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"POLICY SCEPTICISM" AND THE IMPACT OF NORTHERN IRISH HIGHER EDUCATION INSTITUTIONS (HEIs) ON THEIR HOST REGION: ACCOUNTING FOR REGIONAL BUDGET CONSTRAINTS

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"Policy Scepticism" and the Impact of Northern Irish Higher Education Institutions (HEIs) on their Host Region: Accounting for Regional Budget Constraints

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Abstract

This paper replicates the analysis of Scottish HEIs in Hermannsson *et al* (2010b) for the case of Northern Ireland. The motivation is to provide a self-contained analysis that is readily accessible by those whose primary concern is with the regional impacts of Northern Irish HEIs. A comparative analysis will follow in due course. A "policy scepticism" has emerged that challenges the results of conventional regional HEI impact analyses. This denial of the importance of the expenditure impacts of HEIs appears to be based on a belief in either a binding regional resource constraint or a regional public sector budget constraint. In this paper we provide a systematic critique of this policy scepticism. However, while rejecting the extreme form of policy scepticism, we argue that it is crucial to recognise the importance of the public-sector expenditure constraints that are binding under devolution. We show how conventional impact analyses can be augmented to accommodate regional public sector budget 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.

1. Introduction

This paper replicates the analysis of Hermannsson *et al* (2010b,e) for the case of Northern-Ireland, which is why we have given it a (virtually) identical title. The main differences can be found in the tables, graphs and discussion of results. The rationale for this approach is to provide a convenient, readily accessible, self-contained analysis of the expenditure impacts of HEIs in Northern-Ireland for user groups whose primary interest is in Northern-Ireland. Since we are also committed to producing similar analyses for England, this is also an efficient way for us to generate a range of the regional-specific outputs of our research project on *The Overall Regional Impacts of HEIs* quickly.[1] This possible because we have constructed an input-output database that systematically incorporates the incomes and expenditures of each UK HEI, reflecting each region's funding structure, which can then be used as a basis for deriving results on regional expenditure impacts. Subsequent contributions will provide a comparative regional analysis of HEI impacts.

There have been numerous studies of the impact of higher education institutions (HEIs) on their host regional economies, which 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 universities like any other businesses, which demand goods and factor services within the region[2]. The best of these studies employ regional input-output analysis. However, a "policy scepticism" has emerged that challenges the value of such analyses. This scepticism asserts that either demand-side binding budget constraints or supply-side binding resource constraints generate "crowding out" of HEI expenditure effects on the host regional economy, to the point where the regional impact of HEIs expenditures is regarded as negligible. In this paper

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[1] The full details of the project are provided in the acknowledgements.
[2] HEIs may also have important impacts on the supply-side of regional economies through, for example, their impact on skills in the host region's labour market, knowledge effects and wider external benefits. These are discussed in Hermannsson *et al* (2010d).

we provide a systematic critique of this perspective. While we reject the extreme form of policy scepticism we acknowledge the importance of binding public sector budget constraints under devolution, and argue that future regional impact studies should be modified to accommodate these constraints.

Previously we have illustrated this case through an application to Scotland and to Wales (Hermannsson *et al,* 2010b,e). Here the same principles are applied to Northern-Ireland, which is a UK region with a large higher education sector and partially devolved fiscal responsibilities. The study of HEIs in Northern-Ireland is particularly interesting as its devolved status imposes a binding public sector expenditure constraint at the regional level and the variety of spatial origins of HEIs' income motivates a fresh look at the composition of their impact. However, it should be emphasised that this approach is generally applicable to all impact studies of regions with a binding public expenditure constraint.

Our analysis of HEI impacts is based upon an augmented Input-Output (IO) table for Northern-Ireland in which the higher education sector is separately identified[3]. Impact results are derived using standard IO assumptions. However, we also consider how the standard IO assumptions, and current practice, have to be modified to accommodate the binding budget constraint of the Northern Ireland Assembly. We also implement a novel treatment of student expenditure, in which in line with standard IO assumptions, we seek to identify the degree to which students' consumption expenditures can be treated as exogenous Two quite different treatments of student expenditures are apparent in the literature, focussing either on the expenditures of all students in the host region (Harris, 1996) or only those who move into the region to study (Kelly et al, 2004). We argue that both are, in general, approximations to an appropriate

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[3] For details of the construction of the Input-Output table, the derivation of the income and expenditure structure of the HEIs sector and the data sources used see Hermannsson *et al* (2010a). The augmented table builds on previous work by Allan *et al* (2010).

distinction between those parts of student expenditures that can legitimately be regarded as exogenous, and those that should be treated as endogenous.

The remainder of the paper is structured as follows. In Section 2 we outline the approach adopted by conventional (input-output-based) regional HEI impact studies, and summarise the results that the implementation of this approach yields when applied to our Northern-Ireland, HEI-disaggregated input-output database. We explore the basis of the "policy scepticism" in Section 3, attributing this to two broad possible sources: an acknowledgement of a resource constraint on the supply-side and a public sector budget constraint on the demand-side. We argue that the traditional "Green Book perspective" of complete supply-side crowding out of regional expenditures is not applicable to the context of a single devolved region. Indeed, at the regional level the passive supply-side assumptions required to motivate the use of input-output analysis may apply in the longer term. However, we also argue that the presence of a binding constraint on government expenditure, which operates through the Barnett formula in Northern Ireland, is significant for the appropriate conduct of regional impact studies. In particular, in the context of incremental increases (or decreases) in public expenditure on HEIs, the application of conventional impact analysis effectively assumes that these expenditures are externally-financed (through the central government). If, instead, they are financed by switching/ reallocation of the Northern Ireland Assembly's expenditure, then the impact of this should be explicitly identified. We show how this constraint can be accommodated within conventional impact analyses. Inevitably, our results suggest that the aggregate impact on the host region of such switching is significantly less than conventional impact analyses imply. For Northern Ireland the net impact is ambiguous. Measured in terms of output, there is a small, but positive, switching impacts, whereas when the same expenditure switching is gauged in terms of employment impacts the result is a small, but negative, switching impact.

In Section 4 we show that it would be wrong to infer from the small net "balanced expenditure multiplier", which (we establish in Section 3) applies to Northern Irish general government expenditure being switched to HEIs, that HEIs have a negligible overall impact on their host region that is additional to the impact of public expenditure *per se*. We illustrate this through an IO-based attribution analysis, which highlights the fact that HEIs are not part of the public sector. Some 65% of Northern Irish HEIs' funds coming from devolved public sources, but 35% do not. Nonetheless, this is a significantly higher dependence on public funding than Scotland (54%) or Wales (58%). Northern Irish HEIs are relatively export-intensive. We show that of the "total impact" of HEIs on Northern Ireland's output that would be attributed to HEIs in a conventional analysis, only some 63% are in fact attributable to public funding *per se*. However, our findings are sensitive to the specification used to construct the Input-Output table for Northern Ireland, for which four alternative versions are available to use. This sensitivity is explored in Appendix 2 and alternative results presented.

We present brief conclusions in section 5. Overall, our results suggest that conventional impact studies do overestimate the impact of HEIs expenditures on their host region. However, our findings 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. Although this analysis is illustrated in terms of the impact of Northern Irish HEIs, it is relevant to any impact analysis conducted in regions where there is a binding public expenditure constraint.[4]

2. Conventional regional impact analyses

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[4] Indeed the analysis may of rather more general applicability, since even where budgets are not devolved there may be interest in identifying the opportunity cost of public funding.

