciled: for example, “aggregate student lecture hours attended” (Eurostat?) would be equal to

“lecture hours delivered times students attending”(Green Book?). However, if the Eurostat unit was “lecture hours attended and took notes” then this would involve more active consumption behaviour which would definitely seem to stray into Green Book outcomes.

- Wherever possible, *direct* measures of public sector outputs are what are required to conform to EU requirements.
- The Eurostat *outcome* examples again seem to overlap what the Green Book describes as objectives. However, more importantly, both agree (a) that outcomes have a broader, societal, dimension than outputs; and (b) that a particular outcome may only be partly attributable to a specific output. The latter point in particular means that, in general, outcome measures are not acceptable as proxies for outputs.
- A distinction is drawn between “individual” and “collective” goods. This seems to be essentially the same distinction as that between **private** and **public** goods made in the welfare economics literature. The significance of this distinction in the HEI context is discussed subsequently. Here, the important point to note is the recognition that the measurement of output for collective (public) goods may be very difficult.

2.12 In chapter 4 of his report, Atkinson discusses issues relating to the concept of public output in more detail and further reference will be made to points in this chapter subsequently. The relevance here is that he attempts to clarify some of the ambiguities created by the Eurostat definitions of activities, outputs and outcomes. Interestingly, he refers a great deal to education (albeit non-tertiary) in this chapter.

2.13 Fundamentally , Atkinson would like to distinguish outcomes from outputs by **defining** the latter in terms of the incremental effect on the former. Thus:

“...One answer can be given in terms of the degree of *attribution*. If we are confident that the outcome is largely attributable to the supplier, then we may incorporate the quality element into the definition of quantity.” (para 4.13)

“...What it does suggest is that what we want to measure is the *incremental impact on outcomes arising from the activities of the public sector*. In the case of Education, the objective should be to measure the improvement in individual education outcomes attributable to the schools.” (para 4.22)

“If we see the output of Education in terms of the acquisition of skills and qualifications, then their value increases with real earnings. If a University degree adds, say, 20 per cent to earnings.....” (para 4.36)

“It may be argued that education provided by schools is only partly responsible for the increased skills and qualifications.....If 60 per cent, say, of earnings gain is attributable to school education.....” (para 4.37)

2.14 However, it is important to note that Atkinson is not suggesting that it will be feasible to actually measure the first partial derivatives of a myriad of societal outcomes with respect to numerous public sector activities. Rather, he is indicating that simple *volume* measures of public output need to be *quality-adjusted*, and that examining the relevant outcome/output relationships may help in deriving the quality weights.

2.15 This concept of “quality-adjusted volumes” does seem to cause some difficulties in distinguishing outputs from activities, at least if paragraph 4.23 in Atkinson is anything to go by. Here he states:

“.....contrasted with the Eurostat Handbook reference to output as ‘the quantity of teaching (that is, the transfer of knowledge, successfully or not)’ (Eurostat Handbook, paragraph 4.12). This latter definition sounds more like an activity measure....”

2.16 While it is a moot point whether knowledge can be *unsuccessfully* transferred as opposed to *transmitted*, this definition does seem consistent with the output concepts in the Green Book and is consistent with a *passive* consumption interpretation of Eurostat paragraph 3.1.2.1.

Atkinson elaborates:

“Certainly, it does not seem reasonable to treat time wasted in the classroom as an output....”

2.17 However, largely through quotes from another author, Atkinson seems to suggest that “time wasted” is *all time in which the pupil does not actually benefit incrementally (i.e. learn something)*. This, of course, requires an *active* interpretation of consumption and seems to lead straight back into problems of distinguishing outputs from outcomes!

2.18 Two points of relevance can be extracted from the preceding discussion:

- To the extent that methodological, almost philosophical, problems arise in Atkinson, these primarily stem from working almost exclusively in *natural/volume* units. There comes a point in discussion of any *economic* activity where it is necessary to work in **value** units. Atkinson is, of course, entirely aware of this (see e.g. paras 4.19, 4.35 and in particular 6.17-6.21) but clearly feels it infeasible, or perhaps simply premature, to introduce *price weights* for valuing the majority of public sector outputs²⁰. The theoretical Appendix A proves that discussions of “economic value” or “economic efficiency” ultimately require output prices, even if these have to be estimated or inferred (shadow pricing).

Thus, Atkinson’s “unsuccessfully transferred teaching lesson” **is** an output, but *one of low economic value which would be reflected in its low revealed economic efficiency price*. It is not that a poor lecturer does not produce any output, it is rather that the output is not worth very much²¹

- It may be inevitable that a universally accepted allocation of items as activities, outputs or outcomes is unattainable. In any specific case study, what *is* essential is to avoid **double-counting** the volume or value of any item.

²⁰ In fact, the lack of public sector prices is not quite such a problem for Atkinson since his primary goal of obtaining real output *indices* can be reasonably well met using quality-adjusted quantity measures.

²¹ In fact, in the particular “unsuccessful lesson” case, Atkinson could give it a low output “worth” by giving it a low quality weighting.

Thus if a measure of final teaching output of a university is, say, “degrees awarded”, then “teaching hours” cannot be included as a separate, additive, measure, *since it is clearly an activity contributing to the production of the output “degree award”*.

In fact, this suggests a helpful generalisation: *the defining of an item as a final output helps to define others related to it as activities or outcomes*.

Thus, in the present case study, the definition of a set of HEI final outputs will in and of itself help to assign other items as activities or outcomes.²²

2.19 In any event, the key point to be noted at present is that the fundamental definition of HEI output in the present study is entirely consistent with existing and forthcoming UK and EU requirements: that is, the measure required is *HEI direct output*. “Inputs” are not acceptable; “activities” should only be used where there is no alternative, and “outcomes” should be employed primarily to derive “weights” to be applied to the various direct outputs.

2.20 The third key aspect of the present study is that it is concerned with measuring the *economic value* of the Scottish HEIs. As suggested above both economic theory and practice demonstrate that, if one wishes to address *all* the issues concerned with resource allocation and use, then analysis of the outputs (and inputs) in **monetary** units is essential. The value of an HEI’s production of any commodity is:

Volume of output	X	Price per unit
Produced		of output

2.21 Clearly, therefore, the most direct way to estimate the value of production of an HEI is to quantify the volumes of all the designated direct final outputs and multiply (or weight) these by the appropriate output prices. In fact, apart from being obvious, this direct approach has two major advantages:

²² Of course, for this to be **useful**, the defined set of HEI outputs has to be “sensible” and “generally acceptable”

- (a) Depending on whether a financial, economic, or social evaluation is contemplated ²³, then application of the “correct” prices to the “correct” quantities will *guarantee* to give the correct value for incorporation in the subsequent analysis.
- (b) Even if the attempt to estimate correct prices fails (see immediately below), then the accumulated information on the direct output volumes, particularly if quality-weighted, will provide an extremely useful dataset for certain analyses of aspects of the performance of HEIs.

2.22 As indicated above, there will be difficulties in even defining the set of HEI outputs, and there will certainly be difficulties in measuring the volumes of these outputs, since it is very unlikely that the universities collect and process all the data required. In absolute terms these difficulties may be large (Atkinson spends over 200 pages considering the technical issues involved), but they are *relatively* small compared to the difficulties involved in estimating the “correct” prices. This is because, as discussed furthering more detail subsequently, certain characteristics of the Scottish HEIs and the economic environment in which they operate create a situation in which most of the available price data (which is in any event limited) refers to the “wrong” prices. In fact, as soon as one wishes to move beyond simple financial appraisal towards economic or social evaluation, one is confronted with fact that **there is virtually no *observable* information at all on the “correct” prices to be applied to the outputs of the HEIs.**

2.23 Note the crucial difference: by the appropriate application of statistical resources, the HEIs themselves can collect, process, and provide the required volume data on direct outputs. However, the maximum data on prices which the HEIs could provide relates to the “actual” prices they receive for their products, and these are rarely the correct prices for assessing the economic value of the institutions to Scottish society. In fact some of the correct prices derive from interactions between the HEIs and the rest of society *which neither party is necessarily aware of* (in particular, externalities). Thus there is not a “data fix” on the price side: estimation through modelling of the type envisaged in the present study is required.

²³ See discussion in Section 4

2.24 Though very difficult, estimation of correct prices and values for Scottish HEIs is not necessarily impossible in principle. The fact that this information would so greatly enhance the HE policy debate in Scotland is the main reason that this project assesses the feasibility of measuring the “economic value” of the HEIs.

2.25 To round off this section, **Table 2.1** is a stylised schematic of what a complete cost-benefit analysis of “the Higher Education Sector in Scottish society” might encompass. This indicates the likely domain of a large-scale research project, and puts the range and scope of the present study in the broader context.

Table 2.1 Schematic for HE CBA

	HEI	Student	Government	ROS	Society
BENEFITS: Actual/ imputed income for products	* v				*
Net Graduate Premium		*			*
Externalities	*v?		*?	*?	*?
GROSS BENEFITS					
COSTS					
HEI Operating Costs	*				*
Private Payment for HEI Products		*		*?	*
Public Payment for HEI Products			*		*
Forgone Student Income		*			*
Government Taxes / Subsidies	*	*	*	*	0
GROSS COSTS					
NET BENEFITS/ COSTS					

* likely to be important within Scotland

? might be in Scotland but will not be revealed by current study

v what we are looking at

2.26 Along the top of the table are the separately identified groups of agents for which it is felt Higher education is “important”, and/or on which policy attention wishes to

focus. Further subdivision of the Rest of Society (ROS) would be possible; for example, separating out “business”.

Down the left of the table are the benefits and costs associated with higher education activities....those identified are known to be important in the context of HE, but it is not claimed the list is comprehensive.

Each cell of the table, therefore, shows in value terms the benefit or cost accruing to that group in society arising from higher education activities. Based on the pre-existing research literature and the authors’ tacit knowledge, symbols in cells indicate cost or benefit flows of possible importance in the Scottish context.

Cells with an * are *very likely* to be important in Scotland, while cells with an *? may be important, but this would have to be validated or refuted by applied research. Finally, cells with a v indicate those flows which are the principal focus of the present study, and relate to the “economic value” of the outputs of the HEIs specifically.

3 Fundamental Issues in Measuring HEI Prices and Values: Efficiency, Equity and Other Considerations

This chapter covers the necessary welfare economic background in order to understand the issues relevant to the rest of the study, its methodology and conclusions. As such it addresses a diverse and complex array of issues. Discussed are the distinctions between public and private goods, market failure and externalities, the value of imperfect information and the presence or absence of perfect capital markets. Clearly illustrated is that much of Higher Education can be shown to be a private rather than a public good since it does not satisfy the conditions of non-rivalry or non-excludability. The study illustrates the key economic arguments both in the form of equations and graphs.

Starting with the conditions and outcomes for a perfectly competitive environment for Scottish HEIs the study then moves to an analysis which more accurately describes the current situation, that of an administered market with unequal players. As we discuss, in a perfectly competitive market the second fundamental law of economics describes how government may address equity considerations without affecting efficiency. Perfect competition within Scottish HEIs is an idealised concept, based on a number of simplifying conditions. To the extent that these are not in fact valid then there is said to exist market failure –the definitions and scope of market failure in HEIs can then be derived.

It is necessary to identify and explain in detail market failure, that is the conditions under which the Scottish HEI sector may fail to operate /efficiently. On this basis it is necessary to explore market structure and potential for monopoly power within the Scottish HEI sector – monopolies are less efficient than competitive markets and so it is necessary to identify where and when this might occur. One of the most important issue addressed is the presence of externalities, defined as “the effect of an activity on an individual who is not directly involved in undertaking that activity”. Many externalities can be identified and the treatment of them is of importance regarding the final outcomes of any study. We list socio-cultural and economic externalities occurring within Scottish HE and set this in context, for example in terms of agglomeration effects discussed in the less formal literature and in the formal approach firmly rooted in economic growth theory.

This chapter also seeks to examine the motivations and objectives of the Scottish HEIs –universities are usually described as non-profit making organisations but it can be shown that the objectives of universities are often multi-faceted and complex. A further extension to this seeks to address exactly who the “owners” and “shareholders” are in a HEI and who the “managers” run the institution for. Broadly, it can be accepted that universities are not profit maximisers in the strict sense but the key is the extent to which this market failure does or does not impinge on economic efficiency issues – the most important discussion here is one outlining the difference between allocative and technical efficiency as it applies in this context, concluding that it is possible that many HEIs are doing the wrong things very proficiently.

Much financial data necessary for the operations described within this chapter are collected, processed and utilised within the HEIs themselves and a considerable volume is actually available to interested third parties through university accounts and publications of HESA and others. Therefore the real scope of this chapter is not the availability of revenue data but whether these revenue values accurately measure “economic value” or “social values”.

3.1 As indicated in the previous section, in principle the “value” of an HEI’s production of any commodity is obtained from the simple formula:

$$\text{Value} = \frac{\text{quantity of output produced}}{\text{price per unit of output}} \times \text{price per unit of output}$$

3.2 In fact, if *actual* prices received are used in the formula, then the “value” obtained is the **revenue** earned by the HEI from the production of that commodity. Marrying this revenue data with equivalent **cost** data (also derived from *actual* prices) provides the basic information requirements for a variety of *financial analyses*. Typically undertaken by finance offices or accounts departments and validated by auditors, such analyses provide essential information on the financial viability of individual courses, departments and even institutions. This financial data is also used to derive numerous “accounts-based” performance indicators and business ratios.

3.3 A great deal of financial data of this type is collected, processed and utilised within the HEIs themselves and a considerable volume is available to third parties through university accounts and the publications of HESA and others.²⁴ Therefore, the issue for this study is not the availability of revenue data, but whether these “revenue values” accurately measure “economic values” or “social values”.

3.4 To give an initial example of where differences might arise, consider the case of a well-attended public lecture given by an academic. The actual price of entry is zero and hence the revenue value is zero. However, at least the *social* value must have been greater than zero, otherwise citizens would not have voluntarily attended. In the language of chapter 2, for a social evaluation of this output the “actual” price is not the “correct” price.

3.5 For a more rigorous analysis of these different concepts of “prices” and “values”, and the importance of each in evaluating the Scottish HEIs, it is necessary in the first instance to draw on the fundamental economic theory and principles elaborated in Appendix A.

²⁴ See, for example, HESA *Resources of Institutions*

3.6 In Appendix A, four different, but not mutually-exclusive, types of economic efficiency are rigorously defined. All everyday concepts of “value for money”, etc. relate to one or more of these types of efficiency. An economic system embodying all of these types of efficiency is termed *Pareto efficient*. In such an economy, it is not possible through any change in production, trade or consumption to make some agents better off without making others worse off.

3.7 Appendix A then describes an idealised market structure known as Perfect Competition. This is an abstract construct derived from a number of stringent assumptions. The crucial point here is that The First Fundamental Theorem of Welfare Economics *proves that every perfectly competitive economy is also a Pareto efficient one*. What guidance does this give us in assessing the value of HEIs?

3.8 Suppose that, in fact, the Scottish HEIs were operating in a “perfectly competitive environment.” In this case, the HEIs would behave as profit-maximising enterprises able to buy and sell what they wish in product and factor markets, but unable to influence the market prices (i.e. they are “price takers”). The First Fundamental Theorem tells us that the *actual or market* prices received by the HEIs would be exactly the *economic efficiency* prices. Hence the observed revenue values would be equal to the economic values.²⁵ In this special case, the *financial* information also provides the required *economic* information.

3.9 In reality, neither the HEIs nor anyone else operates in a *perfectly* competitive environment. However, the HEIs service many different markets, at least some of which may be sufficiently competitive to allow the observed market prices to be regarded as close approximations to the economic efficiency prices.²⁶

²⁵ Also as discussed in Appendix A and Chapter 4, unless we wish to impose distributional social weights, then economic value is also equal to social value.

²⁶ In the literature, this is described as “workable competition”.

3.10 Hence, in seeking to value the outputs of the HEIs, economic theory tells us to examine the competitive conditions in the markets in which they operate. If these are “workably competitive”, then the actual market price will be close to the “correct” economic price, and the revenue received for the outputs will be a good approximation to the true economic value of those outputs. In these cases, there is no need for further imputations or “shadow pricing”.

3.11 In the “perfectly competitive HEI” scenario, what implications are there for government policy? In terms of the market environment, each institution will be cost-efficient, technically efficient and allocatively efficient. Individually and as a whole sector, the HEIs will be producing the best possible basket of goods to meet consumer demands at the lowest possible cost. In this situation, the only requirement of government with respect to the market would be to establish a regulatory framework to ensure the HEIs continued to operate competitively (contract laws, competition laws, etc).

3.12 However, as discussed in Appendix A, even in this scenario, there is a possible role for government intervention with regard to *distributional* issues, since the actual competitive outcome achieved may not be regarded as “fair”, depending as it does on the initial allocation of resources. The Second Fundamental Theorem of Welfare Economics indicates how, *in theory*, the government may address **equity** considerations without adversely affecting efficiency. Specifically, the government should make “lump sum” redistributions from the “better off” to the “worse off” and allow the competitive markets to operate unhindered.

3.13 In the Scottish Higher Education *sector*, the most important policy-relevant distributional issues are those concerned with ***equality of student access to HE***. Specifically, government wishes that academically qualified students should be able to undertake higher education studies irrespective of background social and economic characteristics (such as gender, race, religion, or income (*ability to pay*)). The motivation for policy intervention comes from years of Scottish evidence that individuals of lower income and/or from particular social classes appear disproportionately *not* to enter higher education.

3.14 The key issues for the present study are in what ways such “student equity” considerations invite government intervention in *the operations of the HEIs themselves*. In the first instance, it may be noted that many of the reasons given for groups of individuals consistently not entering HE (myopia, risk aversion, asymmetric information, etc) appear to relate more to **market failure** than distribution per se. Where relevant, these are discussed in more detail subsequently. Here, it can be noted that economic theory tells us that market failures should be addressed directly rather than indirectly through redistribution, since only the former can increase efficiency as well as equity and hence represent an actual Pareto improvement.

3.15 To the extent that there are distributional issues, especially with regard to ability to pay, then as noted above, theory tells us that these should be addressed by direct transfers among the relevant groups of economic agents, in this case from the rest of Scottish society to capable potential Scottish students. In fact, there are two distinct aspects to the “ability to pay” issue:

- (a) the requirement for the student to find the means to sustain him/herself during his time at university, since there is no wage paid for studying. This is generally described as a “maintenance ” requirement.
- (b) The requirement for the student to pay the HEI for teaching outputs and other services. These are generally referred to as “tuition costs”.

3.16 Regarding maintenance issues, the fundamental theorems indicate these should be treated entirely separately from the operations of the HEIs themselves. If society wishes to give maintenance support to students, this should be done through the general tax/transfer system, not through the HEIs. Generally speaking, this is the approach adopted in Scotland.

3.17 With regard to tuition costs, theory indicates that, to the extent government wishes to provide support, this should be done by providing resources directly to the potential students themselves, who in turn utilise these to purchase HEI outputs at prevailing market prices. As has been proposed before, this could be done through some form of tuition cost voucher scheme. Depending on the value of the voucher, some HEIs may choose to seek prices lower than this and hence be able to offer

students “deals”; others may seek higher prices, in which case prospective students are free to supplement the voucher value from other resources. In all cases, the *outcome* prices and quantities will be determined by the free market interaction of supply and demand, thereby ensuring efficiency. Interventions in the form of “fixing” the prices the HEIs can set or in the form of setting targets/quotas *for the HEIs* for students with specified socio-economic characteristics are not desirable: theory proves that the distortions created will inevitably be to the detriment of efficiency.²⁷

3.18 The “student shopper with voucher” is not the approach adopted in Scotland, where (a) government, not students, purchases products from the HEIs, and (b) HEI tuition prices are fixed within relatively small margins. The former, agent-principal approach, could be argued to be in response to informational market failures (see below), though it is not the only way to deal with this. The latter, price or quantity fixing, seems more difficult to justify from economic principles. Perhaps it results from equating “equity” with “sameness”; i.e. a view that all the HEIs should offer the “same” product at the “same” price. This is, however, destructive to the static and dynamic efficiency gains of competitive market forces, which in order to be realised require freedom of choice among a diversity of alternatives: the fast-food outlet plays as important a role as the five-star restaurant.

