The Economic Impact of Higher Education Institutions in Ireland: Evidence from Disaggregated Input Output Tables.

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Abstract

We provide, for the first time, a disaggregated input output table for Irish higher education. Using this we constructed Type I and Type II multipliers for gross output. We find that Irish higher education institutions (HEI's) have high, but explicable, Type II multipliers. Taking account of the government budget constraint we further decomposed the Type II multipliers into state and non---state impacts. The picture painted overall is of a higher education sector that adds considerable gross value to the economy, whether via state or other income. The gross income of Irish HEIs, a total of €2.6b in 2010---11, generated gross output nationwide of €10.5b.

Keywords

Input output table, Ireland, universities, institutes of education, multipliers, economic impact analysis.

JEL Codes

C67, H52, I23, I26,

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1. Introduction

This paper provides an economic impact analysis of the majority of the Irish tertiary education sector. The use of input---output analysis method originally outlined by Leontief (1936) is used to perform this exercise. This paper constitutes one of the first public attempts to analyse the higher education space in Ireland using this method. We find that Irish higher education institutions have an economic impact consistent with higher education institutions in the United Kingdom, where this type of analysis is commonplace. Irish higher education institutions have a net positive return to the Irish economy from a purely economic activity point of view.

This analysis does not incorporate the human capital, research and development and entrepreneurial economic returns generated by the sector on a general and individual institutional basis. Nor do we look at the non---economic returns of education, be they social, political, public health or psychosocial. To this effect, the study attempts to answer a direct question: does the economy receive more than one euro's worth of economic activity for every euro it spending on tertiary education in Ireland? If evaluated from the point of view of pure economic activity and balanced against the opportunity cost of those exchequer funds being used for other purposes, all Irish higher education institution will return on average slightly more than a euro, in the case of some individual institutions as much as 72 cents more. Type II multipliers are among the highest of any sector in the Irish economy. Higher education institutions generate a significant amount of economic activity, something know to any cabbie, sandwich bar or pub owner in a university town.

The structure of this paper is to outline some basic issues of the tertiary education sector in Ireland, the methodology of input---output analysis, the calculation of Type I and Type II multipliers and the final calculation of the balanced---budget Type II multiplier and compare these results to the United Kingdom. In general, one euro of output from a higher education institution generates approximately 1.3 euro via stimulating supply linkages with other sectors, and a further 1.8 euro via indirect effects arising from increased income in the economy. The gross income of Irish HEIs, a total of €2.6b, generates gross output nationwide of €10.5b.

The Irish Tertiary Education Sector

The Irish educational sector follows the traditional Western format of primary, secondary and tertiary education. The focus of this study is on tertiary education. This does not include all post---secondary education even if the institutions in questions are engaged in certain aspects of delivery of post---secondary but not tertiary education courses. The National Framework of Qualifications outlines levels 7---10 as tertiary education and they roughly equate to the obtaining of a bachelor degree through to a higher doctorate. The delivery of higher education has since the early 1970s been split between the Institutes of Technology and the universities with the Higher Education Authority Act 1971 providing a regulatory framework and structure of a "sector" as opposed to a loose grouping of institutions in receipt of State funds.

Public Sector Context

This paper's analysis is based on 2010---11 data. The sector at that time was only in the beginning of a process of downsizing staff and re---evaluating budgetary positions as a result of the Employment Control Framework and in the wider context of fiscal austerity imposed by the IMF---ECB---EU Bailout of December 2010. The sector at the time had a total of 185,342 students enrolled for the academic year 2010---11. The overall expenditure of the institutional side of the sector, not including the expenditure of staff and students, was €2.61bn of which €1.45 was provided by government sources directly. The sector as a whole employed 21,811 staff for the academic year 2010---11. Between 55% and 75% of all third level expenditure is on staff. In the European contact this range is average to slightly above average. Compared to Mediterranean institutions for instance this is relatively low, especially when broken down to subsector averages of 63% for the universities and 70% for the Institutes of Technology. In comparison to Northern Europe, it is somewhat higher.

In the context of the overall expenditure of the State, education is one of the major expenditure heads, along with Health and Social Welfare. For the financial year ending 31 December 2010, Ireland spent €8.28bn on education. The estimate by the Department of Public Expenditure of the amount of money that was spend by "Third Level and Further Education" was €1.7bn. In terms of the overall expenditure (Comptroller and Auditor General statement of total expenditure: €53.8bn) position of

the State it represented 3.2% of total spend in 2010. In terms of overall revenue (using the Comptroller and Auditor General statement of total revenue: €35.6bn) it absorbed 4.8% of the annual tax intake. In terms of total public sector employees (noting that not all staff working in the Third Level sector would be considered members of the civil and/or public service) the sector represents 7% of the total employees of the State. In 2011 the figures were essentially constant, with the overall expenditure on the Education Vote at €8.28bn with "Third Level and Further Education" expending €1.7bn. A change of approximately ---3% took place year---on---year before rounding. In terms of the proportion of taxation receipts, the overall burden of Third Level was reduced to 4.4% and as a proportion of total expenditure to 2.6%. It should be noted that over the duration of the crisis (2008---present) there has been a reduction of 2,246 staff from the sector and state expenditure per student has reduced from €8,897 in AY2007/08 to €5,212 in AY2013/14. In terms of the public expenditure context, the Third Level sector is nontrivial in terms of exchequer expenditure and direct employment numbers.

According to the 2014 edition of the OECD's *Education at a Glance* Ireland has around 80% of those with a tertiary qualification are in employment, lower than the OECD average but in the same grouping as other distressed economies such as Japan, Hungary, Greece, Italy and Spain. Ireland's level of enrolment of school leavers is very high with 47% of 25---34 year olds holding a third level qualification. The OECD highlights entry rates of 24% of school leavers into vocational third level education and 51% of school leavers into university---style third level education. The net private and public returns to education in Ireland are the highest in the OECD. In 2010 a male third level graduate in Ireland would expect returns over a secondary education of 454,223USD privately and 283,815USD to the public at large, more than twice the OECD average and followed, only distantly, by the United States. These financial returns exclude certain non---monetary outcomes that the OECD has begun to track for third level graduates, such as improved health outcomes, increased level of trust and higher levels of social and political engagement. All of this must be seen within the context of Ireland's difficult domestic labour market situation, outward migration and a worrying increase in the number of persons under 30 who are classified as NEETs (neither in employment nor in education or training). This challenging external macroeconomic environment must also be acknowledged while evaluating the results of this study.