Conventional impact analyses of HEIs on their host regions identify the total effects of HEIs 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. We first consider the application of this approach to institutional and then subsequently to student expenditures

2.1 Theoretical basis of conventional regional impact analyses

Regional impact analyses are frequently employed to capture the total spending effects of institutions, projects or events. In addition to simply identifying the direct spending injection of the studied phenomenon, multiplier, or "knock-on", impacts are estimated by summing up subsequent internal feedbacks within the economy (see Loveridge (2004) for a review). This section briefly outlines the methods adopted by impact studies[5]. Based on the typical assumptions made in the literature we derive the regional demand-side impacts of the HE sector on Northern Ireland's 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. Exogenous expenditures in these models are taken to be independent of the level of activity of the relevant economy; endogenous variables are primarily driven by the overall level of income or activity within the economy. Specifically demand for intermediate inputs and often consumption demand are taken to be endogenous. Other elements of final demand (exports, government

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[5] For a more detailed account of the methodology of impact studies and regional multipliers see e.g.: Miller & Blair (2009), Armstrong & Taylor (2000).

expenditure, investment) are taken to be exogenous[6]. There is then a clear causal pathway from exogenous to endogenous expenditure.

In addition, interpreting the results of these demand driven models rests on the assumption that the supply-side of the economy operates in a passive way. At the regional level, conventional multiplier analyses can be validated by either of two sets of conditions. In the short and medium runs this would be where there is general excess capacity and regional unemployment. In the long-run, it is where factor supplies effectively become infinitely elastic, as migration and capital accumulation ultimately eliminate any short-run capacity constraints (McGregor *et al,* 1996)[7].

The derivation of the multipliers draws on the notion of exogenous expenditure driving endogenous activity. In the standard Leontief Input-Output approach total activity within the economy can be described in terms of an equation where the total output of each industry equals final demand, which is exogenous, times multipliers as represented by the Leontief inverse. This can be summarised as:

$$\boldsymbol{q} = (\boldsymbol{1} - \boldsymbol{A})^{-1}\boldsymbol{f} \qquad \qquad \textbf{Equation 1}$$

where $\boldsymbol{q}$ is a vector of gross outputs, $\boldsymbol{f}$ is a vector of final demands and **(1-A)**[-1] is the Leontief inverse. The output multiplier for each 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

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[6] The distinction between endogenous and exogenous activity depends on the model and the application. In particular, what is exogenous and what is endogenous to the model does not have to correspond with what is 'inside' and what is 'outside' the region in spatial terms.
[7] The nature of the regional economy naturally governs the realism of such an assumption. One limiting case is the example of the island economy of Jersey where the institutional framework restricts migration so that crowding out can be expected even in the long run. See Learmonth *et al* (2007).

sum of columns 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:

$$q_i = l_i f_i$$ **Equation 2**

Where l_i is the output multiplier for sector i.

Multipliers can be derived to relate a variety of activity outcomes, such as employment, income, output or GDP, to exogenous changes in demand. Although a number of variants can be applied 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, and treat household consumption as exogenous. Type-II multipliers also include induced consumption effects as endogenous For further details see: Hermannsson *et al* (2010a), Miller & Blair (2009, Ch. 6).

We base this study on an augmented Northern Irish Input Output table (Hermannsson *et al* (2010a). The basic Northern Irish Input Output table that we employ was constructed by Allan *et al* (2010). Income and expenditure data for Northern Irish HEIs are used to identify a separate HEIs sector. That is to say the existing education sector is split into two elements, HEI and non-HEI education. This disaggregation reveals the income and expenditure structure of Northern Irish HEIs and makes it possible to derive appropriate, sector specific, multipliers. The table, and associated model, treat the HE sector on the same basis 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 and the linked exogenous expenditure of their students.

2.2 The regional impact of HEIs' own expenditures

An extensive literature estimates the impact of HEI spending on their host regional economies solely through these demand side (expenditure-related) effects. For example Florax (1992) identified over 40 studies of the regional economic impact of HEI expenditure and much has been published since. Table 1 below presents a summary of the major Scottish HEI impacts studies. Most, especially the earlier analyses, are based on Keynesian income-expenditure models e.g. Brownrigg (1973), Bleaney *et al* (1992), Armstrong (1993) and Battu *et al* (1998), 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* (2010c)[8]. These studies differ in the type of multiplier they report, the approach used to derive the multiplier values and the geographical definitions of the studies. Unsurprisingly therefore, the multiplier values generated differ somewhat and are in most cases not directly comparable[9]. McGregor *et al* (2006) summarise the methods and findings of the main UK studies.

Table 1 Overview of main Scottish HEI impact studies[10]

Subject of study	Multiplier value	Geographic boundary	Source of multiplier value
St. Andrews University (Blake & McDowall, 1967)	1.45 (Household income)	St. Andrews (pop. 10,000)	Input Output table
Stirling University (Brownrigg, 1973)	1.24 - 1.54 (Income)	Parts of Sterling and Perth (pop. 96,000)	Brown et al (1967), Greig (1971)
Strathlcyde, Stirling and St. Andrews Universities (Love & McNicholl, 1988)	1.34, 1.43, 1.36 (student spending)	Scotland	Brownrigg & Greig (1975), McNicholl (1981)
Aberdeen, Dundee and Stirling Universities (Love & McNicoll, 1990)	2.18 (output), 1.75 (GDP), 1.95 (employment)	Scotland	Scottish Input Output Tables (1979)
Aberdeen University (Battu et al, 1998)	1.46 (spending), 1.61 (employment)	North East of Scotland	Greig (1971), Brownrigg (1971), McGuire (1983), Harris et al (1987)
Strathclyde University (Kelly et al, 2004)	1.63 (output), 1.38 (employment)	Scotland	Input Output table
Strathclyde University (McNicholl, 1993)	2.15 (output), 1.66 (Income)	Scotland	Scottish Input Output Tables (1989), Survey
Scottish HEIs (1) 1995	1.76 (output), 1.7 (employment)	Scotland	Scottish Input Output Tables (Hybrid, 1994-5)
Scottish HEIs (2) 1999	1.73 (output), 1.42 (employment)	Scotland	Scottish Input Output Tables (SLMI, 1997)
Scottish HEIs (3) 2004	1.6 (output), 1.4 (employment)	Scotland	Scottish Input Output Tables (2000)
HEI impacts projects 2009	1.3 (output type I), 2.1 (output type II)	Scotland	Scottish Input Output Table (2004)

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[8] McGregor et al (2006) argue 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.

[9] Except perhaps in the most recent studies based on the Scottish Input-Output tables.

[10] The multipliers presented are in most cases not directly comparable among studies as their exact definition varies. Furthermore, they differ in terms of what spending is treated as exogenous.

A variety of multipliers can be derived to link a particular exogenous change to changes in a number of economic outcome metrics. The output multipliers relate changes in final demand to the change in gross output. Therefore, an output multiplier of 2.15 as found in McNicoll (1993) implies that a unit (£1) 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 income multipliers used by Brownrigg (1973) relate exogenous changes in regional income to the overall change in regional income[11].

When we apply conventional input-output analysis to our HEI-disaggregated Input-Output table for Northern Ireland, we find that in 2006 the Type-I output multiplier for the HEIs sector is 1.29 and the Type-II multiplier is 2.29. That is, each £1 of final demand for the output of HEIs should generate a Northern Ireland-wide output amounting to £1.29 if indirect knock-on effects are included and £2.29 if induced impacts are counted as well. As is summarised below, based on these assumptions the HEI sector drives a significant amount of economic activity within Northern Ireland: approximately 1.53% of total output and 1.73% of overall employment.

Table 2 Summary of expenditure impacts of HEIs, based on traditional IO-assumptions, £m and FTE's

	Final demand		indirect and induced impacts		Total impact	
Output, £m	385	0.67%	498	0.87%	882	1.53%
Employment, FTE's	6,322	0.93%	5,476	0.80%	11,798	1.73%

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[11] Where regional income is equivalent to GDP as derived by the expenditure method. For further details on Keynesian multiplier models see Chapter 1 in Armstrong & Taylor (2000).

