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**“POLICY SCEPTICISM” AND THE IMPACT OF SCOTTISH
HIGHER EDUCATION INSTITUTIONS (HEIs) ON THEIR
HOST REGION: ACCOUNTING FOR REGIONAL BUDGET
CONSTRAINTS UNDER DEVOLUTION.**

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“Policy Scepticism” and the Impact of Scottish Higher Education Institutions (HEIs) on
their Host Region: Accounting for Regional Budget Constraints under Devolution

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Abstract

A “policy scepticism” has emerged that challenges the results of conventional regional HEI impact analyses. In this paper we provide a systematic critique of such scepticism. While rejecting its extreme form, we note the limiting effect of the binding public-sector expenditure constraints under devolution and show how conventional impact analyses can be augmented to accommodate these constraints. While our results suggest that conventional impact studies overestimate the expenditure impacts of HEIs, they also demonstrate that the policy scepticism that treats these expenditure effects as irrelevant neglects some key aspects of HEIs, in particular their export intensity.

Keywords: Higher Education Institutions, Input-Output, Scotland, Impact study, Multipliers, Devolution.

JEL classifications: R51, R15, H75, I23.

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1. Introduction

There have been numerous studies of the impact of higher education institutions (HEIs) on their host regional economies that focus solely on their effect on the local demand for goods and services (see e.g. Florax, 1992 and McGregor *et al.*, 2006, for reviews). These demand-side studies treat a university like any other business which demands goods and factor services within the region. The best of these studies employ regional input-output analysis, though a “policy scepticism” has emerged that challenges the value of such analyses. This scepticism asserts that either binding demand-side budget constraints or supply-side resource constraints “crowd out” HEI expenditure effects on the host regional economy, to the point where the regional impact of HEIs expenditures is taken to be negligible. A further complementing factor is the perception of a moral hazard in evaluation studies, which undermines the credibility of impact studies. In this paper we provide a systematic critique of this view. However, while we reject the extreme form of policy scepticism, we acknowledge the importance of binding public sector budget constraints under UK devolution and argue that future regional impact studies should be modified, where appropriate, to accommodate these constraints. Furthermore, we acknowledge the importance of methodological rigour and transparency of assumptions, in order to maintain the credibility of impact studies.

The argument is illustrated through an application to Scotland. This is a UK region with a large higher education sector and partially devolved fiscal responsibilities. The choice of Scotland is particularly appropriate for two reasons: Scotland’s devolved status imposes a binding public sector expenditure constraint at the regional level and the availability of relevant data for the Scottish economy and Scottish HEIs allows a degree of confidence in the results that is more difficult to replicate for other regions in the UK. However, it should be emphasised that this approach is generally applicable to all impact studies of publicly-funded activities in regions with a devolved budget.

Our analysis of HEI impacts is based upon a purpose-built, HEI-disaggregated set of Input-Output (IO) accounts for Scotland, in which the higher education sector is

separately identified¹. We derive the expenditure impacts of HEIs using standard IO assumptions. However, we also consider how these assumptions, and their associated current practice, have to be modified to accommodate the binding budget constraint of the Scottish Parliament. We also implement a novel treatment of student expenditure impacts in which, in line with standard IO assumptions, we seek to identify the degree to which student's consumption expenditures can be treated as exogenous.

This paper focuses exclusively on the expenditure impacts of HEIs and their students. However, it must be stressed that these are only part of a broader interaction between HEIs, the economy and the wider community. Importantly, HEIs stimulate the supply side of their host regional economies through activities such as: improving the skills in the labour force (Blundell *et al.*, 2005; Bradley and Taylor 1996; Checchi, 2006; Harmon and Walker, 2003; Psacharopoulos and Patrinos 2004), undertaking knowledge exchange (Acs, 2009; Anselin *et al.*, 1997; Fischer and Varga 2002; Parker and Zilberman 1993; Varga and Schalk 2004) and contributing to innovation (Andersson *et al.*, 2009; Anselin *et al.*, 2000; Jaffe 1989; Lundvall 2008). Recent evidence suggests human capital plays a key role in the causal link from HEIs to innovation (Faggian and McCann, 2009; Faggian *et al.*, 2010). Furthermore, a persuasive case has been made that a more educated population results in long term indirect benefits, such as improved public health and lower crime rates (McMahon, 2004, 2009). Supply side-impacts are potentially large relative to demand-side impacts (Hermannsson *et al.*, 2010c) and merit a systematic study at the regional level.² However, that does not mean expenditure impacts are yet fully understood. This paper seeks to clarify some of those demand-side issues.

The remainder of the paper is structured as follows. In Section 2 we outline the approach taken by conventional (IO-based) regional HEI impact studies and summarise the results from using this method. In Section 3 we explore the basis of "policy scepticism". We argue that complete supply-side crowding out is not applicable in the context of a single devolved region. However, the recognition of a binding government expenditure constraint should be incorporated into HEI impact calculations in the case

¹ For details of the construction of the Input-Output accounts, the derivation of the income and expenditure structure of the HEIs sector and the data sources used see Hermannsson *et al.* (2010a).

² For an overview see: Goldstein (2009), Hermannsson and Swales (2010) and McMahon (2009).

of UK devolved regions such as Scotland. In so far as increased HEI activity in Scotland is financed by the Scottish Government's reducing expenditure on other activities, then the effect of this expenditure switching should be explicitly identified. The aggregate impact of expenditure switching is much lower than the impact of a corresponding level of additional expenditure, though in the Scottish case the net impact remains positive.

In Section 4 we show that it would be wrong to infer from the small net "balanced expenditure multiplier", which applies to Scottish general government expenditure being switched to HEIs, that HEIs have a negligible net overall demand-side impact on their host region. 45% of Scottish HEI's funds do not come from the Scottish Government reflecting the export intensity of Scottish HEIs as a group.

We present brief conclusions in Section 5. Overall, our results suggest that conventional impact studies overestimate the impact of HEIs expenditures on their host region. However, we also demonstrate that the policy scepticism that treats the expenditure effects of HEIs as irrelevant neglects some important characteristics of these institutions, notably their export intensity. The measured impact of Scottish HEIs is used to illustrate this analysis. However, the approach is relevant to measuring the impact of activities requiring any degree of public funding in regions where budgets are devolved.³

2. Conventional regional impact analyses

Conventional demand-side impact analysis of HEIs on their host regions identifies the total effect as the sum of the impact of institutional expenditures and of (typically part of) the expenditures of their students. We begin with a brief account of regional input-output-based impact analyses, starting with institutional, and then subsequently student, expenditures

³ Indeed the analysis may have a more general applicability, since even where budgets are not devolved there may be interest in identifying the demand-side implications of expenditure switching.

2.1 Theoretical basis of conventional regional impact analyses

Regional impact analysis is frequently employed to capture the total spending effects of institutions, projects or events. In addition to identifying the direct spending injection, multiplier, or “knock-on”, impacts are estimated by summing the subsequent internal feedbacks within the economy. In this section we briefly outline the standard methods adopted by impact studies⁴. We use these standard methods to derive the conventional expenditure, or demand-side, impacts of the HEI sector on the Scottish economy for 2006.

Most regional demand-driven models (e.g. Export base, Keynesian multiplier, Input-Output) make a crucial distinction between exogenous and endogenous expenditures. In these models, exogenous expenditures are those determined independently of the level of activity within the relevant economy, whilst endogenous variables are driven by, and therefore dependent upon, such activity. Specifically, the demand for intermediate inputs, and often the domestic demand for consumption goods, is taken to be endogenous. Other elements of final demand (exports, government expenditure and investment) are typically taken to be exogenous⁵. The models therefore trace a clear causal pathway from exogenous to endogenous expenditure.

In the standard Leontief Input-Output approach, total activity within the economy can be expressed as the product of final demand and a multiplier process, represented by the Leontief inverse. This is summarised as:

$$q = (1 - A)^{-1} f \quad \text{Equation 1}$$

⁴ For a more detailed account of the methodology of impact studies and regional multipliers see Armstrong and Taylor (2000), Loveridge (2004) and Miller and Blair (2009).