History & Institutional Development

As of 2014 the sector is made up of seven universities, fourteen institutes of technology and six colleges (institutions with specialised course delivery in the areas of education and medicine)[1]. Until the 1970s there was relatively strict segregation between the National University of Ireland (founded in 1908) and Trinity College. Teacher training colleges were (and to a large extent still are) aligned to the religious patron. University College Dublin, though a secular foundation, had its origins in Cardinal Newman's failed Catholic university of the mid---nineteenth century. Similar foundations were made at the same time (the so---called Queen's Universities at Galway, Cork and Belfast). What was to become the National University of Ireland at Maynooth was founded in 1795 as a Catholic seminary. The Royal College of Surgeons, Ireland was founded in 1784. Two national institutes of higher education were also formed in the 1970s and were to become Dublin City University and the University of Limerick during the course of the 1980s.

The Dublin Institute of Technology, the oldest and largest of the institutes of technology dates back to 1887, with the majority of the institutes of technology dating from the mid---1960s onwards. During most of this time the institutes of technology were largely engaged in further education and apprenticeship activities with some of the larger institutes gradually taking on an active role in higher education delivery. The Dublin Institute of Technology was at the forefront of this with a relationship with Trinity College dating from 1977. At present the institutes of technology are primarily engaged in higher education delivery with a number aiming to transit to the new status of technological university, pursuant to the Technological Universities Bill currently being drafted.

Following the expansion of Irish secondary education in the mid---1960s are a result of the introduction of free secondary education by Minister for Education Donogh O'Malley, TD in 1969, the massification of higher education began. The continuous increase in student numbers was to continue from the early 1970s to the present day with at present in excess of 60% of school leavers entering the sector. The national

[1] The oldest institution in the Republic of Ireland is the University of Dublin, Trinity College, founded in 1592. Though of a relatively old foundation, Ireland does not have truly ancient foundations such as those that exist in the UK or in Continental Europe.

target, as stated in the *National Plan for Equity of Access to Higher Education* (July 2008) was 72% of school leavers by 2020. Though universities and education have been considered to be an important part of the national manpower strategy, a crucial component of the national economic strategy, they only began to be considered as part of a national innovation, research and development industrial policy towards the late 1990s. This was following the milestone event of introducing free third level education in 1996 by Minister for Education Niamh Bhreathach, TD. The period between 1996 and the present has been one of great activity in terms of national policy, with the Universities Act 1997, Institutes of Technology Act 2006, the establishment of Science Foundation Ireland in the Industrial Development (Science Foundation Ireland) Act 2003 and the creation in 2001 of the Irish Research Councils for Humanities and Social Sciences and Science, Engineering and Technology, now merged into the Irish Research Council. In 2006 the Department of Enterprise, Trade and Employment published the Strategy for Science Technology and Innovation aimed at placing research and higher education at the core of Irish economic policy. This was followed up by the Innovation Task Force, which reported in 2010, again placing the universities and their role in research and development at the core of Irish industrial policy. Despite all this and a multitude of official and other reports on the finances and structures of the sector, little in the way of formal economic impact analysis has been undertaken.

2. Previous research on university impact

Hundreds of papers and reports in the last decades have examined the economic impact of such diverse actions as sports events, large scale cultural projects, and of course the impact of geographical or industrial sectors of the economy. Two main methodological strands have been used, often concurrently – one relies on the use of input---output analysis, the other on a macroeconomic approach.

In the context of evaluation of the economic impact of higher education institutions a comprehensive review of some of the methodological and interpretational challenges can be found in Siegfried *et al.* (2007). More recent discussions include McHenry, Sanderson, and Siegfried (2012), Garrido---Yserte and Gallo---Rivera (2009), Pastor, Pérez, and Fernández de Guevara (2013), which papers all in effect urge caution on over grandiose claims for impact. Modelling of university and college impact in the

modern sense began with the work of Caffrey and Issacs (1971), who outlined a template which has been generally followed, especially in the USA. Much of the work in the USA has been in the context of regional impact analyses, whereby state and regional colleges and universities have produced analyses, often in the context of budgetary negotiations. We should note that the overall economic impact of an institution, sector or industry is multifaceted. In the context of universities for example there are significant downstream effects on society and on the economy from skill enhancement. These are both conceptually and empirically difficult to measure. Private and public benefits are clearly identified from attainment of higher education – see Kelly, O'Connell, and Smyth (2010), Long (2010), and Oppedisano (2014) as examples of studies that focus on different aspects of this measurement issue. In this paper we concentrate on a high---level macroeconomic impact. Thus the overall impact will be greater than that which is implied here as we are concentrating on the higher education institutions (HEIs) as single units of production

In the UK and European context the foundational work is that of Brownrigg (1973) on Stirling, followed by Bleaney et al. (1992) on Nottingham. Similar studies have been conducted on many other universities such as Portsmouth (Harris (1997)), public universities in Valencia (Pastor *et al.* (2013)), Izmir (Sen (2011)), Scottish universities (Hermannsson *et al.* (2013)), educational institutions in Canterbury (Canterbury City Council (2001)), Higher Educational institutions in London (Hermannsson et al. (2014)), Aberdeen (Battu *et al.* (1998)) etc..

Most early studies used a Keynesian multiplier approach while more recent work has tended to concentrate on input---output modelling. Outside the USA the largest extant set of studies is on the UK, and the drive to recent input---output modelling may in part reflect the existence of earlier multipliers from Keynesian modelling.