2.3 The treatment of students' consumption expenditures

In addition to the impact of the institutions' own expenditures a further impact that we need to account 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 Northern Ireland's economy, and identifying how student expenditures are distributed among sectors. Perhaps the most difficult part of this process is the disaggregation of students' consumption expenditures into its exogenous and endogenous components.

There have been two alternative treatments of student expenditures in past impact studies: 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, 1996). Here we argue that each of these past treatments of student expenditure impacts represents an approximation to an input-output accounting approach in which the crucial distinction is that 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.

The case of external students is straightforward: their expenditures are unambiguously exogenous, as their incomes are derived from an external location. The treatment of their expenditure is similar to that of tourists. For local 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 from wages earned from local industries and transfers from within local households. For local students simplifying assumptions are adopted in line with the typical 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, education-related grants and bursaries and social security benefits. When estimating the balanced expenditure impact of student's consumption expenditure we identify grants and bursaries provided for by funding from the Northern Irish block grant.

For details of Northern Irish students' income and expenditures this study draws on a study by the National Centre for Social Research and Institute for Employment Studies for the academic year 2004/05 (NATCEN & IES, 2006). The full details of how student expenditures are determined are reported in the Appendix. This reveals that *per student* the net contribution to final demand is greater for incoming students than local ones as there are less deductions of incomes that should be treated as endogenous.

Table 3 Derivation of per student spending disaggregated by place of domicile

Location of domicile		Northern Ireland	Rest of the UK	Rest of the World
Gross average student spending £	+	10,178	10,178	10,178
Income from employment £	-	2,025	2,025	
Within household transfers £	-	1,299		
Other income £	-	135		
Dissaving £	-	2,788		
Tuition fee expenses	-	1,150	1,150	1,150
Spending attributable to new commercial credit £	+	384		
Exogenous average per student spending	**=**	**3,165**	**7,003**	**9,028**
Direct imports £ (32%)	-	955	2,113	2,724
Net change in final demand per student £	**=**	**2,210**	**4,890**	**6,304**
Number of students FTE's	x	34,462	583	3,948
Estimated net contribution to final demand by student population £ m	**=**	**76.2**	**2.9**	**24.9**

Once students' net contribution to final demand has been determined the next step is 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 Northern Ireland. The output multiplier for student spending derived from the IO tables is 1.77. Hence, a direct injection of £m 103.9 (sum of the bottom row in Table 3), drives £ 84 million of output in the Northern Irish economy, as is summarised in Figure 1 below, or approximately 0.32% of economy wide output. As the preceding discussion indicates the consumption multiplier cannot be applied directly to students' gross term-time spending as reported in income and expenditure surveys. Gross expenditures have to be adjusted for spending financed by income sources endogenous to the Northern Irish economy. When these adjustments are applied to multipliers we find that for each £1 of local students' gross term time expenditures the Northern Ireland-wide economic impact is only 38 pence. This is because these expenditures represent, to a significant extent, a redistribution of spending within the Northern Ireland economy and so only partially constitute an additional injection. The impact of per unit gross spending of incoming students is stronger as more of it represents an additional injection into the regional economy.

Despite the relatively modest per student impact, Northern Irish students make up 88% of the student population and therefore drive approximately 73% of the total student consumption impact. The second most important group in terms of the output impact of their consumption expenditures are students from the rest of the World, who drive approximately 24% of the total consumption impact. The remaining 3% is made up by the expenditure of students from the rest of the UK.

Figure 1 Output impact of student spending in Northern Ireland disaggregated by student origin, £m
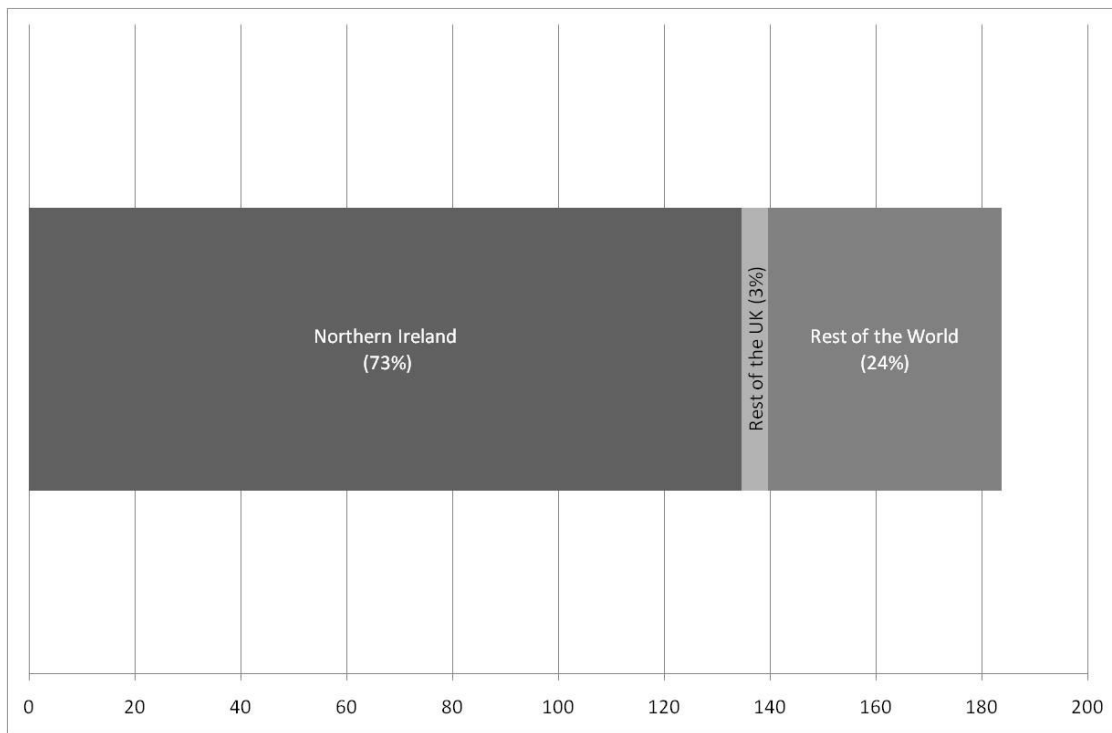
Students' consumption impact is a significant complement to institutional expenditures when measured in terms of total Northern Irish output. Whereas institutional expenditures support 1.53% of overall output in the economy an additional 0.32% is provided for by students' consumption. In output terms these represent 17% of the total impact of HEIs. The employment impact of student's consumption is more subdued, however. Whereas HEIs support 1.73% of overall employment, student's consumption expenditures provide an additional impact of only 0.13%, or approximately 7% of the overall employment supported by HEIs and related expenditures in Northern Ireland.

This section has summarised typical practice for estimating the regional expenditure impact of HEIs and their associated student population. The next section examines criticisms of this approach and considers appropriate responses to these.

3. Policy scepticism and the impact of HEIs

There appear to be two main ways of motivating an assumption of complete "crowding out" of HEIs expenditures within their host region: a tight resource constraint; a binding regional public sector budget constraint. We consider each in turn.

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 characterised the HM Treasury Green Book's analysis of regional impacts. 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 NAIRU). However, even if there was a 100% crowding out at the level of the UK as a whole, this would not apply at the level of the host regional economy[12]. It is quite legitimate for Scottish, Welsh or Northern Irish 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.

Of course, none of this implies that the supply side is unimportant. Rather it simply emphasises that the demand side cannot be dismissed as irrelevant at the level of the individual devolved region. There undoubtedly is, and certainly ought to be, policy interest in the demand side impact of public expenditure decisions in a regional context. Furthermore, the issue of supply-side crowding out must depend on supply-side conditions in national and regional economies

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[12] Though it could under limiting conditions of a completely inelastic labour supply curve or infinitely elastic labour demand curve, but these are extreme and empirically unlikely parameter values (McGregor and Swales, 2005).

and on institutional arrangements: there certainly is no "law" of 100% supply-side crowding out of regional demand changes. For the remainder of this paper we therefore concentrate on the other possible motivation for policy scepticism: a binding regional public sector budget constraint.