⁵ The distinction between endogenous and exogenous activity depends on the model and the application. Extended and dynamic IO models endogenise additional elements of final demand, such as government expenditure and investment (Batey and Madden 1983, Batey and Rose 1990, Madden 1993). Also in the environmental accounting literature, McGregor *et al.* (2004) suggest endogenising trade in a single region context in an attempt to link local polluting emissions fully to local private and public consumption.

where q is the vector of gross outputs, f is the vector of final demands and $(1-A)^{-1}$ is the Leontief inverse matrix. The output multiplier for any sector is the change in total output for the economy as a whole resulting from a unit change in the final demand for that sector. It can be found as the sum of the entries in the relevant column of the Leontief inverse. This allows a convenient expression for the gross output q_i attributable to the final demands f_i for the output of sector i :

$$q^i = l_i f_i \quad \text{Equation 2}$$

where l_i is the output multiplier for sector i .

Although a number of variants are available, the Type-I and Type-II demand-driven multipliers used here are typical for Input-Output based impact studies. Type-I multipliers incorporate the increase in demand for intermediate inputs but treat household consumption as exogenous. Type-II multipliers include both induced intermediate and household consumption demands as endogenous. Multipliers can be derived that relate a variety of activity outcomes to changes in exogenous demands. Examples are employment, income, output or GDP multipliers. For further details, see Hermannsson *et al.* (2010a), Miller and Blair (2009, Ch. 6).

A key assumption underpinning the conventional interpretation of these demand driven models is that the supply-side of the economy operates passively. That is to say, a change in demand in a particular sector generates a proportionate change in supply, where the additional output is supplied in exactly the same way, with exactly the same production processes, as the original output. At the regional level, multiplier analysis is conventionally validated by assuming one of two sets of conditions. In the short and medium run, passive supply is justified by general excess capacity and regional unemployment. In the long run, it is supported by factor supplies effectively becoming infinitely elastic, as migration and capital accumulation ultimately eliminate any short-run capacity constraints (McGregor *et al.*, 1996)⁶.

⁶ The nature of the regional economy naturally governs the acceptability of such assumptions. For example, in the island economy of Jersey the institutional framework restricts migration so that supply-side crowding out can be expected even in the long run (Learmonth *et al.* 2007).

We base the present study on an adjusted version of the official Scottish Input Output table (Hermannsson *et al.*, 2010a). Income and expenditure data for Scottish HEIs are used to specify a separate HEIs sector. That is to say, the education sector given in the official IO table is split into two elements, HEI and non-HEI education. This disaggregation necessarily identifies the income and expenditure structure of Scottish HEIs and makes it possible to derive appropriate (sector-specific) multipliers. The table, and associated model, treat the HE sector as any other sector: as a demander of goods and services and factor inputs, and as a supplier of services to meet intermediate and final demand. Applying these principles to derive the demand-side impacts of HEIs entails estimating the economic activity contingent upon the economy's final demand for the HEIs' services.

In addition to the impact of the institutions' own expenditures a further impact that needs to be accounted for is the implicitly linked (exogenous) students' consumption expenditure that occurs within the local economy. In practice this involves: determining the level of student spending; judging the extent to which this is additional to the Scottish economy; and identifying how student expenditures are distributed among sectors. The most difficult part of this process is the disaggregation of students' consumption expenditures into its exogenous and endogenous components.

2.2 The regional impact of HEIs' own expenditures

An extensive literature estimates the demand-side impact of HEI spending on their host regional economies solely through these expenditure-related effects. Florax (1992) lists over 40 studies of the regional economic impact of HEI expenditure. Much has been published since, and McGregor *et al.*, (2006) summarises the methods and findings of the main UK studies. Table 1 below reviews the major Scottish HEI impacts studies. Most UK studies, especially the earlier work, are based on Keynesian income-expenditure models e.g. Armstrong (1993), Battu *et al.* (1998), Bleaney *et al.* (1992) and Brownrigg (1973), whilst a smaller number use some variant of IO modelling e.g. Blake and McDowell (1967), Kelly *et al.* (2004) and most recently Hermannsson *et al.*

(2010b)⁷. These studies differ in the type of multiplier they report, the approach used to derive the multiplier values and the geographical scale over which the impact is measured. Unsurprisingly, therefore, the multiplier values generated differ somewhat and are in many cases not directly comparable⁸.

A variety of multipliers can be derived to link a particular exogenous change to changes in a number of economic activity metrics. The output multipliers relate changes in final demand to the change in gross output. Therefore, a Type-II output multiplier of 2.15, as found in McNicoll (1993), implies that a unit increase in the final demand for the outputs of Strathclyde University leads to a Scotland-wide change in output of £2.15. The stated employment multipliers show the economy-wide change in employment caused by a unit increase in direct employment. The household income multiplier used by Blake and McDowell (1967) is slightly unusual, but appropriate for their small borough application, where they relate changes in the total output of the University of St. Andrews to changes in local household income. The GDP multipliers used by Brownrigg (1973) link exogenous changes in regional GDP to the overall change in regional GDP⁹.

⁷ McGregor *et al.* (2006) argues that although less frequently applied, the IO analysis is methodologically superior to Keynesian income-expenditure models. However the latter might be used in circumstances where indicative results are considered sufficient or IO accounts are not available and cannot be constructed with the resources available.

⁸ Except perhaps in the most recent studies based on the Scottish Input-Output tables. Although it should be noted that the multipliers for HEIs cannot be obtained directly from the Scottish Input-Output tables but have to be disaggregated from the education sector based on supplementary information. The final outcome of this process is sensitive to the exact process and the data sources. Some aspects of the HEIs incomes and expenditures are particularly important in this regard, such as the quality of available data on imports.

⁹ For further details on Keynesian multiplier models see Chapter 1 in Armstrong and Taylor (2000).

Table 1 Overview of main Scottish HEI impact studies

Subject of study	Multiplier value	Geographic boundary	Source of multiplier value
St. Andrews University (Blake and McDowell, 1967)	1.45 (household income)	St. Andrews (pop. 10,000)	Local Input Output Table: See Blake and McDowell (1967)
Stirling University (Brownrigg, 1973)	1.24 - 1.54 (GDP)	Parts of Stirling and Perth (pop. 96,000)	Keynesian multiplier: Brown (1967), Greig (1971)
Strathclyde, Stirling and St. Andrews Universities (Love and McNicoll, 1988)	1.34, 1.43, 1.36 (student spending)	Scotland	Keynesian multiplier: Brownrigg and Greig (1975), McNicoll (1981)
Aberdeen, Dundee and Stirling Universities (Love and McNicoll, 1990)	2.18 (output), 1.75 (GDP), 1.95 (employment)	Scotland	Scottish Input Output Tables 1979
Aberdeen University (Battu <i>et al.</i> , 1998)	1.46 (spending), 1.61 (employment)	North East of Scotland	Keynesian multiplier: Greig (1971), Brownrigg (1971), McGuire (1983), Harris <i>et al.</i> (1987)
Strathclyde University (Kelly <i>et al.</i> , 2004)	1.63 (output type-II), 1.38 (employment, type-II)	Scotland	Scottish Input Output Tables 2000
Strathclyde University (McNicoll, 1993)	2.15 (output type-II)	Scotland	Scottish Input Output Tables 1989
Scottish HEIs (1) (McNicoll, 1995)	1.76 (output type-II), 1.7 (employment type-II)	Scotland	Scottish Input Output Tables 1994
Scottish HEIs (2) (McNicoll <i>et al.</i> , 1999)	1.73 (output type-II), 1.42 (employment type-II)	Scotland	Scottish Input Output Tables 1997
Scottish HEIs (3) (McNicoll <i>et al.</i> , 2003)	1.6 (output type-II), 1.4 (employment type-II)	Scotland	Scottish Input Output Tables 2004
HEI impacts project (Hermannsson <i>et al.</i> , 2010a,b)	1.3 (output type I), 2.1 (output type II)	Scotland	Scottish Input Output Tables 2004

When we apply conventional input-output analysis to our HEI-disaggregated Input-Output table for Scotland, we find that in 2006 the Type-I output multiplier for the HEIs sector is 1.33 and the Type-II multiplier is 2.12. That is, each £1 of final demand for the output of HEIs should generate Scotland-wide output amounting to £1.33 if indirect knock-on effects are included and £2.12 if the induced impacts on household consumption are counted as well.