3.19 Thus, economic theory indicates that student “equity” issues should be dealt with through direct transfers to the students from the rest of society. The role of the HEIs is to efficiently supply the products which satisfy the revealed student demands.

Two final points on equity may be noted:

1. No efficiency problems arise if HEIs *voluntarily* choose to offer student scholarships; indeed competitive market forces will almost certainly lead to many HEIs choosing to do this.
2. *If* there was evidence that the Scottish HEIs were ***actively discriminating*** against students from certain backgrounds through irrational prejudice, then

²⁷ The policy debate on this area is still very much alive and ongoing. Currently in Scotland there *are* targets set for student numbers, with a ‘premium’ attached to students from certain postcode areas.

the government could quite properly deal with this through appropriate anti-discrimination legislation.²⁸

3.20 Returning now to the main focus of the study, it is clear that much of the theoretical, applied and policy-related argument to this point is premised on the supposition that the HEIs operate in an approximation to a perfectly competitive environment. However, as summarised in appendix A, perfect competition is an idealised concept, based on a number of simplifying assumptions. To the extent that any of these assumptions are not in fact valid, then there is said to be **market failure**. It is extremely important to give consideration to “market failures” in the context of the HEI economy, since, depending on the nature and prevalence of such failures, any or all of the following may be true:

- (a) the HEIs may not be Pareto efficient; that is they may be cost/technically inefficient and/or allocatively inefficient.
- (b) Following from (a), the observed prices for HEI outputs may not be good approximations of the economic efficiency prices, in which case the revenue value of output will not be a good approximation for the economic efficiency value.
- (c) Direct intervention by government in the operations of the HEIs may be justified *on the grounds of improving efficiency* (i.e. a completely different justification from the “equity” considerations discussed above).

3.21 In short, the existence of significant market failures can modify, or even invalidate, the “strong” arguments and conclusions drawn from the Fundamental Theorems, insofar as they are dependent on the assumption of perfect competition.

²⁸ Thankfully, this appears **not** to be the case in Scotland. Specifically, the only discrimination-related variable directly under HEI control is “the percentage acceptance rates among groups of equally-qualified applicants from different socio-economic backgrounds”. Taken year-on-year, for the Scottish HEIs these percentage rates appear to be approximately equal across all social classes; that is, evidence of no discrimination.

The economics literature distinguishes certain generic *types* of market failures, and this classification scheme is used to organise the following discussion of market failure in the specific context of the Scottish HEI sector.

Motivation and objectives

3.22 As demonstrated in Appendix A, one of the assumptions of perfect competition (and one which is necessary to ensure the economy attains Pareto efficiency) is that all producing organisations are *profit-maximisers*.

3.23 It may seem immediately obvious that, since Scottish HEIs are legally established as non-profit making organisations, they are almost automatically not profit-maximisers. However, this is an over-simplification. HEIs can, and do, on occasion earn “surpluses” (a sector-specific euphemism for profits); indeed, it could be fairly said that many HEIs *do* “seek to maximise disposable surpluses” on at least some of their activities.²⁹

3.24 Rather, the key points arising from the status of Scottish HEIs as NPISH relate to the implications this has for *ownership and control*, which in turn determines the plausibility or otherwise of assuming profit-maximisation is the fundamental organisational objective. From the one person owner/manager firm through to the largest PLC, the owners of the organisation gain their income from it in the form of actual or deferred (in the case of capital gains) distributed profits. Since it is rational for the owners to wish to maximise their own incomes, they will seek to ensure that the organisation maximises its profit, which is the source of their incomes.

3.25 In truth, in many Scottish companies, the *managers* are salaried employees while the *owners* are un-salaried shareholders. This undoubtedly gives management a certain degree of discretion in setting its *own* objectives on a day-to-day basis. However, owners are ultimately able to compel, or discipline, managers to satisfy *their* objectives through hiring and firing policies and even company take-overs. Hence, in any private for-profit business, the earning and increasing of profits will

²⁹ And indeed the reports of the Joint Costing and Pricing Steering Group explicitly encourage HEIs to generate surpluses on *non-government* work

always be the core strategic objective, and this will frequently be reflected operationally in profit-related targets and reward structures.

3.26 In the case of the Scottish HEIs, it is actually very difficult to identify who, if anyone, the owners actually are. However, the important point is that the legal instruments by which the institutions were established exclude the distribution of profits to “owners” as a return on their investments and/or entrepreneurial inputs. Any surpluses earned have to be spent on recognised proper activities of the HEIs themselves.³⁰ Hence the managers of HEIs, which includes academics in managerial functions, are not constrained to a core objective of maximising profits for a cadre of external or internal owners. Rather, applying Williamson’s managerial discretion model³¹ to the analysis of NPISH behaviour (see, for example, Pauly and Redisch 1973)³² suggests that HEIs will maximise their *own* utility functions subject to a financial viability constraint. Typically, such utility functions will include elements relating to size, prestige, job satisfaction, and others. Furthermore, the utility function formulations for non-profit institutions generally incorporate the idea that the relevant decision makers take cognisance of *social* outcomes and objectives as well as strictly *private* ones.

Accepting that Scottish HEIs are not profit-maximisers in the strict classical sense, the key is the extent to which this particular “market failure” does, or does not, impinge on economic efficiency.

3.27 Firstly, and crucially, non-profit maximisation *does not preclude an organisation from being cost/technical efficient*. As shown formally in Appendix A, cost-minimisation depends only on input-prices and the technology available to produce a given commodity. In fact, because of internal and external pressures, it can

³⁰ This legal framework of the HEIs may itself be a source of market failure, since it may make it difficult or impossible for the institutions to raise investment funds from the financial sector, the Stock Market or individual venture capitalists. This will be particularly true of “risky” projects, since the would-be investor has to see an upside potential as well as a down-side risk. For an overview of the extent to which HEIs can or cannot borrow, see HEFCE 2004/13 *Private investment in higher education*

³¹ Williamson O.E (1970) *Corporate Control and Business Behaviour*

³² Pauly MV & Redisch M (1973) *The Not-for profit Hospital as a Physician’s cooperative* American Economic Review 63:87-100

reasonably be argued that Scottish HEIs *are* cost-minimisers, or perhaps better, *seek to be* cost-minimisers. Internally, separate power groups in an HEI seek to maximise their own sub-utility functions (increase departmental staff, obtain more laboratory equipment, etc). Part of the bargaining process involves each group demonstrating that the improvements it seeks for itself will be undertaken at the lowest possible cost; that is, at *minimum sacrifice* on the part of the other groups. Externally, HEI clients exert ever-increasing pressure on the HEIs to offer “value for money”, with the value targets and performance indicators frequently (usually?) being expressed in terms of **cost** criteria.

3.28 Secondly however, the fact that the Scottish HEIs are non-profit maximisers *does mean that they may not be allocatively efficient*; that is they may not produce the “correct quantities of the correct goods”. As shown in Appendix A, profit-maximisation is the motivation by which the signals provided by external output prices are translated into the efficient production of the goods *demand*ed by the market. This is not to say that the HEIs are able to ignore the market (ultimately there is the financial viability constraint), but they do have a certain discretion in how they respond to market signals, being able to address internal as well as external objectives, and “social” as well as economic goals. Furthermore, if other market failures mean that the market signals provided to the HEIs are not economic efficiency prices (see below), then they will not be allocatively efficient even if they tried to be by mimicking profit-maximising behaviour.

3.29 To summarise, the fact that the Scottish HEIs are not profit-maximisers is a potential source of market failure. It does not mean that they need be cost/technically inefficient; indeed, in the real world it is likely that Scottish institutions are cost-minimisers to a first approximation. However, particularly in combination with other price distorting market failures, the lack of a profit motivation does make it unlikely that the HEIs are allocatively efficient. It is more probable that in various parts of the Scottish HEI sector, institutions are “doing the wrong things very proficiently”. That is, cost/technical, but not allocative, efficiency is achieved.

Market Structure and Monopoly power

3.30 The market structure underlying The Fundamental Theorems is that of perfect competition. Among other things, this structure assumes that individual buyers and sellers are all price takers i.e. their individual actions do not affect the market price, though they can buy or sell as much as they want at the given market price. The extreme opposite form of market structure to perfect competition is **monopoly**, which is a market in which there is a *single* buyer or seller. In this case, the monopolist does have **market power**. Specifically, the monopolist can determine the price at which he wants to buy or sell and let the market determine the quantity, or he can determine the quantity he wishes to buy/sell and let the market determine the price: typically the monopolist will select the price/quantity combination which maximises his own utility.

3.31 The important point here is that, as demonstrated in any intermediate textbook³³, on a comparative static *ceteris paribus* comparison ***a monopoly market is less socially efficient than the equivalent perfectly competitive market.*** There is a reduction in social welfare which is called the *deadweight loss of monopoly*. Dropping some of the “other things equal” assumptions makes the situation more complicated, but that is not the issue here: theory tells us that the existence of monopoly power creates a strong presumption that there is market failure.

3.32 Given this, it is necessary to examine whether or not there are elements of monopoly power in the Scottish HEI market. As in any market, there are both suppliers and customers. On either side of the market, if there are “many” buyers/sellers, then competition among them will mean that the degree of monopoly power is insignificant; if there are “few” buyers or sellers, then agents on that side of the market may indeed exercise a degree of monopoly control.

3.33 Considering firstly the supply of Higher education products in Scotland, a significant fraction of production is supplied by the Higher Education Institutions. At

³³ Eg Mas Colell A, Whinston M, Green J (1995), *Microeconomic Theory*, Robert S Pindyck and Daniel L Rubinfeld (2000), *Microeconomics*, 6th ed, or Varian Hal R (2000), *Intermediate Microeconomics*,

the present time, there are 20 of these receiving funding from the SHEFC, legally constituted as independently operating entities, and providing broadly similar portfolios of outputs. In general terms, this number of independent agents would suggest that that side of the market was broadly competitive: in this case that there is little supplier monopoly power. However, there are three important caveats which must be considered before this conclusion can be drawn:

- (a) Some of the institutions are distinctly larger than others, and may be able to exercise a degree of monopoly power on behalf of the group as a whole through formal or informal arrangements.
- (b) In certain instances, the Scottish HEIs act together to jointly supply products to a particular market or customer, and in these cases they may have a degree of monopoly power.
- (c) There are niche markets for specific HE products which are supplied by only one or a small number of Scottish HEIs. Again, in these markets, the supplier(s) may exercise a degree of monopoly power.

3.34 These points imply that simply “counting” the number of Scottish HEIs (with a view to proxying competition among these institutions themselves) is insufficient to establish whether or not there is supply-side monopoly power in the Scottish market for higher education products.

3.35 However, the case for arguing that the supply side is “competitive” (rather than “monopolistic”) is greatly strengthened by the fact *that the Scottish HEIs are not the only agents supplying products into the Scottish HE markets*. In particular:

- (a) in terms of teaching, HE courses in certain subjects and to certain levels are offered by a number of Scottish *Further Education Institutions*.
- (b) In terms of teaching, Scottish customers can choose to study elsewhere in the UK or even abroad. Conversely, students domiciled outside of Scotland will only consider studying at a Scottish HEI as one of a very wide range of options.
- (c) In terms of teaching, the Open University and other providers of distance-learning HE courses are actually or potentially active in Scotland.

- (d) In terms of research, for many proposed programmes the Scottish HEIs are in direct competition with HEIs elsewhere in the UK, or even in the EU as a whole.
- (e) In terms of research /knowledge transfer, for many programmes the Scottish HEIs face competition not only from non-Scottish HEIs, but also private consultants and government research institutions. In some cases, these competitors are very large international organisations.

3.36 Thus, in the majority of their activities, the Scottish HEIs face actual or potential competition from a wide range of alternative local and external suppliers. In such circumstances, the theory of “workable competition” indicates that the Scottish HEIs will tend to operate as if they were in a perfectly competitive market on the supply-side.³⁴

3.37 Based on actual and potential competition, it can be reasonably argued that the Scottish HEIs supply in the context of an approximately perfectly competitive environment: there is no significant market failure arising from supply-side market power.

3.38 On the demand side of the Scottish market for HE, the situation is immediately and obviously different. A recent study has shown that some 67% of the total revenue of the Scottish HEIs came from a single customer: the UK (subsuming Scottish) public sector.³⁵ Taken at face value, a single customer market share of this size would indicate a considerable degree of market power on the demand side: a single buyer is termed a *monopsonist* and (as in this case) a dominant buyer is termed a *quasi-monopsonist*. The degree of market dominance enjoyed by the UK public sector varies in different Scottish HE sub-markets:

- it is probably strongest in the market for teaching domestic (Scottish and rest of UK) undergraduate students where, as indicated previously, in the large majority of cases the UK government acts as agent purchasing HEI teaching

³⁴ There may still be certain niche markets (“medieval Scots law”?) in which only a small number of Scottish HEIs can provide the supply; in which case they may enjoy monopoly power in those markets).

³⁵ *The economic impact of Scottish Higher Education* McNicoll, Kelly & McLellan, Universities Scotland 2003

outputs for student principals. In particular, public *Funding Councils* pay a certain unit price to HEIs to provide specified units of taught output to a designated number of eligible students.

- It is also strong in certain areas of HEI research, notably in what is (fairly loosely) described as “basic” research. A very high proportion of HEI income for these types of activities comes either from the aforementioned Funding Councils or from public sector *Research Councils*.
- UK public sector dominance is probably weakest in the area of postgraduate teaching of international students, where public sector support (if any) is typically provided by the students’ own government.

3.39 Assuming that the public sector enjoys quasi-monopsonistic power in some Scottish markets for HE products, what are the implications? Economic theory demonstrates that, in comparison with a perfectly-competitive equivalent, a monopsonistic market will be *inefficient* and lead to a *lower outcome level of social welfare*. In particular, it can be shown ³⁶that, compared to perfect competition, a profit-maximising monopsonist will purchase a **lower level of output at a lower price**.³⁷ However in the present case, two important caveats to this conclusion must immediately be made:

- (i) like the HEIs themselves, UK public agencies would not generally be described as profit-maximisers. Their utility functions will typically contain variables other than “profits”. Thus it would be wrong to assume that the UK public sector will always seek to use its monopoly power to extract the maximum economic rent from the market situation at the expense of the HEIs.
- (ii) *Other* sources of market failure (see below) may make it desirable, even essential, that the public sector is the main purchaser of some HEI products. Alleviation of the problems caused by such market failures may

³⁶ See Stiglitz J (2000) Economics of the Public Sector

³⁷ Which is precisely the argument being made by small UK farmers with regard to large supermarket customers.

create efficiency gains which more than compensate for any efficiency loss attributable to monopsonistic power.

3.40 However the market structure of the Scottish HE sector as formally described, and the real world interactions between the HEIs and the public sector, has led to a structure of what is described in the literature as “administered prices”. That is, the prices agreed between the HEIs and public agencies are typically derived from relatively simple formulae³⁸, usually based on cost considerations (such as “direct cost +% overhead” or “last year’s price +inflation”...and so on). Reflection will indicate, and economic theory will verify, that the market prices resulting from such procedures need bear little relationship to economic efficiency prices. As has been stated before, in such circumstances the “revenue value” of the HEIs sales to the public sector will not be a good approximation to the true “economic value”; the HEI sector is extremely unlikely to be allocatively efficient and its contribution to Scottish social welfare will not be maximised. Thus, the market structure of the Scottish HEI sector *is* a source of market failure, leading almost inevitably to allocative inefficiency, though not necessarily to cost/technical inefficiency. The wrong volumes of certain HEI outputs may be produced, though each unit of these outputs may be produced at minimum cost.

Public Goods

3.41 It must be stated at the outset that an economic public good **is not** any good produced by the public sector; in fact, as will be seen subsequently, most goods produced by the public sector are “private” in the economic sense.

Rather, an economic *public good* is one which has the following fundamental characteristics:

- it is **non-rival** in consumption. That is, one person’s consumption of the good does not detract from or prevent another person’s consumption of the same

³⁸ That is, “simple” in the fundamental economic sense. They may be extremely complex in the bureaucratic sense.

good. Put formally, an additional person's consumption does not incur any incremental opportunity or resource costs.

- It is **non-excludible**. That is, once the good has been produced, it is not possible to prevent any individual enjoying the benefits of it.³⁹

A *pure public good* is one which is completely non-rival and completely non-excludable. In the real world, formally pure public goods are rare, but national defence and lighthouses are frequently cited as being very close approximations.

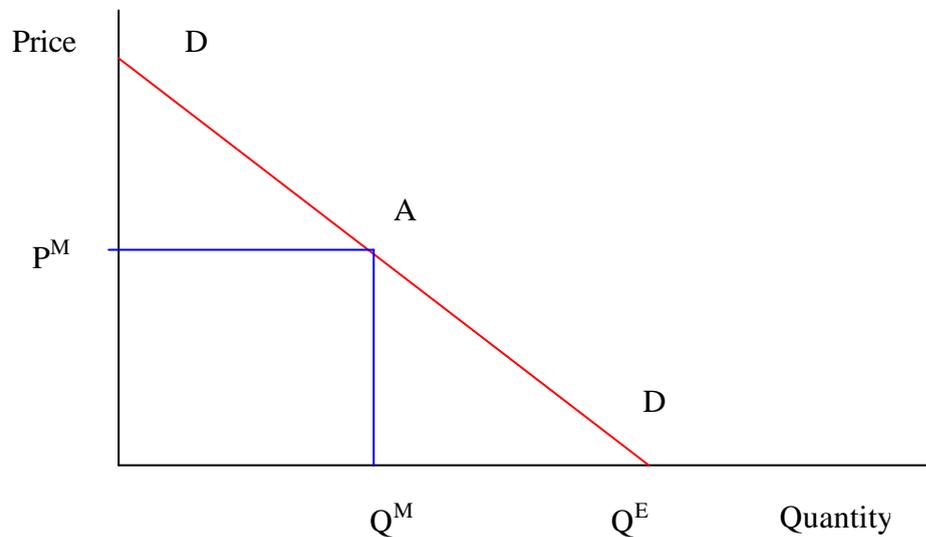
3.42 Given this definition, the first point to be considered is why these characteristics of a public good lead to market failure. Figure 3.1 shows the demand curve for a public good, DD. Every point on DD above the quantity axis represents a situation where at least one person would benefit from incremental consumption of the good and, since there is no cost to that person's consumption, undertaking it represents a clear gain in social welfare. Thus the optimum efficient volume of the public good is Q_E , but at this quantity *the price is equal to zero*. In fact, the theoretical Appendix A indicates that this must be the case, since economic efficiency requires that:

$$\text{Price} = \text{Marginal Cost}$$

And, since in this case marginal cost is zero, then the economic efficiency price must be zero.

³⁹In some textbooks, the characteristic of **non-rejectability** is also mentioned; that is, once produced, it is impossible for any individual not to consume the good even if they wanted to. However, this property is neither necessary nor sufficient to define a public good.

Figure 3.1 Consumption of a Public Good



3.43 The *problem* of course is that, with a zero price (and revenue stream), there is no incentive whatsoever for the *private* sector to produce this good. In fact, if there are set-up costs involved in production start-up, then a private company will be guaranteed to make a loss. Hence, in the case of a pure public good the market failure is as follows:

“ although production of a certain quantity of the good would be economically and socially efficient, such production will *not* be undertaken in a perfectly competitive economy consisting of private (profit-maximising) firms.”

