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Measuring the volume and value of the outputs of higher education institutions

Ursula Kelly

Iain McNicoll

1. Introduction

One of the key issues facing the Scottish Government and Scottish Funding Council is how to assess the contribution made to Scotland's economy by Scotland's higher education sector. In Scotland (as well as in the rest of the UK) it is widely accepted that higher education institutions (HEIs) have an observable economic impact through their activities as large businesses and that they generate output and employment. HEIs are important export earners through their attraction of international students together with internationally funded research and consultancy.

There is also interest in how higher education can support wider economic growth and development through 'knowledge transfer' from universities to the wider region, including through students and graduates as well as through fuller exploitation of the results of university research. An emphasis on universities' role in the economy has grown in tandem with a desire from government to maximise the return on public investment in higher education. Higher Education's contribution to the economy and society at large is viewed as providing one of the most important justifications for government expenditure on higher education. The Scottish Government has recently expressed an explicit desire for universities to demonstrate that the public funding provided to universities is used in ways that are aligned with the Government's strategic objectives, particularly its economic and skills strategies with the contribution to the economy being one of the most important areas ("New Horizons" Taskforce Report 2008.)

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 a paucity of robust quantitative evidence against which related resource allocation decisions aimed at encouraging economically valuable activity can be made.

The Scottish Funding Council (SFC), which distributes the largest share of the public funds received by Scottish Universities, has invested considerable effort into identifying aspects of higher education activity that could be defined as being primarily concerned with 'knowledge transfer' to businesses and the wider community; it has sought to encourage such 'knowledge transfer' activity through resource allocation mechanisms (SFC "Knowledge Transfer from Scotland's Higher Education Institutions" 2005.) However taking higher education activity as a whole there has been no practical, valid, way to analyse the economic

value of what universities do, or to compare the value thus created with that generated by other activities in the economy. Indeed, as the emphasis on the importance of higher education to the economy grows, there is an increasing need for more in-depth knowledge of HEI activity and hard quantitative evidence of HEI impact on the economy and society. Therefore, further analysis of HEI operations and interactions is key to understanding which elements of higher education activity may be most valuable.

2. Objectives and guiding methodological principles

Fundamentally the Scottish HEI sector is an industry, comprised of enterprises using economic resources to produce economic outputs. The overall objective of this paper is to show how the development of a framework with comprehensive and detailed quantitative measures of the outputs of HEIs in both volume and value terms can enable a holistic analysis of higher education institutions' economic value.

Producing a set of comprehensive quantitative measures of higher education institutional outputs would:

- 1) Allow assessment of the 'size' of the contribution of the HEI sector to the Scottish economy in terms comparable with those of other industries
- 2) Provide information for the evaluation of the efficiency (both technical and allocative) of the Scottish HEIs in production; i.e. "value for money" calculations
- 3) Assist in the creation of appropriate signals/incentives to encourage the HEIs to achieve technical and allocative efficiency
- 4) Create a statistical data set for the HEIs equivalent to that likely to be required in due course for Scottish and UK public sector and third sector bodies (Atkinson 2005.)

The present paper draws on initial case study research supported by the Nuffield Foundation which was further elaborated in two substantive reports to the Scottish Funding Council. The initial case study work of a Scottish HEI (Kelly & McLellan 2004) explored the potential for defining and identifying all the case study HEI outputs; the subsequent study (Kelly, McNicoll & McLellan 2005) assessed the feasibility of extending this approach to all Scottish HEIs. The 2005 report gave a comprehensive exposition of how the principles of welfare economics could be applied to Scottish higher education institutions to enable the outputs of the Scottish HEIs to be identified, quantified and valued in ways that are economically valid and policy meaningful. The conceptual framework was further developed in Kelly, McNicoll & Brooks (2008) and a pilot study undertaken applying the principles to selected sub-sections of HEI outputs.

The approach devised for estimating the economic value of Scottish higher education institutions is rooted in the fundamental principles of welfare economics. It is consistent with national and international best practice as exemplified in the UN System of National Accounts

(SNA1993) and the European System of Accounts (ESA 1995). It is also consistent with developments in the Office of National Statistics and government statistical services for productivity measurements of non-marketed services (see Atkinson 2005.)

There are 3 key procedural steps involved:

1) Identification of the outputs of HEIs (what HEIs actually produce.) This should include all meaningfully separable outputs of the HEIs, covering all activities, not only conventional 'Teaching and research'

2) Quantification of the volume of HEI outputs (how much they produce). This involved defining one or more natural units of volume measurement applicable to each of the outputs identified in (1) above.