2.3 The treatment of students' consumption expenditures

In past impact studies student expenditures have been treated in two alternative ways: one incorporates only the expenditures of in-coming students (e.g. Kelly *et al.*, 2004), the other includes all student expenditures, irrespective of their origin (e.g. Harris, 1997). Here we argue that each of these past treatments represents an approximation to an input-output accounting approach in which the crucial distinction is between the exogenous and endogenous components of student expenditures. While it is true that the whole of external students' expenditures can be regarded as exogenous to the host region, home students' expenditures cannot legitimately be treated as either wholly endogenous, which is what would be required to validate the first approach, nor wholly exogenous, which would be required to validate the second.

We make a distinction between three types of student. These are: students from outwith the UK; students from the UK previously domiciled outwith Scotland; and students from Scotland. We identify these as foreign, RUK and Scottish students respectively. Our treatment of foreign students is straightforward: their expenditures are taken to be unambiguously exogenous, as their incomes are assumed to be derived wholly from an external location. The appropriate treatment of their expenditure is similar to that of tourists.

From a Scottish perspective, RUK students are very similar to foreign students in that most of their income is sourced externally. However, we assume that a proportion of their expenditure is covered by wages earned locally. In an Input-Output framework,

this expenditure simply displaces the expenditure of other local workers who would have taken these jobs; the corresponding expenditure is not exogenous.

For Scottish students, the distinction between their endogenous and exogenous consumption is less clear cut. To a large extent their income, and hence consumption, is endogenous to the local economy in that it comes not only from wages earned from local industries but also from transfers from within local households. For Scottish students we adopt simplifying assumptions that are in line with the standard IO-notion of exogeneity. The exogenous components of local students' consumption expenditures are assumed to be expenditures financed from commercial credit taken out during their years of study, student loans and education-related grants and bursaries.

For information on Scottish students' income and expenditures we draw on a comprehensive survey by Warhurst *et al.* (2009). A more detailed account of our treatment of student expenditures is given in the Appendix. The multiplier impact of this consumption is calculated using a student expenditure vector estimated by Kelly *et al.* (2004). For student consumption spent on Scottish goods and services, the output multiplier is 1.8. However, the following adjustments need to be made to derive the impact on Scottish economic activity from student consumption. First, almost a third of student consumption expenditure is on imports to Scotland. Second, the non-exogenous expenditure needs to be removed from the impact calculation. After these adjustments the multiplier values for foreign, RUK and Scottish student consumption are 1.22, 0.89 and 0.50 respectively. This implies that £100 of consumption expenditure from foreign students in Scotland supports £122 of Scottish output whilst the corresponding expenditure from a local student supports £50 of Scottish output.

2.4 The aggregate output supported by the expenditures of HEIs and their students in Scotland

Table 2 shows the aggregate output supported by the expenditures of Scottish HEIs, together with the corresponding figures for student consumption. We begin with the institutional expenditure. The direct expenditures of Scottish HEIs in 2006 are £1,913 million, measured in 2006 prices. This equals just over 1% of total Scottish output. The

indirect and induced Type II multiplier effects are given as £2,148 million, so that the conventional, demand-driven impact calculation ascribes 2.28% of Scottish output, either directly or indirectly to the HEI sector. The associated direct employment is 31,520, which makes up nearly 1.6% of total Scottish employment. When multiplier effects are added the level of employment conventionally taken to be supported by the HEI sector is 55,136, just over 2.75% of Scottish total employment. The greater impact of HEI expenditure on employment derives from the fact that the sector itself is relatively labour intensive so that a relatively large share of the initial expenditure is on labour.

The demand-side impacts associated with student expenditure quantifies the output and employment effect of the additional exogenous consumption expenditure made by students. The direct output is the domestic output purchased by this exogenous expenditure. It amounts to £394 million, which is just over 0.2% of Scottish output. Again multiplier effects generate an additional £314 million, implying that Scottish student exogenous expenditure makes up, directly or indirectly, 0.4% of Scottish output. The associated direct employment is calculated as the direct employment required to produce the direct output. This is 3,545 Full Time Equivalent (FTE) jobs with an associated 3,334 indirect and induced FTEs generating a total of 6,879. This is 0.34% of total Scottish employment.

Table 2 Summary of expenditure impacts of HEIs, based on traditional IO-assumptions (output in £m and employment in FTE's, or % of Scottish total).

	Final demand for domestic output		indirect and induced impacts		Total impact	
HEIs output, £m	1,913	1.07%	2,148	1.20%	4,062	2.28%
HEIs employment, FTE's	31,520	1.58%	23,616	1.18%	55,136	2.76%
Students output, £m	394	0.22%	314	0.18%	708	0.40%
Students employment, FTE's	3,545	0.18%	3,334	0.17%	6,879	0.34%
Total output, £m	2,308	1.29%	2,463	1.38%	4,770	2.67%
Total employment, FTE's	35,065	1.76%	26,949	1.35%	62,014	3.10%

It was noted in Section 2.3 that the impact of a given amount of expenditure by students from outwith the UK or by students from the rest of the UK has a bigger demand impact on the Scottish economy because a bigger proportion of the expenditure is exogenous. It

is also the case that expenditure per head is higher for foreign students. However, despite the relatively modest per student impact, Scottish students make up 70% of the student population and therefore drive approximately 50% of the total student consumption impact. The significance of the consumption spending of students from the rest of the world is little less at approximately 30% of the total consumption impact, whereas the remaining 20% is made up by the expenditure of students from the rest of the UK.

This section has outlined best practice for estimating the demand-driven impact of HEIs and their associated student population using the conventional Input-Output approach. That is to say, it has attempted to identify exogenous final demand expenditures and then calculate the indirect and induced effects using a standard Input-Output multiplier. The results suggest that in 2006 the expenditures made by Scottish HEIs and their students directly or indirectly supported almost 2.7% of Scottish output and 3.1% of Scottish employment. The next section examines the policy scepticism aimed at this approach and considers appropriate responses.

3. Policy scepticism and the impact of HEIs

There is a distinct degree of "policy scepticism" aimed at multiplier based studies of the expenditure impacts of HEIs. This has been expressed in private conversations within HEI policy-circles in Scotland and the UK, as well as in questioning during knowledge exchange seminars and other public engagement activities, where expenditure impacts have been presented¹⁰. We detect three sources for this scepticism. These are that demand-driven multiplier studies do not recognise resource restrictions; that they are often commissioned for advocacy purposes and tend to overstate the potential demand-side knock-on effects; and that they fail to incorporate public sector budget constraints. The cumulative impact of these criticisms is to undermine the credibility of such studies within the policy community. However, we argue that only the third of these concerns has fundamental validity when considering the regional demand-side impacts of specific

¹⁰ The authors participated in a 3-year long UK-wide initiative on the economic and social impacts of HEIs for which the funders (ESRC, DELNI, HEFCE, HEFCW, SFC) emphasised regular public engagement in pre-arranged knowledge-exchange seminars across the UK. For details of the initiative see: <http://ewds.strath.ac.uk/Default.aspx?alias=ewds.strath.ac.uk/impact>

publically funded activity. Further, in the case of HEIs, this reduces, but does not eliminate, their significant demand-driven impacts.