The key point is that, in the case of pure public goods, government intervention in the market to ensure production of the required quantity is justified *on strict economic efficiency grounds*.

3.44 Even if a product only has some of the characteristics of a public good, there may still be problems of market failure. Consider a good which is non-rival but excludable (scrambled TV channels are an excellent, if relatively recent, example). In

this case, it is possible to charge a positive price and therefore there is an incentive for a private company to supply, as Sky has successfully demonstrated in the case of television. This situation is also shown in Figure 3.1, where the private sector chooses to supply at price P_M , at which price quantity Q_M is demanded. It can be seen immediately that Q_M is less than Q_E , which is the efficient level of consumption of this good. Hence, the combination of non-rival and excludable characteristics creates a problem of **under-consumption**, which in turn leads to a loss of social welfare, shown in Figure 3.1 by the triangle $Q_M A Q_E$.

3.45 Now consider a good which is non-excludable, whether it is rival or not. Examples might include national defence, police services, etc. To supply such goods, the private sector would wish to charge for them. However, a potential private producer would immediately recognise there was a **free rider problem**. Specifically, once the good is provided, there is no way to prevent anyone from benefiting from it, and hence individual consumers would not pay for it while still enjoying the benefits. Thus private producers will not supply the good, creating the problem of **under-supply**.

Given that public good characteristics cause problems of market failure, the next key point to consider is the extent to which the products of the Scottish HEIs do or do not have these characteristics.

3.46 As recognised in UK and international manuals, the large majority of an HEI's *teaching* outputs are essentially **private** goods. Clearly, they are excludable; however it used to be argued they were non-rival, at least to the point where larger class rooms were required to accommodate more students. In Scottish HE today, this latter argument is no longer valid: increased continuous assessment and feedback, provision of student learning packs, assistance with personal development plans, etc all mean that the marginal cost of teaching an incremental student is significantly greater than zero, in fact probably close to average variable cost. Thus, teaching provision is excludable and rival: a private good.

3.47 In some areas of HEI research (including non-student "knowledge transfer") the situation may be very different. Indeed so-called *basic research* would seem to be

almost defined in terms of that which embodies the characteristics of non-rivalry and non-excludability. Some problem-solving work undertaken for a specific customer on a client-confidential basis is clearly a private good⁴⁰ However, it seems probable that a significant fraction of an HEI's research/knowledge transfer portfolio will have at least some public good characteristics. In particular, many products may be non-rival, but at least partly excludable through client confidentiality clauses, patenting, copyright, etc. The problem is that, to the extent that the HEIs can exclude a non-rival good, there is under-consumption of that good. On the other hand, if the HEIs cannot exclude consumption ("protect their intellectual property rights"), then they will under-supply the good.

These market failures can only be alleviated by public sector intervention in the affected components of the research/knowledge transfer market: either the public sector can pay the HEIs to produce the required volumes of goods or it can produce them itself in public research bodies.

3.48 The preceding points on research may also apply to other aspects of HEI activities, notably in the areas of community and cultural engagement. Many of these goods may again be non-rival but excludable leading, other things equal, to undersupply. As before, in such circumstances public sector intervention would be warranted *on efficiency grounds alone*.

Imperfect Information

3.49 The perfect competition model underlying the Fundamental Theorems assumes that all economic agents have complete knowledge of all the economic conditions in every market. This is clearly a theoretical ideal, but what is required in the real world is that all producers and consumers have sufficient information to make rational "well-informed" decisions.

⁴⁰ This type of work is frequently described in the HEIs as "consultancy" or "services rendered" or similar.

A comprehensive discussion of the issues and problems associated with imperfect information is far beyond the scope of the present study.⁴¹ The following simply indicates key ways in which imperfect information may create market failure in the Scottish HE sector.

3.50 Firstly, the provision and reception of information (together “information transfer”) on the Scottish HE market are far from costless. On the teaching side, it is expensive for an HEI to supply glossy “information packs” to thousands of potential students (most of whom will end up elsewhere). It is expensive for the prospective student to assimilate the voluminous information provided by a myriad of HE providers. On the research/ knowledge transfer side the situation may be even be worse: certainly in Scotland it seems to be extremely difficult (i.e. costly) to even transfer the information that there *might* be mutually beneficial interactions between the HEIs and private companies.

3.51 In fact, this basic type of information on “supply capabilities” and “demand requirements” has many of the characteristics of a public good. It would be economically efficient for this information to be freely and universally available, but there is little incentive for any of the private agents involved to provide it. In this case, the public sector could act as an “information broker”. A good example of this taking place within Scottish higher education is the development of the ‘Scottish Research Information System’ or *Scottish Research.com*. Supported by the SHEFC on behalf of all of the Scottish HEIs, this is an information repository concerning the research strengths of Scottish HEIs , explicitly intended to play an information broking role, to be: “ *The one stop source linking industry and academic research in Scotland.*”

However, even when the information is not a public good, there may still be a role for third party information transfer on cost-effectiveness grounds: indeed, this is clearly the case in HE, given the commercial production of various “Which University?” guides.

⁴¹ Some economists would argue, quite persuasively, that virtually all market failures are ultimately attributable to imperfect information of one form or another. The key issue then is to identify the causes and effects of different types of imperfect information

3.52 Secondly, in advance of almost every transaction there is *asymmetry of information*. Usually, but not always, there is greater initial information on the supply side, with the seller having greater ex ante knowledge of the product than the prospective buyer.⁴² In the case of many physical goods, this asymmetry may be relatively unimportant or it may be possible to mitigate its consequences in various ways. For example, given the newness of the technology, very few people have much idea about what is inside a plasma TV or how it works. However this information is of limited interest to most buyers: they wish to know what the set looks like and how well it performs, and they can obtain this information from demonstrations and/or published third-party reviews. Furthermore, consumer legislation, warranties, guarantees, etc provide the buyer with assurance that the set will continue to provide a specified level of performance over a stipulated time period. None of this *eliminates* the market failure problems arising from information asymmetry, but it does reduce them to such a level that virtually everyone in Scotland is happy to buy and use extremely technologically advanced products on a daily basis.

3.53 In the case of *specialised personal service products*, such as many of those produced by HEIs, the situation is *very* different. Here information asymmetry leads to the seller having a very strong initial information advantage. As subject specialists, lecturers know precisely what is in their courses and why, they know the processes by which the material will be delivered (lectures, tutorials, handouts, etc) and they know the means by which student learning will be assessed (coursework, essays, exams, etc). More generally, they “know” if they have good or bad presentational skills, interpersonal skills, etc.

3.54 To the extent that some of this information is purely factual, it can be provided to prospective students in advance, but even this may be imperfect. For example, a student can be told what will be in Economics 101, but how does he or she know that this is what *should be* in a “proper” Economics 101 course? Information on the

⁴² Insurance markets are examples of where the buyer frequently has greater initial information. The individual knows how he/she specifically will behave when insured, while the seller only knows the average behaviour for that type of person. Note, that in spite of this initial advantage, in the case of a careful 19-year old driver of a Ferrari the information asymmetry will be to their disadvantage in obtaining car insurance. This is allocatively inefficient.

personal attributes of the lecturer will be very difficult to obtain (later year students may get some word-of-mouth information, but even this is of limited value, since one person's "good" lecturer is invariably someone else's "bad"). Furthermore it would be very difficult to legally frame contracts which mandated anything more than minimum or satisfactory standards of content, process and "personal performance", since evaluation in such areas involves so many subjective elements as to defy binding legally rigorous scrutiny. It is also virtually impossible to provide "guarantees" of successful individual student outcomes since, as discussed earlier, this partly depends on the *active* learning participation of the student him/herself. It is difficult to see how an HEI could be held legally responsible for a student failing a course who evidentially did not attend any of the lectures or tutorials.

Basically, as a specialised personal service, it is a characteristic of HE teaching that *the purchaser is not fully aware of the benefits or disbenefits from consuming it until after consumption, by which time it may be too late to do anything about it.*

3.55 Some of the above points may also apply to other areas of HEI activity, notably research. For basic research it may be impossible to specify outputs at all, only activities to be undertaken. Even in applied research, while it is possible to specify the *nature* of the content of a contracted report, it would be very difficult to specify that the *quality* of the content be "excellent" as opposed to "very good"...the distinction is too subjective to be legally binding.

The market failure in HE which arises from asymmetric information is that some HE products will be under-produced and consumed and others over-produced and consumed, which is allocatively inefficient.

3.56 Attempting to address the market failures caused by imperfect information (especially in teaching) is the implicit or explicit motivation for a plethora of public sector interventions in the HEI market.⁴³ Most fundamentally, it is at least part of the

⁴³ Imperfect information leads to a market failure which is extremely important in policy terms for the Scottish HE sector as a whole, rather than the HEIs as such. Specifically, there is good evidence that potential students from backgrounds without prior HE experience find it very difficult (i.e. costly) to inform themselves on the nature of HE and to properly evaluate the costs and benefits of participation. In particular, such potential students typically exhibit:

reason why the government acts as the purchasing agent of HEI courses on behalf of many students. The idea is that the public agency has greater expertise to evaluate and validate courses offered, and produces a list of those it regards as acceptable for its student clients. In order to provide *itself* with information, the government requires the HEIs to participate in a wide range of audits, quality assurance exercises, etc.

It can also be noted that the HEIs themselves provide “quality assurance” type information through, for example, the use of external examiners, and that some third-party private information is available in the form, for example, of “league tables” produced in national publications.

Imperfect Capital Markets

3.57 This is discussed briefly here, since it creates a market failure in the Scottish HE sector rather than in the HEIs themselves.

The specific point of interest is that (arguably) the operations of the financial sector are such that prospective students are unable to obtain private sector loans against future earnings to cover subsistence and tuition costs while studying, and hence are dissuaded from participating in HE.

3.58 There are two principal reasons why financial institutions are reluctant to lend to prospective students:

- (a) the students frequently have very little collateral (houses, valuables, etc) against which the financial institutions can secure the loans.

Myopia. That is, they tend to evaluate the costs and benefits of HE participation over far too short a time scale. Since the costs tend to occur in the short-term and the benefits over the long term, they underestimate the net gains from HE participation.

Risk Aversion. Students from certain backgrounds give very high weights to the certain costs of attending an HEI (foregone income and tuition fees) and very low weights to the uncertain subsequent rewards (in the form of the graduate earnings premium). Again, this leads to underestimation of the net gains from HE participation.

In view of all these negative biases, it is hardly surprising that large numbers of well-qualified individuals in Scotland choose, quite erroneously, not to participate in HE. This market failure is a serious source of economic and social inefficiency in Scotland, but it is beyond the scope of the present study to discuss the ways in which it might be addressed.

- (b) The financial institutions cannot *compel* graduates to stay in employment long enough to ensure that the loans will be repaid.

The public sector could intervene to address this market failure through, for example, the provision of a government-backed student loan scheme.

Externalities.

3.59 It can be said at the outset that, in an already complex subject, consideration of externalities in Higher Education raises some of the most difficult issues, both theoretically and empirically. However, before considering specifics of the HE case, it is necessary to explain what is meant by externalities and how they give rise to market failure.

An **externality** can be defined as follows:

“ an effect of an activity on an individual *who is not directly involved in undertaking that activity*”

3.60 The crucial point is that the recipient of the effect (which could be good or bad) did not actively seek it, did not necessarily expect it, and did not participate in its creation. From the opposite perspective, an externality is an effect of an activity which is not felt by, and therefore not considered by, those undertaking the activity.

3.61 Within this general definition, four sub-types of externalities are separately identified:

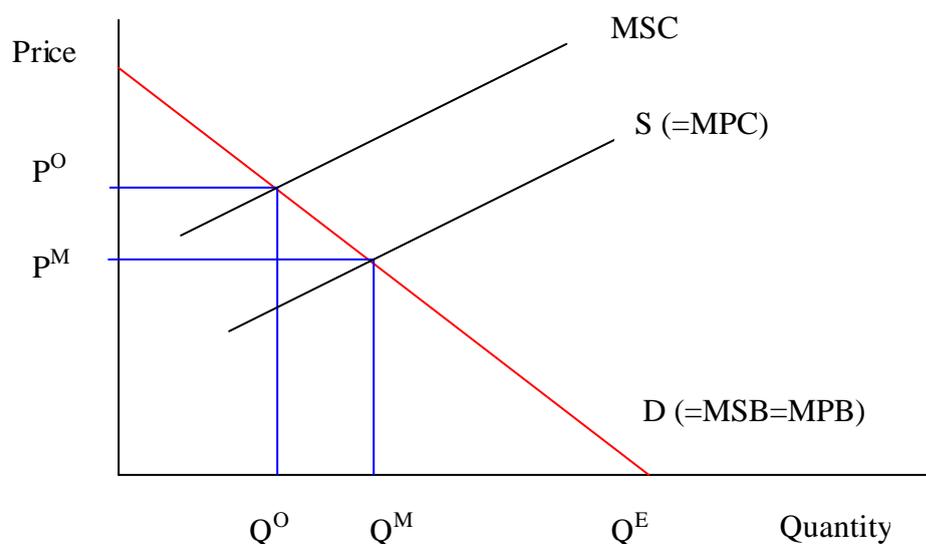
- *Positive Production Externalities.* The classic textbook example is the bee keeper, whose aim is to produce honey, but whose bees also pollinate neighbouring orchards, assisting the fruit growers to produce *their* outputs.

- *Negative Production Externalities.* A well-used example is that of the chemical factory discharging pollution into the river, thereby destroying the fishing grounds and hence the livelihoods of the downstream fishing communities.
- *Positive Consumption Externalities.* An individual creates a beautiful front garden, thereby giving pleasure to local residents and passers-by.
- *Negative Consumption Externalities.* An HE example is the student in a hall of residence playing very loud music, thereby preventing neighbouring students from sleeping or studying.

3.62 Given that these are what externalities are, how do they give rise to market failure? As noted above, agents choose to enter into a transaction or undertake an activity based on an assessment of the *private* costs and benefits accruing to themselves. However, in the presence of externalities, this transaction/activity will also affect other members of society; that is, there are additional *social* costs and benefits. This is the source of the market failure: ***externalities cause a divergence between social costs and benefits and private costs and benefits.***

Figure 3.2 illustrates the case of a negative production externality, which we can take to be the example of the chemical plant polluting the river.

Figure 3.2 Negative Production Externality



3.63 In the diagram, D is the demand curve for the output of the plant. Each point on it shows how much consumers were willing to pay to purchase the last incremental unit of output; that is, the *marginal private benefit*. Hence, the demand curve is also the *marginal private benefit (MPB) curve*. In this example, there are no consumption externalities, and thus there is no divergence between private and social benefits. Therefore, the demand curve is also the *marginal social benefit (MSB) curve*. In short, where there are no consumption externalities:

$$\mathbf{D = MPB = MSB}$$

3.64 In Figure 3.2, S is the supply curve of chemicals from the plant. Each point on it shows the cost of producing the last incremental unit of output; that is, the *marginal private cost*. Hence, the supply curve is also the *marginal private cost (MPC) curve*. However, in this example there is a negative production externality, which means the social cost of producing chemicals is greater than the private cost. This is shown in the diagram as the *marginal social cost (MSC) curve* lying above the supply curve.

Now, the agents in the chemical market are only interested in their own private costs and benefits from buying and selling chemicals: they may not even be aware that there are broader social implications. Thus, operations in the chemical market will take place, until market equilibrium is reached, where supply = demand. In Figure 3.2, this is at price/quantity combination (P_M, Q_M). As can be seen, at this point:

$$\mathbf{D = MPB = MSB = MPC = S}$$

However, it is equally clear that at quantity Q_M , marginal social costs are significantly higher than marginal private costs. Therefore, at the equilibrium reached by the free operation of private markets, the existence of the negative externality has created a situation where:

$$\mathbf{MSC > MSB.}$$

However, from Appendix A , it is known that a socially efficient outcome requires that these are equated. In short, a free market economy with externalities will not in itself yield a Pareto efficient outcome: there is market failure. In this case, chemical production needs to be reduced to maximise social welfare.

3.65 Depending on the nature of the externality, there are various ways in which attempts may be made to try to correct the resulting problems of market failure, many of which imply intervention by the government. Since this is not a textbook in economics, the following are simply very brief notes to give a “flavour” of the principles involved.

- **Enforceable property rights.** Here, the general idea is that those affected by the externality would have the right (established by a suitable legal framework) to *compel* those responsible for creating the externality to take cognisance of their actions. In the case of the polluting chemical plant, the downstream fishermen would have an enforceable right to stop it polluting, or more generally, they would be able to demand sufficient compensation for them agreeing to allow the plant to continue to pollute.
- **Ownership.** If the owners of the chemical plant also owned the fishing grounds, then they would take account of the pollution externality in their *private* economic calculations. This is an example of the principle of *internalising the externality*.
- **Taxation/ Subsidies.** In Figure 3.2, the government could introduce a tax per unit of chemical output sufficient to push the price up to P_O . At this price, the new equilibrium level of output will be Q_O . As can be seen, at (P_O, Q_O) :

$$MSC = MSB$$

As required for Pareto efficiency.

While taxes and subsidies can be used in other ways to address externalities, this particular example is an illustration of *the polluter pays* principle.

- **Quantity controls.** Rather than raising the price of chemicals through taxation, the government could simply put a quota control on the chemical plant, restricting the quantity produced to Q_0 . Alternatively, rather than control the output of chemicals, the government could put an upper limit on the volume of pollutants which the plant was allowed to generate. This would require the plant either to reduce the production of chemicals and/or to introduce lower pollution chemical production technology and/or to introduce technology which converted the pollutants in less harmful products. The latter two examples are illustrative of the *technology fix* principle.

3.66 Turning now to the issue of externalities in Higher Education specifically, this is a research area in which there has been a *very* considerable increase in interest among economists in the past fifteen years or so. The impetus for this comes primarily from relatively new theories of *endogenous economic growth* and *endogenous economic development*. These theories emphasise the importance of factors in, and attributes of, the country itself for generating economic growth: growth comes from inside (endogenous) rather than outside (exogenous). The key point here is that all model variants include as primary “drivers” of economic growth and development some or all of the following: education, human capital and R&D, *and higher education is involved in producing all of these*.

3.67 Research in this area is highly active and evolving: even the agenda has not been finalised. Much of the voluminous literature is in the form of specialist books or academic journal articles, and can be very demanding of both mathematical and econometric skills. It is completely impossible to even begin to justice to all of this material in the present study. What follows is simply an attempt to provide the reader of this report with some insight into the key areas involved in what can fairly be described as a “frontier” area of economics research.

3.68 At least as an initial attempt at classification, it is useful to identify two separate, but not mutually exclusive, categories of HE externalities:

- Socio-cultural
- Economic

3.69 Considering firstly *socio-cultural* externalities, these are in fact the ones which were given most prominence in the “economics of education” literature in the 1960’s and 70’s. Based partly on “thought experiments” and to a lesser extent empirical evidence, lists of 20 or more claimed socio-cultural externalities of education have been compiled. However, the majority of these reduce to the following core elements:

1. Improved appreciation of culture and cultural diversity.
2. Improved ability to participate in political processes.
3. Better able to fully function as a member of society (form-filling, and so on.)
4. Improved health
5. Reduced crime.
6. Greater congestion caused by HEIs and disruption by rowdy students.
(note: these are the only negative externalities generally mentioned in relation to HE)

On considering this list, some issues and problems are immediately suggested.

3.70 Firstly, the first five items are usually claimed as benefits for education as a whole. In at least some cases (for example, item 3), it must be true that most of any gains are realised in *non-tertiary* education. Noting that the relevant comparison is between a graduate and someone equally-qualified who chose not to go to university, the *incremental* gains from Higher Education will be small.