3) Pricing the outputs to impute value. This involves identifying appropriate prices or unit values to be applied to each of the volume measures in (2) above.

The application of (1) and (2) would provide volume measures of HEI outputs. These can be used, for example, to derive indices of production and for analyses of growth, productivity and cost/technical efficiency.

Application of all steps, from 1 through 3, provides value measures of HEI outputs.

Value = quantity of output produced x price per unit of output

Application of all steps can provide size and growth measures in terms of GDP, etc and can also inform both cost/technical and allocative efficiency calculations. Application of all 3 steps would be an essential precursor to a full cost-benefit analysis of the activities of the HEIs.

3. Key issues

o Outputs and Outcomes

Current discussion regarding the contribution of higher education to the economy and society is frequently expressed in language that relates to 'desired outcomes' such as 'a higher skilled workforce' or 'improved social cohesion'. These tend to be outcomes desired by 'society' or by 'government' acting on behalf of society.

Evaluation of government investments is usually focussed on the relevant investments' impact on the government's overall desired outcomes. Such evaluation is usually undertaken within a 'policy cycle' framework which considers 'Rationale, Objectives, Appraisal, Monitoring (Implementation), Evaluation, Feedback (ROAMEF) (HM Treasury Green Book 2003.) From a government perspective, investment in higher education fits into this framework in the same way as investment in any other commissioned programmes and services. It forms part of the

Implementation phase and government's main concern is properly focussed on achieving final desired outcomes such as 'sustainable economic growth', a 'Wealthier & Fairer', 'Smarter', 'Healthier', 'Safer', 'Greener' society etc (Scottish Government National Performance Framework Outcomes 2007.)

Within the ROAMEF framework higher education institutions (which are not part of government but are third party organisations) are on the supply side of the production boundary and not on the commissioning side. They can be asked to deliver outputs(they can teach an agreed number of students, work with local businesses, spin out companies, run workshops for schoolchildren from disadvantaged areas) that contribute to government objective outcomes, but they cannot actually deliver or guarantee the outcomes (a Wealthier and Fairer society' etc.) Overall desired outcomes are dependent not only on the work of the HEI but on a range of factors over which the HEI may have little or no control (this could include, for example, the willingness or ability of students to learn, the degree of real interest from local business, the willingness of schools or parents for schoolchildren to participate in workshops etc.)

Figure One: Example of HEI output and possible related outcome

HEI Input	HEI Activity	HEI Output	Societal Desired Outcome
Lecturer time	Teaching	Hours of teaching delivered to X number of students	A more highly educated and productive population

To summarise: outputs are what an HEI can actually produce. Outcomes are more generic societal results or "the eventual benefits to society" (HM Treasury Green Book 2003) to which the HEI outputs may partly contribute but cannot guarantee. Making a clear distinction between outputs and outcomes is essential for assessment of the value of the work of higher education institutions and particularly when considering performance indicators to assist decisions on resource allocation for higher education institutions. Any value indicator needs to relate to things over which the HEI has control and can do something about. Otherwise there is the risk of penalising HEIs for things they cannot help or rewarding them for things they did not do. It *may* eventually be possible to estimate the degree to which HEI outputs contribute to overall desired outcomes but in the first instance at least there must be much more thorough analysis of HEI outputs i.e. what they actually produce.

○ **Higher education institutional outputs : value and pricing**

When considering the 'value' of higher education institutional outputs, there are predominantly three measures that are economically meaningful and policy-relevant.

1) Financial value. This relates to the actual revenues which the HEIs receive in exchange for supplying their outputs and is basically what appears in the HEI

accounts. It relates to the financial viability of HEI operations: i.e. whether they break even, make a surplus or go into deficit. The information is essential for accounting purposes but may be of limited value for economic analysis.

2) Economic value This is the value obtained when the prices applied to HEI volume outputs are economic efficiency prices. In many cases these can be approximated by 'free market' prices and in others can be estimated from economic principles. This information is essential for assessing the true 'worth' of the HEIs to the economy, for efficiency calculations and for informed incremental resource allocation decisions.

3) Social value. This could be interpreted in terms of the application of 'social prices' to HEI volume outputs, but is better interpreted as being the modification of HEI economic value by the application of appropriate social weights. These weights will generally be determined by government agencies reflecting Scotland's chosen social welfare function (e.g. related to desired outcomes such as 'a fairer society'.) HEI social values can be used for similar analysis to economic values, notably for resource allocation decisions, but with the emphasis on contribution to general social welfare rather than the economy per se. The use of social weights could be a way of translating HEI outputs into desired societal outcomes.