Input---output analysis has become one of the most widely applied methods in economics. Developed by Leontief in the late 1930s, the input---output framework aims to analyse the interdependence of industries in an economy at many geographic levels ---local, regional, national, and international. The seminal paper is Leontief (1936) and a discussion of the importance of the approach is given in Baumol (2000). When constructing the Leontief input---output model, one is concerned with the flows of products from each industrial sector, considered as a producer, to each of the sectors, itself and others, considered as consumers. Dependent on specific sector classifications,

the number of industries considered in practice may vary significantly. Nevertheless, input---output analysis has been recognised as a useful tool to understand the impacts of individual industries in the whole economy.

In the UK, we have seen analyses of higher education institutions (HEIs) via the input---output model over the last 15 years (see for instance Kelly and McNicoll (1997), UniversitiesUK (2014) The model has been further extend to construct an HEI---disaggregated input---output table, with each HEI being considered as a separate sector (Hermannsson et al. (2010), Hermannsson et al. (2010), Hermannsson et al. (2010)).

To our knowledge, little research of this kind has been undertaken in the context of Irish higher education sector. This is a gap that this paper seeks to fill.

3. Constructing Type I and Type II output multipliers

In general, the methodology employed in this paper for the construction of the input---output tables follows the normal approaches that have been clearly defined in previous studies. There are a variety of multiplier effects one could derive from the input---output analysis, including output, income, employment or gross domestic product (GDP). The *output* multiplier for each sector refers to "*the change in total output for the economy as a whole resulting from a unit change in the final demand for that sector*" (Hermannsson et al. (2014)). The Type I output multiplier for a particular industry is defined to be "*the total of all outputs from each domestic industry required in order to produce one additional unit of output*" (Scottish Government, 2011), while the Type II output multiplier incorporates "*not only the increase in demand for intermediate inputs but also induced household consumption effects*" (Hermannsson et al. (2014))). In other words, the Type I multiplier can be defined as direct and indirect effects (as the input---output model is open with respect to households), and the Type II multiplier can be defined as direct, indirect and induced effects (as the input---output model is closed with respect to households). As this paper is concerned with the high level economic impact of Irish HEIs we present mainly Type II and we concentrate on output multipliers.

In the standard input output model endogenous final output is determined by exogenous final demands via the Leontief inverse. Let

$$X_{!} + f = q \; ; \; i^{!}X + y^{!} = q^{!}$$

where X is an nxn matrix of intermediate sector to sector transactions with x_{ij} being the individual element of transactions from sector i to j, q the $nx1$ vector of output and

$y^{!}$the $1xn$ vector of value adding inputs. If we replace x_{ij} with

$$a_{!"}\ q_{!},\ \text{where}\ a_{!"} = {}^{x_{!"}}\!/_{q_{!}}$$

then we can express the system as

$$\mathrm{Aq} + f = q$$

where A is an nxn matrix of the technical coefficients. Subtracting Aq from both sides we get

$$f = q - \mathrm{Aq} = {}^{(}I - A^{)\,!!} f = q$$

which if we then premultiply both sides by the inverse of the $^{(}I - A^{)}$ matrix yields

$$q = {}^{(\quad)}I - A^{\,!!} f$$

where

$$I - A^{(\quad)\,!!}$$

is the Leontief inverse matrix, q is the endogenous vector of final outputs and f the endogenous vector of final demands. The Leontief inverse shows the induced effects of any change in exogenous demand. Indirect effects arise from an increased demands for intermediate goods and, with Type II multipliers, induced effects arise via the impact of increased household income being directed to increased consumption demand.

The *output multiplier* for each sector i, $m_{!}$, is derived from the above. It is the change in total economic output from a unit change in final demand for that sector and

is estimated as the sum of the entries in the relevant column of the Leontief inverse.

This gives gross output $q^{!}$ attributable to the final demands for the output of sector i as

$$q^{!} = m_{!} f_{!}$$

A further exposition of input---output modelling is provided by many authors, see Miller & Blair (2009) for a pedagogical demonstration.

Conventionally each sector is an industry, defined at, e.g., a 2 digit NACE classification. We proceed here to first disaggregate the two components of the HEI sector from the education sector as a whole (NACE 85); this gives us an Institute of Technology (IoT) Sector, a University sector and a residual education sector. We then further disaggregate the two new sectors into each individual HEI. This augmented or disaggregated matrix is the basis for our analysis.

Input---output modelling assumes two types of spending – exogenous and endogenous. Exogenous spending, as we might imagine, is assumed to be independent of the sectors being modelled while endogenous spending is determined within and reacts to shocks to the sectors. Typically government spending, exports and investment are taken as exogenous. Household spending can be treated as either exogenous or endogenous. If endogenous, the system is said to be "closed" to the household sector. A system that is so closed yields Type II multipliers. A key assumption underlying input---output modelling is that the system is demand not supply determined, thus the supply side is passive, fixed. We can justify this either by suggesting we are in a situation of excess capacity and negative output gap (as was certainly the case in Ireland in 2008---13) or if we concern ourselves with long---run scenarios where such limitations are non---binding, that the system can draw in more than sufficient labour and capital to eliminate capacity constraints.

4. Construction of an HEI---disaggregated input---output table

Our analysis is confined to a single base year, 2010---11, which reflects the latest year for which comprehensive comparable accounting data are available for Irish HEIs. The HEI disaggregated input---output table is developed based on the 2010 Input---Output Table for Ireland with an individual row and column being created for each institution

and added into the national table. The main focus is on the seven universities and 14 institutes of technology (IoTs), where the bulk of third---level public and private spending and students are located. The 2010 Input---Output Table for Ireland was published by the Central Statistical Office (CSO) in January 2014 and provides a detailed picture of the transactions of goods and services by industries and consumers in the Irish economy. An essential task is to separate out the HEIs from the 'Education Service' sector as a whole from the National Accounts.

Our analysis draws on a number of data sources, both secondary and primary. Ireland's higher education is provided in the main by seven universities, 14 institutes of technology (IoTs), including Dublin Institute of Technology and seven colleges of education. Due to data limitations we exclude the colleges of education and the private higher education institutions such as Hibernia College and Royal College of Surgeons in Ireland. There are also a number of third level institutions that provide specialist education in such fields as art and design, medicine, business studies, rural development, theology, music and law. The main focus of our analysis is on the seven universities and the 14 IoTs, where the bulk of third level public and private spending and students are located and we report the results for the university sector and the IoT sector respectively.