3.71 Secondly, the gains, for example in improved health and reduced crime, seem in some of the literature to include those accruing to the graduate him/herself. This is inconsistent with the definition of an externality given above, and would seem to be fundamentally incorrect: surely any such gains accruing to the individual who

actually participated in HE are *private non-pecuniary benefits*. In fact, at least in principle staying out of hospital or jail would have been included in their calculations on whether or not to participate in HE. Sometimes the argument is couched in terms of savings of hospital or prison/victim costs,⁴⁴ but these largely reflect other imperfections in the economy which mean that individuals do not pay their full medical or “crime” costs. In fairness, this latter point does raise “second best” issues that *might* allow some gains to graduates to be counted as externalities: clearly the whole area needs more thought.

What is not in question is that, to the extent that graduates somehow influence non-graduates to behave in a healthier and more law-abiding manner, this *is* a positive externality of higher education.

3.72 Thirdly, from the perspective of the HEIs the only obvious externality which they generate in the above list is the negative one of congestion. This is highly unlikely to be very important across the Scottish HEI sector as a whole. However, all the other externalities arise from the actions of the students and graduates of the HEIs. From an earlier discussion, (it is clear that the behaviour of graduates is an *outcome* of the higher education process, not an *output* of the HEIs. However, again as discussed earlier, and following Atkinson, it is possible to define and measure output *in terms of a specified contribution to an outcome*. Therefore, in the present case, it is legitimate to ask:

- Can some part of the benefits enjoyed by graduates be treated as outputs of the HEIs?
- Can some part the benefits enjoyed by others through graduate externalities be treated as outputs of the HEIs?
- If the answer to one or more of the above questions is in the affirmative, what fractions of the outcomes are HEI outputs?

⁴⁴ See, for example, *Revisiting the benefits of higher education* Bynner, Dolton et al , Bedford Group for Lifecourse and Statistical Studies, Institute of Education 2003. This report indicates that there is evidence of improved health, employability etc accruing to the individual graduate but also seek to suggest societal benefit in terms of “graduates cost the community less...place less burden on the National Health Service...” etc

Even a cursory review of the voluminous literature on education externalities makes it clear how very difficult it is to answer these and similar questions.

3.73 *Pace* the items on any list, it is probably fair to say that the major interest in HE socio-cultural externalities today stems from the perception that they contribute to a politically stable, dynamic and flexible society. This in turn is believed to create the necessary “underpinnings” or *social infrastructure* which encourages and permits economic growth and development. Thus, socio-cultural externalities *are* still seen as important, but more taken in the round than as individual items.

3.74 Turning now to the *economic externalities* associated with higher education, at the present time there are two approaches to considering these: one is less formal in mathematical terms and encompasses a wide range of possible externalities; the other is founded in formal theoretical modelling terms and tends to consider a specific, rigorously defined, set of externalities. These approaches are **not** inconsistent or incompatible; rather, it is simply that at this stage of the evolution of the subject, complete synthesis has not been achieved.

3.75 The “informal” approach draws on the work of Porter (1990), Reich (1990) and others, and a summary “flavour” of the relevant arguments is given here. Externalities by their very nature are hard to identify, they have no market price and are hard to measure. Higher education externalities may be closely related to the kind of **agglomeration effects** identified and analysed by authors such as Michael Porter (1990), however little higher –education specific work has been undertaken on this.

3.76 Agglomeration effects arise when there are positive locational spill-overs associated with a particular industry. Agglomeration effects are often used to explain the clustering of firms in the same industry in particular locations--for instance, the clustering of high technology firms in Silicon Valley. Firms in the same (or similar) industry may benefit from locating near each other since, by being in close proximity, they can gain from (i) increased interaction that facilitates the transfer and development of ideas; (ii) economies of scale in the production of industry-specific infrastructure; (iii) the presence of a large pool of skilled personnel. See Krugman

(1991) for an overview of some of this work⁴⁵. In the case of HEIs we can identify two main types of externalities. ‘Location’ economies arise from the scale or concentration of HE institutions within the region and ‘urbanisation’ economies where external firms benefit from information spillovers from the HEIs.

3.77 For example positive externalities could form in several discrete ways. A university may contribute infrastructure which can be utilised outside the university itself or the climate for business surrounding a HEI may be highly positive due to the strength of contact between the institution and local business. Businesses could be attracted to an area due to skilled graduate workers wanting to locate near to the HEI. Agglomeration effects tend to manifest themselves in the supply of specific factors – for example there may be benefits for a company to site near an HEI as it might be possible to obtain new technical knowledge through “spillovers”. As Porter states,

“The pool of factors and the rate at which they are created are also shaped by the presence of related and supporting industries. Such industries possess or stimulate their own mechanisms for creating and upgrading specialised factors.....The existence of a cluster ...that draws on common inputs, skills, and infrastructure also further stimulates the creation of factor creating mechanisms. Specialised infrastructure is enlarged and spillovers are generated that upgrade factor quality and increase supply.” (Porter, P.135).

3.78 We can describe some of the agglomeration economies which might be associated with HEIs.

- Enterprises are likely to cluster together primarily in a few locations where there are already a concentration of establishments of what Porter calls the same ‘focal industry’ or closely interconnected set of related industries. As the major supplier and trainer of skilled labour in a region, HEIs can clearly be seen as part of the upstream and downstream linkages of ‘local’ clusters.
- ‘Urbanisation’ economies may be strongly associated with HEIs in many areas. Financial services, music and sectors with rapid turnaround such as design are believed to be strongly associated with HEIs in metropolitan areas (Kolko, 1999), although Duranton and Puga (2000) assert that externalities change with the nature of product life cycles, and hence the portfolio of products which benefit from positive HEI externalities may change over time.

⁴⁵See also Grossman and Helpman (1991) for an overview of industries and agglomeration effects.

3.79 However, there are some critics of these arguments. Krugman (1991) argues against ‘selective targeting of knowledge –intensive industries’ such as Higher Education on the back of the ‘*positive technical spillover externality*’ argument since, (although he admits the argument has merit in theory) it is difficult to measure, distorts market forces and may lead to concentration on regional rather than national or international interaction. For example it may be that an individual HEI would be best placed to interact with national or even foreign firms in sharing technical knowledge rather than with firms at the regional level.

3.80 Within countries, Krugman (1991) has examined the extent of localisation in production for manufacturing industries in the US and Europe. He finds that industries are typically highly localised but that (i) high-tech industries are not particularly localised - the textile industry, for example, is one of the most geographically concentrated; and (ii) historical (even accidental) factors often determine where an industry begins but the agglomeration process that follows reflects the advantages of local externalities, particularly the gains from local labour pooling. Interestingly Krugman also finds that the three localities where innovative industries developed recently in the US (Silicon Valley, Route 128 and North Carolina's Research Triangle) began from initiatives by university presidents (Silicon Valley, Route 128) and state research park support (North Carolina). Higher education and the state may therefore have a role to play in development of such clusters. However, both Krugman (1991) and Porter (1990) suggest that the factors initiating industries in specific regions are various; the key role for HEIs appears to be in sustaining the agglomeration process rather than initiating it.

3.81 Robert Reich (1990) also shows how local areas are highly specialised in the United States and how the education offered by ‘local’ HEIs in these areas reflects and builds on the strengths of these clusters, undoubtedly forming positive feedback loops and agglomeration externalities within individual regions. He describes how HEIs and the local regions themselves reinforce each other and it is worth quoting at some length.

“In the United States as in no other nation, symbolic analysts [suggested as the most valuable worker types by Reich] are concentrated in specialised regional pockets

where they live, work and learn with other symbolic analysts devoted to common problem solving. The cities, regions and institutions of learning around which they have clustered and the specialities with which these places are identified are valued around the world: Los Angeles in music and film; San Francisco and Boston in science and engineering; New York and Chicago in global finance, law and publishing.and around every major American university team of professors, graduate students ,and recent graduates selling world – class expertise in particular technologies , markets or management practices” (1990, p.234-235).

3.82 Reich goes on to explain the importance of attending an institution of higher learning in proximity to one of these clusters. As he informs us with regard to education in one of the creative arts:

“The budding movie director can gain significant insight into the making of a successful motion picture without ever setting foot in Hollywood. The point is that one can learn so much, so easily, by being there” (1990, p.235).

3.83 For example the area around a technical university can be thought of as a ‘technoburb’ replete with almost invisible positive externalities which link the local industry cluster and the institution in a tight web of transactions of thought and methods. The area around HEIs is full of large, informal organisations, where it can be argued that:

“Members skills are combined in different ways for different projects and subsequently recombined in different ways for others. Information travels quickly within the fluid geographical organisation” (Reich, P.237)

3.84 Indeed, Reich identifies a (world class) University, along with an international airport as the two most important amenities which can be placed in a region or urban area. So important that he states

“ Their presence would stimulate some collective symbolic-analytic effort even on parched desert or frozen tundra” (1991, p. 238-239).

3.85 One enduring problem with much of this literature has been that, while it contains many attractive ideas and notions which lend themselves well to abstract common sense, they have not lent themselves in any particular fashion to concrete empiricism. As such, many of the ideas of relationships attributable to these ‘informal externalities’ continue to remain somewhat untested and for the large part, unmeasured. Hence, it is difficult to translate much of the thinking that emerges from this literature into concrete policy proposals. We will now turn our attention to the more formally presented aspects of externalities as they relate to the outputs of HEIs.

3.86 The “formal” approach is firmly founded in *economic growth theory*. A good summary of technical details of the approach, with an orientation to explaining the role of education is given in Gemmell (1998). Here, we attempt “a summary of a summary”, highlighting the main points as non-technically as possible.

3.87 We begin by considering the *neoclassical growth model*, attributed to Solow (1956). The fundamental equation of this model is given by:

$$(1) \quad Y = Af(K, L)$$

Where:

Y is national income or GDP

A is an exogenous parameter.

L is labour

K is capital

Equation (1) is in fact an *aggregate production function*, postulating that GDP is determined by the levels of capital and labour inputs and a shift parameter A. It is straightforward to reformulate (1) in terms of *growth* or *change*

3.88 For present purposes, there are two important points to be drawn from equation 1:

- (a) **L**, labour, is measured in homogenous primary units such as “person years” with no skill dimension. Similarly, **K** is in homogenous units with no quality dimension.
- (b) **A** is strictly speaking a catch-all residual variable, but it is often interpreted as reflecting “the level of technology”, but even on this interpretation it is not explained why **A** is at a given level or why it might change. **A** is an unexplained “black box” in the model.

Clearly, in the neo-classical growth model, it is difficult to find a role for education in explaining economic growth: it certainly does not appear explicitly, nor is it easy to infer any implicit influence.

3.89 By comparison with equation 1, equation 2 is an aggregate production function in the spirit of the *new growth models*. It is not claimed that equation 2 has actually been used in the literature.

$$2 \quad Y = A L^a K^b H^e R^g$$

In equation 2, **A**, **K** and **L** are as in equation 1, and the new variables are as follows:

H is a measure of *human capital*, which might be “total years in education” or better, “the average qualification level” (eg mean SVQ) of the workforce or population.

R is a measure of *research and development activity*, which might be “total spend on R&D” or “proportion of GDP spent on R&D”.

Equation 2 postulates that the level (growth) of GDP is, inter alia, a function of the level(growth) of human capital and the level(growth) of R&D. Specifically, it is hypothesised that:

$$dY/dH > 0, \text{ and } dY/dR > 0$$

that is, the partial derivatives of Y with respect to H and R are positive. These are testable hypotheses.

3.90 Assume they are “true”; that is, GDP does depend on the levels of human capital and R&D. **This does not provide any evidence of externalities.** These partial derivatives measure the *direct* or *internal* contributions of H and R to GDP, no externalities are involved. Evidence for externalities requires examination of various cross-partial and partial derivatives among the right hand variables of equation 2. There are many of these, but the following hypotheses relating to specific derivatives are highlighted as being of particular interest in the present context.

3.91 $dY/dLdH > 0$ This hypothesis states that the marginal productivity of primary (or “unskilled”) labour increases as a result of an incremental increase in human capital. How *might* this hypothesis be true? Assume the increment to human capital is in the form of a “newly skilled worker”. The literature argues that other workers may benefit from this through *observing* and *interacting* with the skilled worker. The newly computer-qualified secretary brings her skills to the general office where the other secretaries can observe her in action. She may even provide informal on-the-job training to colleagues. Her new word-processing and e-mail skills will increase the throughput of management correspondence and documents, increasing managers’ productivity. This hypothesis is testable. To the extent that it is true, it is evidence of a positive externality to human capital.

3.92 $dA/dH > 0$. The hypothesis is that an increase in human capital increases the level of technology in the economy. The argument is that a well-educated workforce is more flexible and adaptable, more willing to learn new processes and practices, more willing to be innovative...generally, has more “entrepreneurial spirit”. This is a testable hypothesis. To the extent that it is true then, since $dY/dA > 0$, human capital contributes to economic growth through a positive externality effect on “technology”

3.93 $dA/dR > 0$. The hypothesis is that an increase in R&D will increase the level of technology in the economy. The arguments in favour are similar to those made for human capital. Most obviously, R&D can lead to technological innovation. However,

the literature envisages a broader interpretation of R&D encompassing *knowledge broker* functions which encourage the economy to adopt existing best-practice technology. Again, this is a testable hypothesis. To the extent that it is true then, since $dY/dA > 0$, R&D contributes to economic growth through a positive externality effect on the level of technology. In the case of R&D, this may be particularly important, since it might be found that $dY/dR = 0$; that is R&D has no *direct* effect on GDP, in which case *the way*, and the only way, it contributes to economic growth is through positive externalities.

3.94 It will be noted that, while equation 2 sets out an endogenous growth framework, there is still no explicit role for Higher Education. However, we can remedy this by introducing ancillary equations into the model along the following lines:

$$3 \quad H = f(OE, HE, T, Z^0)$$

where HE is higher education “teaching”

OE is other education

T is training

Z^0 is a set of other relevant variables

$$4 \quad R = g(HER, BR, GR, OR)$$

where:

HER is higher education “R&D”

BR is business R&D

GR is government R&D

OR is R&D undertaken by other members of society.

3.95 Incorporating specific formulations of 3 and 4 into 2 would give a reduced-form aggregate economic growth model explicitly incorporating higher education “teaching” and “research”. Again, examining the relevant partial and cross-partial

derivatives would reveal the extent to which HE contributed to economic growth directly and indirectly (i.e. through positive externalities).

3.96 Finally, we can the equation 2 type framework to illustrate how the “formal” and “informal” approaches might ultimately be synthesised and to outline how socio-cultural externalities could appear in the growth model.

Firstly, some of the ideas of the informal approach could be incorporated along the following lines:

..... Incorporate a variable explicitly relating specifically to **HEI staff**. This would allow any positive externalities on the *non-HEI workforce* arising from observing or (more probably) interacting with HEI staff to be captured.

..... re-interpret HEI “R&D” more broadly as **HEI research and Knowledge Transfer**, and incorporate in the model appropriately.

3.97 Secondly, define a variable **S** as some broad measure of the socio-cultural outcomes of higher education.

It may be difficult either theoretically or empirically to justify supposing anything other than:

$$dY/dS = 0$$

That is, the socio-cultural outcomes do not directly contribute to economic growth. However, to the extent that they help to create a stable, outward-looking and tolerant environment or social infrastructure, then it could certainly be hypothesised that:

$$dA/dS > 0$$

That is, an increase in socio-cultural outcomes increases the level of “technology”. To the extent that this is true then(via $\delta Y/\delta A > 0$) then socio-cultural outcomes contribute to economic growth through a positive externality effect on technology.

3.98 Furthermore, improved socio-cultural outcomes certainly represent an increase in human capital in a fundamental sense, and hence it would be very reasonable to hypothesise that:

$$dH/dS > 0$$

If this is true, then socio-cultural outcomes would, through positive externality effects, contribute to economic growth in up to three ways in the model if the following were also true:

$$\delta Y/\delta H > 0 \quad (\text{from paragraph 3.78})$$

$$\delta Y/\delta L\delta H > 0 \quad (\text{from paragraph 3.80})$$

$$\delta A/\delta H > 0 \quad (\text{from paragraph 3.81})$$

3.99 In principle, therefore, *if* one could obtain empirical estimates of selected partial derivatives, then firm evidence on the importance of various HEI externalities could be obtained. In reality, there are formidable data and econometric problems involved in estimation.

4 Alternative empirical measures of HEI “economic value” and related evaluation techniques and indicators

The study utilises several different ideas of “prices”, “values” and “efficiency”, however, these should be seen as complementary in their approach, each with a precise definition and interpretation. Together these provide valuable and insightful information for policy purposes. Furthermore, as this chapter illustrates, these can all be derived from a single fundamental equation based around a net benefit stemming from a flow of benefits from which a stream of costs are deducted. The fundamental issues are the treatment of prices and quality and the size and sign (direction) of the social weights α and β derived from the applicable social welfare function. These then determine the treatment within the equation of “outputs”. Depending on the treatment utilised or revealed by underlying data, several appraisal frameworks are implementable including economic cost-benefit analysis, cost-effectiveness analysis and cost-utility analysis. However, of these economic cost-benefit analysis it is the only one which says anything about allocative – efficiency and therefore the only framework presented which can actually say anything about the evaluation of a project or expansion / retraction of policy in terms of a Pareto efficient outcome. The chapter concludes that it is necessary to calculate three separate measures of value, which it explains in considerable detail; the net financial value, the net economic value and the net social value. For any given project or policy, examination of these measures in combination provide powerful information in terms of policy guidance.

4.1 Throughout this report, reference has made to different concepts of “prices”, “values” and measures of “efficiency”. This not intentionally confusing: each of these concepts has a precise meaning and, interpreted and analysed appropriately, gives different *but complementary* policy relevant information.

4.2 This section attempts to provide some clarification by illustrating how different measures, indicators and forms of analysis can all be derived from a *single fundamental equation*.

The fundamental equation is :

$$1. \quad \text{NB} \quad = \quad -\text{C} \quad + \quad \text{B}$$

(net benefit) (costs) (benefits)

$$= \frac{-\sum p_i q_i \alpha_i}{\text{(inputs)}} + \frac{\sum p_j q_j \beta_j}{\text{(outputs)}}$$

where:

p = “prices”, to be defined according to the form of analysis

q = quantities in natural, or physical, units

α, β = social weights, derived from the applicable social welfare function.

From this general fundamental equation, we can derive specific variants of real-world policy relevance:

(A)

If in equation 1, all the prices and quantities are those actually observed (including $p = 0$) and all the $\alpha, \beta = 1$ (which indicates “social indifference”), then **B** is actual *gross revenue*, **C** is actual *gross cost*, and **NB** is actual *profit or loss*. In other words, equation 1 becomes simply a summary form of the organisation’s financial accounts.

This type of financial information is used in *business ratio analyses* of the form: Revenues/Costs.

However, for present purposes, the most important policy-relevant information provided by this variant of equation 1 relates to the *financial viability* of the programme. Specifically, if FNB (financial net benefit) is positive, then in principle the programme will be undertaken by the private sector without intervention, while if FNB is negative it will not be undertaken by the private sector.

(B)

If all quantities are as observed, all prices are standardised at unity, and all $\alpha, \beta = 1$, then the information is essentially in volume terms. While it may not

be possible to undertake the summation in equation 1, this type of disaggregate data is used in *performance indicator analyses* of the form : q_j/q_i ; that is, volume output measures related to volume input measures.

Comparisons of these types of indicators across different entities producing the same q_j can provide evidence relating to **technical efficiency**.