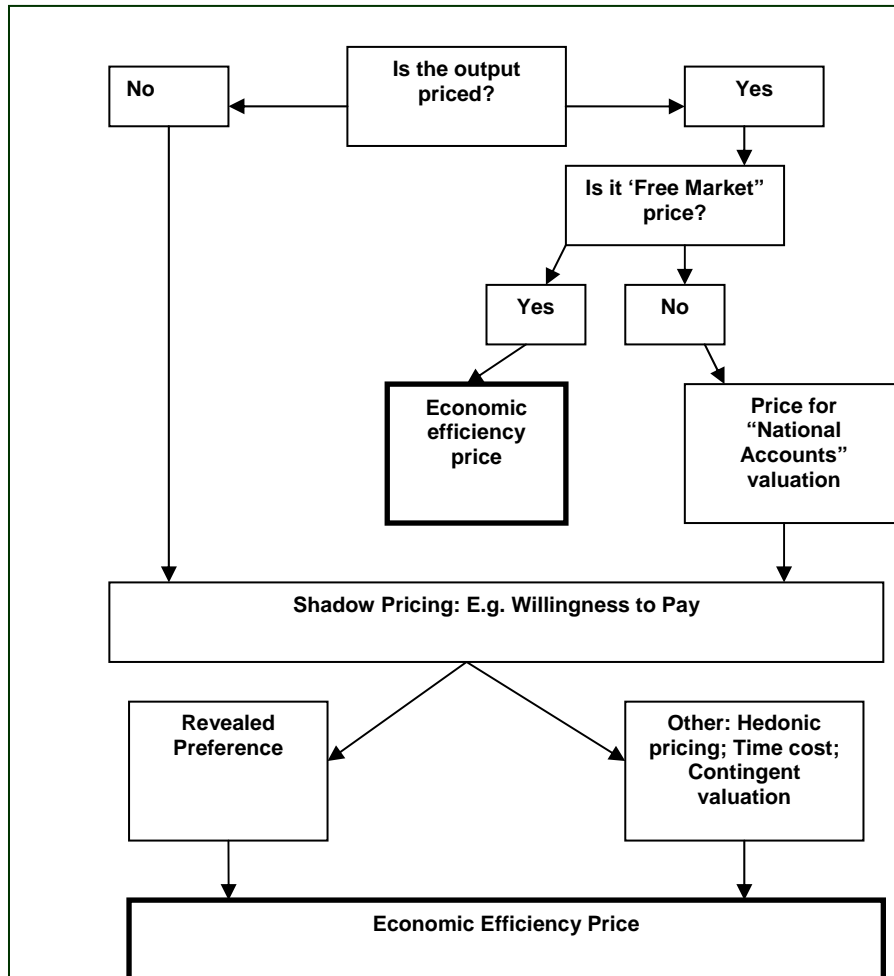
This paper is focussed on the holistic analysis of the economic value of HEI outputs (the wider application of other measures of value, particularly social value, is further elaborated in Kelly, McNicoll & Brooks 2008.) In order to impute an economic value to higher education institutional outputs, the relevant outputs need to be priced. The prices to be identified should relate as closely as possible to the 'economic efficiency' price (which could be loosely referred to as the 'free market' price.)

Identifying the prices to be applied to higher educational institutional outputs is not always a straightforward procedure, particularly because Scottish HEIs do not operate within an entirely market-based framework and there are numerous outputs which have no actual 'price' attached. However a range of 'shadow-pricing' techniques can be adopted where actual prices are either not appropriate (clearly below or above free market prices) or do not exist.

Every identified output can be subjected to a 'price analysis', where the first step is to assess the financial value, or the actual price received by the HEI, and whether or not this is a 'market' price. If it appears to approximate a market price (for instance the non-EU tuition fee rate in Scottish Universities appears to be very close to free market rates) that can be used as the value. If the output does not appear to be market- based (for instance domestic tuition fee rates) or is not priced at all (for instance open public lectures), then a system of shadow-pricing can be operated. This can include a wide range of economic techniques such as

contingent valuation, time cost etc. Sometimes a number of different techniques may be feasible; triangulation of the results could produce the most suitable price figures.