3.2 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 a Northern Irish context, this operates through the Barnett formula, which determines the allocation of Nothern Ireland Assembly funding from the central government in Westminster[13]. The conventional regional multiplier analysis, which we presented in Section 2 above, implicitly assumes that the financing of the HEI expenditures in Northern Ireland comes from outwith the country – from the Westminster Government – with no ramifications for other elements of government expenditure.

Does taking account of the Northern Irish public sector budget constraint imply that host-region employment multipliers are zero? To address this question it is helpful to begin by focussing simply on changes in the public funding of HEIs in Northern Ireland and note that increased public spending on HEIs may have to be financed by contractions in other government expenditures. Although the Northern Ireland Assembly has wide-ranging devolved powers in making spending decisions, its income is constrained each year by the block grant it receives from Her Majesty's Treasury. Therefore, if the Northern Ireland Assembly allocates additional funds to HEIs, less funds are available for other public expenditures. Given this context it can be misleading for an impact study to treat the Northern Ireland Assembly's funding of HEIs as an exogenous stimulus to the regional economy, although that is standard IO practice.

[13] For further details see e.g. Ferguson *et al* (2003, 2007).

To illustrate the significance of the difference between the cases we conduct two simulations of the introduction of a hypothetical additional £100m of expenditure on HEIs in Northern Ireland. 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, and does not have any ramifications for other public spending in Northern Ireland. The second case examines how the impacts change when there is a corresponding reduction of other public spending in Northern Ireland. In the latter case the offsetting £100m reduction in public spending is applied to an aggregation of those sectors that receive 95%[14] of central and local government final demand in the Northern Irish IO tables.

The Type-II multiplier for the HEIs sector is 2.29. Without any offsetting cutbacks in public spending the additional spending on HEIs has an output impact of £229m. Approximately half of that impact is realised as a direct consequence 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 4. These impacts are shown graphically in the darker shaded bars in Figures 3 and 4.

A more complex picture emerges with expenditure switching. The Type-II multiplier for other public expenditure in Northern Ireland is 2.23. If an increase in HEIs funding is met by cutbacks in other Northern Irish public expenditure the 'multiplier' for switching is equal to 2.29-2.23=0.6[15]. That is to say, for every £100 m directed from the public sector to HEIs the output impact of switching is £6 m. In particular the estimated import propensity of HEIs (13%) is

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[14] The public sector is aggregated from 4 sectors in the HEI-disaggregated IO table (IO69, IO70, IO71 and IO72a). Approximately 21% of the sector's final demand is from other sources than government.
[15] For further discussion of analysing the impact of expenditure switching within an IO context, see Allan et al (2007).

lower than the public sectors' import propensity (19%). Therefore for every £1 spent on HEIs more is retained within the regional economy than for government spending in general.

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 4 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 " Distribution and retail". An overall negative result emerges for employment impacts. The net result is a loss of 393 FTE jobs. It transpires that average wage expenditures per FTE job in the public sector is amounts to £24,577, whereas for the HEI sector this is significantly higher at £36,221. Hence, even if the HEI sector devotes a larger portion of its expenditures to wages than the public sector (59% v 47%) each job in the HEI sector is almost 50% more 'expensive' than in the public sector[16].

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.

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[16] A note of caution should be made in that it is possible that this effect is partially driven by data issues rather than actual differences between the sectors. Official IO-tables are not constructed and published for Northern Ireland as is, for example, the case for Scotland. Hence an IO table based on non-survey methods had to be used, which slightly reduces our degree of confidence in the results. However, the differences between the two sectors seem too large to be qualitatively reversed based on revisions of data.

Table 4 Impact of £100m increase in final demand for Northern Irish HEIs

| Sector	Without Spending Substitution			With Spending Substitution		
	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	11	68	0	2	10
Manufacturing	0	26	216	0	8	65
Construction	0	9	89	0	5	50
Distribution and retail	0	21	367	0	-3	-47
Hotels, catering, pubs, etc.	0	8	178	0	1	20
Transport, post and communications	0	10	112	0	0	4
Banking and financial services	0	8	60	0	1	9
House letting and real estate services	0	14	22	0	4	5
Business services	0	9	133	0	2	34
Public sector	0	6	108	-100	-115	-2,201
HEIs	100	101	1,658	100	101	1,656
Other services	0	7	54	0	0	2
	100	**229**	**3,065**	**0**	**6**	**-393**

Figure 2 Output impact of £100m increase in final demand for Northern Irish HEIs
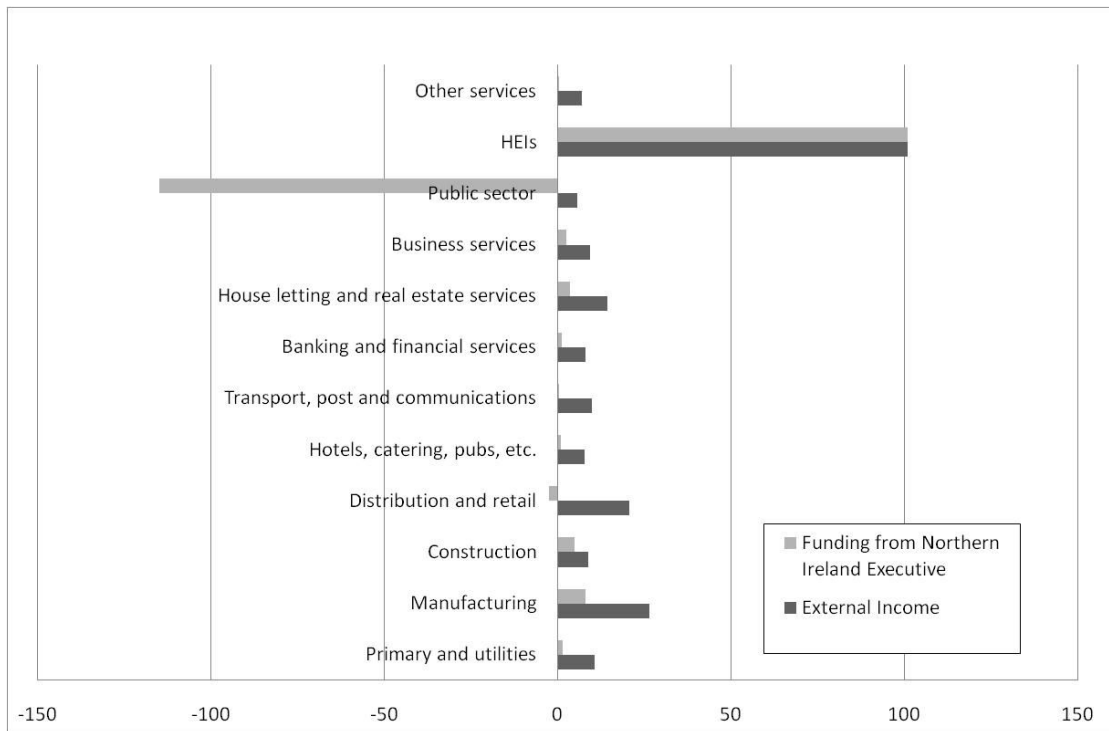
Figure 3 Employment impact of £100m increase in final demand for Northern Irish HEIs
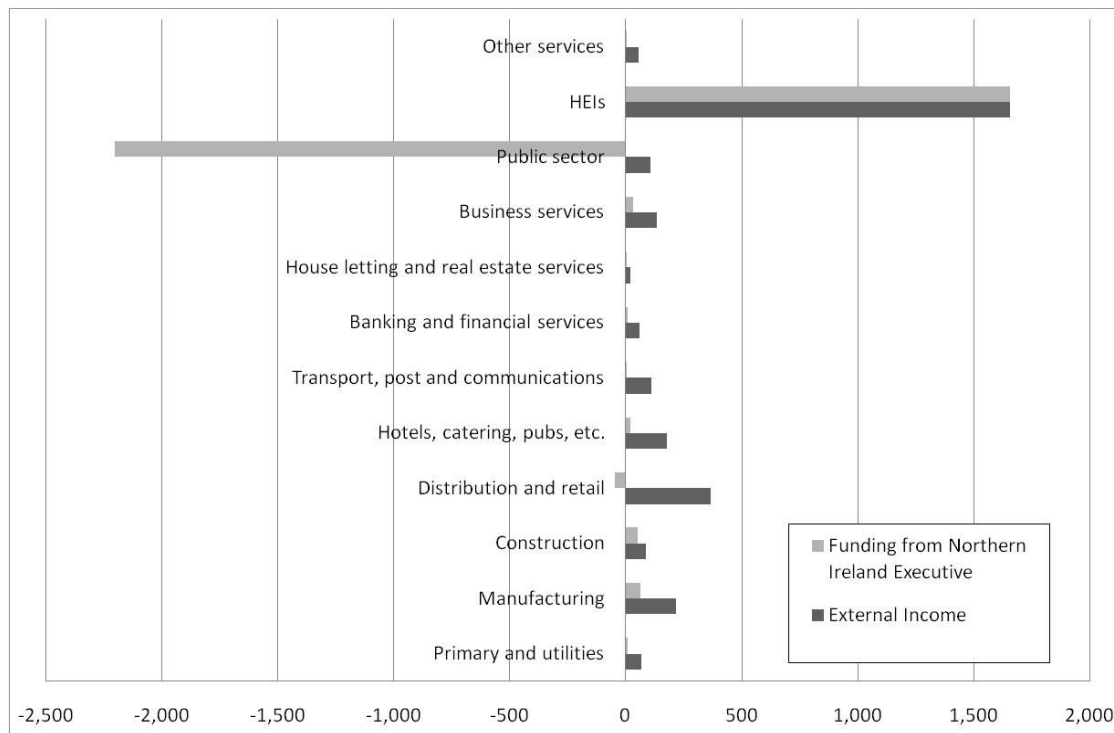