HEI Expenditure

In an input---output table, a column reveals the total expenditure of a sector and how it is divided between intermediate inputs, imports and value added. Table 2 below describes the data sourced in creating a separate column for each HEI. Data on the institute expenditure in 2010---11 was sourced from the Higher Education Authority (HEA), the statutory planning and policy development body for higher education and research in Ireland. Both the university and IoT sectors include institutions that vary significantly in terms of size measured by expenditure. The HEA accounting data also shows, for each individual HEI, the compensation of employees, consisting of all payments in cash, as well as in kind, to employees.

To estimate *imports* for each institution, we used data provided by the Irish Universities Association (IUA) through an analysis of university supplier information in 2010---11. As indicated by the IUA data, the proportion of goods and services purchased by Irish universities from nationally based businesses ranges from 77% for University

of Limerick to 97% for University College Cork. While there is no comparable detailed information on the supplier base of IoTs, we used the average ratio for the university sector as a proxy for IoTs in the estimation of their imports. Therefore, we assume that imports to each IoT accounted for 10% of the value of total output in the year of 2010---11, although it could be expected that many IoTs, in particular those smaller ones, would be more likely to purchase goods and services from proximate businesses.

Operating surplus and product taxes less subsidies were determined for each university and IoT as the same proportion of overall expenditure as in the education service sector as a whole. These elements represent a small share of overall expenditure: 2.7% for operating surplus, and 1.3% for product taxes less subsidies. Finally, the amount of intermediate purchases from Irish industries was determined as the residual after deducting all the above cost elements from the total expenditures. It was assumed that the university and IoT sectors purchase from other industries in the same way shown by the education service sector as a whole.

HEI Income

In an input---output table, a row reveals the total income of a sector and how it is divided between intermediate sales to other production sectors and sales to final demand sectors such as households, government and exports. Table 3 below describes the data sourced in creating a separate row for each HEI. In Table 4 below, we show, in more detail, the input---output rows which reflect the particular structure of the university and the IoT sectors .

It is clear that income from the Irish Government accounted for a large share of total income for both the university and IoT sectors. In comparison, universities were more successful than IoTs in sourcing international funding, e.g. international student tuition fees, international research grants and industry funding. The category '*Other income*' under '*Exports*' was allocated by the share of the number of international students, based on the data released by Education Ireland in a series of statistical reports.

5. Output multipliers

Disaggregating the HEIs as a sector, using the approach noted above, we find IoT's with a Type I multiplier of 1.1 and universities a Type I multiplier of 1.27. These may seem low by comparison with other sectors, for example warehousing at 1.7 or retail trade at 1.4. These figures are in line with comparable studies; Hermannsson et al. (2010) suggests a Type I multiplier for Northern Irish Universities of 1.30 ; for Wales and Scotland they find (Hermannsson et al. (2010), Hermannsson et al. (2010) type I multipliers of 1.33 and 1.30 respectively.

Of perhaps more interest are Type II as these show the direct, indirect and induced output effects. Figure 1 below displays conventional Type II impact estimates for individual Irish HEIs, with the use of the HEI---disaggregated input---output table. An overall conclusion is that Irish HEIs, either universities or IoTs, exhibit rather high Type II multipliers, indicating that they have a relatively strong impact on the economy via the household expenditure. Among the 21 HEIs considered in the analysis, the lowest conventional Type II output multiplier is 3.62, associated with Dun Laoghaire Institute of Art, Design and Technology, while Letterkenny Institute of Technology shows the highest multiplier of 4.25.

There is a distinction between Dublin---based universities and those situated elsewhere with regards to their Type II multipliers. In particular, the three universities in the capital city – DCU, TCD, UCD – are among the top institutions for impact, with multiplier between 4.14 and 4.17. By comparison, the other four universities, namely UCC, NUIG, NUIM, UL, are lower, with the highest multiplier of this group at 3.86. However, the IoT sector does not seem to show the same geographic split.

These multipliers, even at the lower end, are high by comparison to other studies, although not perhaps abnormally so. Kelly, McNicoll, and McLellan (2004) in a study of the impact of the university of Strathclyde found multipliers of between 1.2 and 1.7. Examining the impact of Portsmouth University, in the 1990s, Harris (1997) estimated multipliers of 1.66. A study of Scottish universities by Hermannsson et al. (2013) puts typical multipliers at just over 2, while a study of London higher education institutes by Hermannsson et al. (2014) provided typically higher figures, most institutions having a multiplier of around 3. London however is a very concentrated market with over 50 higher education institutions in a very concentrated area, and thus it is highly probable that factors such as economies of co---production across the city are at play in the

generation of these high multipliers. Individual HEI Type II multipliers of 2 to 2.2 were estimated for Northern Ireland HEI's (Hermannsson, Lisenkova, and McGregor (2011)) and of between 1.9 and 2.2 for Welsh HEI's Hermannsson et al. (2010)

We should also note that although not strictly comparable these multipliers are higher by a significant margin than the overall national fiscal multiplier of 0.5 as used by the IMF and the Irish Fiscal Advisory Council and those of the Economic and Social Research Institute (see Kearney, Fitzgerald, and Bergin (2013) for the ESRI and Council (2013) for the IFAC assessment). The ESRI multipliers range from 0.3 to 1.2. Our estimates here are closet to but greater than the overall expenditure multipliers in O'Farrell (2013), Table 14 which range from 1.06 to 1.76. We should also notice the short---run government investment multiplier of Clancy et al. (2014), which is of a similar magnitude, 1.8 for the first quarter.

We can look at the sectoral impact by examining the intra---sectoral multipliers (recall that the overall multiplier is made up of the sum of the individual column elements of the Leontief inverse). From Table 6 we can see that an injection of one euro into the University/IoT sector results in an increase mainly in Distribution etc of 54c/52c , in Business Services of 68c/63c, in other services of €1.36/€1.29 and an increase in overall economic output via increase income and concomitant spending of €1.18c .