3.1 Resource Constraint

One potentially important source of scepticism within the UK about regional demand-driven impact multipliers is the 100% crowding-out argument that characterises the HM Treasury Green Book's analysis of regional impacts (HM Treasury, 2003). Here a pure demand disturbance that stimulates employment in one region has an equal and offsetting impact on employment in other regions of the UK, given that the UK economy is taken typically to operate at "full employment" (or the natural rate of unemployment or NAIRU).

However, even if there were 100% crowding out at the level of the UK as a whole, this would not apply at the level of the host regional economy. This result requires fixed, fully-employed resources. This is much less credible at the regional level than at the national level. In the short run regional policy is typically attempting to increase activity in an underemployed local economy, and in the long run both capital and labour are mobile between regions. It is therefore quite legitimate for Scottish and Welsh governments, for example, to be concerned about the demand-side impact of particular institutions/expenditures for their own economies. In this context, aggregate host-region employment multipliers are clearly not constrained to be zero.

3.2 Moral Hazard in Evaluation Studies

Demand-driven impact studies often adopt extreme assumptions in order to maximize the estimated economic contribution of a particular institution or activity. This line of criticism, as applied specifically to identifying the impact of HEIs, is picked up in Sigfried *et al.* (2007, p. 546) who conclude: "If these economic impact studies were conducted at the level of accuracy most institutions require of faculty research, their claims of local economic benefits would not be so preposterous, and, as a result, trust in and respect

for higher education officials would be enhanced". For a similar criticism of demand driven local impact studies of biofuel initiatives see Swenson (2006).

The policy scepticism that this engenders is a classic case of moral hazard in information transmission (Osborne, 2004, Ch. 10). Those commissioning the impact analysis have an interest in finding large effects. Further, the method of calculation, whilst conceptually rather straightforward, is technically quite complex. Therefore policy makers distrust the figures and one response is simply to discount them altogether. We view this as a serious issue but to ignore possible large variations in demand-side effects when taking policy decisions is not sensible. The most appropriate response is to require greater methodological rigour, which we hope to show in this paper.

3.3 Expenditure impacts under a budget constraint

The idea here is that an increase in public expenditure on HEIs will induce offsetting changes in demand through the operation of a binding regional public sector expenditure constraint. In the UK, the Barnett formula allocates a block grant to each of the devolved administrations, a grant that is calculated on a population basis¹¹. The devolved administrations have limited additional sources of revenue and cannot borrow or carry significant funds from one year to the next.¹² Therefore essentially UK devolved authorities, including the Scottish Government, have fixed annual budgets. However, there are no constraints on the allocation of these budgets across the devolved policy areas, one of which is higher education. There is no ring-fencing of expenditure within the budget, so that when the Scottish Government allocates expenditure to one activity, there is a clear opportunity cost in terms of possible

¹¹ The precise way the formula works is given in more detail in Ferguson *et al* (2003, 2007), though its operation in practice is thought to be rather more flexible, so that what is known as formula bypass can occur (Christie and Swales, 2010; Heald, 1994). This would be additional funding that extends the binding budget constraint and does not trigger the expenditure shifting discussed here. However, such formula bypass is typically linked to the funding implications of decisions taken by the central UK government on devolved budgets rather than funding outwith the block grant for additional expenditure decisions made by the devolved governments.

¹² The Scottish Government does have limited powers to vary its expenditure through adjusting the standard income tax rate up or down by 3 pence in the pound. This is the Scottish Variable Rate but it has never been used. For details see e.g. Lecca *et al.* (2010) and McGregor and Swales (2005).

expenditures on other activities. Within this framework, variation in any specific form of public activity can be seen simply as expenditure switching. From this perspective, policy makers could regard with extreme scepticism any demand-driven argument for a particular type of public expenditure. This is because it replaces other public expenditures which would have broadly the same demand-side impact. The multiplier would then be approximately zero.

Given this context, it can be misleading for an impact study to treat the Scottish Government's funding of HEIs as an exogenous stimulus to the regional economy, although that is standard IO practice. We regard this argument as valid and pursue the implications of taking the government's budget constraint into account in identifying the demand-driven impact of HEIs.

4. Expenditure switching, HEIs and public budget constraints

We wish to illustrate the importance of recognising the public sector budget constraint and the consequent expenditure switching that this implies. We therefore conduct two simulations. In each we introduce a hypothetical additional £100m of expenditure on HEIs in Scotland. In the first case we adopt the traditional impact study assumption that the exogenous increase in expenditure is entirely externally funded, for example from UK-level funding or foreign students' fees. This would have no direct ramifications for other public spending in Scotland. The second case examines how the impacts change when there is a corresponding reduction of other public spending in Scotland. In the latter case the offsetting £100m reduction in public spending is applied to an aggregation of those sectors that receive 93%¹³ of central and local government final demand in the Scottish IO tables.

The conventional Type-II multiplier for the HEIs sector is 2.12. Without any offsetting cutbacks in public spending the additional spending on HEIs therefore has an output impact of £212m. Approximately half of that impact is realised as a direct consequence

¹³ The public sector is aggregated from 5 sectors in the HEI-disaggregated IO table (IO115, IO116, IO117, IO118 and IO119). Approximately 10% of the sector's final demand is from other sources than government.

of increased activity in the HEIs themselves, whereas the other half is generated via “knock on” effects in other sectors, particularly the retail and service sectors. The total change in output and employment, and the distribution across sectors, is summarised in Table 2. These impacts are shown graphically in the darker shaded bars in Figures 2 and 3.

A more complex picture emerges with expenditure switching. The Type-II multiplier for other public expenditure in Scotland is 1.97. If an increase in HEIs funding is met by cutbacks in other Scottish public expenditure the ‘multiplier’ for switching is equal to $2.12 - 1.97 = 0.15$ ¹⁴. That is to say, for every £100m directed from the public sector to HEIs the output impact of switching is £15m. In particular the estimated import propensity of HEIs (13%) is lower than the public sectors’ import propensity (17%). Therefore for every £1 spent on HEIs more is retained within the regional economy than for government spending in general. A qualitatively similar result emerges in results for employment impacts.

The recognition of the regional budget constraint implies that multiplier effects on individual sectors are no longer universally positive, as in the conventional case. The net changes are again shown in Table 2 and in the lighter shaded bars in Figures 2 and 3. In particular, there is a significant contraction in the public sector and a net contraction in other sectors that are more sensitive to changes in general public expenditure rather than the expenditure on output in the HEI sector. “Banking and financial services” and the “Transport, post and communications” sector show small net reductions in activity. In a UK devolved context, changes in public expenditure, determined by the regional government and therefore financed through Barnett, typically involve expenditure switching (and certainly have an opportunity cost in terms of alternative uses within the region), and the multiplier effects are accordingly more subdued. Indeed, even the direction of the net impact cannot be known a priori. This is a crucial result that appears not to be widely appreciated in existing impact studies.

¹⁴ For further discussion of analysing the impact of expenditure switching within an IO context, see Allan *et al.* (2007).

Table 3 Impact of £100m increase in final demand for Scottish HEIs

Sector	Without Expenditure Switching			With Expenditure Switching		
	Change in Final Demand (£m)	Output Impact (£m)	Employment Impact (FTE)	Change in Final Demand (£m)	Output Impact (£m)	Employment Impact (FTE)
Primary and utilities	0	8	37	0	2	9
Manufacturing	0	14	99	0	7	50
Construction	0	8	78	0	3	31
Distribution and retail	0	21	364	0	3	61
Hotels, catering, pubs, etc.	0	5	140	0	1	16
Transport, post and communications	0	10	90	0	0	-4
Banking and financial services	0	8	48	0	-2	-12
House letting and real estate services	0	17	44	0	4	11
Business services	0	8	134	0	0	-6
Public sector	0	6	95	-100	-103	-1,735
HEIs	100	101	1,666	100	101	1,662
Other services	0	6	88	0	0	2
	100	212	2,882	0	15	86

Figure 1 Output impact of £100m increase in final demand for Scottish HEIs (£m).