As can be seen from the analysis above, care must be taken in determining the source of financing for any impact study applied to a region with a devolved budget. While the example of HEIs is used here, the principle is, of course, quite general. Binding public expenditure constraints matter a great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

These results might be interpreted as suggesting that the impact of HEIs' spending is very limited at the Northern Ireland level, because of expenditure switching within Northern Ireland, since in the absence of HEIs the funding would simply be allocated to public services. However, while HEIs are often perceived 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 65% of their income can be traced back to the Northern Ireland Assembly. Just under one fifth (18%) stems from sources outside Northern Ireland and approximately 17% originates from households, businesses, charities and other institutions whose funding is

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independent of the block grant. The external income is unambiguously additional to the Northern Ireland 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 considerable 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 Northern Ireland HEIs are given in Figure 4. In the next section we explore the significance of this pattern of funding for the attribution of HEI impacts on the host region.

Figure 4 Income structure of the HEIs sector in the HEI-disaggregated Input-Output tables
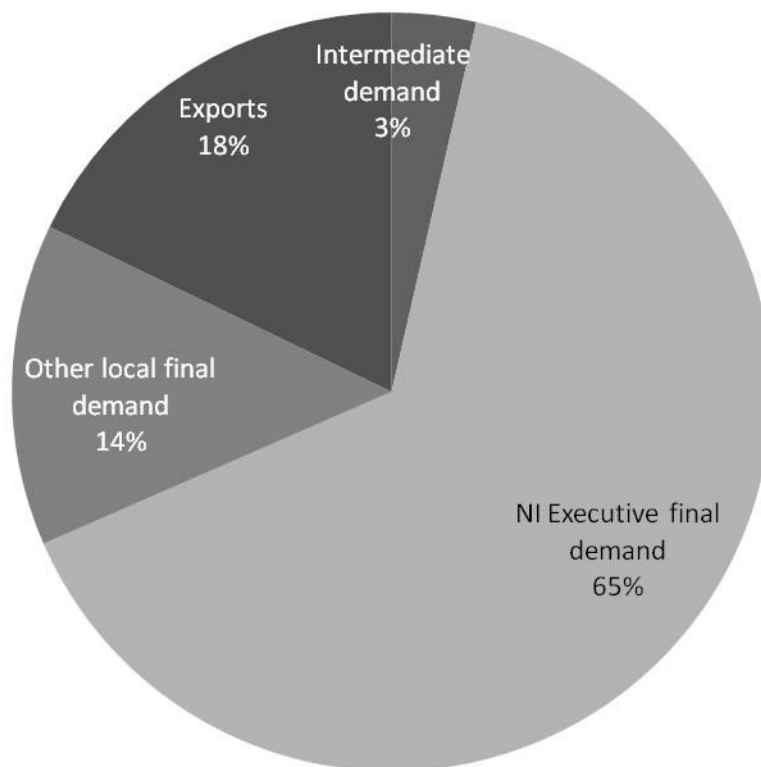
4. Accounting for the regional budget constraint within the Input-Output framework

The Input-Output tables provide a useful accounting framework. Based on the dichotomy of exogenous (final demand) and endogenous ('knock-on' effects) activity, each sector can be attributed with the total activity driven by its final demand within the regional economy. While this activity can be measured in terms of output, employment or GDP we illustrate our approach using output. The total impact of HEIs on output is composed of both the final demand for the output of the sector and also the knock-on impacts on other sectors, through directly and indirectly linked intermediate demand and household consumption. One key strength of Input-Output as an accounting framework is that it is consistent. When such an attribution exercise is carried out on a sector by sector basis, the sum of the impacts attributable to each sector equals the economy-wide total[17].

As discussed in the previous section, one of the criticisms levelled against deriving the economy-wide expenditure impact of HEIs in such a way is that, given their funding arrangements in Northern Ireland, attributing HEIs with the impact of spending public funds is disingenuous. Such an impact is not so much caused by the HEIs *per se* as it is by the availability of public funds and potentially similar results could be obtained if the funds were to be switched to be spent on 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

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[17] Moreover, the validity of this attribution method does not rest on the same strict assumptions as identified for IO modelling in Sections 2 and 3. For example, CO_2 attribution analyses of the type associated with the carbon footprint is most rigorously calculated using IO tables.

sector under a traditional IO approach should in fact be attributed to the expenditure of the Northern Ireland Assembly.

Based on conventional assumptions, HEIs account for 1.53% of Gross Output, 1.89% of GDP and 1.73% of employment in Northern Ireland. Adding the impact of student's consumption spending as derived in Section 2, Northern Irish HEIs support 1.85% of Gross Output, 2.29% of GDP and 1.86% of employment in the region. Taken at face value it is clear that the sector is important as a supporter of employment and output within the regional economy. The controversy concerns whether the traditional IO-accounting approach may be providing a misleading estimate of the sector's contribution.

In order to explicitly take account of the public expenditure switching effects, as discussed in Section 3, we deduct the impacts of the Northern Ireland Assembly's ('Barnett') funding from the overall expenditure impact. The direct expenditure on the output of Norther Irish HEIs is divided into Barnett funding (BF), which comes through the Northern Ireland Assembly, 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 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 6. 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 attrribution is therefore given by equation 3.

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

To summarise, the output impact of HEIs net of Northern Ireland Assembly funding equals the output 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 Northern Ireland Assembly funding upon HEIs can be re-arranged into a 'generic' public expenditure impact and a 'net' impact. The output impacts of the HEIs sector are illustrated in these terms in the lower bar of Figure 5 below. As the diagram reveals, when the expenditure impact of HEIs is broken down according to the source of income, just under half of it can be classified as a generic public sector, leaving just over half of it as a net impact, that is not subject to the budget constraint of the Barnett funding received by the Northern Ireland Assembly.