Balanced---Budget Multipliers

As highlighted earlier, a large proportion of HEI income is derived from official sources. Government budgets are limited, a euro spent on higher education is, at the limit, a euro that cannot be spent on other public sector activities. In the context of the fiscal crisis of 2008---14, HEIs, as were all other recipients of exchequer funding, were put under pressure to ensure both value for money and to ensure that expenditure was as effective as possible. An investigation of the financial health of the Irish higher education sector was undertaken in 2013 by an international accounting firm Grant Thornton Associates (2013). They noted the financial strains the system is under, and believes that this sector had reached "an inflection point". The report highlighted the continual decline of state support since 2008. We see from Table 1 that there is considerable variation in the degree of state support across institutions. In that context therefore it is useful to consider disaggregation of these multipliers to reflect this. Doing so allows us then to construct "balanced" multipliers.

Consider the following as being the impact for an HEI *i,* where *G* and *O* stand for the share of total funding from government and other sources respectively and *m* is the multiplier.

$$impact_i = m_i\ (G_i + O_i)$$

This is intuitive – the impact comes from both forms of expenditure. If we subtract the impact that comes from the government funding,

$$m_i G_i,$$

where m_i is the multiplier for general government we can see the "balanced" impact as

$$Balanced\_impact_i = m_i\ (G_i + O_i) - m_i G_i = O_i m_i + G_i(m_i - m_i)$$

Dividing this through by total spend,

$$(G_i + O_i)$$

we get a "balanced multiplier" of

$$m^{i"\#"\$\%\&'} = (1 - \alpha_i)\ m_i + \alpha_i(m_i - m_i) = m_i - \alpha_i m_i$$

where α_i is the government share in total final demand of the institution.

We show in Figure 2 these balanced---budget multipliers for each HEI. As can be expected, netting out the impact of government support reduces quite significantly the impact of each HEI. The range of impact is now also expanded from its previously highly condensed distribution. Raw multipliers vary, but slightly, with the lowest being 85% of the highest. Taking into account government expenditure we see the lowest being some 30% of the highest.

As shown in Figure 3 the balanced---budget multipliers for Ireland (both sectors) are compared to 73 UK HEIs across England, Scotland, Wales and Northern Ireland. We note

that the Irish institutions are well distributed. Five institutions rank in the top 20 for balanced expenditure multipliers – DCU, UCD, UCD, UL and Letterkenny. Only two rank in the lowest quartile (DIT and Cork IT). Looking at an all---island comparison we see the Irish HEI's performing well, with only QUB showing a balanced budget multiplier above the median. When we compare the balanced budget multipliers against income, a somewhat different picture emerges, as per Figure 4

There is no clear relationship between income and the multiplier. We can note that the very largest multipliers belong to specialist institutions – LBS and LSE, London School of Hygiene and Tropical Medicine, Courtalds Institute. Amongst comprehensive institutions the Irish HEIs, namely UCC, UCD, DCU and TCD stand out. It is noteworthy that in reality only UCC, UCD, TCD and St Andrews can be described as fully comprehensive universities in the top 20, by which we mean covering all aspects of higher education inclusive of the arts and humanities, social sciences, physical and life sciences, mathematics, medical and. para---medical disciplines. This is important to note since the 1997 Universities Act orientates itself towards comprehensive institutions when allowing the use of the title university.

In terms of the other sectors we might here note that the individual HEI type II multipliers are not the highest. Sectors such as construction (this is 2010 recall), financial intermediation, and accounting services are typically 30---50% higher again. The expanded IO table has 79 sectors (including the individual HEI's). All HEI's are above median.

An additional matter is note is that of spatial location. It is clear from the Hermannsson et al. (2014) study that multipliers are higher in London. This is a by---product of agglomeration effects and the unique economy of Greater London. There appears to be a minor Dublin effect but overall such spatial results are not apparent. It is clear that the status of the HEI does matter. IoTs and small universities tend to have low balanced multipliers. This reflects the limited diversity of income sources that exist for these HEIs. A greater diversity of income sources allows for a higher Type II balanced---budget multiplier.

Employment Multipliers

We can also calculate employment multipliers, analogously with the gross output multipliers. Here instead of the output flows being included in the A matrix we instead include job numbers, scaled by output. As with the output multipliers we can create both Type I and Type II multipliers. These are shown in Table 7. We can interpret these as being the effects of an additional one million euro on employment. Thus on average the monies on the universities supports, in addition to the employment in the sector of 13,701 an additional 1781 persons through indirect effects and an additional 66,470 persons via induced demand. These figures are high, but reflect some US findings (Siegfried, Sanderson, and McHenry (2007)). We should be cautious in the interpretation of such high employment multipliers. That said, it is well recognised that the high salary levels paid to high skilled workers can result in high sectoral (or institutional) multipliers – see for instance Moretti (2010), Moretti and Thulin (2013). We might also note that the type 1 multipliers compare well in magnitude for other Irish economic sectors calculated from disaggregated IO tables – see for example Morrissey and O'Donoghue (2013) disaggregating the 2007 table to obtain information for marine industries with a multiplier of 2.9.

6. Conclusions, Caveats and Further issues.

In this paper we explore the expenditure impacts of Irish HEIs on the economy of Ireland by applying an input---output analysis. The results suggest that Irish HEIs have significant economic impacts on the national economy. While HEIs show average Type I multipliers, they are among the sectors with the highest Type II multipliers. A possible explanation for this could be that, compensation of employees forms a larger share of expenditure of HEIs and might be, on average, at a higher level, in comparison to other sectors. At the institutional level, there seems a clear distinction between universities in Dublin and those outside in terms of their economic impacts. More specifically, Dublin---based universities show relatively higher multipliers than those situated elsewhere in the country, a finding which needs further investigation but is consistent with results from London.

This analysis has the potential to contribute to the current policy debates about the future financial sustainability of higher education in Ireland. A number of caveats need to be stated:

- While we have some considerable degree of certainty about the inputs and outputs of each individual higher education institution, this can always be refined. In particular it would be useful to obtain greater depth of information on the expenditure on purchased goods. We need more information on the "residual" categories.