(C)

Again referencing equation 1, if (a) for the *inputs*, all the prices and quantities are as actually observed and all $\alpha = 1$, and (b) for the *outputs*, the quantities are as observed, all prices are standardised to unity, and all $\beta = 1$, then the information is in the form used for *cost-effectiveness analysis*. This analysis uses ratios of the following type:

$$C_j/q_j$$

That is, money cost of inputs divided by physical volume of output.

If there is more than one combination of inputs capable of producing good j , then the one with the lowest C/q is the least cost. If there is more than one organisation producing j , then the one with the lowest C/q ratio is the most cost-effective.

Thus, cost-effectiveness analysis provides information relating to **cost efficiency** and **cost minimisation**.

(D)

Assume all the variable values are as in cost-effectiveness analysis C, except that all the outputs are *quality-adjusted or translated into "quality" units* (call these q_j^*). Information in this format is used for *cost-utility analysis* based on ratios of the form:

$$C_j/q_j^*$$

Cost-utility analysis is more flexible than cost-effectiveness analysis since it can allow aggregation of outputs measured in different original units and it allows cost comparisons of different outputs in original units.

In terms of policy relevance, cost-utility analysis also provides information relating to cost-efficiency.

(E)

Assume all quantities are as actually observed and all $\alpha, \beta = 1$. Now, assume all the prices are *economic efficiency prices*, approximated in the real world through observed market prices where appropriate or through shadow pricing. Then item B on the right-hand side of equation 1 measures the true *gross economic benefit* of the programme and item C measures the *gross economic cost or opportunity cost*. Thus, ENB measures the true *net economic benefit or cost*.

In some circumstances (which may well include analysis of higher education), it may be desirable to separate ENB into two components as follows:

$$\begin{array}{rcccl}
 \mathbf{ENB} & = & \mathbf{PENB} & + & \mathbf{SENB} \\
 & & \text{(effects on those} & & \text{(effects on the rest} \\
 & & \text{directly involved} & & \text{of society i.e.} \\
 & & \text{in the programme)} & & \text{externalities)}
 \end{array}$$

This variant of equation 1 is the configuration used in *economic cost-benefit analysis*....the tool used in the UK and internationally for the appraisal and evaluation of projects and programmes.

In policy-relevant terms, this variant can provide all the information required for technical and cost efficiency analyses; more importantly, this is the *only* variant which provides any information relating to **allocative efficiency**. That is, only an economic CBA can indicate whether, in the interests of Pareto

Since it also increases economic efficiency and social welfare, there is no need for public sector intervention.

- $FNB < 0$ and $ENB > 0$ This could be a public good or a project with strong positive externalities. The private sector will not produce it since it is not financially viable. Since, however, it would increase economic efficiency, the government may produce it itself or subsidise a private producer.
- $FNB > 0$ and $ENB < 0$. The private sector would like to undertake this project but it has such strong negative externalities that society would become less economically efficient if it went ahead. The government may simply prohibit the project or intervene to ensure at least a minimum ENB value of zero.
- $ENB > 0$ and $SNB < 0$. This project would be economically beneficial to society but its distributional effects are such as to actually worsen social welfare (e.g. it makes the rich richer and the poor poorer). Either a yes or no decision confronts the government with an equity- efficiency trade-off. In many real world cases, the government may allow the project to proceed, but try to mitigate the negative distributional consequences through the tax/transfer system.

5 Towards the empirical estimation of the economic value of the outputs of the Scottish HEIs ⁴⁶

This chapter presents a detailed account of the methods utilised in the construction of output metrics for Scottish HEIs. The specific methods discussed are founded on the economic theory and principles presented in earlier chapters in this study.

As discussed throughout the report, the focus of the present study is on “value”, defined as a quantity times a price. The rationale of chapters 3 and 4 of this study is carried throughout chapter 5.

In the Nuffield study immediately preceding the present project, a considerable amount of effort was put in to identifying, initially in descriptive terms, the “outputs” of Strathclyde University specifically. While this work serves mostly to illustrate the methods underlined here, it has ‘revealed’ categorisations of outputs which have more general validity. The groups identified in this chapter are; Teaching (defined by students and courses), Research (dominated by published outputs), Consultancy/Advisory (activities carried out by university staff for third parties), Cultural Outreach (cultural activities occurring outside the University), Community Outreach (activities benefiting the city surrounding the University in the case of Strathclyde) and Other Activities (a catch all of activities with overlap or which did not fit into other categories). These groups were defined as including activities thought to utilise similar production technologies, similar volume units or face similar market conditions.

These groups are not dissimilar to, and can be reconciled with those considered by SHEFC for derivation of “metrics” to assist in funding allocation decisions.

The chapter develops a methodology to ascertain and ‘price’ the outputs of HE according to detailed criteria, drawing on shadow pricing to obtain economic efficiency prices. Different metrics are required to be priced in different ways as they correspond to various levels of actual market pricing. Reference is made to the results of the detailed Strathclyde work which is included in appendices.

The overall outcomes of the method proposed suggest that pricing using a cost – benefit derived approach offers considerable scope for pricing of outputs in the context of Scottish HEIs.

Objectives and principles

5.1 The principal goal of the present study is to assess the feasibility of quantifying, in the language of section 4, the gross economic benefit of the Scottish HEI sector. This overall feasibility assessment involves examination of the extent to which three distinguishable, but inter-related, objectives can be satisfied. These are:

- Identification of all the outputs of the Scottish HEIs.

⁴⁶ Much of the discussion in this section draws significantly from a 2004 study on Strathclyde University supported by the Nuffield Foundation Social Sciences Small Grants Scheme, which support is gratefully acknowledged.

- Measurement of the volumes of all of these outputs in natural (or physical) units.
- Finding the *economic efficiency prices* to be applied per unit of all of these outputs.

This section discusses the outcomes of a preliminary, or “scoping”, attempt to satisfy these objectives.

5.2 In undertaking this work, a number of principles were adopted, reflecting “best-practice” in the area from the national and international reference literature. In summarising these, comparisons are made where appropriate with those suggested in the Atkinson Report, given the likely influence of this on the development of economic statistics in the UK NPISH sector. Though derived independently, similarities are greater than differences, which is unsurprising, given that both sets of principles derive from the same applied theoretical framework.

5.3 To be specific, the following key principles underlying the work to be reported subsequently can be highlighted:

A. Treatment of non-market outputs in line with National Accounts

Atkinson (Para 4.7, page 36) states the following:

“Therefore, we start from **Principal A: the measurement of government non-market output should, as far as possible, follow a procedure parallel to that adopted in the national accounts for market output** (original bold)”

5.4 In the context of HEIs, this is a principle with which the present authors entirely agree, and indeed have adopted in virtually all of their previous research into higher education. Fundamentally, the Scottish HEI sector is an *industry*, comprised of *enterprises* using *economic resources* to produce *economic outputs*. As with elements of government production such as the health service, many people find this difficult to accept: arguments relating to “society”, “culture”, “equity” and so on

enter discussions of higher education quickly and often emotionally. To a significant degree, these arguments miss the point: if society “wants”, or “demands”, HEI cultural outputs (say) then *these outputs have an economic value though they may not have a market price.*

5.5 Put the other way round, anything which an HEI produces which has zero economic value is essentially a “hobby good”: personally and institutionally satisfying, but something that the rest of society is very unlikely to pay for.

Thus, in the same spirit as Atkinson, the present study seeks to identify *only* those HEI outputs which have economic value, but also to identify *all* of those outputs which have economic value.⁴⁷

B. Identification and measurement of direct outputs

5.6 In complete agreement with Atkinson, the aim in the present study is to identify and measure the *direct outputs of the HEIs*, as opposed to measuring inputs or outcomes.

5.7 Thus, an input measure such as “number of lecturers” is not proposed as a proxy for “volume of teaching output”: such a measure would be grade C in EU/Eurostat regulations and hence would be unacceptable. However, in an “economic value” as opposed to “national accounts value” study, there may be a role for using input prices to obtain a direct measure of output prices. Specifically, given the assumptions of perfect competition:

The sum of all inputs measured at economic efficiency prices plus normal profit will equal the economic efficiency price of output.

⁴⁷ In practice, no great harm is done if an initial list erroneously includes HEI “hobby goods”, since they will be subsequently revealed as such by having a zero economic efficiency price.

As discussed subsequently, this may be helpful for valuing some HEI activities for which the inputs can be priced, or shadow priced, more easily than the outputs.⁴⁸

5.8 The present study also accepts the Atkinson distinction between outputs and outcomes, and that the former can be defined and measured in terms of incremental contributions to the latter. Given the broad and diffuse nature of HE outcomes (especially if externalities are included), it is very difficult in many cases to translate them into specific HEI outputs, as will be seen. However, this remains an important guiding principle.

C. Maximum disaggregation

5.8 A fundamental principle in devising a classification system for any set of statistics is that, as far as possible, intra-group homogeneity and inter-group heterogeneity are both maximised. For example, an industry is a group of firms which produce the “same” commodity, which is “different” from the commodities produced by other firms in different industries.

5.9 Since, in the real world, we may not know *ex ante* how best to group items to satisfy this principle, *it is invariably good practice to work initially to the most detailed and disaggregated classification levels possible*. As will be seen below, this is the approach adopted in the present study. Subsequently, for presentational and day-to-day work, aggregation will usually be possible; however, all experience indicates that creating and maintaining a “master” set of maximally disaggregated data will frequently be necessary and will always be desirable.

5.10 At numerous points in his report, Atkinson also argues for maximum disaggregation of outputs for two principle reasons:

⁴⁸ In particular, it may be useful approach to obtaining one estimate of the economic value of the Scottish HEI sector as a whole. In fact, a variant of this method is discussed in Atkinson, where it is indicated that a quality-weighted measure of inputs could serve as a grade B measure of output for collective services such as R&D.

- (a) it is more accurate to apply quality (or price) weights to a homogenous volume of output.
- (b) Again relating to quality weighting, and quoting Eurostat: “ part of the quality change(that part due to compositional changes in an aggregate) can be captured by differentiating as many qualities of a product as possible. These different qualities are then in fact treated as different products”.

5.11 Atkinson notes that a volume measure (or index) of output, derived from quality-weighted disaggregated component output data, could be an A method (and would certainly be at least a B method) in Eurostat terms. This is an important “bonus” to SHEFC and the Executive from the approach proposed in the present study: even if the third objective (estimation of efficiency prices) in the end proves infeasible, then satisfaction of the first two objectives (identification and measurement of disaggregate outputs) will still provide a top international standard measure of volume HEI output. Undoubtedly, this will be desirable, perhaps even essential, for many purposes.

5.12 The aim in the present study is to estimate prices applicable to each disaggregate volume measure of HEI output to obtain value measures of output. In Eurostat terms, a “correct” value measure of output *will always be a Grade A measure*. As discussed in Chapter 4, the nature of the value measure obtained depends on precisely which prices are applied. The orientation of this present study is towards measuring the economic value of the Scottish HEIs, with a view to evaluation and appraisal, and hence the desired prices are economic efficiency prices. As shown in Appendix A, these are the prices which would be observed in a Pareto efficient perfectly competitive economy. Actual (or observed) market prices can only be used as proxies for efficiency prices if the assumptions of perfect competition are approximately realised in the case in hand (or, better, if “workable competition” exists).

5.13 For Atkinson, the search for efficiency prices is not essential. His desire is to find values of government and NPISH outputs which are equivalent to, and hence comparable with, those observed elsewhere in the domestic UK economy (essentially

the private sector). Hence, what are required are actual prices in parallel UK markets as theoretically valid *revealed preference measures of willingness to pay*. This is stated quite clearly:

“.....A second example would be the provision of personal care by social services, where there is a parallel market. If people are prepared to pay p_i for daily care, then this can be used for the marginal valuation. It is sometimes objected that the parallel market is artificial, dominated by public purchasing, or that, in other cases, prices are monopolistic. The basis for the pricing is irrelevant; it is sufficient that consumers are willing to pay those prices (providing, of course, that there is a sufficiently wide market to obtain reasonable price observations). The prices may not be equal to marginal costs, but that does not matter if we are seeking to measure v_i , not c_i ”

5.14 This creates the possibility of the approach proposed in the present study satisfying another highly desirable intermediate goal for SHEFC and the Executive. Specifically, suppose objectives one and two can be satisfied, but in the case of the third it proves more feasible to estimate actual market prices to be applied to HEI outputs rather than economic efficiency prices (this may well be the case in reality). Then, following Atkinson, these market prices can be used to obtain *grade A measures of the values of Scottish HEI outputs in national accounts terms*.

D. Triangulation

5.15 The present study recommends the principle described by Atkinson as “triangulation”. In applied economics work, it is frequently the case that alternative real world approximations are available to measure a theoretically idealised variable. In the present context, for example, measures of “HEI teaching output” could be based on, say, number of teaching hours, number of courses delivered, number of students, number of degrees awarded and so on. Closer evaluation will probably eliminate some possibilities as clearly inferior, but one may still be left with a number of viable alternatives with different combinations of strengths and weaknesses. Furthermore, it is sometimes possible to obtain estimates of the *same* variable value from different directions. A classic example is in the social accounting matrix

formulation of national accounts, where in principle a single cell value can be measured independently both from the supply-side and from the demand-side.

5.16 Given these circumstances, the principle of triangulation indicates that alternative measures should be calculated and that different approaches to obtaining the same measure value should be adopted. This is not a “do everything” recommendation. Rather, a portfolio of alternatives should be adopted on the premise of synergistically seeking to maximise their combined strengths and minimise their combined weaknesses. In this way, one is seeking to “home in “ on a single best estimate of the value sought.

5.17 Having outlined some of the key principles adopted, we now turn to a preliminary exploration of the feasibility of realising the three objectives outlined at the beginning of this section for the Scottish HEI sector. Considering each in turn:

Identification of Scottish HEI outputs.

5.18 In the Nuffield study immediately preceding the present project, a considerable amount of effort was put in to identifying, initially in descriptive terms, the “outputs” of Strathclyde University specifically. The outcome classification listing, which is shown as column one in Table B1 (Appendix B), was based on principles 2 and 3; that is, only direct outputs are included, at maximum possible disaggregation.

5.19 While there is nothing especially atypical about Strathclyde, it is not suggested that all of these specific outputs would appear in equivalent listings for other Scottish HEIs. Furthermore, there may be some activities in other Scottish HEIs (notably related to Medicine) which would require additional outputs to be added to the list. Nevertheless, the Strathclyde template given in Appendix B is an excellent illustrative example for the present discussion and also provides a valuable reference point for any future work in this area. To the authors’ knowledge, it is the most

detailed purpose-designed classification of outputs produced to date for a Scottish HEI.⁴⁹

5.20 At the greatest level of disaggregation, there are 220 separately identified outputs. At the highest level of aggregation, each of these was included in one or other of the following groups:

- Teaching
- Research
- Consultancy/Advisory
- Cultural Outreach
- Community Outreach
- Other

5.21 In terms of fundamental principles, these groups were defined to include activities thought to have “similar” production technologies, and/or similar output volume units, and/or to face similar market conditions. More pragmatically, these groupings were essentially those by the University itself for internal management and external reporting purposes, and hence were those for which the University had the greatest volume of collected and processed data. Furthermore, these groups are not dissimilar to, and can be reconciled with, those being considered by SHEFC for the derivation of “metrics” to assist in funding allocation decisions.

5.22 As is always the case, there were difficulties in allocating particular detailed outputs to specific groups at the margin. For example, with regard to “Teaching”, the following questions arose:

- Should “extra-mural” or “lifelong learning” classes provided to the surrounding community be classified under “Teaching” or “Community Outreach”?

⁴⁹ The fact that the Strathclyde list contains some 220 separate items indicates the diversity and complexity of the business of a modern HEI, and also indicates the large, formidable, task involved in obtaining quantitative measures for all of these outputs.

- Should information-providing school visits by lecturers be classified as “Teaching” or “Community Outreach”?
- Should specialist tailored CPD courses or credit bearing courses which could be used towards a university qualification be included in “Teaching” or “Community Outreach”?

5.23 In fact, it was eventually decided that the first two items had greater similarities in terms of production methods and market structure and audience to other community outputs and hence were allocated to the “Community Outreach “ group. Similar thinking, however, led to CPD/credit bearing courses being allocated to “Teaching”. In the context of the present study, these particular allocation decisions are unimportant, and in reality most such marginal decisions are unlikely to have much quantitative impact. The key point is that each detailed output should be allocated to one, and only one, group. These examples also illustrate the great virtue in working initially at a highly disaggregate “master” level: it becomes straightforward subsequently to group or re-group according to judgement or purpose.

5.24 More general issues arose in the treatment of certain *activities* undertaken by the University which were explicitly intended to provide certain non-pecuniary benefits to its own staff and to the wider community. For example, the University actively supports Public Art through the commissioning of works for display in its own grounds ; it also contributes to the restoration or preservation of historic buildings. In the end, it was decided that such activities could be seen as producing *direct final outputs*. Internally, they enhance efficiency through improving staff morale and working conditions. Externally, the community and environmental benefits are realised as *externalities*; that is, they have economic value, although this does not accrue to the University as payment for direct output. Again, working at a highly disaggregate level makes all such marginal judgements transparent and subject to amendment.

5.25 Returning to the classification scheme in Table B 1, it can be seen that in a number of areas (notably Teaching and Cultural Outreach) there are intermediate levels of disaggregation, which can be termed divisions. In the case of Teaching,

these divisions are essentially the Faculties or Schools through which broadly cognate subjects are taught. Clearly, there are “organisational” reasons for identifying these divisions, but there is a more fundamental one: a large body of empirical research (notably on “rates of return”) suggests that, while efficiency prices may be similar among individual cognate subjects, they may be significantly different among various divisions of cognate subjects.

5.26 The divisions in Cultural Outreach largely reflect internal organisational structures in Strathclyde itself, identifying sub-units producing baskets of individually detailed direct outputs. In applied and policy work, this type of classification is useful in identifying who does what, and, equally importantly, in identifying who can provide *information* on who does what.

5.27 Table B1 (Appendix B) can be studied in more detail by the reader for interest. Here a number of preliminary conclusions from the Strathclyde example can be drawn. Firstly, the Strathclyde detailed classification scheme could, with (in most cases, minor) modifications, be applied to all other Scottish HEIs, with a final “master” list being derived for the Scottish HEI sector as a whole. Second, for applied and policy work, the six major groups identified would appear to have general usefulness across the HEI sector. Third, intermediate divisions of groups may have general applicability and usefulness when based on fundamental principles of aggregation; however, divisions based on institutional internal organisational constructs are likely to be case-specific.

5.28 Finally, and most importantly, the preliminary work on Strathclyde strongly suggests that the first objective towards measuring the economic value of the Scottish HEI sector *can* be realised: that is, it is possible to define and identify a highly detailed and comprehensive listing of HEI direct outputs.

Measuring the volumes of Scottish HEI outputs in natural units

5.29 The preliminary work on Strathclyde is also used to inform the general discussion in this section. As such, reference is again made to Table B1, and in

particular to columns 2, 3 and 4 which relate to issues involved in the physical quantification of HEI outputs.

5.30 Column 2 is simply a yes/no checklist response to the question: is it feasible in principle to quantify the volume of each identified Strathclyde output? The very fact that this question needs to be asked at all is a reflection of the nature of many of a university's outputs. If the outputs are in the form of *tangible* products ("types of widgets"), then volume measurement involves little more than taking inventory of what goes out the "factory door"; however, when, as in the case of an HEI, much of the output is in the form of *intangible services*, volume measurement is inherently much more difficult.