Figure 5: Output impact of HEIs disaggregated by origin of final demand. Upper bar shows the components of the gross impact while the lower bar breaks the impact into a generic public sector impact and net impact by implementing expenditure switching, £m

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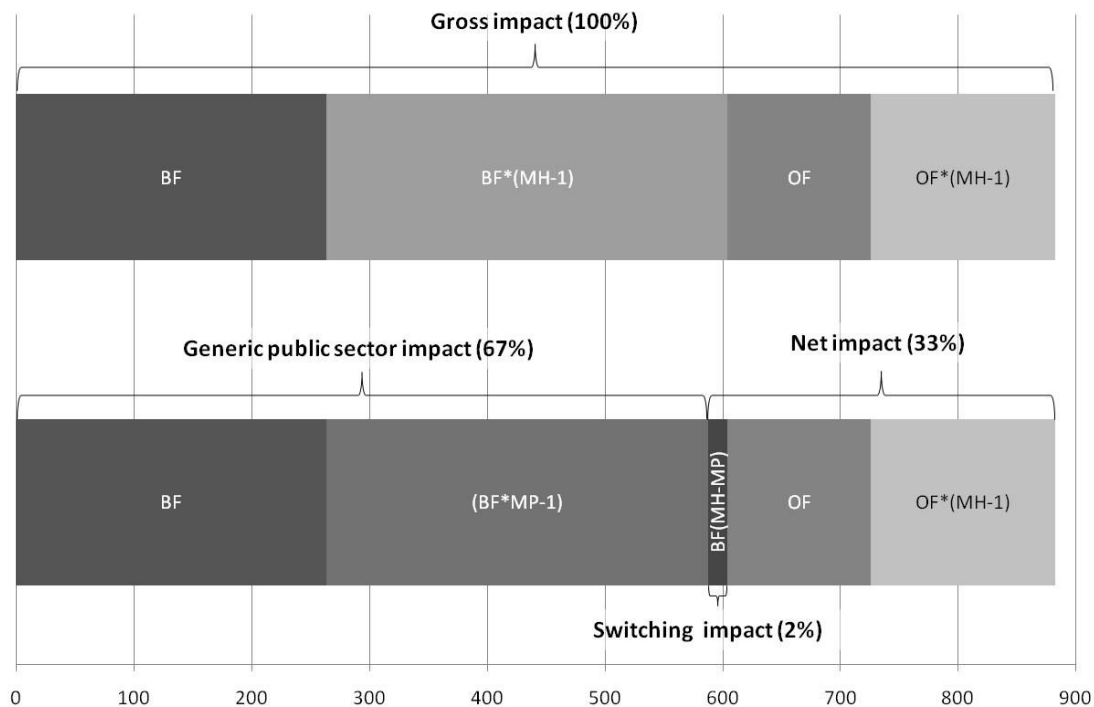
An exactly analogous argument can be made in respect of the appropriate treatment of student expenditure impacts. In this case we have:

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

Where, BF_S is student's consumption final demand attributable to Northern Irish Government student support[18], 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.

When students' consumption expenditures are analysed in this way the results are qualitatively different from those for the HEIs' institutional expenditures. Primarily due to the strong direct import component of students' consumption expenditures the output multiplier is smaller than for public sector expenditure *per se*. In this case the Northern Ireland Assembly gets a smaller demand stimulus for expenditures on student support than on other public expenditures on average. In this case the switching impact is negative, whereas it is positive for HEIs' institutional expenditures. The impact of students' consumption expenditures has been combined with the impacts of HEIs institutional expenditures in Table 5 below.

The Northern Ireland IO-table (Allan *et al,* 2010) was disaggregated using location quotients from a UK IO-table (Turner, 2009). Four alternative specifications were used, which resulted in four slightly different versions of the table. In Appendix 2 we explore the sensitivity of our results to the version of IO-table used for Northern Ireland and present alternative results. It transpires that the specification of the economic database can affect the final results quantitatively to the extent that the impact of Northern Ireland's HEIs is attributed 70% to a

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[18] A part of Northern Irish students' expenditures is funded by student support grants provided by the Northern Irish Assembly Government. For details see Appendix.

generic public sector impact and 30% to a net impact, instead of a 64%-36% attribution as in our base case.

Table 5 Summary of overall spending impacts attributable to HEIs, by origin of final demand and type of impact (output, £m).

	Generic public sector impact	Net impact	Gross impact
Institutional spending	264	121	385
Knock on impacts	341	157	498
Switching impact		17	17
Institutional impact total	**604**	**295**	**899**
– % of total impact	*67%*	*33%*	*100%*
Exogenous student spending	43	106	149
Knock on impacts of student's consumption	10	25	35
Switching impact		-43	-43
Student's consumption impact total	**53**	**87**	**141**
– % of total impact	*38%*	*62%*	*100%*
Total impact attributable to HEIs	**657**	**382**	**1,040**
– % of total impact	*63%*	*37%*	*100%*

In this section of the paper we examine the impact attributable to the HEI sector in Northern Ireland in more detail than impact studies usually do. In addition to the traditional approach of attributing the sector its impact (as the final demand for institutional expenditures times the HEI multiplier plus the direct impact of exogenous student's consumption expenditure times the student consumption multiplier) the origin of the final demands is examined and knock-on impacts attributed to each of these. In an accounting sense the total impact of the HEIs' sector is the same in each of these exercises. However, instead of simply revealing an aggregate impact, that impact has been disaggregated into components that reflect the origin of the exogenous demand.

Although overall the impact of HEIs is unchanged by this attribution, the analysis reveals that there is some justification for a degree of policy scepticism based on the binding regional public

budget constraint. Some 63% of the impact of the HEI sector in Northern Ireland 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. A small qualification to this point of view is provided by the small positive 'switching impact' of public funding for HEIs' own expenditures, but for students' consumption expenditures the switching impact is negative.

However, the analysis also reveals 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. Indeed, some 37% of the sector's impacts are additional to the public expenditure impact. These are attributable to funding from sources independent of the Northern Irish block grant and the consumption expenditures of students that are not supported by the Northern Ireland Assembly.

5. Conclusions

In this paper we replicate our analysis of Scottish HEIs' expenditure impacts (Hermannsson *et al* (2010b)) for the case of Northern Ireland. The paper is intended to provide a self-contained, accessible source of information for user groups whose primary interest is in the impact of HEIs in Northern Ireland. While we include brief comparative comments in this paper, our focus is primarily on the Northern Irish results.

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 Northern Ireland. Our results offer some support for policy scepticism in that we estimate that just under two thirds of the regional expenditure impacts of Northern Irish 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, importantly, the remaining impact is nonetheless substantial in the Northern Irish case, and is certainly not negligible as the extreme form of policy scepticism implies. In fact, it transpires that if funds used directly to finance the Northern Irish public sector were instead used to finance HEIs, there would be a small net positive multiplier effect reflecting the lower import propensity of HEIs. However, when gauged in terms of employment numbers the switching impact is negative. For similar reasons the switching of public funds to students and away from the public sector would have a net negative multiplier impact.

Comparing the host economy impacts of the Northern Irish HEIs to our previous finding for Scottish and Welsh HEIs (Hermannsson *et al,* 2010b, e) reveals that the Northern Irish HEIs are significantly more dependent on devolved government funding and therefore the 'generic' component of the institutional impact is larger than in both Scotland and Wales. The impact of students' consumption expenditures is relatively weak for Northern Ireland as just under three quarters of the student population are local and hence do not provide as big an expenditure injection into the local economy as incoming students. The three studies are comparable in their treatment of institutional impacts. However, for student impacts the comparison should be regarded as only broadly indicative, since the available student expenditure surveys carried out in Scotland, Wales and Northern Ireland are not identical in their reporting units or methodologies.