- Input output analysis interpretation is typically as we have done here. However, it is an "all or nothing" approach ; the output is generating whatever it does at the scale that it is at. We do not have information on marginal spend impacts, per se, and thus while it is convenient to take the sectoral or institutional multiplier and apply it to marginal expenditure this may not be strictly accurate.

- Residual income is allocated across rows in the same proportions as the overall education sector. This is a modelling constraint.

- This analysis, while enabling a discussion of the effects of increasing or decreasing exchequer funding to HEIs in the immediate, will not provide a statement on the effects of that change towards a wider industrial policy.

- This analysis cannot be used to evaluate the return---on---investment in education as part of a public or private human capital policy. The evaluation of the effects, in monetary gain to the public and to the individual of tertiary education is the matter for a different study.

- This study will not provide any direct information on solving the ongoing problem of NEETs, though it might provide information about the relative economic costs and effectiveness of different post---secondary education approaches.

- This study is of necessity silent on matters relating to quality in higher education. There is indicative evidence of different types of results depending on types of institutions (specialist versus comprehensive) but this does not make any clear declaration on the academic quality of the institution. Nor can we make a

statement using our analysis on any direct or indirect linkages between funding quantum, source or mixture and academic quality. That again is a matter for another study.

- This analysis does not incorporate non---economic economic impact. This includes social, political, psychological and public health results at a society and individual of mass higher education. This study also makes no statement and cannot make a statement on the fundamentally normative and political judgement of what aspect and/or proportion of tertiary education should be considered part of the public good and supported as such.

- The 2010 input---output table and associated employment and household expenditure data reflect a society still transiting from an artificial environment, induced by the bubble. The underlying assumption of IO modelling , apart from linearity of the economy, is that the inkages are stable ad change slowly. This has been the case for Ireland to a great degree (See Keogh and Quill (2009)) but whether this held over the period around the boom and the bust is debatable. This is particularly important when examining employment multipliers.
- We have yet to include the impact of students. Evidence from the UK suggests that the impact of students is modest – typically of the order of 1/10 of the magnitude of (type II) balanced multipliers. Nonetheless, this has not been captured.

This study can provide clear counterfactuals on the effects of the presence or absence of an HEI on a local economy. We can also provide clear results related to present questions of mergers and co---location of institutions and how their income diversity will result in desirable or undesirable policy outcomes. This analysis clearly can inform the ongoing debate about the role of exchequer funding of higher education and provide empirical evidence. We can provide empirical evidence about the impact that HEIs have on local employment and how many direct and indirect jobs an HEI can support in a locality.

Ultimately, this study is the first step in forming an evidence base for policy decisions. This work, combined with work on macroeconomic multipliers can go on to

inform the major challenges facing the sector in a post---Bailout environment. Irish institutions, as a whole, provide the public exchequer with "value for money" in that they have strong gross economic outputs and generally strong net economic outputs and are commensurate, if not slightly superior in specific instances, with their UK counterparts. This result, in the context of a small open economy suffering a protracted and deep recession, should provide the Department of Public Expenditure and the leadership of the third level sector in Ireland with a source of pride.

Table 1 Characteristics of Irish HEI's 2010---11

Formal name	Total income, €m	of which Irish Governme	Percentage of income from Irish Government, %	Total expenditure, €m	of which nt wages etc	Wages etc as % total
University College Dublin	411	204	49.5%	403	269	66.8%
University College Cork	348	175	50.4%	344	206	59.8%
National University of Ireland, Galway	234	142	60.9%	227	142	62.7%
Trinity College Dublin	321	175	54.6%	332	218	65.7%
Maynooth University	127	73	57.8%	123	76	61.3%
University of Limerick	204	89	43.7%	199	110	55.1%
Dublin City University	175	85	48.5%	173	117	68.0%
Universities	1820	944	51.9%	1801	1138	63.2%
Cork Institute of Technology	92	63	68.4%	91	62	67.8%
Dundalk Institute of Technology	51	30	59.3%	48	34	71.7%
Institute of Technology, Sligo	43	26	59.1%	41	29	71.2%
Limerick Institute of Technology	47	28	60.4%	45	32	70.9%
Waterford Institute of Technology	90	58	64.9%	87	63	72.4%
Dublin Institute of Technology	185	123	66.5%	182	124	68.3%
Institute of Technology,	35	21	61.8%	34	24	70.8%

Carlow						
Athlone Institute of Technology	46	29	62.6%	48	31	65.2%
Institute of Technology, Tralee	33	21	63.1%	34	23	67.4%
Galway---Mayo Institute of Technology	60	37	61.3%	60	43	71.8%
Dun Laoghaire Institute of Art, Design & Technology	23	13	57.3%	21	13	61.6%
Institute of Technology Tallaght, Dublin	37	23	62.8%	34	24	70.9%
Institute of Technology, Blanchardstown	21	13	61.2%	20	15	72.4%
Letterkenny Institute of Technology	31	19	62.2%	31	23	75.4%
IoTs	793	504	63.6%	774	540	69.7%
	Staff FTE	**Total income per staff, €**	**Students**	**Total income per student, €**		
University College Dublin	2,978	138,079	23,600	17,424		
University College Cork	2,507	138,771	17,366	20,033		
National University of Ireland, Galway	2,003	116,675	16,479	14,182		
Trinity College Dublin	2,819	113,799	16,486	19,459		
Maynooth University	749	169,426	9,485	13,379		
University of Limerick	1,436	142,201	11,890	17,174		
Dublin City University	1,209	144,913	10,954	15,994		
Universities	13,701	137,695	106,260	16,806		