5.31 In fact, based on tacit knowledge and discussions and preliminary data evaluation within Strathclyde, it proved possible to insert a "yes" response to the question of measurement feasibility for the large majority of listed outputs, as can be seen in column 2 of Table B1... Furthermore, blanks or other responses in the table ***do not mean that it is actually infeasible to measure these outputs***; rather, they simply mean that it was not possible to validate feasibility with the time and resources available. The reason for this gratifyingly positive outcome is not that Strathclyde finds it *easy* to quantify these outputs; rather, it has become *accustomed* to measuring them through the accumulated experience of satisfying the requirements of various internal and external audits and evaluations. Since all other Scottish HEIs face essentially the same requirements, it is reasonable to assume that they also would find it "feasible" to quantify most of their outputs.

5.32 The third column of Table B1 suggests possible natural units of measurement for the volumes of identified HEI outputs, and this is clearly pivotal to the whole analysis. However, before considering some of these suggested units in more detail, an important general explanatory point must be made.

5.33 As discussed throughout the report, the focus of the present study is on "value", and value is defined as a quantity times a price. Thus, while we discuss quantity units and prices sequentially, what we are actually contemplating are price/quantity (P, Q) *combinations* which are internally consistent and compatible. This is a fairly obvious

theoretical requirement, but there is also a real world feasibility issue: a particular natural unit of output may be “valid” when evaluated independently, but if it is not possible to find a price for that unit, then it will not be possible to form a (P, Q) combination to estimate value.⁵⁰ Anticipation of the need to find a commensurate price influences the choice of many of the volume units in the Table.

With this in mind, we can consider some of the main measurement units suggested in each of the six groups.

5.34 Firstly, in **Teaching**, the principal unit of measurement suggested is “student numbers”, either on a head count basis or in terms of full-time equivalents. In practical terms, this has the major advantage of being readily measurable in all Scottish HEIs. More fundamentally, appropriately quantified, this would give the same volume of output as “years of student tuition provided”, which would perhaps be a better way of expressing *HEI* outputs. The suggested unit does not allow for any quality-weighting, which could allow for drop-out rates, grades, degrees awarded, etc. There are two reasons for this: firstly, as discussed in Chapter 2, in considering education generally, there is a lack of clarity over what is a teaching output and what is a learning outcome, with the difference being in terms of the implied passivity/activity on the part of the student consumer. Certainly, quality-weighting by indicators of student success such as those mentioned above would seem to be more an outcome, if the distinction between outputs and outcomes is to have any policy relevant meaning. This is not to say that quality weights for teaching outputs could not be found, through for example peer review of teaching methods and course content; in fact, relevant data would be already be available from QAA reports and similar sources.

5.35 Secondly, and actually more importantly in the context of the table itself, this quantity unit is selected *because it is directly related to the unit prices suggested in columns 6 and 7 of Table B1*. In the real world, whether termed a “grant” or “fee” or whatever, there is a price associated with every single FTE student in any given year.

⁵⁰ Of course, this is also true if one can find a price, but not a consistent measure of quantities; however, this situation is less likely to arise in the real world study of HEIs.

That price is not contingent on whether the individual “graduates” in that year or passes or fails their examinations. Thus observed prices tend to relate to that charged for the provision of “one year full-time equivalent “ tuition, and are not dependent on the “quality” of student outcomes.

5.36 Thus, some variant of “student FTEs” would seem to be a valid and feasible measure of teaching output volumes for which compatible observed prices can be found, and for which it may be possible to estimate efficiency prices. However, it should be stressed that other volume measures of teaching output may be appropriate if different unit prices are adopted. In particular, if the unit output prices are derived from student outcomes, then quality-weighted volume measures may be required (see discussion in Section 2).

Research.

5.37 As is actual practice throughout the entire Scottish and UK HE systems, many of the unit volume measures suggested in Table B1 relate to publications of one form or another. These are clearly direct research outputs and are tangible. Given the importance of publications for staff promotion and for compliance with the Research Assessment Exercise in particular, Strathclyde in common with every other HEI has voluminous data on this particular form of output. In the present context, it is important that *all* publications are included irrespective of length, content, “quality” or publication vehicle.

5.38 Fundamentally, the issue of whether publications should be quality-rated or not is the same as in teaching: it depends on whether or not the chosen unit prices relate to basic natural units or quality-weighted quantity units. However, in this case the interrelationships between price and quality create additional difficulties:

(a) Almost all prices relating to publications relate to a greater or lesser extent to a quality-weighted product: no one publishes and pays for a 1000 randomly-generated words. In fact, in many cases the outcome price may depend, at least in part, on the revealed outcome quality.

(b) In an assessment of the economic value of the research outputs of HEIs, *the quality of a publication is theoretically defined in terms of the price it commands*. That is, revealed quality depends entirely on the outcome price. This implies that the correct prices themselves are the required quality weights.

5.39 Given that the RAE has made quality ranking of publications a topic of great importance in the Scottish and UK HEI sectors, it is worth considering point (b) in a little more detail.

The RAE in particular quality ranks HEIs primarily in terms of publications in designated “prestige” journals supplemented, at least in theory, by “peer review” of other aspects of the institutions’ research. This is of course entirely subjective⁵¹, but more importantly, it is essentially *intra-sectoral*: the HEIs are ranking themselves, though not necessarily with regard to the true impact of their work on the rest of society (in the language of the present study: there are no external market signals to indicate to the HEIs what research they should be doing.). This is market failure, compounded by the motivational factors in the HEIs which could tend to give too high a weight to personal and institutional prestige relative to objective economic value (see pages 32 - 35.). From the theoretical discussion in this paper, it will be clear that, at best, exercises such as the RAE may help in identifying pockets of technical and cost-efficiency in research across institutions, but are not very helpful in assessing allocative efficiency and economic value.

5.40 In satisfying the objectives of the present research programme, these issues relating to publications create at least two problems in applied work:

- (i) the indications are that it may be necessary to estimate many different publication prices, but available data provides little guidance on how many, and precisely which, prices should be estimated.

⁵¹ The apparent objectivity of the “prestige journal article” count is largely illusory since the rankings of the journals themselves depend on the subjective judgements of interested parties.

- (ii) Existing publication quality review data may be inappropriate even for realising the intermediate objective of creating a Eurostat Grade A or B publication quality-weighted volume output index.

5.41 Considering other research items in column 2 of Table B1 , it can be seen that a number of “publication-related” outputs are included (editing, reviewing) on the argument that these embody “research” rather than “textbook” knowledge of the subject area. This is a reasonable if not wholly convincing argument: reviewing, for example, could arguably be described as an intermediate activity rather than a final output.

5.42 Inclusion of contract research reports is clearly essential: often they are the first, and sometimes the only, final output of a research activity. Furthermore, the fact that someone is prepared to purchase them is a strong revealed preference indicator that they do have economic value, and what that value is: the purchase value is the market price, which in turn, if the consumer was in the private sector, is a good approximation to the economic efficiency price. The separate inclusion of consultancy projects here and consultancy hours in Consultancy/Advisory is legitimate in volume terms, but care must be taken to avoid double-counting the values if, in particular, the price of the consultancy report output is the agreed value of a specified number of consultancy hours input.

5.43 Production of new software and software packages is of growing importance in a number of HEIs, while outputs of films and videos may be more specific to Strathclyde which has an active Audio-Visual department. A key point is that outputs like these are often excluded entirely in assessment exercises premised on the bureaucratic principle that only *designated* HEI departments and categories of staff (usually academic) *can* actually produce research outputs. This is clearly incorrect in theory and, to an increasing extent, in practice.

5.44 Finally, Table B1 includes important HEI research outputs which, though difficult to summarise in a single phrase, tend to involve the creation or exploitation of physical artefacts. These include inventions, innovations, spin-out companies, and pull-out companies. Generally, these types of outputs are associated with science and

engineering research activities, but not necessarily so: a spin-out management consultancy company could encompass research in many disciplines.

In the context of current policy relevance in Scotland, some of these outputs (along with others from, for example, Consultancy/Advisory and Community Outreach) could be included in a new group termed Knowledge Transfer. Working from a detailed master listing, there is no great difficulty in doing this.

5.45 Columns 3-5 in Table B1 give an indication of the feasibility of quantifying the identified research outputs in physical units. Again based on the preliminary investigation, the initial conclusion is that all of these outputs can in fact be quantified, and column 5 indicates that the required data is likely to be accessible to all of the Scottish HEIs. Column 4 suggests possible quantity units, none of which are quality-weighted. In the light of the preceding discussion, it would be sensible to the process the data in this form initially, with any outstanding quality issues being addressed *after* consideration of price estimation.

Consultancy/Advisory

5.46 All of the outputs in this group involve HEI staff providing expertise, advice, guidance or support to external third parties.

Consultancy projects should only be included here if not already included in research...the precise allocation depending on the intellectual content of the work.

HEI staff, notably academics and senior administrators, quite frequently act in advisory capacities to Scottish and UK public sector bodies. Sometimes there is an actual payment for labour input (usually termed a “fee”), but often only expenses are met. Although the government is the client, these are not public goods in the economic sense, rather they are non-priced private outputs. As such, they have an economic value which can be estimated through shadow pricing.

The remaining items in column 2 are self-explanatory from their descriptions; these are further candidates for inclusion in a new Knowledge Transfer group.

5.47 Column 3 suggests quantity units for all but two of the identified outputs, most of which are in terms of staff hours (this could probably also be used for the missing values).

The reader of the report to this point will immediately complain that this breaches one of the basic principles espoused; that is, that inputs should not be used as proxies for measures of direct outputs. In fact, in the present case, the principle is not broken, but only because of very specific characteristics of the products involved. As Atkinson (citing WJ Baumol) puts it:

“...there are a number of services in which the labour is an end in itself, in which quality is judged directly in terms of the amount of labour”

(Atkinson Report page 13)

The more the service demanded is specialised to a named individual, the more true this will be. For these particular types of services, which include all of those considered here to a first approximation, the following relationships hold:

Labour Input = Labour Activity = Direct Output.

HEIs produce other outputs with these characteristics, notably in the area of Community Outreach, as will be discussed subsequently.

5.48 As shown in column 5 of Table B1 , at least from the Strathclyde example, it may be difficult for many HEIs to produce the required quantity data for these activities. Some relevant information is almost certainly collected in staff reviews, but not apparently systematically, and certainly not processed into the desired form. In part at least, this probably illustrates the classic case of something that is under-priced also being under-valued.

Cultural Outreach

5.49 Column 2 of Table B1 gives a fairly lengthy list of HEI cultural outputs, perhaps surprising to those who think that HEIs are institutions only for “teaching and research”. As described, some of the individual items are clearly Strathclyde-specific, and certainly the “divisions” listed entirely reflect Strathclyde’s own internal organisational structures; however, as elsewhere, it is not expected that other Scottish HEIs would find it difficult to adapt this list to suit their own particular circumstances.

5.50 At the risk of over-simplification, the detailed cultural activities listed appear to fall into one of three main areas:

- Performing Arts (concerts, recitals, performances, etc)
- Broadening and informing cultural development (exhibitions, workshops, seminars, tours, etc)
- Preservation of cultural heritage (historical archiving, preservation of historic buildings and artefacts).

5.51 Columns 3-5 indicate gratifyingly, if somewhat unexpectedly, that virtually all of these cultural outputs can be measured, that valid quantity units can be proposed, and that empirical data for volume estimation may be obtainable. Given all this, it may be asked why “hard” information on HEI cultural outputs is not more regularly produced by HESA for example? At least in the case of Strathclyde, the answer would appear to lie in column 5: the data is not centrally collated and processed, ready for immediate collection and use by the third-party analyst; rather, the information is held in the divisions from which the outputs originate, requiring greater data searching effort on the part of the researcher. In the Strathclyde study, the authors were informed on a number of occasions that they were the first people ever to have *asked* for this information.

5.52 A quantity unit suggested for many cultural outputs is “number of attendees”. This relates very well to at least one method of pricing . Furthermore, especially where the output is produced on more than one occasion (repeat concert performances, exhibitions lasting more than a day....and so on) the total number of attendees may adequately allow for quality without further adjustment.

Community Outreach

5.53 Derived from the Strathclyde study, column 2 of Table B1 identifies a significant number of the university’s outputs which can be classified in this group. As can be seen, many of these outputs arise from programmes or activities *specifically* designed to provide services to members of the community *other* than the university’s own principal clients (which, simply for the present discussion, can be taken to be degree students, large corporations and charitable foundations , funding/research councils and other elements of central government). It is because of this non-principal, or secondary, market orientation that certain “teaching” and “advisory” activities are included here rather than in the groups in which they are principal products.

5.54 Column 3 indicates that preliminary investigation suggests that virtually all of these community outreach outputs are measurable, and column 4 proposes possible quantity units. Given that the outputs in this group are heterogeneous, a number of different volume units are suggested. Since a number of the outputs relate to specialised services, “staff hours” is proposed in such cases on the basis of the same arguments made above with regard to Consulting/Advising. Similarly, in cases where the earlier arguments relating to Teaching outputs apply, “number of attendees” or “attendance hours” are proposed as suitable quantity units.

5.55 Column 5 indicates that, to the extent that Strathclyde is not atypical, collecting actual data on community outreach outputs may be relatively resource intensive. As with Cultural Outreach, it appears that much of the required information does in fact presently exist, but it is not collected and processed centrally in a useable format.

5.56 As with Cultural Outreach, a number of the proposed output measures in this group can be interpreted as already adequately reflecting quality considerations. In any event, in the context of a holistic “first steps” project covering *all* HEI outputs, the fine-tuning of the quality weights for Community Outreach outputs is unlikely to be an efficient allocation of resources.

Other

5.57 Almost by definition, “other” tends to be a catch-all, residual, category. However, as can be seen from Table B1, in Strathclyde at least, this group was found to subsume a number of large divisions producing significant and policy-relevant outputs. In fact, looking anew at this group suggests that some of the included items might sensibly be included in other named groups in future work. In particular:

- Library Services could be allocated to *Cultural Outreach*.
- IT Services, Sports/recreational Facilities and Learning Services could be allocated to *Community Outreach*.
- Career Services could be included in *Community Outreach* or *Consulting/Advising* if own graduates were designated as a principal product market.

5.58 This group also includes Residence and Catering, which in Strathclyde is an operation with a turnover of some £7 million per annum. In fact, R&C services two distinct sub-markets, distinguishable in terms of both nature of clientele and timing of delivery.

5.59 During term time, the principal sub-market comprises the University’s own students, both undergraduate and post-graduate. Nearly 2000 thousand students live in University residential accommodation, and they and non-residential students make use of University catering facilities, primarily for lunch and coffee breaks. The University’s staff also make limited use of in-house communal catering facilities. During term, the external market is generally small, consisting of modest numbers of

conference delegates and visitors on University business (external examiners, academic speakers, etc)⁵² .

5.60 During vacation, the principal sub-market is *tourism*, consisting both of *holiday tourists* and *business tourists*. In the university of Strathclyde this was estimated to be over 95,000 bednights in 2002/03. The own-student sub-market is relatively small during vacation, to a large extent consisting of post-graduate students not domiciled in the UK.

As shown in columns 3-5, preliminary investigation suggests that the outputs of this group are measurable and sensible quantity units can be suggested. Questions relating to quality-weighting remain to be addressed, but since many of these outputs are “near market” or “market”, this may not be a significant issue. As in some other groups, identifying the sources of relevant data may require some effort.

5.61 Finally, to summarise the main findings of this section, the investigations to date suggest that **the volumes of all Scottish HEI outputs can be measured in natural units**. Taking into account both *feasibility* (i.e. what *can* be measured) and *plausibility* (i.e. what *should* be measured) considerations, quantity units are proposed for virtually all of the detailed outputs listed in Table B1 . However, while chosen with care, in many cases the units selected are non-unique. The principle of triangulation indicates that all reasonable alternatives should be evaluated and the various results obtained subjected to sensitivity analysis prior to final unit selection.⁵³

Thus, one can be reasonably confident that objective 2 of the overall programme outlined at the beginning of this section can be satisfied. However, if the outcome volume measure of Scottish HEI outputs is to achieve Eurostat Grade A or B status, then quality issues will have to be addressed. As discussed in the text, for a number of defined outputs the quantity unit selected will *implicitly* reflect “quality” to an

⁵² On occasion, the University does host larger conferences during term time, but in-house residential capacity constraints mean that most of the delegates are housed in private hotels throughout the city. However, R&C Services frequently provides group catering facilities.

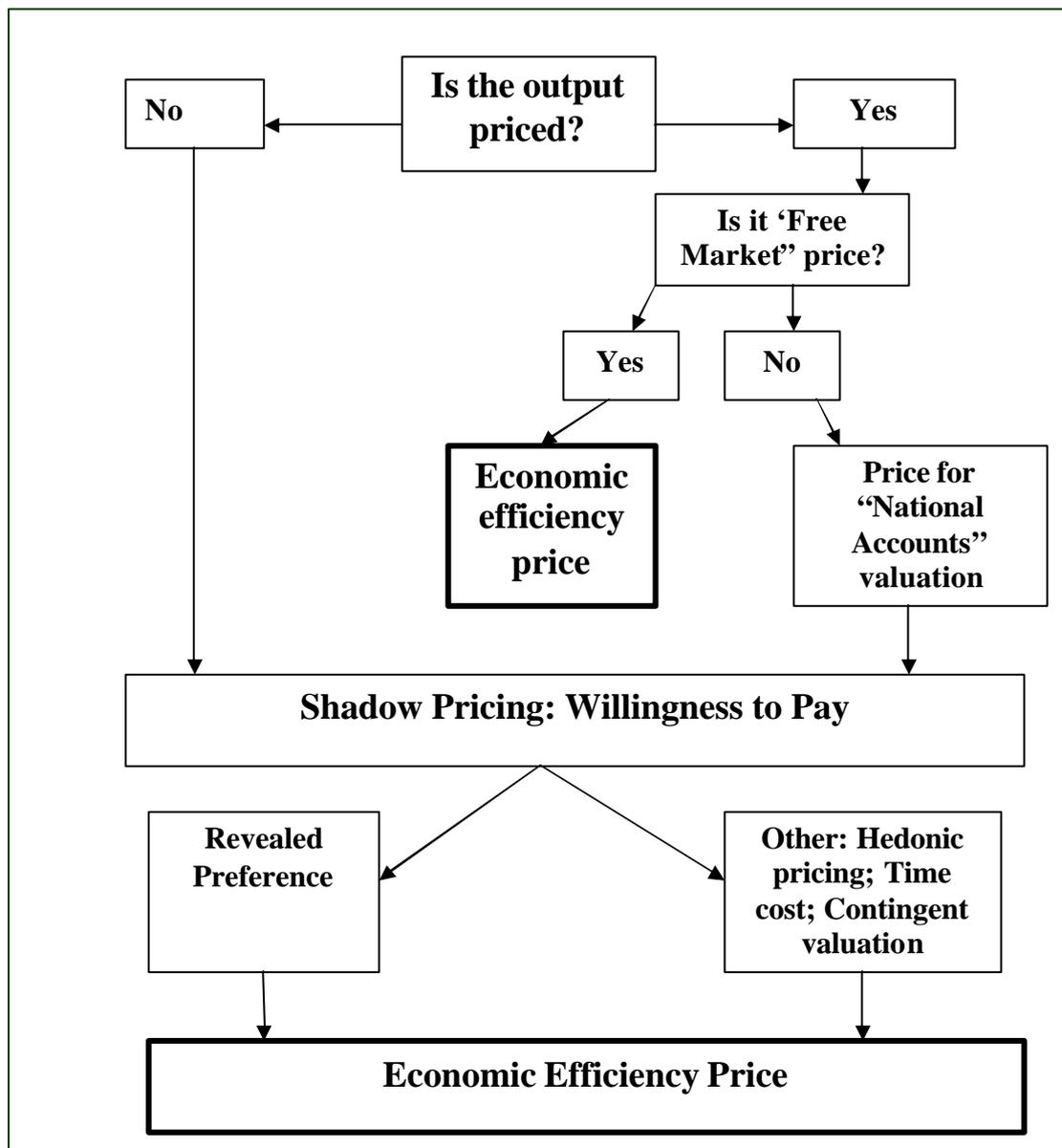
⁵³ The point made earlier must also be remembered: the selection of a quantity unit implies, or is implied by, the feasibility of defining and measuring a matching price unit.

adequate extent. In other cases, it will be necessary *explicitly* to derive quality weights. Undoubtedly, extant quality-related vehicles (such as QAA reports, the RAE, etc) can provide valuable guidance on the derivation of these weights, but they will have to be used with care: “fitness for purpose” is crucial here.