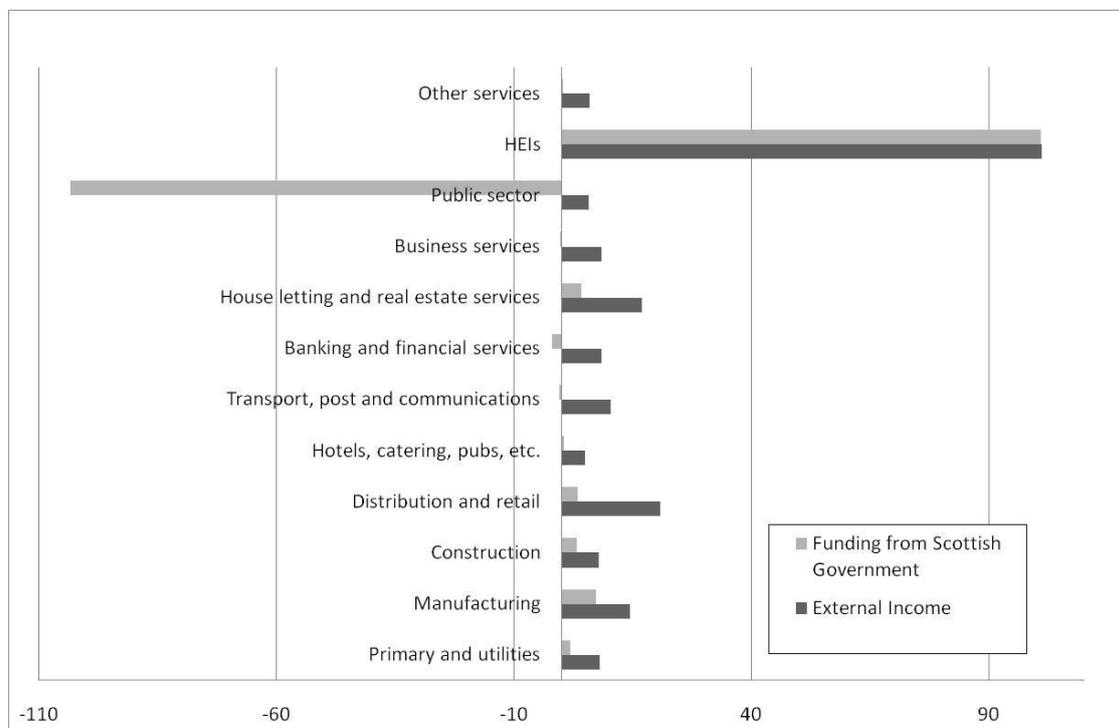
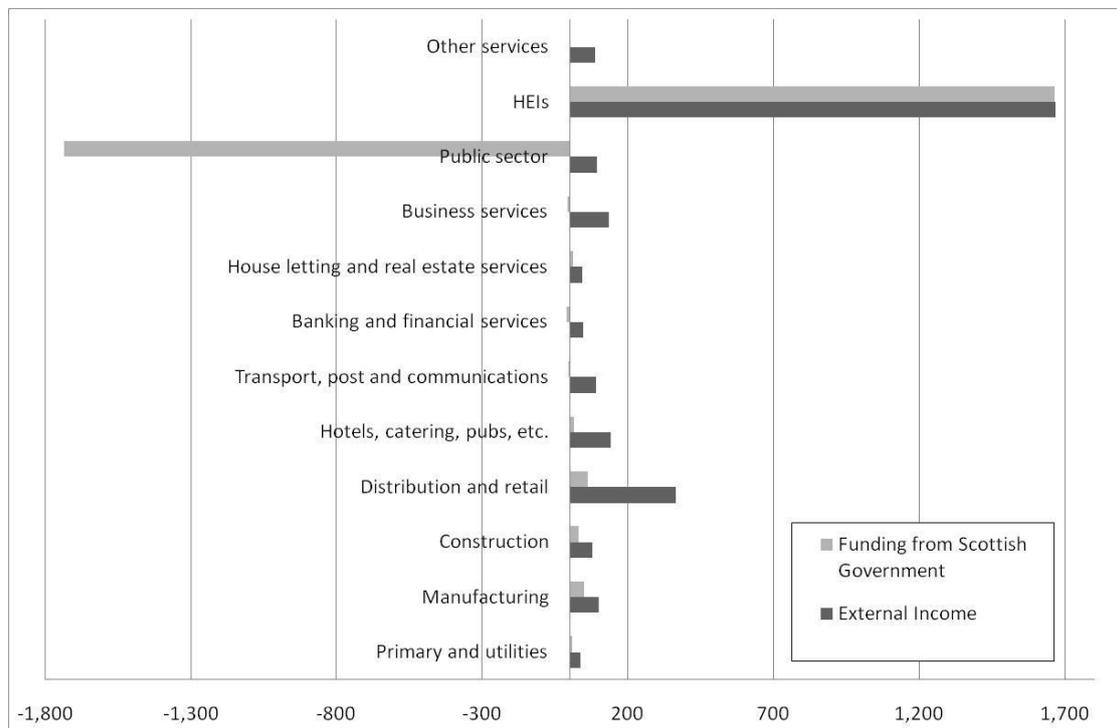


Figure 2 Employment impact of £100m increase in final demand for Scottish HEIs (£m).

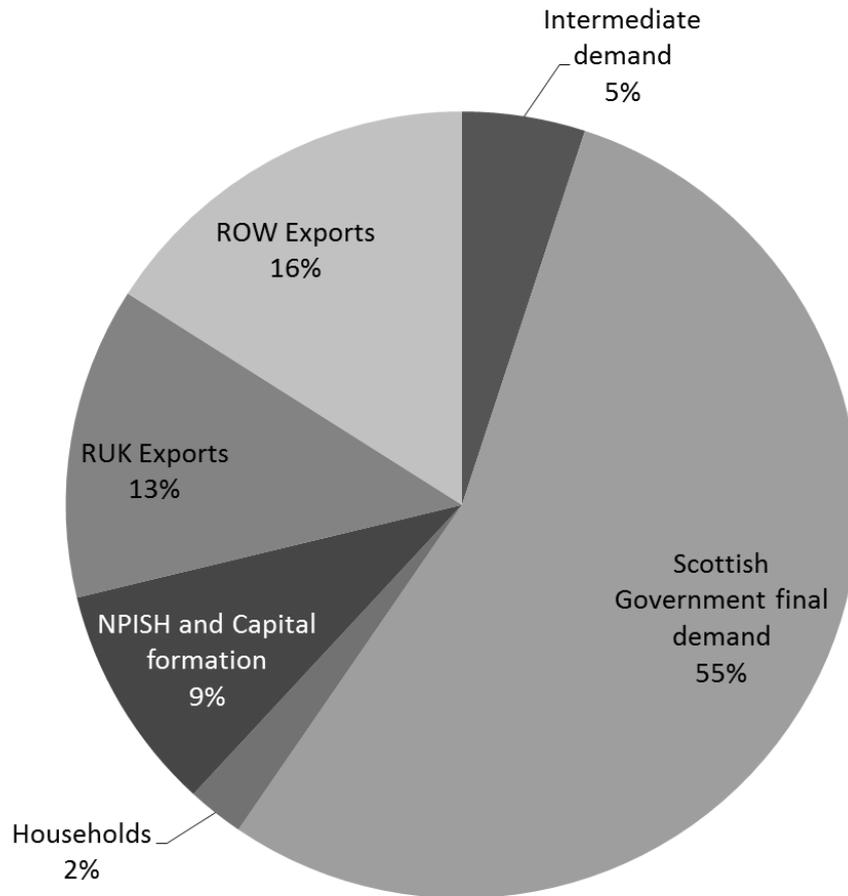


As can be seen from the analysis above, care must be taken in determining the source of financing for any impact study applied to a region with a devolved budget. While the example of HEIs is used here, the principle is quite general. Devolution matters a great deal for the appropriate conduct of regional impact analyses.