Cork Institute of Technology	963	95,639	9,189	10,023
Dundalk Institute of Technology	498	102,008	4,660	10,901
Institute of Technology, Sligo	461	93,926	5,275	8,209
Limerick Institute of Technology	494	95,142	4,984	9,430
Waterford Institute of Technology	890	100,787	8,074	11,110
Dublin Institute of Technology	1,888	98,199	15,459	11,993
Institute of Technology, Carlow	359	96,379	4,869	7,106
Athlone Institute of Technology	509	90,373	4,885	9,417
Institute of Technology, Tralee	319	102,821	2,711	12,099
Galway---Mayo Institute of Technology	647	93,354	6,523	9,260
Dun Laoghaire Institute of Art, Design & Technology	202	112,376	2,205	10,295
Institute of Technology Tallaght, Dublin	335	109,254	4,754	7,699
Institute of Technology, Blanchardstown	210	99,524	2,525	8,277
Letterkenny Institute of Technology	335	91,642	2,969	10,340
IoTs	8,110	98,673	79,082	9,726

Table 2 Summary of HEI columns

Total expenditure	Individually determined	Individually determined	HEA accounting data
Imports	Individually determined	Proxied by assuming ratios for the university sector as whole hold for IoTs	IUA unpublished data
Operating surplus	Proxied by assuming ratios for the education service sector as whole hold for universities	Proxied by assuming ratios for the education service sector as whole hold for IoTs	Input---Output Table for Ireland 2010
Compensation of employees	Individually determined	Individually determined	HEA accounting data
Product taxes less subsidises	Proxied by assuming ratios for the education service sector as whole hold for universities	Proxied by assuming ratios for the education service sector as whole hold for IoTs	Input---Output Table for Ireland 2010
Intermediate expenditures	Determined as a residual item and distributed uniformly across all universities in the same pattern as the education service sector as whole	Determined as a residual item and distributed uniformly across all IoTs in the same pattern as the education service sector as whole	Input---Output Table for Ireland 2010

Table 3 Summary of HEI rows

Income from exports	Individually determined	Individually determined	HEA/ HEI accounting data
Income from Irish Government	Individually determined	Individually determined	HEA/HEI accounting data
Income from other final demand categories and intermediate demand	Income apart from exports and Irish Government funding is uniformly distributed along the row based on proportions of the overall education service sector	Income apart from exports and Irish Government funding is uniformly distributed along the row based on proportions of the overall education service sector	Input---Output Table for Ireland 2010

Table 4 Income of Irish HEIs by source – Sectoral Aggregates, 2010---11, €m and %

Income category	% of total income	% of total income	Note
Irish Government			
State grants	20.30%	43.90%	
Academic fee income	16.00%	12.70%	
State and semi---state research grants	15.10%	7.10%	
Contribution in respect of overheads	0.50%		Amount paid by organizations such as SFI (Science Foundation Ireland)
Exports			
Academic fee income	9.50%	2.30%	Amount paid by international students
European Union research grants	2.20%	1.30%	
Industry income	0.60%		The amount paid by international companies and allocated as 50% of total income from industry
Other income	2.60%	0.40%	The amount paid by international students and allocated by the share of the number of international students
Other	33.30%	32.30%	Determined as a residual item

Table 5 Income of Irish HEIs by source Individual Institutions, 2010---11, €m and %

	Irish Government		Exports		Other		Total
	€m	%	€m	%	€m	%	€m
Universities							
UL	89.2	43.7%	31.7	15.5%	83.3	40.8%	204.2
UCD	203.6	49.5%	63.5	15.4%	144.0	35.0%	411.2
UCC	175.2	50.4%	51.2	14.7%	121.5	34.9%	347.9
TCD	175.0	54.6%	45.7	14.2%	100.2	31.2%	320.8
NUIM	73.4	57.8%	18.6	14.7%	34.8	27.4%	126.9
NUIG	142.3	60.9%	34.0	14.5%	57.3	24.5%	233.7
DCU	85.0	48.5%	25.3	14.4%	64.8	37.0%	175.2
Institutes of Technology							
Cork	63.0	68.4%	4	4.3%	25.1	27.3%	92.1
Dundalk	30.1	59.3%	2.2	4.3%	18.5	36.4%	50.8
Sligo	25.6	59.1%	1.7	3.9%	16.0	37.0%	43.3
Limerick	28.4	60.4%	1.7	3.6%	16.9	36.0%	47.0
Waterford	58.2	64.9%	5.2	5.8%	26.2	29.2%	89.7
Dublin	123.3	66.5%	6.6	3.6%	55.6	30.0%	185.4
Carlow	21.4	61.8%	1.3	3.8%	11.8	34.1%	34.6
Athlone	28.8	62.6%	1.8	3.9%	15.5	33.7%	46.0
Tralee	20.7	63.1%	1.1	3.4%	10.9	33.2%	32.8
Galway---Mayo	37.0	61.3%	2	3.3%	21.3	35.3%	60.4
Dun Laoghaire	13.0	57.3%	0.9	4.0%	8.9	39.2%	22.7
Tallaght	23.0	62.8%	1.4	3.8%	12.2	33.3%	36.6
Blanchardstown	12.8	61.2%	0.7	3.3%	7.4	35.4%	20.9
Letterkenny	19.1	62.2%	0.9	2.9%	10.7	34.9%	30.7

Table 6 Sectoral Type II impacts of overall HEI expenditure.

Sector	HEIs	IoTs
Agriculture, forestry and Fishing	0.026	0.026
Manufacturing	0.256	0.215
Construction	0.018	0.015
Distribution, Transport and Communication	0.542	0.526
Business Services	0.683	0.633
Other Services	1.363	1.291
Income effect	1.188	1.180

Table 7 Employment Multipliers per €m of university income

	Type I	Type II
UL	1.15	4.91
UCD	**1.16**	**5.82**
UCC	1.16	5.36
TCD	**1.13**	**6.90**
NUIM	1.09	4.45
NUIG	1.11	6.07
DCU	**1.13**	**5.65**
Athlone	1.07	8.04
Blanchardstown	1.09	7.77
Carlow	1.06	7.74
Cork	1.06	7.51
Dublin	1.07	7.42
Dun Laoghaire	1.07	5.77
Dundalk	1.07	7.27
Galway---Mayo	1.07	8.17
Letterkenny	1.06	8.84
Limerick	1.07	7.80
Sligo	1.07	7.70
Tallaght	1.06	6.73
Tralee	1.06	7.30
Waterford	1.06	7.48