Finding the Prices to be applied to Scottish HEI outputs.

5.62 Columns 6-9 of Table B1 refer to the key issues relating to the definition and measurement of the prices to be applied to the output volumes of the Scottish HEIs. The sequencing of these columns and their headings reflects a general *price search strategy* which can be summarised in the following flowchart:

Figure 5.1 Price Search Strategy



5.63 Thus, in column 6, the initial question is asked: is the classified HEI output actually priced? If the answer is “no”, then one is immediately in the realm of *shadow pricing*: that is, the indirect estimation of appropriate prices to apply to outputs which have economic value but no market price. As noted earlier in this report, in particular circumstances input prices can be used to derive shadow prices for outputs, but, based on welfare theory, the principal approach to shadow pricing is based on assessment of “willingness to pay”; that is, if a free market for this good did in fact exist, how much would individual consumers be prepared to pay for a unit of it?

5.64 Given “willingness to pay” as the basic criterion, then *revealed preference* is the theoretically preferred method of assessing it. The idea is to find, paraphrasing Atkinson, a “free parallel market” in which the good (or something very like it) is actually bought and sold. The World Bank recommend the use of world market prices for traded goods, these being subject to the full rigours of international competition. The observed price in the parallel market is used (possibly with some further adjustment) as the shadow price for the non-marketed good under examination. In some cases it may not be possible to find an appropriate parallel market, in which case the “willingness to pay” principle can still be applied using other techniques developed in Cost-Benefit Analysis. A number of the more important of these are listed in the flow-chart, and these will be discussed further subsequently as appropriate.

5.65 If the answer to the question in column 6 is “yes”, then the question in column 7 is “is this a free market price?”. If the good is bought and sold in competitive conditions (numerous buyers and sellers, existence of close substitutes, easy entry/exit, etc; basically, no obvious sources of serious market failure), then this question can be answered in the affirmative *and the observed market price used directly as a measure of the economic efficiency price*. At the margin, it will obviously be a judgement call whether or not a market is sufficiently competitive, but it is probably fair to say that most applied economists working in this area would

prefer to use an actual market price where at all reasonable rather than turn to shadow pricing.

5.66 Even given this bias in favour of observed market prices, there will be cases where market failure is clearly so significant that the actual price cannot reasonably be used as a proxy for the economic efficiency price, in which case, the answer in column 7 would be “no”. As shown in the flow chart, even in this case the observed price has policy-relevant usefulness since, a la Atkinson, it may provide the basis for valuing HEI outputs in “national accounts equivalent” terms. However, to estimate efficiency prices use will have to be made of shadow pricing techniques, at a minimum to make adjustments to the actual price.

5.67 Depending on the yes/no combinations obtained from columns 6 and 7, preliminary methods and measures for obtaining efficiency prices for the detailed outputs of the Scottish HEIs are proposed in column 8 of Table B1 . Column 9 gives, in a number of cases, initial numerical estimates of the economic efficiency prices deemed to be applicable to the specific outputs of Strathclyde at the time of the original research. Although a considerable amount of effort went into estimating some of these during the Nuffield study, they are not generally discussed in any detail here: these would clearly be updated, refined and generalised in the context of a full study of the Scottish HEI sector. They are included here primarily for the reader’s information and to provide a “feel” for the likely orders of magnitude of the unit values being considered.....important for guiding resource utilisation in any future work.

As in the previous section, specific pricing issues are now discussed under each of the 6 major output group headings.

Teaching

5.68 As noted in an earlier section, the teaching outputs of HEIs are essentially private goods, and as such should not have observed zero prices arising from the market failures associated with pure public good provision. Teaching column 6 of Table B1 seems to confirm this, at least for Strathclyde: all of the detailed teaching outputs

listed had a positive price, which means there is no *immediate* requirement to turn to shadow pricing. Following the search strategy described above, the next question relates to whether or not these actual prices charged can be assumed to correspond to those that would be the outcome in a free, competitive market. As shown in column 7 of the table, the authors' research to date suggests that the answer is variously "yes", "no", or "maybe".

5.69 Of course, these varying responses reflect the fact that the university's outputs are sold into different market segments with differing competitive characteristics. Since they are the most straightforward cases, it is sensible to first identify those market segments in which the observed price can be assumed to be "competitive". From the case study, these appear to be as follows:

- Undergraduate students not eligible to pay tuition fees at the "EU rate" negotiated between the HEIs and the UK government. This rate applies to most suitably qualified individuals domiciled in the European Union, and is an administered price generally paid by government acting as agent for the student principals. "Non-EU rate" students comprise of non-EU domiciled individuals. The tuition price paid by these students undoubtedly reflects the operation of market forces: on the one hand, the students themselves typically have a wide range of institutions, both nationally and internationally, from which to choose to study; on the other hand, the specific HEI seeks to charge its price according to "what the market will bear" (a phrase expressed frequently to the authors). In short, *the actual price paid by these students is a market price and that market price is a good approximation to an economic efficiency price.*
- The majority of in-house taught and research post-graduate students, whether domestically domiciled or international. There are a small number of post-graduate students for whom the UK public sector (funding and research councils and others) pays tuition fees, frequently to study in a particular subject area such as "teacher training". Here, the government also acts as

agent and the negotiated prices would appear to be largely administered. However, from the perspective of the would-be HEI supplier, the majority of potential post-graduate students are *independent self-financing agents*. These students can and do “shop around” a very wide range of national and international providers looking for the best price/quantity package to satisfy their demands, and they are knowledgeable consumers. Competition among HEIs to attract these students is fierce, and prices are frequently changed (increased *and* reduced) on at least an annual basis to reflect changing market conditions.....a sure sign of market forces at work. This is clearly a competitive market and the realised prices are economic efficiency prices.

- Distance learning and overseas delivery courses. There are a very large number of international potential suppliers, both public and private, into these markets, and no Scottish HEIs have anything like a captive audience: on the contrary, they frequently face competition from some of the largest and richest institutions and corporations in the world. Our discussions made it clear that the Scottish HEIs are extremely “market sensitive” in this segment, varying prices over both time and space according to prevailing market conditions. This is a virtually classic competitive market, and the realised prices are economic efficiency prices.

5.70 Having identified those areas of Scottish HEI teaching where competitive market conditions prevail, it is now necessary to examine those market segments where they do not. In fact, it is clear from the discussion in the preceding bullet points what these segments are: they consist of the domestic and EU students, both undergraduate and postgraduate, for whom the UK public sector acts as agent and pays the HEI an “agreed” per capita price for tuition. As discussed elsewhere in this report, the prices in these segments are administered prices, determined by administrative pricing “rules” dictated largely by the public sector. As with all administrative pricing systems, the list of rules applicable here is lengthy and complicated, but seems to encompass three principal considerations: (a) some reference to the accounting costs of actual provision; (b) modification at the margin to reflect various “social” or “equity” issues of the time; (c) limits on the aggregate amount the public sector is prepared to spend on tuition (exchequer considerations), which places upper limits on the individual per capita tuition rates. It *is* theoretically possible for administered

pricing systems to yield something close to competitive efficiency prices, but over all real-world time and space, few if any have ever actually done so. In the present case, it is necessary, at least *ab initio*, to assume that the answer to question 7 for these market segments is “no”; that is, there is no presumption that the observed prices approximate free market prices.

5.71 Following the strategy outlined in the flow-chart, it is therefore necessary for these market segments to estimate the efficiency prices using shadow pricing techniques. In doing this, we are helped a very great deal by the aforementioned evidence that Scottish HEIs also sell their outputs into competitive markets. Formally, the prices realised in these latter markets are *revealed preference willingness-to-pay competitive prices*. As has been noted before, all national and international reference agencies would regard these, on both theoretical and practical grounds, as being among the best estimates of shadow prices which it is possible to obtain. This is reinforced in the present case by noting that the competitive price in many cases is not only for a “similar” product, but is actually for the same product as that delivered to the administered price cohort.

Thus there are *very* strong arguments ***for adopting the realised prices in the competitive market segments as the shadow economic efficiency prices in the equivalent administered price market segments.***

5.72 At least in terms of Strathclyde 2002/03, the implications of this in terms of differentiating economic value from revenue value are quite profound. As shown in column 9 of Table B1, the list price (see below) quoted by the University for a year’s in-house undergraduate degree teaching in Business disciplines was £7400. In the same year, the university received £3352⁵⁴ from the public sector to provide identical tuition to a member of the administered price cohort; that is the efficiency price was more than double the administered price. The authors examined many other relevant undergraduate and postgraduate courses, and in all cases found differences between economic and administered prices of the same order of magnitude. The importance of these substantial price differences is greatly magnified by the fact that the

⁵⁴ The 2002/03 ‘Unit of Resource’ for an undergraduate social sciences student.

administered cohort forms the largest single percentage of the Strathclyde student population, something that will be at least as true in most other Scottish HEIs

In World Bank and other international project appraisal studies, it is common practice to calculate *accounting price ratios* defined as follows:⁵⁵

$$\text{Accounting Price Ratio} = \text{Shadow Price/ Actual Price.}$$

5.73 For the administered price component of Strathclyde's teaching output, accounting price ratios of the order of 2.0 appear to be the norm. In the authors' knowledge and experience (which includes actual World Bank CBA experience), APRs so different from unity are fairly unusual and are always evidence of market failure, making it virtually impossible to achieve allocative efficiency . In the present case of the Scottish HEI sector, the inevitable allocative *inefficiency* is likely to manifest itself in over-demand for administered price provision and under-supply of it.

5.74 In future empirical applications of this revealed preference method, two points from the present study may be noted:

- (a) although Strathclyde published list prices to be applied to "non-EU rate" students for all teaching programmes, in a number of cases the actual price charged differed from this. The latter, of course, is what is required for the estimation of "free market," or efficiency, prices.
- (b) In certain Strathclyde programmes, the non-EU rate market was very thin. Care would be needed in inferring an efficiency price from a very small number of observations.

5.75 Following the principal of triangulation, it is recommended that, at least in an initial full study of the Scottish HEI sector, alternative methods of estimating the free

⁵⁵ The value of these accounting price ratios in future work in this area on the Scottish HEIs is discussed on page 115.

market prices for the administered cohort of students should be evaluated. Two promising approaches are discussed briefly here.

5.76 (Approach 1) Based on the parallel markets idea, find the actual prices for “similar” goods being sold in markets which are believed to be competitive. The most obvious choice would be the prices charged in a UK private commercial HEI sector. Unfortunately, only the University of Buckingham fits into this category, and there are obvious problems in generalising from a single set of observations. An alternative, drawing on the World Bank’s “world prices” approach, would be to consider international comparisons, with the US private HEI sector being one obvious point of reference (US public universities also work in an administered price system). A final suggestion, especially for students in the early years of study, would be to examine the prices charged by private UK sixth-form colleges and similar institutions.⁵⁶

5.77 (Approach 2) A radical alternative, based on Atkinson’s “output as a contribution to outcome” idea, would be a variant of the “rates of return” methodology. What would be required in the present context is not the calculated Internal Rate of Return, but rather the Net Present Value of the tuition costs discounted at the social rate of time preference. Specifically, one would be seeking the solution value to some variant of an empirically estimated equation of the following form:

$$TV = -GOEF + \alpha \cdot \sum (GGP_i)/(1+r)^i$$

Where:

TV = the Tuition Value, which is identical to the calculated tuition costs.

GOEF = the Gross Opportunity Earnings Foregone during the period of study

⁵⁶ The authors did briefly review some of these parallel markets, which suggested that shadow efficiency prices might be *higher* than Strathclyde list prices. However, the analysis was too cursory to be given any weight.

α = the “alpha factor”. This is the proportion of a graduate’s incremental pecuniary and non-pecuniary benefits which are attributable to his/her learning in higher education as opposed to other factors such as innate ability or personal dynamism.

GGP = the Gross Graduate Premium. This is a measure of the pecuniary and non-pecuniary benefit which a graduate enjoys over an initially equally well-qualified individual who chose not to attend an HEI

r = the Social Rate of Time Preference. As stated in the Treasury Green Book: “This guidance recommends that the STPR be used as the standard real discount rate”.

As calculated, TV would be the maximum total amount an incremental individual could be charged for tuition to make it just worth still taking an HE teaching programme (i.e. the marginal valuation, which is the price). TVs would have to be calculated for different teaching programmes, both in terms of level and subject. The quantity units to which TVs would be applied are graduates (or degrees awarded) and also drop-out student numbers, for which specific TVs would be estimated.

Preliminary inspection of sources (both data and literature) suggests that equations of the above type could be estimated for Scotland.

Research

5.78 Given the complex characteristics of HEI research outputs, it was beyond the resources of the present study to progress much beyond the identification of promising approaches to deriving appropriate prices and these are summarised in this section and the reader can also refer to Research columns 6-9 in Table B1.

As with teaching, it is sensible to begin by identifying those research outputs for which the observed price can reasonably be taken to be a good approximation to the

free market price. At least on first inspection, these would appear to include the following:

- Reports which are the delivered outcomes of commissioned/contract projects which are won in at least potential competition with private consultants (*inter-sectoral competition*). Here, the actual value of the contract, plus any bonuses minus any penalties, is the free market price.
- Books, software packages and other products explicitly aimed for open market sales (textbooks are a good example), for which the economic value is the actual price times number of copies sold.
- Outputs for which, through legally enforceable property rights, the HEI obtains its share of market proceeds through royalties, fees, profit shares and so on. These would include outputs covered by patents, licensing agreements, copyright, and similar vehicles. Typical outputs would be inventions, innovations and media products not intended for open market sale. Other profit or revenue sharing agreements would cover “spin-out” companies, etc.

5.79 There are well-known problems with actually enforcing intellectual property rights in many cases; however, there is a strong *prima facie* case, based on the revealed preference willingness-to-accept principle, for arguing that the monies that the HEI actually receives for these outputs is a fair measure of the true economic value to the HEI. Certainly, evidence that someone else makes even more money than the HEI from exploiting its outputs does not prove that the HEI is undervaluing these products: on the contrary, it is selling-on at least part of the risk of exploitation and encouraging the deployment of complementary skills to maximise the gross benefits of the outputs, from which it will receive its agreed share. It has been argued that information asymmetry in these areas does lead to market failure on the part of the HEIs; however, for this to be true in general, the following must also be true:

- (i) the information asymmetries must persistently work against the HEIs. That is, compared with their partners or clients, they must consistently have poorer information to assess the risks and returns *of their own products*. On the face of it, this seems unlikely.

- (ii) In spite of repeated engagement in such arrangements, the HEIs must be unable to learn how to improve their techniques for evaluating the values of their own products. Again, this seems unlikely.

5.80 The next set of research outputs to be considered are those for which a market price is paid, but the price does not emerge from the operation of competitive market forces. The most important of these are research outputs associated with projects undertaken for Research Councils, Charitable Foundations, certain other government departments and some quangos. The key characteristics of the markets for these products is that they involve primarily *intra-sectoral competition* (i.e. among the HEIs themselves) and that the principal client is *the UK public sector*. As with components of Teaching, the prices in these markets are essentially administered, in many cases intended primarily to distribute a given volume of money among competing HEIs rather than reflecting economy-wide allocative efficiency considerations. As in teaching, there are complex sets of administrative rules used to determine the price, mostly it would seem based on the money (accounting rather than economic) value of inputs rather than outputs, which in principle may be justifiable for “basic” research projects with public goods characteristics. However, in some cases the rules forbid even the money costs of all the resources utilised in the project being included in the price determination (various exclusions include so-called “overheads”, full-time university “principal investigators” and so on). Currently, this latter anomaly at least is being examined in work arising from the Transparency Review, which will help to identify the full accounting costs of certain public sector projects. In the present context, this material could provide valuable information as follows:

- (i) the total accounting values of inputs to projects could identify “market prices” which would be suitable for “national accounts” purposes, but these are not efficiency prices leading to estimates of economic value.
- (ii) The input *volume* data collected in compliance with Transparency Review could be useful in measuring the economic value of research outputs if combined with *shadow efficiency input prices*. This is discussed further below.

The obvious alternative method for estimating efficiency prices for this group of outputs is to identify competitive parallel markets as with teaching. Again, this could involve comparisons with “equivalent” projects undertaken for the Scottish and UK private sectors, or with projects undertaken by HEIs in other countries.

5.81 As can be seen from Table B1 Research column 2, the remaining important group of research outputs are publications for which no *direct* price is paid, or if a “fee” is paid, it is nominal (formally, a “non-economically significant” price). Most of these publications could be described as “academic” in nature, drawing on highly personalised interests and expertise, often quite abstract or “basic” in content, and aimed at a specialist professional, rather than general, audience. Arguably, more than any other broad categories of HEI research outputs this group has many of the characteristics of pure public goods. To the extent that this is true, then as discussed earlier, any observed price for these outputs will not be the efficiency price, and hence immediate recourse has to be made to shadow pricing techniques.

5.82 The summary suggestions made in column 8 of Table B1 in fact subsume two distinct shadow pricing strategies, both of which would be worthy of further consideration in future work.

Firstly, the feasibility of directly measuring the free market prices of these types of publications (i.e. using willingness-to-pay and parallel market concepts) was explored. This involved three separate strands of investigation:

- (a) Examining evidence of the willingness of individuals themselves to pay to be published.
- (b) Seeking out commercial rates paid for articles of equivalent “quality”
- (c) Assessing the market prices for those journals that specialise in the publication of these types of articles (“academic journals”).

5.83 It proved impossible in the present study to make much headway on the above, beyond forming an impression that the general approach may be useful in some cases. Even the preliminary investigation of (c) alone revealed a situation of such

complexity, but interest, that a summary of the team's findings are included as Appendix C for the reader's information.

5.84 The second approach would essentially accept that these research outputs are public/collective goods, in which case both theory and practice would permit their prices to be estimated as the appropriate total value of inputs. However, for this to be valid, the following conditions must be realised:

1. The prices of all inputs must be included in the valuation process.
2. All input prices must be economic efficiency prices.

With regard to point 1, a key missing input price in any form of extant Scottish HEI accounts is a return to capital/ entrepreneurship/ risk-taking which economists describe as "normal profits". However, a value for this can be imputed by reference, for example, to the commercial Scottish R&D sector.

5.85 With regard to point 2, for the vast majority of non-labour operating expenditures, actual market prices adjusted for expenditure taxes and subsidies will serve as efficiency prices. The same cannot be so easily said for labour. In the HEI sector, most (though not all) wage/salary outcomes are the result of national bi-lateral monopoly negotiations between employer associations and trade unions. There is nothing in economic theory to suggest that the outcome prices from such a market structure will be efficiency prices, a point reinforced in the case of HEIs where the motivations of those involved (see pages 32 – 33) allow considerations other than marginal productivity to become involved in the wage setting process (in particular, wage differentials seem to be given prominence). In any event, at least in the first instance, the shadow pricing of HEI labour inputs must be contemplated. This is an achievable task, since there is a great deal of relevant evidence and data both on the UK (and Scottish) HEI labour market specifically and on wage rates in the labour market generally. This is also a *worthwhile* task, since, as will be seen subsequently, shadow-priced labour inputs can be used to estimate efficiency prices for HEI outputs other than the research category under current discussion. Given this, using Strathclyde as an illustrative example, Appendix C provides details of the processes involved in the estimation of shadow wage rates for the Scottish HEIs.