Such expenditure switching might be interpreted as implying that the impact of HEIs' spending is very limited at the Scottish level. However, while HEIs are often thought to be part of the public sector they are in fact non-profit organisations. An analysis of their income based on data from HESA (Hermannsson *et al.*, 2010a) reveals that just 55% of their income can be traced back to the Scottish Government. Some 29% comes from sources outside Scotland and approximately 16% originates from households, businesses, charities and other institutions whose funding is independent of the Scottish Government. The external income is unambiguously additional to the Scottish economy and it is reasonable to assume the latter part is as well. Even if the regional public sector budget constraint implies complete crowding out of public spending on HEIs within the region, only a part of HEIs activities is publicly funded. In fact, HEIs are characterised by significant exports (to the rest of the UK and the rest of the world), and

changes in export demand do not trigger any offsetting expenditure switching among final demands. The sources of income of Scottish HEIs are summarised in Figure 4¹⁵. In the next section we explore the significance of this pattern of funding for the attribution of HEI impacts on the host region.

Figure 3 Income structure of the HEIs sector in the HEI-disaggregated Input-Output tables



¹⁵ It should be noted that RUK exports include central government expenditures such as grants offered by research councils based on UK-wide competitive bidding. However, this category also includes income from non-government sources, such as tuition fees paid by students from the RUK. Furthermore, income from intermediate demand is treated as endogenous in the IO-model and is therefore counted as part of the "knock-on" impacts, rather than driving a "knock-on" impact. For a discussion of this point and how it is sometimes misunderstood in impact studies in practice see Oosterhaven and Stelder (2002). For details of how these incomes are determined see Hermansson *et al.* (2010a).

5. Accounting for the regional budget constraint within the Input-Output framework

The Input-Output tables provide a useful accounting framework. Based on the distinction between exogenous (final demand) and endogenous ('knock-on') expenditure, all activity within the regional economy can be attributed to elements of regional final demand. As discussed in the previous section, there is a criticism levelled against the conventional way of deriving the economy-wide expenditure impact of HEIs. This is that, given their funding arrangements in Scotland, attributing to HEIs the impact of spending Scottish Government funds is disingenuous. Such an impact is not so much caused by the HEIs per se as it is by the availability of funds from the Scottish Government and potentially similar results could be obtained if the funds were to be switched to other public services. The Input-Output framework, combined with detailed information about the income sources of HEIs, enables a disaggregation of the sector's impacts in terms of the origin of the exogenous final demands. This allows an analysis of the extent to which the impacts attributed to the HEIs sector under a traditional IO approach should in fact be attributed to the expenditure of the Scottish Government.

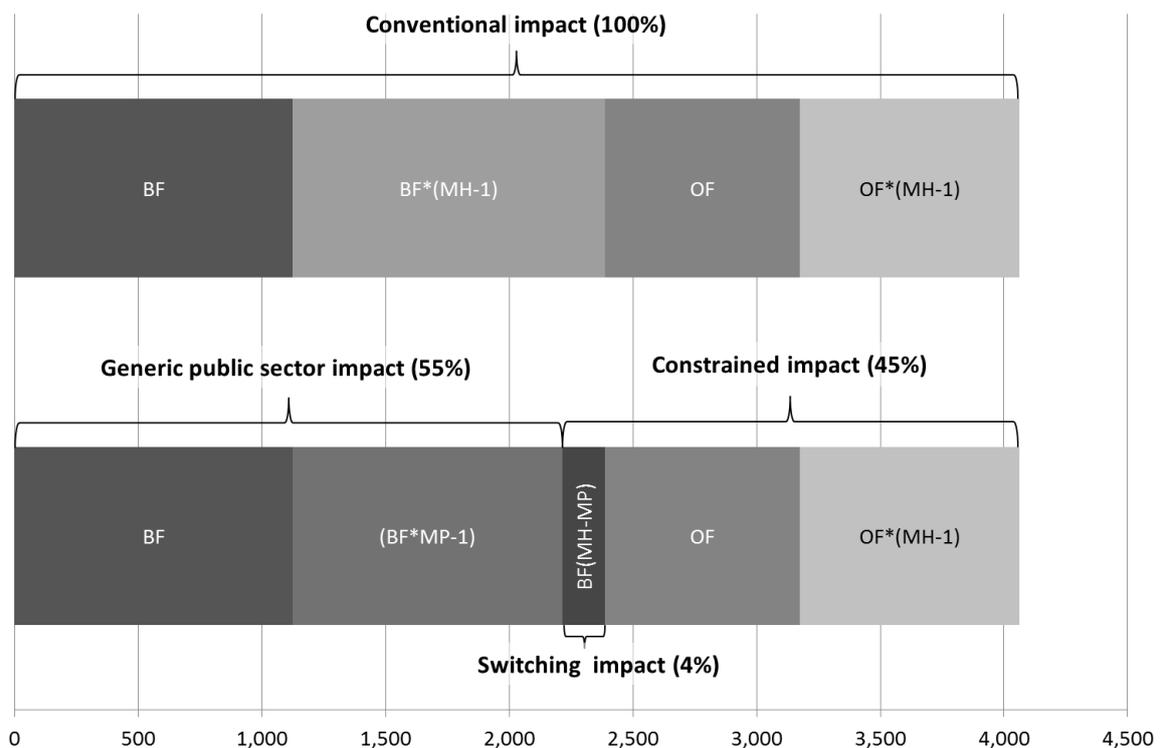
In order explicitly to take account of the public expenditure switching effects, as discussed in Section 3, we deduct the impacts of the Scottish Government ('Barnett') funding from the overall expenditure impact. The direct expenditure on the output of Scottish HEIs is divided into Barnett funding (BF), which comes through the Scottish Government, and other funding (OF) which includes all other sources, including exports to the rest of the UK and the rest of the World. The conventional attribution to HEIs, as performed in Section 2, is simply $(BF+OF)M_H$, where M_H is the multiplier value for the HEIs sector. The results of this attribution are summarised in Figure 5. The adjusted attribution subtracts the Barnett funded element and its own multiplier effects, which equals $BF*M_P$ where M_P is the multiplier for the aggregated public sector. The adjusted attribution is therefore given by equation 3.

$$(BF+OF)M_H - BF*M_P = OF*M_H + BF(M_H - M_P) \quad \text{Equation 3}$$

where $M_H - M_P$ is the switching multiplier value identified in Section 3.4. To summarise, the demand impact of HEIs net of Scottish Government funding equals the impact attributable to other funding sources $OF * M_H$ in addition to the switching impact $BF(M_H - M_P)$.

To clarify, the impact of Scottish Government funding upon HEIs can be re-arranged into a 'generic' public expenditure impact and a 'constrained' impact. The demand impacts of the HEIs sector are illustrated in these terms in the lower bar of Figure 5. As the diagram reveals, when the expenditure impact of HEIs is disaggregated according to the source of income, just under half of it can be classified as a generic public sector impact, leaving just over half of it as a constrained impact. This constrained impact comprises the direct, indirect and induced effects of the HEI expenditure that is not subject to the budget constraint of the Barnett funding received by the Scottish Parliament plus the switching impacts..

Figure 4: Output impact of HEIs disaggregated by origin of final demand. Upper bar shows the conventional components of the gross impact while the lower bar breaks the impact into a generic public sector impact and constrained impact by implementing expenditure switching, £m



An exactly analogous argument can be made in respect of the appropriate attribution of student expenditure impacts. In this case we have:

$$(BF_S + OF_S)M_S - BF_S * M_P = OF_S * M_S + BF_S(M_S - M_P) \quad \text{Equation 4}$$

where, BF_S is student's consumption final demand attributable to Scottish Government student support¹⁶, OF_S is students' exogenous final demand for consumption from other sources, M_S is the output multiplier for students' consumption expenditures and M_P is the output multiplier for the public sector.