Our analysis is capable of extension in a number of directions. Firstly, the analysis can be applied to individual Northern Ireland HEIs, as well as to the HEI sector as a whole. In Hermannsson *et al* (2010c) 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 of course 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 involves any element of local public funding conducted for any region that is subject to a binding public expenditure constraint, such as Scotland, 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 Northern Irish 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 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 decide on the distribution of projected cuts in 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. 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 supply-side effects may be large relative to the expenditure effects of HEIs (see e.g. Hermannsson *et al*, 2010d).

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Appendix 1: Derivation of student's consumption expenditure

This appendix presents the details of how the impact of students' consumption expenditures was derived. This draws on a study by the National Centre for Social Research and the Institute for Social Research for the academic year 2004/2005 (NatCen & IES, 2006). They interviewed 354 undergraduate students at Northern Irish institutions and collected expenditure diaries from 302 of those. Based on these methods the average term time expenditure was estimated at £10,178 in the academic year 2004/2005. This is significantly higher than estimates for comparable groups in Scotland[19]. However, estimates between the regions are not directly comparable as in NatCen & IES (2006) tuition fees are counted as part of student's consumption expenditures. Thus we deduct £1,150 of tuition expenses as reported in NatCen & IES (2006, table 5.1, p. 91), which gives an estimate for student's term time consumption expenditures of £9,025. This is still significantly higher than available estimates for Scottish students but slightly less than the estimated expenditures of Welsh students[20].

These results only refer to a part of students at Northern Irish HEIs as just over one tenth come from outwith Northern Ireland (RUK 1.5% and ROW 10.1%). Surveys have not been carried out relating to the expenditure of students of RUK and ROW origin. Generally foreign students' expenditures are expected to be greater as these students are staying away from home and so must pay for accommodation in full. Contrary to this expectation, (NatCen & IES, 2006) who compare expenditures of Northern Ireland domiciled student's by housing status, find relatively small variation in overall expenditure levels by student accommodation type. Students living independently are found to spend £10,720[21] while those living with parents spend £9,660 and the average is 10,178. However, the composition of the spending varies as students living

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[19] Warhurst et al (2009) estimated the average term time expenditure of Scottish domiciled undergraduates at Scottish institutions at £6,604 for the academic year 2007/08.
[20] Based on estimates from Johnson *et al* (2009) tuition fee adjusted average spending of Welsh students was found to be £10,205. For details see Appendix in Hermannsson *et al* (2010e).
[21] For details see NatCen & IES, 2006, Table A4.5 p. 83.

independently spend more on housing and less on other elements of consumption. Passing a judgement based on comparison with Scottish findings from Warhurst *et al* (2009) this suggests that the spending level of undergraduates living at home is quite high and therefore the average for Northern Irish undergraduates (once adjusted for tuition fees) is a reasonable proxy for incoming students.

A number of adjustments have to be applied to the 'gross' student spending as reported by (NatCen & IES, 2006) to conform with IO assumption (their main findings on student spending in Northern Ireland are outlined in Table A2 below). In particular, care must be taken to deduct non-additional ('endogenous') spending components to avoid double counting. We need to be careful to deduct tuition fee expenditure as these have already been counted as part of the institutions income. These are attributed to student expenditure in (NatCen & IES, 2006) but in practice mostly funded by loans and grants that are paid directly to the institutions.

For Northern Irish domiciled students this means that the components of consumption that are treated as additional (exogenous) are those that are attributable to student loans and support, social security benefits as reported by NatCen & IES (2006) and new commercial credit taken out by students to support their studies (as detailed below). This changes slightly when the budget constraint of public expenditures in Northern Ireland is acknowledged, as student support and grants are, to a significant extent, funded by the Northern Irish block grant and therefore represent a re-allocation of Northern Ireland Assembly spending within Northern Ireland (see general discussion in section 3). The student loans received by Northern Irish 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 Northern Ireland as they are a re-allocation of total household

spending[22]. Term-time labour market earnings are equally not-additional to the Northern Irish economy as under IO assumptions, of a passive supply-side, if the student was not earning that wage income some other Northern Ireland resident would be. That leaves other income, which is assumed to be endogenous to the Northern Irish economy 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 can be expected to constitute some combination of informal income/credit not previously accounted for and commercial credit. New commercial credit taken out by Northern Irish 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.

NatCen & IES (2006) provide an overview of debts accumulated by Northern Irish students at the end of the academic year. We choose to use the total of commercial debt accumulated at the end of year 1, £384, as a proxy for average term time incurrence of new debt by local students. This is quite possibly biased upwards as a casual look at the results of the table for accumulated debt at the end of subsequent years suggests students become on average more savvy in handling their finances as their studies progress. However, deriving an average for later years is not possible as we don't know the number of years involved or the number of students at each year.

Table A1 Commercial credit at the end of term by year, £. Source: NatCen & IES (2006, A6.10, p. 157).

	1st year	Other year	Final year
Commercial credit	272	357	525
Overdraft	112	177	183
	384	534	708

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[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.

Table A1.1 Average term time income and expenditures of Northern Irish HE students (source: NatCen IES, 2006, Tables 2.1 & 4.1)

	£	% of income	% of expenditure
Average total income	**7,390**	**100%**	**73%**
Main sources of student support	2,978	40%	29%
Other sources of student support	662	9%	7%
Income from family and friends	1,299	18%	13%
Term-time earnings	2,025	27%	20%
Social security benefits	291	4%	3%
Other income	135	2%	1%
Average total expenditure	**10,178**	**138%**	**100%**
Housing costs	1,042	14%	10%
Living costs	6,763	92%	66%
Participation costs	2,245	30%	22%
Child specific costs	128	2%	1%
Dissaving	**2,788**	**38%**	**27%**

NatCen & IES (2006) estimate the average term time employment income of Northern Irish undergraduates at £ 2,025. 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 Northern Irish households in general (30%) as reported in the Northern Irish Input-Output table.

Table A1.2 Derivation of per student spending

Location of domicile		Northern Ireland	Rest of the UK	Rest of the World
Gross average student spending £	+	10,178	10,178	10,178
Income from employment £	-	2,025	2,025	
Within household transfers £	-	1,299		
Other income £	-	135		
Dissaving £	-	2,788		
Tuition fee expenses	-	1,150	1,150	1,150
Spending attributable to new commercial credit £	+	384		
Exogenous average per student spending	=	**3,165**	**7,003**	**9,028**
Direct imports £ (32%)	-	955	2,113	2,724
Net change in final demand per student £	=	**2,210**	**4,890**	**6,304**
Number of students FTE's	x	34,462	583	3,948
Estimated net contribution to final demand by student population £ m	=	**76.2**	**2.9**	**24.9**

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 Northern Ireland. In total they support approximately 0.32% of output.

Table A1.3 Impact of student spending in Northern Ireland

| | Student origin | | | |
	Northern Ireland	Rest of the UK	Rest of the World	Total
Output impact of student spending £m	135	5	44	184
% of Gross Output	*0.23%*	*0.01%*	*0.08%*	*0.32%*
GDP impact of student spending £m	*75*	*3*	*25*	103
% of GDP	*0.29%*	*0.01%*	*0.10%*	*0.40%*
Employment impact of student spending FTEs	*667*	*25*	*218*	910
% of Scotland employment	*0.10%*	*0.00%*	*0.03%*	*0.13%*

Appendix 2: Sensitivity of results to IO-table

This appendix describes the sensitivity of previously presented results to the alternate specifications of the Northern Ireland HEI-disaggregated Input-Output tables. The Input-Output tables for Northern Ireland estimated by Allan *et al* (2010) are derived through the use of non-survey techniques. This is unlike the official Scottish Input-Output tables, for example, which are based on Scottish-specific data. The NI-table is derived indirectly through estimating Northern Ireland's share of the United Kingdom IO-table[23]. For this Allan *et al* (2010) use location quotients[24] in the first instance but constrain their table to conform to control totals obtained from NI economic data using a RAS method. Non-survey techniques[25] are frequently applied in situations where a relevant fully surveyed IO-table is not available or the time and/or resources are not available to estimate one as it is a costly undertaking. Their shortcomings are well documented and have been explored widely in the literature along with potential remedies. Perhaps the most problematic aspect of IO-tables estimated via location quotient approaches is that they have been found systematically to overstate the intensity of intermediate demand of (local) production sectors and underestimate imports and exports (see for example Harris & Liu (1998)). This artificially inflates the output multipliers of local sectors. Hybrid tables such as that by Allan *et al* (2010) have been found significantly to reduce that problem (again see Harris & Liu (1998)) although there will still be variation in the output multipliers depending on what location quotient technique is used.