Consultancy/Advisory

5.86 Virtually all of these are the types of personalised/specialised outputs for which the value of labour input is in fact the correct value of output . Where the output is actually sold in the free market, the observed market price is the economic efficiency price. In those cases where the output is not economically significantly priced (notably advisory), the appropriate shadow price would be the price charged by an equivalently qualified professional consultant working in the commercial sector. Based on the authors' own knowledge of the consultancy market, column 9 gives examples of the professional rates prevailing in Scotland as of autumn 2004.

Cultural Outreach

5.87 As noted earlier, there is a wide range of HEI cultural outreach activities, differing in terms of production and market characteristics. As can be seen from Cultural Outreach column 8 in Table B1 , it is unclear at the moment if any of these are priced at commercial rates, but it is reasonable to suppose that most are not.⁵⁷ Hence, shadow pricing will be required and different techniques may be appropriate for different outputs.

5.88 At the time of preparing Table B1 , the authors envisaged the use of two shadow pricing techniques for valuing Cultural Outputs, both of which have been discussed earlier and hence need only be summarised here.

- The input pricing method. This would be appropriate for Cultural Outreach activities which have strong public good characteristics, notably preservation of cultural heritage activities, but possibly also other “open” exhibitions, tours, etc. Here, the output value would be estimated as the sum of *all* input costs valued in terms of economic efficiency prices. This would also be appropriate for individualised/specialised services, such as artists in residence, some

⁵⁷ A more general point, pertinent to the pricing of all HEI outputs, may be made. In principle, it does no *harm* to assume all outputs need to be shadow priced. If in fact the observed price was a competitive market price, this will be revealed through analysis by the outcome result: shadow price = observed price.

workshops, personal recitals, etc. In these cases, the value of output is the value of *labour* input measured in economic efficiency prices.

- The willingness-to-pay parallel market method. As has been discussed, this involves using the observed price of a “similar” output which is bought and sold in a competitive market as the shadow price. This approach would seem obviously applicable to outputs such as concerts, plays, some exhibitions, etc.

5.89 However, in the course of preparing the present report, the authors identified a third shadowing pricing technique which would appear to be valid across a wide range of identified cultural outputs, and which in some cases seems preferable to the two techniques summarised above (remembering though that preferably more than one technique should be used to value each output.). This is the **time-cost method**, also known as the **travel-cost** method since it is used extensively in transport appraisals as can be seen from the following quote:

“Within central government, the Department for Transport’s (DfT) approach to valuing time in the appraisal of road schemes and other projects is well established. This approach uses different values for “employers” time and “own” time (or working and non-working time)”

Treasury Green Book pg 59.

5.90 The basic idea is that a person’s time is a scarce resource and as such has economic value. Time spent working has obvious value in terms of the pecuniary and non-pecuniary benefits derived from employment. However, leisure time also has economic value: it is enjoyed in its own right as a consumption good and it involves an opportunity cost in terms of forgone working. The DfT and others have expended considerable effort in obtaining quantitative estimates of the value of a unit of leisure time.

5.91 While the time-cost method has been used most frequently in transport studies, there is no reason it cannot be applied in other suitable cases, and many of the identified cultural outputs would appear to fall into this category.⁵⁸ Clearly, visiting an

⁵⁸ In fact, a growing use of the time-cost method is in environmental appraisals of natural heritage sights, game parks, and so on. This is clearly very analogous to the evaluation of cultural outputs.

exhibition or attending a concert involves time, and this is leisure time. Hence, an appropriate shadow price would be the economic value of a unit of leisure time. With this price, the appropriate volume measure of output would be “attendance time”.⁵⁹

5.92 The real virtue of the time-cost method in the present context is, not only is it applicable to a significant number of the identified cultural outputs, *but it would seem to be relatively straightforward to implement empirically*. In particular:

- It would make sense for anyone, but especially public bodies such as SHEFC and the Scottish Executive, to use the DfT’s estimate of the value of leisure time. Thus the *single* shadow price to be applied across-the-board is readily available from an “impeccable” third-party source.
- From Cultural Outreach columns 3 and 4 of Table B1 , it can be seen that in many relevant cases the required volume of “attendance time” *is* readily available, not directly, but through the simple multiplication of two **known** values. For example, for a concert:

$$\text{Total attendance time} = \text{number of attendees} \times \text{length of performance.}$$

5.93 More generally, where applicable the time-cost method would yield estimates of the economic value of the cultural outputs of the HEIs as:

Economic		Unit Price		Number		Average
Value	=	of Leisure	X	of	X	length of
		Time (DfT)		Attendees (HEI)		Attendance Time
						(HEI)

⁵⁹ A “next steps” refinement would be to include the time spent travelling to and from the activity. This would significantly complicate the analysis, but would be worth considering for the “out-of-town” Scottish campus HEIs in particular. In all cases, however, the volume measure proposed in the text will give a *firm minimum* economic value for the cultural outputs, which is usually the most useful value in policy debates.

Community Outreach

5.94 Although there are a large number of outputs listed in Table B1 , all the pricing principals involved have been discussed previously and hence the discussion here is brief. This is *not* to minimise the significance of these outputs, particularly in relation to the broad “HEI Knowledge Transfer” discussion currently taking place in Scotland.

As can be seen from Community Outreach column 6 in Table B1 , some of the identified outputs, notably in the areas of “continuing education” and “lifelong learning” teaching provision, are actually priced. Column 7 suggests that few of these are free market prices, but where they are, this should be adopted as the economic efficiency price.

5.95 However, perhaps more than in any other group, Community Outreach outputs seem to be non-priced or not economically significantly priced. Hence, in most cases shadow pricing will be required to estimate economic value.

As shown in column 8 of table B1 , two (by now familiar) shadow pricing techniques are suggested as being applicable to the majority of community outreach outputs.

5.96 For outputs of a “taught course” or “advisory service” nature, the proposed method is to identify the price in the commercial sector offering comparable services. For “individualised” services, the value of labour input at efficiency prices would be an appropriate estimate of output price. The time-cost method *might* be usable in some cases, but consideration would have to be given to whether the unit value of working time rather than leisure time should be utilised, since, for example, the courses included here are “educational” rather than “recreational”.

Other.

5.97 As discussed earlier, some reclassification of items here into other groups may be desirable. Taken as it stands, the most important point to note is that all of the outputs of Residence and Catering are priced, and as a first approximation all of these prices are free market prices. *Hence there is no need to shadow price this large*

volume of output at all. This is obviously true of operations in the holiday and business tourism markets. However, it is also true of student residential provision and day-to-day catering activities, with the University's R&C department being "price conscious" and "market sensitive" to actual and potential competition from commercial sector providers.

5.98 If Strathclyde's R&C services department operates in a "competitive environment", then this is probably also true for all other Scottish HEIs located in cities and large towns. However, one would wish to look more closely at R&C pricing policies in out-of-town, or small town, Scottish HEIs. In principle, these departments would appear to enjoy a quasi-monopolistic position in the provision of some R&C services, but this does not necessarily mean that they choose to exploit it.

Columns 7 and 8 indicate that most or the remaining items in this group will have to be shadow priced, using techniques discussed earlier in this report.

5.99 In summary, obtaining efficiency prices for Scottish HEI outputs is the most difficult of the three programme objectives to accomplish. Using actual prices where appropriate and shadow pricing techniques elsewhere, the task appears to be feasible, though requiring effort and care. Inevitably, particular problems arise in pricing those HEI outputs which have public good characteristics.

6

Conclusions and next steps

6.1 The key aim of this project was to assess the feasibility of developing an economically meaningful approach to the measurement of Scottish higher education institutional outputs. The particular microeconomic approach adopted was based on welfare economic theory and principles.

6.2 The project was devised as essentially a scoping study to determine:

- how far an economically valid approach could be developed to cover all of the work of Scottish higher education institutions
- whether it would be practically feasible for the approach to be used for a full-scale assessment of the economic value of the outputs of Scottish HEIs.
- whether such a full-scale assessment would yield additional insights to assist the SHEFC in resource allocation issues, particularly in relation to knowledge transfer

6.3 The original proposal envisaged the outcome to be a report which covered a number of areas. These are discussed in turn.

6.4 Grounding the study approach in fundamental economic principles

- *a review of the economic principles underlying this approach to Higher Education Institutions and how policy terms such as ‘value for money’, ‘performance indicators’, ‘trade-offs’ etc can be interpreted in terms of fundamental concepts of economic efficiency and equity.*

Technical Appendix A (*Relevant Fundamental Principles of Welfare Economics: Efficiency, Equity and Social Welfare*) together with Sections 3 (*Fundamental issues in Measuring Higher Education Institution Prices and Values: Efficiency, Equity and Other Considerations*) and 4 (*Alternative Empirical Measures of HEI “Economic Value” and Related Evaluation Techniques and Indicators*) of this report have

presented a comprehensive exposition of the relevant economic theory and the fundamental issues involved in its application to higher education institutions.

6.5 As highlighted in the introduction to this report, the project team viewed such an exposition to be essential for the credibility of this new approach to higher education. It was also extremely important for the measurement of Scottish higher education institutional outputs to be put into the context of ‘recommended best practice’ for the measurement of NPISH outputs; the benefits to the SHEFC of this having been done are outlined subsequently in discussion of the possible next steps to this project and the potential future research agenda.

6.6 Identification of variables and feasibility of measurement

- *A recommended set of identified activity variables and volume measures.*
- *An indication of how far appropriate economic efficiency prices can be derived for the relevant activity measures and where additional data may be required.*

Drawing on and developing previous case study research on Strathclyde University, Section Five (*Towards the Empirical Estimation of the Economic Value of the Outputs of the Scottish HEIs*) and the extensive Table B1 in Appendix B of this report explains the identification, classification and volume measurements possible for Scottish HEI outputs both in physical and monetary units.

6.7 A major outcome is that it does appear to be feasible to identify variables and obtain volume and value measures for the large majority of Scottish HEI activities. Some measures can be obtained from observed data, and others developed using Cost-Benefit Analysis techniques. It was found that all areas of higher education activity, including those related to culture and community engagement, are amenable to such techniques.

6.8 Externalities

- *Consideration of the issues relating to externalities.*

There has been discussion relating to various aspects of externalities throughout this report (see for example pages 48 - 63). The study team have found that there are many difficulties with the treatment of externalities, including the identification of what genuinely constitutes an externality to higher education institutions. There is an extensive body of literature focussing on externalities – but there remains considerable difficulty in separating the elements of what may be considered as an externality to *higher* education from that believed to be created by education more generally. As discussed in pages 52 - 54 , a number of the identified externalities (such as the ability to participate as a citizen in society through capacity to ‘fill in forms’, for example,) are skills more likely to be acquired during earlier stages of education rather than being attributable to higher education per se.

6.9 Furthermore a number of the ‘additional benefits’ seen as being associated with higher education (the graduate’s propensity to enjoy better health for example) are really *private* benefits accruing first and foremost to the graduate him or herself, the value of which may already have been taken into the graduate’s own calculations of the outcome of their investment in higher education. The externality arising is more likely only to be if the example of the graduate’s better health positively influences other non-graduates to behave in a healthier way.

6.10 The team could find no work having been undertaken focussing on externalities to Scottish higher education specifically. However the team consider it unlikely that study of externalities would have a particular ‘Scottish’ dimension over and above the more generic issues that may be applicable UK-wide.

6.11 It can also be observed that *the further one can go towards the measurement of direct outputs, the less relevant any measurement of ‘externalities’ becomes.* The definition of externalities depends at least in part on the equivalent defined volume

measurement and value measurement of direct outputs. The more the ‘products’ that can be included as direct outputs, as is the principle in this report, the fewer things remaining as ‘externalities’. It is a way of ‘internalising the externality’. So, for example, being able to put an economic value on the cultural outreach outputs of an HEI obviates the necessity to postulate the existence of other benefits in the form of externalities. By far the largest part of economic value will have already been captured within the measurement of direct output.

6.12 This would mean that in evaluation of investment in particular initiatives, where direct output value is equal to or exceeds the direct cost of a particular activity, it is not necessary to be overly concerned about capturing the value of externalities. It is worth noting that practically all of those externalities suggested in the literature as being linked to higher education are positive. Hence an externality effect, where it exists, can be regarded as a ‘bonus’ - but detailed consideration of the value of any related externality only needs to come into play in a situation where the direct output value is less than the direct cost.

6.13 Future agenda and policy relevance

- *An outline agenda recommending where additional investigation could be productive and where further investment could be best focussed, including on appropriate surveys etc.*
- *A discussion of the possible ways in which such future investigation could be of assistance to policy-makers, especially with regard to efficient and equitable resource allocation.*

Following on from points 6.8 – 6.12 above, in the research and overview of key literature undertaken in the course of this study it is clear that the whole area of externalities - not only the definition, but also empirical measurement, is large and complex and is worthy of examination in considerably more depth than was possible within this project.

6.14 However the major reason and motivation for undertaking this study was to assess if it is possible to gain insights into the economic value of higher education institutional activity, particularly to inform public resource allocation decisions.

6.15 As Section 5 of this report(*Towards the empirical estimation of the economic value of the outputs of the Scottish HEIs*) elaborates, the study has demonstrated that an economically valid approach to assessing economic value is possible and also the study authors believe it is feasible to undertake this analysis for Scottish higher education institutions. The results would immediately inform a comprehensive evaluation of resource allocation and use in Scottish higher education; that is, issues relating to all aspects of economic efficiency in Scottish HE could be addressed from a firm evidence base. The study also has shown that such an assessment would help to identify the likely orders of magnitude in any equity-efficiency trade-offs, which is valuable because equity considerations are an integral component of the policy agenda on higher education..

6.16 It should be highlighted that because Section 5 of this report takes each category of outputs sequentially, it may at first sight appear to be a larger and more extensive task that it actually is. The most difficult task is not in fact the collection of the required information for volume measurements but rather the development of some of the necessary shadow-prices. But once one has developed a shadow-price for some areas of output, one finds that the same measure can be applied to a number of other areas. (For example in relation to shadow-pricing labour). The single set of prices thereby derived would apply to all HEIs – it does not have to be done separately for each. This would require largely desk-based input.

6.17 In the original project proposal a preamble to the proposed delivery outcomes suggested that a more aggregate list of variables may be developed for all Scottish HEIs, largely because at that point the team believed that this would be the best way forward. The team had thought that disaggregated data on all HEI outputs may not exist or be impossible to locate. However the project evolved beyond its original conception and it was realised that:

- a) maximum disaggregation was essential (See Section 5 , pages 74 -75) for rigorous analysis and

b) maximum disaggregation did not necessarily militate against the practical implementation of a full-scale assessment.

6.18 On consideration the authors realised that the vast majority of the data required to develop physical volume measures of HEI outputs exist in one shape or form. It may not currently be collated or processed in the way required for this approach but Scottish HEIs regularly collect an extraordinary amount of data for a very wide range of purposes. This can be both for internal management reasons (information on external advisory appointments, other staff contributions to external activities, publications, seminars etc are all requested within personnel review procedures) and also in response to the external requirements of HESA, the RAE, the Higher Education Business and Community Interaction Survey, reporting for Transparency Review requirements etc. It is likely to be easier for HEIs to extract the ‘raw’ disaggregated data than to expend additional resources in processing and classifying all of the data into more aggregate form – which would be the case should a more aggregate set of variables be used for data collection.

6.19 Indeed it may only require a one-off refinement of some current and extant annual surveys (the HEBCS for example) to yield a large proportion of what is necessary - rather than having to initiate an entirely new survey - and this is likely to be the best way to obtain the required information.⁶⁰ A preliminary brief note of *some* of the extant HEI-wide data sources and surveys is included as Appendix F.

6.20 The accounting price ratios developed from the assessment would remain valid for a number of years and could be used for application to specific incremental projects. In Cost-Benefit Analysis the accounting price ratios are similar to and can be used in a similar way to the ‘multipliers’ derived from HEI impact studies.

6.21 Conducting a full-scale assessment of Scottish HEI outputs following this method would yield a number of policy relevant benefits for the SHEFC.

⁶⁰ The development of institutional repositories (which many Scottish HEIs are in the process of establishing) could also make it relatively easy for HEIs to harvest relevant data on all research outputs (beyond that used for the RAE).

- The assessment of Scottish higher education institutional outputs would yield previously unavailable information regarding not only technical and cost efficiency aspects of higher education outputs but an insight into the *allocative* efficiency of the HEIs. Knowledge relating to allocative efficiency is essential for the development of evidence based policy in relation to resource allocation, particularly the allocation of resources intended to support the most economically valuable aspects of higher education institutional activity.
- An overall evaluation of the economic value of Scottish HEI output would provide evidence that the SHEFC can use in discussions with the Scottish Executive and the Scottish Parliament as well as to inform discussion with Scottish Enterprise. All parties are interested in the extent to which Higher Education Institutions can contribute to the economy. The outcome of a full-scale assessment would strip away at least some of the elements of the ‘black box’ that currently exists, whereby investments are de facto made ‘in hope’ rather than in knowledgeable expectation.
- By adopting the output measurement approach, the SHEFC would also have the necessary information in relation to higher education outputs that is fully consistent with the National Accounts and the new developments recommended by Atkinson – which are now being implemented by government throughout the UK, including in Scotland.

6.22 In relation to the latter point, it is worth highlighting that in Scotland discussions are already underway within the Scottish Executive concerning how the Atkinson approach can be implemented for those elements of Education that form part of government output. The UK Department of Education and Skills have also been working on measures of Education output and have announced (February 2005) that a review group for these measures is being formed . It is almost inevitable that in due course Government will seek NPISH sector measurements that conform to this approach.

6.23 Having already developed the necessary direct output measurements for higher education institutions , the SHEFC would not only ‘be ahead of the game’ elsewhere

but would also be empowered to compare and contrast different elements of the education system in terms of economic value.

6.24 Development of performance indicators

The project outcomes will assist the SHEFC in the refinement and formulation of appropriate performance indicators for a full range of higher education activity across Teaching, Research, Consultancy/Advisory Work, Community Outreach and Cultural Outreach.

6.24 Section 4 of this report (*Alternative empirical measures of HEI “economic value” and related evaluation techniques and indicators*) gives a comprehensive explanation of how a range of different measures, indicators and forms of analysis can be derived. These include business ratios together with indicators of technical efficiency, cost- efficiency, cost-utility and allocative efficiency, together with explanation of how the calculation of net financial value, net economic value and net social value can be made.

6.25 Adopting the proposed HEI output measurement approach is to a large extent a logical extension of work that the SHEFC has been already engaged in. For example, the efforts to develop knowledge transfer and other metrics against which the SHEFC can justify investment.

6.26 It would also be feasible to conduct a partial assessment of those areas of HEI activity of most interest – for example a programme of analysis with separate components examining outputs under some of the 6 divisions used (Teaching , Research, Consultancy, Advisory, Cultural Outreach , Community outreach) or a selection of the disaggregated output variables regrouped into a ‘Knowledge Transfer’ classification .

6.27 This report began by outlining the increasing policy interest in the role of higher education in the economy, and the growing desire for ways to assess the economic contribution that higher education institutions make. Being able to assess the

economic value of Scottish higher education outputs would provide one piece (but a fairly substantial piece) of the overall ‘Higher Education and the Economy’ jigsaw. It will not answer every question – and indeed the principle of triangulation that is discussed in this report underlines the good judgement of the SHEFC in seeking to encourage research into higher education’s economic role and value from a variety of perspectives.

6.27 Insights gained from implementation of the microeconomic approach developed in this study should ideally be examined alongside outcomes of research from other perspectives such as the macroeconomic. The proposed collaboration between the SHEFC and the Research Councils to stimulate further research into the economic aspects of higher education is to be warmly welcomed.