Table 4 Summary of overall spending impacts attributable to HEIs, by origin of final demand and type of impact (output, £m).

	Generic public sector impact	Constrained impact	Conventional impact
Institutional spending	1,125	788	1,913
Knock on impacts	1,091	885	1,976
Switching impact		172	172
Institutional impact total	2,216	1,846	4,062
– % of total impact	55%	45%	100%
Exogenous student spending	87	495	582
Knock on impacts of student's consumption	84	108	192
Switching impact		-65	-65
Student's consumption impact total	171	538	708
– % of total impact	24%	76%	100%
Total impact attributable to HEIs	2,387	2,384	4,770
– % of total impact	50%	50%	100%

When students' consumption expenditures are analysed in this way the results are qualitatively different from those for the HEIs' institutional expenditures. Primarily as a result of its strong direct import component, the output multiplier associated with students' consumption expenditure is smaller than that for public sector expenditure per se. In this case the Scottish Government gets a smaller demand stimulus from expenditures on student support than from general public expenditure. In this case, the switching multiplier is negative, whereas it is positive for HEIs' institutional

¹⁶ For details see Appendix.

expenditures. Table 4 shows the impact of students' consumption expenditures together with that of the Scottish HEIs institutional expenditure.

In this section of the paper we examine the impact attributable to the HEI sector in Scotland in more detail than is typical for impact studies. The analysis reveals that there is some justification for a degree of policy scepticism based on the binding regional public budget constraint. Slightly less than half of the impact of the HEI sector in Scotland is a 'generic' public spending impact that would have materialised anyway had the public funds been used to expand the host region's public sector, although there is a small positive switching impact of public funding for HEIs' own expenditures, and a small negative switching impact for students' consumption expenditures. However, the work also shows that the extreme form of policy scepticism, which argues that once the public budget constraint has been accounted for the impact of the HEIs' expenditures on the host region is negligible, is not supported by the evidence. This result is primarily attributable to the funding for HEI and student consumption expenditures that comes from sources independent of the Scottish Government.

6. Conclusions

A "policy scepticism" appears to have developed that constitutes a major challenge to studies of the regional impacts of HEIs. In the limit this policy scepticism suggests that the expenditure impacts of HEIs on their host regions are negligible, and can therefore be ignored. We reject the binding resource constraint rationale for policy scepticism on a priori grounds, but do acknowledge the significance of the binding regional public sector budget constraint under devolution. We build this constraint into an augmented IO analysis using our purpose-built HEI-disaggregated IO table for Scotland. Our results offer some support for policy scepticism in that we estimate that half of the regional expenditure impacts of Scottish HEIs is attributable to public funding that could generate similar (though not identical) effects if put to alternative uses, such as expansion of the public sector within the host region. Conventional multiplier/ impact analyses therefore do overstate the expenditure impacts attributable to HEIs per se. However, the remaining impact is nonetheless substantial in the Scottish case, and certainly not negligible, as the extreme form of policy scepticism implies. In fact, if funds

used directly to finance the Scottish public sector were instead used to finance HEIs, there would be a small net positive multiplier effect reflecting the lower import propensity of HEIs. But for similar reasons the switching of public funds to students and away from the public sector would have a net negative multiplier impact.

Although the hypothetical notion of switching public funding illustrates the point that expenditure impacts vary between expenditure categories, as a practical proposition we do not envisage policy makers engaging in significant alterations of spending priorities based on expenditure impacts alone. Altering public expenditure significantly is likely to be difficult, at least in the short run, and policy makers should have a wider agenda than just expenditure impacts. This paper has presented an attribution analysis based on the existing state of affairs. However, it is impossible to tell how the HEIs sector would respond to changes in funding at the margin. It is unclear if public funding is a complement or substitute for other sources of funding. Therefore, we caution against a mechanical use of our approach to project the likely impacts of government expenditure cuts,

Our analysis is capable of extension in a number of directions. Firstly, the analysis can be applied to individual HEIs, as well as to the HEI sector as a whole. In Hermansson *et al.* (2010b) we show that there is considerable heterogeneity among Scottish HEIs in terms of their dependence on public funding, and identify the significance of this for the scale of “balanced expenditure” multipliers. Secondly, although we focus here on the expenditure impacts of HEIs, the principles apply equally to any sector of interest which is at least partly publicly-funded. Naturally, our judgement about policy scepticism does not necessarily generalise: this will depend on the characteristics of both the sector under consideration and the region. Thirdly, the analysis can clearly be applied, and indeed should be applied, to all impact analyses that involve any element of local public funding conducted for any region that is subject to a binding public expenditure constraint, most obviously Wales and Northern Ireland in the UK context. In these circumstances, researchers seeking to identify the economic activity attributable to a particular sector should acknowledge the devolved budget constraint explicitly and identify the fraction of activity attributable to the public funds. In general this will reveal that a significant part of HEIs impact is in fact a ‘generic’ public expenditure

impact and in the limit this may reveal the demand side impact of particular regional institutions to be effectively zero once the regional public budget constraint has been taken into account. However, in the case of Scottish HEIs considered in this paper, substantial impacts can be attributed to HEIs activity, in addition to those driven entirely by local public expenditures. Fourthly, the analysis may also be usefully applied to regions that are not subject to a binding expenditure constraint, such as the English regions in the UK context. Even where there is no binding constraint on public expenditure at the (relevant) regional level, it may still be of interest to assess the demand-side opportunity cost of the public funding involved by exploring the impact of their alternative use within the region.

Finally, it should be noted that our analysis in this paper is, in common with conventional regional impact analyses, focussed solely on the expenditure or demand-side effects of HEIs. This is a rather restrictive context in which to consider policy impacts. So we would not, for example, advocate the use of estimated net “balanced expenditure” multipliers to prioritise public expenditures. In the case of HEIs the message would in any case be mixed: HEIs’ own institutional expenditures have a rather higher multiplier than public expenditure per se, but the reverse is true of students’ expenditures funded by government grant. However, much more importantly in the case of HEIs, at least, is that we would expect many of their impacts on regional economies to come through the direct stimulation of the supply side, for example, through their impact on the skills of the host region’s labour force and through knowledge exchange activities. These impacts can only be explored in a framework that explicitly accommodates these supply side effects, so that input-output analyses are inadequate to the task, even if, as here, they are augmented to accommodate regional public expenditure constraints. This may be particularly important for policy given that there is some evidence that the supply-side impacts of Scottish HEIs may be large relative to their expenditure impacts (see e.g. Hermansson *et al.*, 2010c).

A poignant example of the dilemma policy makers face in balancing demand- and supply side impacts is the case of local and external students. As this paper reveals, there are significant expenditure impacts from attracting external funding and incoming students. However, it is an open question whether emphasising the export role of HEIs is

ultimately desirable for the Scottish economy. If a focus on external income complements the HEIs' capacity for building human capital and engaging in knowledge exchange it is clearly a good thing overall. However, if there is some trade-off between focusing on external competitiveness of the institutions and their role in producing graduates for the local labour market and engaging with local businesses, the outcome would be ambiguous. Current understanding of these potential trade-offs is very limited but we hope that highlighting the gap will encourage future research.

Appendix

In this appendix we present the details of our derivation of the impact of students' consumption expenditures. We draw on a comprehensive survey by Warhurst *et al.* (2009)¹⁷, who conducted a large scale survey complemented with face to face interviews. They interviewed 1,000 Scottish domiciled undergraduate students at Scottish institutions and estimated their average term time expenditure at £6,404 in the academic year 2007/2008. However, these results only refer to a part of students at Scottish HEIs as a third comes from outwith Scotland¹⁸ and 19%¹⁹ are postgraduate. Surveys have not been carried out relating to the expenditure of students of RUK and ROW origin nor for Scottish domiciled postgraduate students. These students' expenditures are expected to be greater as expenditures generally increase with age and the year of study, and these students are staying away from home and so must pay for accommodation in full.