For the construction of the NI IO-table Allen *et al* (2010) derive four different versions of the table based on alternative locations quotient approaches. These are the FLQ formula (Flegg *et al*,

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[23] For details of the UK IO-table used, see Turner *et al* (1999).
[24] See Miller & Blair (2009, Ch. 8), Flegg *et al* (1995), Flegg & Webber (1997, 2000) Brand (1997), McCann & Dewhurst (1998).
[25] For an overview see Miller & Blair (2009, Ch. 7-8).

1995, Flegg & Webber 1997), Round's (1978) Semi Logarithmic Location Quotient (RLQ), the Cross Industry Location Quotient (CILC) and a variant of the Cross Industry Location Quotient with imports adjusted (CILC2).

For the analysis presented in this paper the uncertainty about the precise values of the Northern Ireland Input-Output table is critical. Which version of the NI-tables is chosen as the basis for the analysis not only affects the precise quantitative results, but also changes qualitative findings to some extent.

Table A2.1 Comparison of Type-II output multipliers (M_i) by different estimates of the Northern Ireland IO-table and the official Scottish IO-table

Sector	FLQ		CILQ		RLQ		CILQ2		SCO IO	
	M_i	Rank	M_i	Rank	M_i	Rank	M_i	Rank	M_i	Rank
Primary and utilities	2.08	5	2.19	10	2.04	8	2.10	7	2.10	2
Manufacturing	1.70	11	2.14	11	1.79	11	1.79	11	1.83	10
Construction	2.15	3	2.44	3	2.32	1	2.36	1	2.07	3
Distribution and retail	1.97	9	2.22	9	2.01	9	2.02	9	1.90	9
Hotels, catering, pubs, etc.	2.11	4	2.38	5	2.17	4	2.20	3	1.80	11
Transport, post and communications	2.08	6	2.42	4	2.11	6	2.15	5	2.03	4
Banking and financial services	2.04	8	2.33	7	2.05	7	2.09	8	1.96	8
House letting and real estate services	1.47	12	1.47	12	1.37	12	1.39	12	1.55	12
Business services	2.04	7	2.34	6	2.11	5	2.11	6	1.99	5
Public sector	2.23	2	2.47	1	2.26	2	2.27	2	1.97	7
HEIs	2.29	1	2.44	2	2.20	3	2.18	4	2.12	1
Other services	1.87	10	2.22	8	1.96	10	2.02	10	1.98	6

As the table above reveals the output multipliers for Northern Irish production sectors differ in their magnitude depending on which location quotient method is used to construct the tables. Furthermore, the relative standing of the sectors is altered. For our base case presented in the main body of this paper we have chosen to use the IO-table derived via the FLQ location quotient method. This version provides multiplier values most similar to that of the fully surveyed Scottish Input-Output table. Furthermore, analysis based on this table reveals results that are qualitatively identical to those produced for Scotland (Hermannsson et al, 2010b) and Wales (Hermannsson et al, 2010e). In our judgement, a prudent stance is to adopt for the base case a version of the dataset that provides results that are the most similar to those found based on more robust datasets for Scotland and Wales. However, it is of course quite possible that Northern Ireland is in fact qualitatively distinct from Scotland and Wales as suggested by some versions of the Input-Output table.

Table A2.2 Switching multipliers and impacts for different versions of the Northern Irish IO-tables

Table	Multipliers			Impact of £100 switching	
	Public sector (MP)	HEIs (MH)	Switching (MP-MH)	Output £m	Employment FTEs
FLQ	2.23	2.29	0.06	6.4	-393
CILQ	2.47	2.44	-0.03	-3.2	-493
RLQ	2.26	2.20	-0.06	-6.3	-575
CILQ2	2.27	2.18	-0.09	-9.1	-621

As the table above reveals the multiplier for switching final demand from the public sector to HEIs differs both quantitatively and qualitatively depending on which of the Northern Ireland IO-tables is used as the basis for the HEI disaggregated IO-table (Hermannsson et al, 2010a). In all cases this results in a negative employment impact as discussed in Section 3. Furthermore, for the tables estimated based on the CILQ, RLQ and CILQ2 location quotients the output impact of the switching is negative. However, this does not imply that the net impact of HEIs in Northern Ireland is negative, since as we saw in Section 3, 35% of NI-HEIs income is from sources that are not subject to the budget constraint of the Northern Ireland Assembly. However it is clear that a reduced or negative switching impact will act to reduce the net impact of NI-HEIs.

Table A2.3 Summary of overall results for the impacts of the NI-HEIs sectors and the associated students' consumption expenditures depending based on different versions of the Northern Ireland IO-table (reproduces Table 5 for different versions of the dataset).

	Results based on FLQ table			Results based on CILQ table			Results based on RLQ table			Results based on CILQ2 table		
	Generic public sector impact	Net impact	Gross impact	Generic public sector impact	Net impact	Gross impact	Generic public sector impact	Net impact	Gross impact	Generic public sector impact	Net impact	Gross impact
Institutional spending	264	121	385	264	121	385	264	121	385	264	121	385
Knock on impacts	324	157	481	387	174	562	333	146	479	336	144	480
Switching impact		17	17		-9	-9		-17	-17		-24	-24
Institutional impact total	**587**	**295**	**882**	**651**	**287**	**938**	**597**	**251**	**847**	**599**	**241**	**840**
– % of total impact	*67%*	*33%*	*100%*	*69%*	*31%*	*100%*	*70%*	*30%*	*100%*	*71%*	*29%*	*100%*
Exogenous student spending	43	106	149	43	106	149	43	106	149	43	106	149
Knock on impacts of student's consumption	53	25	78	63	35	99	55	12	66	55	9	64
Switching impact		-43	-43		-49	-49		-50	-50		-52	-52
Student's consumption impact total	**96**	**87**	**184**	**107**	**92**	**199**	**98**	**67**	**165**	**98**	**63**	**161**
– % of total impact	*52%*	*48%*	*100%*	*54%*	*46%*	*100%*	*59%*	*41%*	*100%*	*61%*	*39%*	*100%*
Total impact attributable to HEIs	**684**	**382**	**1,066**	**757**	**379**	**1,137**	**695**	**318**	**1,013**	**698**	**304**	**1,001**
– % of total impact	*64%*	*36%*	*100%*	*67%*	*33%*	*100%*	*69%*	*31%*	*100%*	*70%*	*30%*	*100%*

As table A2.3 reveals, the method of construction of the NI IO-table significantly affects the attribution of the gross impact of HEIs between a generic public sector impact and a net impact. The results are affected both through reducing the switching impact of HEIs institutional expenditures (from positive to negative) and student expenditures.

On balance it is evident that our base case assumption is the most optimistic it terms of its estimate of the net overall impact of HEIs. For this we find that 36% of Northern Ireland's HEIs gross impact constitutes a net impact and 64% represent a generic public sector impact. Conversely, results based on the CILC2 IO-table, which is the most pessimistic one, reveals a greater dependency of NI-HEIs on funding from the Northern Ireland Assembly, with a 30% net impact and a 70% generic public sector impact. This particular source of uncertainty can only ultimately be reduced by the construction of a survey-based IO table for Northern Ireland.