Figure Two: Price Search Strategy



4. Observations from initial empirical case-study work

While the primary mission of Scottish higher education institutions is usually described as 'teaching and research', Scottish HEIs are in fact involved in a very wide range of activities, some of which are related to or spring from their 'teaching and research' mission but not all of which are obviously or easily classified. However the initial case study work found that it is possible to identify a comprehensive and detailed set of HEI outputs which are meaningfully separable in both statistical and policy-relevant senses. In the detailed case-study institution this set contained over 220 separate outputs allocated into six major groups:

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

- Other (this included, for example, Library, Career and sports services or facilities provided to external parties)

It was also possible to derive one or more natural volume units of measurement for each of the separately identified outputs. A significant amount of the required output volume data is already generated by the Scottish HEIs, though not all of it is collected or processed centrally. In many cases minor modifications to existing data-generation procedures could provide explicitly fit-for-purpose information.

In terms of pricing data however, the only “price” information held by the HEIs relates to financial values. Estimation of efficiency prices needs to be done by third-party desk based research (this is probably desirable in any event, in the interests of objectivity.) In the case study and pilot work, it was observed that application of economic techniques could in most cases provide price estimates. Almost by definition, social weight values will be given by external third parties, notably public sector bodies (for instance the HM Treasury Green Book gives explicit sets of social weights.)

Figure Three: Example HEI outputs

Output Type	Measurable	Possible natural unit measurement	Possible appropriate pricing to be applied
Teaching: MSc International Marketing	Yes	Number of FTE students	Non-EU fee rate
Research: Articles published	Yes	Number produced	Possibly Commercial NUJ rates for written articles
Consultancy /public policy /Advisory work e.g. serving on UK Gov committees	Yes	Number of staff hours involved	Commercial consultancy rate for equivalently qualified personnel
Cultural Outreach e.g. Chamber Choir performance	Yes	Number of Performances x attendees x hours spent	Time cost
Community Outreach e.g. public lectures	Yes	Number of events x no. of attendees x hours spent	Time cost
Other e.g. Sports Centre facilities provision to local communities	Yes	Number of hours hired	Equivalent rates for similar commercial sports facilities

In some areas of activity (teaching of domestic students, advisory work for government and third sector bodies and cultural outreach) there are early indications that economic values of HEI outputs differ significantly from financial values. This emphasises the need for the type of analysis envisaged in the present paper. In each of the areas mentioned the economic value is greater (sometimes significantly so) than financial value, but there is no general presumption that this will be the case in all areas.

In terms of estimating both output volumes and economic prices, the most difficult area appears to be “research”. There needs to be further consideration of the extent to which some research outputs (e.g. a seminar paper) are intermediate rather than final outputs. A wide range of outputs which are research-related such as, say, a newspaper article explaining a piece of research to the general public, are not always recorded or recognised within the institution as a research output and hence it would be difficult to obtain reliable data on these. Reliably pricing or shadow-pricing academic journal articles is difficult.

However the advance of the ‘open access’ movement and establishment of digital repositories (where all university staff deposit copies of their research work – articles, reports and other forms of output) to make them openly accessible over the internet could potentially be helpful in the future in relation to both harvesting output volume data and also, by providing usage (download) statistics, possible ways to impute value through tracking actual research output usage.

Some technical issues remain to be resolved, notably with regard to externalities and the output/outcome interface. In particular, what is the precise relationship between HE-related ‘outcomes’ and HEI ‘outputs plus externalities’?

5. Concluding remarks

Implementation of something like the programme outlined in the present paper would seem to be necessary and desirable if policy discussion about Scottish HEIs is to evolve in a productive and progressive manner. Certainly, informed rational resource allocation decisions with regard to the HEIs require estimates of at least economic value, if not social value.

There can be initial hostility in some parts of the HE sector to quantitative analysis of HEI outputs. In the course of the pilot work undertaken, for example, the view was sometimes expressed by participants that the importance of HEI cultural activities is beyond economic evaluation and that attempts should not be made to assign monetary values to cultural outputs. However this discomfort was to the most part overcome once

participants more fully understood the scope and broader purpose of economic valuation (in particular the difference between financial and economic valuation.) In any event, to the extent to which activities of a 'cultural' nature use resources that would otherwise be applied elsewhere (building a Chemistry lab, for example, or paying health worker salaries), they have an opportunity cost and therefore will always have an economic dimension.

Pragmatically, it is likely that the HEIs will have to produce at least volume estimates of output in the near future in the light of national and EU legislation regarding statistical requirements from public bodies and non profit-making (third sector) bodies.

Implementation of the programme would not appear to be excessively expensive, and would be particularly cost-effective if:

- (a) data generated for the programme could be used to replace or subsume other questionnaires and surveys, and
- (b) the price and social weight estimates derived could be used for non-HEI government funded projects and programmes.

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