According to Warhurst *et al.* (2009) Scottish domiciled undergraduates living independently spent on average £7,187 in 2007/2008 while those living with parents spent £5,317. The expenditure level of Scottish students who are living independently is used as a proxy for expenditures of incoming students. However it is reasonable to expect incoming students to have to incur more costs than locals if only due to unfamiliarity with local conditions and an inability to draw on a social network, in contrast to local students. A higher estimate for living costs is, for example, suggested by the Icelandic Student Loan fund, which estimates student expenditures (apart from tuition fees) for an academic year in Scotland at £8,520²⁰. Here the rather conservative approach is adopted that the average for Scottish domiciled undergraduates is applied to all Scottish domiciled HE students and the average expenditures of Scottish domiciled undergraduates living independently is applied to all incoming students.

¹⁷ Warhurst *et al.* (2009) build on and expand work by Callander *et al.* (2005).

¹⁸ See Hermansson *et al.* (2010c). Table 5.

¹⁹ See HESA (2007) Students in Higher Education, Table 0b

²⁰ For the academic year 2008/2009 the Icelandic Student Loan Fund (LÍN) estimates the cost of subsistence for obtaining a single ECTS credit in Scotland is £142, where a full academic year will consist of 60 credits, amounting to anticipated costs of £8,520. See: <http://www.lin.is/Namslan/utlan/framfaerslutafla.html>

A number of adjustments have to be applied to the 'gross' student spending as reported by Warhurst *et al.* (2009) to conform with IO assumption (their main findings on student spending in Scotland are outlined in Table A2 below). In particular care must be taken to deduct non-additional ('endogenous') spending components to avoid double counting. For Scottish domiciled students this means that the components of consumption that are treated as additional (exogenous) are those that are attributable to student loans, commercial credit students take out to support themselves and student support and grants as reported by Warhurst *et al.* (2009). This changes slightly when the budget constraint of public expenditures in Scotland is acknowledged as student support and grants are to a significant extent²¹ funded by the Scottish block grant and therefore represent a re-allocation of Scottish Government spending within Scotland (see general discussion in Section 3). The student loans received by Scottish students are, however, treated as additional as they are provided by the Student Loans Company, a UK-level non-departmental public body. Informal transfers within the family do not constitute additional spending in Scotland as they are a re-allocation of total household spending²². Term-time labour market earnings are equally not-additional to the Scottish economy as, under the IO assumption of a passive supply-side, if the student was not earning that wage income some other Scotland resident would be. That leaves other income, which is assumed to be endogenous to the Scottish economy²³ and the student's income shortfall (expenditure in excess of income). Precise information is not available on the composition of this income shortfall, but it is expected to constitute some combination of informal income/credit not previously accounted for and commercial credit. New commercial credit taken out by Scottish domiciled students represents an exogenous impact on the local economy, while informal credits are assumed to be obtained locally and therefore represent a transfer within the economy rather than an additional impact.

²¹ The category also includes support from private charities. Here the conservative stance is adopted that the charities are funded from Scottish contributions and therefore represent a re-distribution within the Scottish economy rather than an additional injection.

²² In principle parents could be funding these transfers by drawing on savings or taking out new credit, but we assume they are met with consumption switching from parents to student.

²³ Information on the composition of other income is not available in Warhurst (2009). Therefore we adopt the conservative stance that it is non-additional to the Scottish economy.

Warhurst *et al.* (2009) provide information on the amount of commercial credit taken out by Scottish students during their time of study, which is used to estimate the magnitude of this impact. Care must be taken to count only the net commercial credits obtained as students run up commercial debts during term time but typically repay these to some extent between years. Table 4.15 in Warhurst *et al.* (2009, p. 100) reports the amount of commercial credit owed by students at the end of each of their year of study. They find a wide range of commercial debt incurred by year of study. Of course it must be born in mind that their survey is a cross section but interpreted literally it suggests that students rely less on commercial credit as they progress through their studies (and a net repayment occurs between years 3 and 4). This is in line with their findings that students' earning power increases with year of study. Here the assumption is adopted that commercial debt levels at the end of year 4 are representative for their overall net-incurrence for the entire duration of undergraduate study.

Table A1 Commercial credit at the end of term by year, £. Source: Warhurst *et al.* (2009, Table 4.15, p. 100).

	Year 1	Year 2	Year 3	Year 4
Commercial credit owed at the end of term time	968	1,240	1,699	1,384
Net change in commercial debt between years of study	968	272	459	-315
Implied average per year of study	968	620	566	346

Based on these assumptions the average additional ('exogenous') component of Scottish students' term time spending is £346 (1,384/4). The assumption suffers from a potential downward bias in that 4th year students are less than one quarter of the student population. However, it could be counter-argued that students will use income earned in the following summer to make additional payments to their commercial debt. Available evidence unfortunately does not allow a precise estimate but on balance the assumption adopted here should be seen as rather conservative. Available evidence (see Table A2 below) suggests that the average income shortfall of Scottish undergraduates is significantly larger each year, amounting to £ 1,073. Unfortunately Warhurst *et al.* (2009) do not elaborate on how the income shortfall might be explained but here it is expected to be met by some combination of underreported informal contributions (within household transfers), earnings outwith term-time (drawing on savings) and commercial credit.

Table A2 Average term time income and expenditures of Scottish undergraduates, £. Source: Warhurst *et al.* (2009, Table 2.4 and 3.4, pp. 24, 56).

	£	% of income	% of expenditure
Average total income	5,157	100%	83%
Student loan	1,430	28%	23%
Informal housing contribution	163	3%	3%
Informal living contribution	290	6%	5%
Term-time earnings	1,945	38%	31%
Education related grants and bursaries	759	15%	12%
Other	570	11%	9%
Average total expenditure	6,230	121%	100%
Housing costs	1,116	22%	18%
Living costs	3,954	77%	63%
Participation costs	957	19%	15%
Child specific costs	203	4%	3%
Other costs	110	2%	2%
Dissaving	1,073	21%	17%

Warhurst *et al.* (2009) estimate the average term time employment income of Scottish undergraduates at £ 1,945. Here it is assumed that this average holds for incoming students from other parts of the UK, while foreign students are assumed not to participate in the labour market. Finally we deduct the direct import content of student's expenditure, which is assumed to equal that of Scottish households in general (32%) as reported in the Scottish Input-Output tables.

Table A3 Derivation of per student spending

Location of domicile		Scotland	Rest of the UK	Rest of the World
Gross average student spending £	+	6,230	7,187	7,187
Income from employment £	-	1,945	1,945	
Within household transfers £	-	453		
Other income £	-	570		
Dissaving £	-	1,073		
Spending attributable to new commercial credit £	+	346		
Exogenous average per student spending	=	2,535	5,242	7,187
Direct imports £ (32%)	-	816	1,688	2,315
Net change in final demand per student £	=	1,719	3,554	4,872
Number of students FTE's	x	114,262	22,052	24,555
Estimated net contribution to final demand by student population £ m	=	196.4	78.4	119.6

Having estimated the students' net contribution to final demand it is possible to estimate the "knock on" impacts of their consumption spending. A student expenditure vector estimated by Kelly *et al.* (2004) is used to derive the spending impact of the different student groups in Scotland. In total they support approximately 0.40% of output.

Table A4 Impact of student spending in Scotland

	Scotland	Student origin		Total
		Rest of the UK	Rest of the World	
Output impact of student spending £m	353	141	215	708
<i>% of Gross Output</i>	<i>0.20%</i>	<i>0.08%</i>	<i>0.12%</i>	<i>0.40%</i>
GDP impact of student spending £m	195	78	119	391
<i>% of GDP</i>	<i>0.22%</i>	<i>0.09%</i>	<i>0.13%</i>	<i>0.44%</i>
Employment impact of student spending FTEs	1,721	687	1,048	3,456
<i>% of Scotland employment</i>	<i>0.09%</i>	<i>0.03%</i>	<i>0.05%</i>	<i>0.17%</i>

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