Figure 1 Type II output multipliers for Irish HEIs

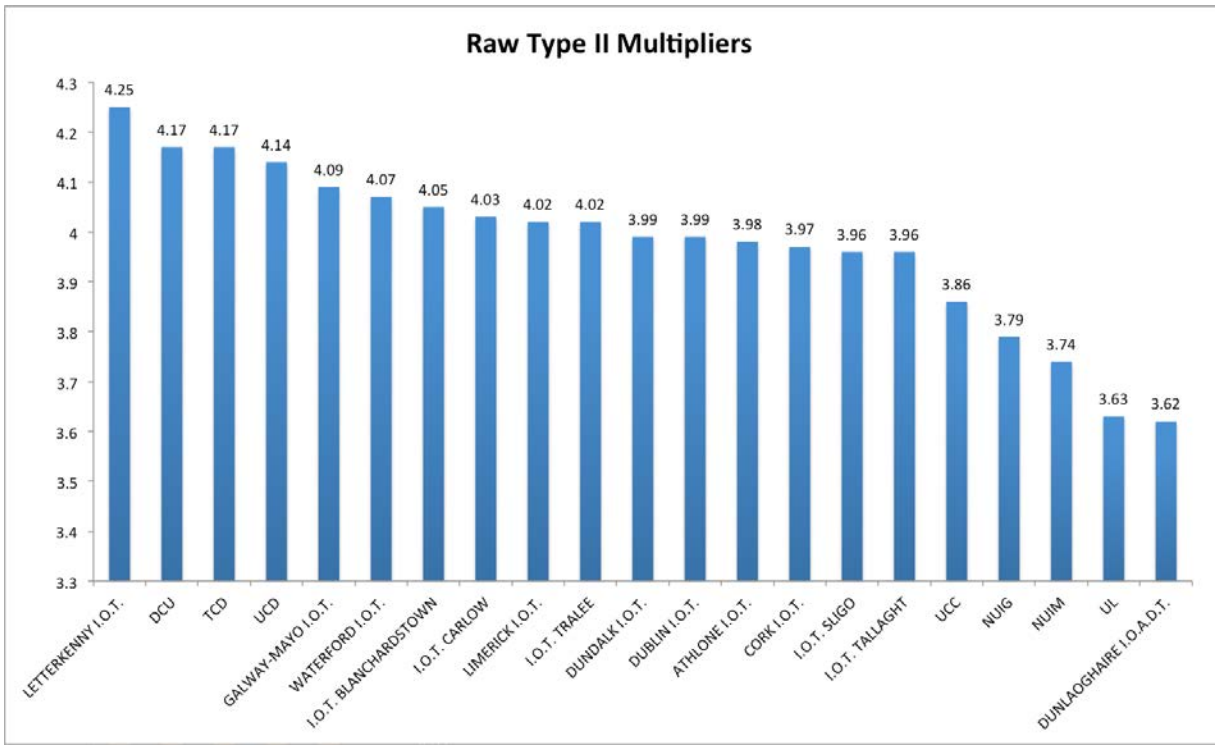
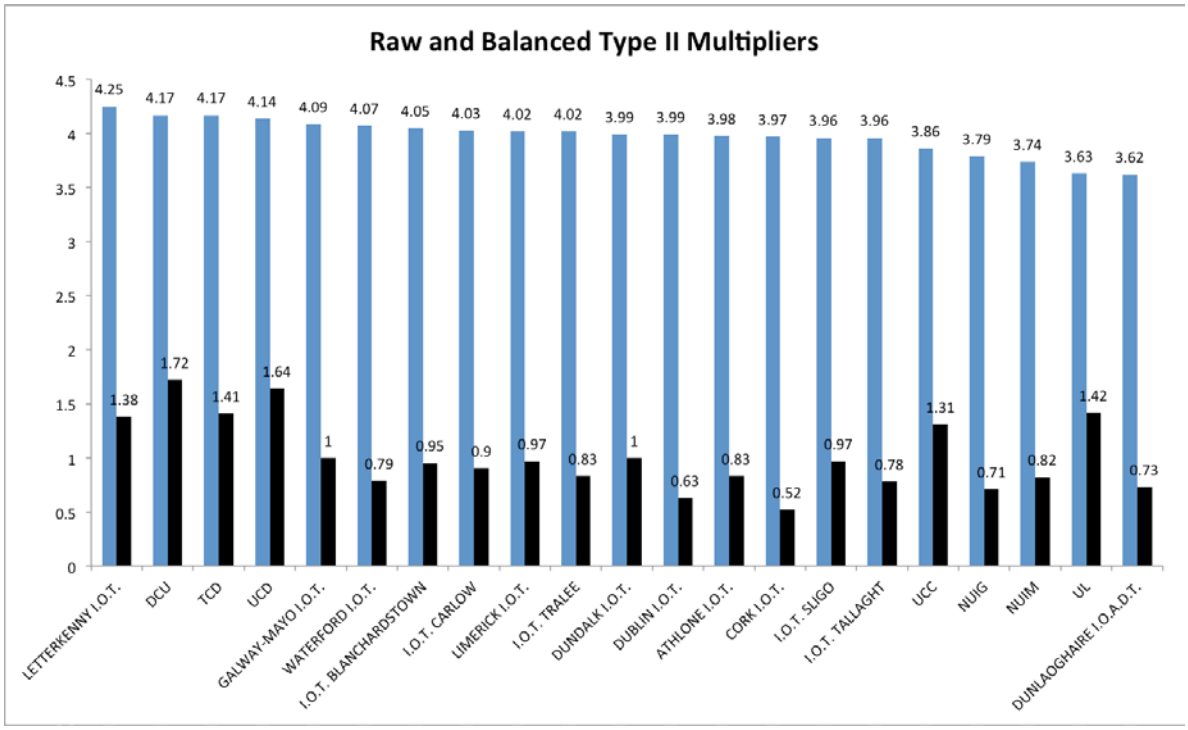


Figure 2 Raw and Balanced Type II output multipliers for Irish HEIs



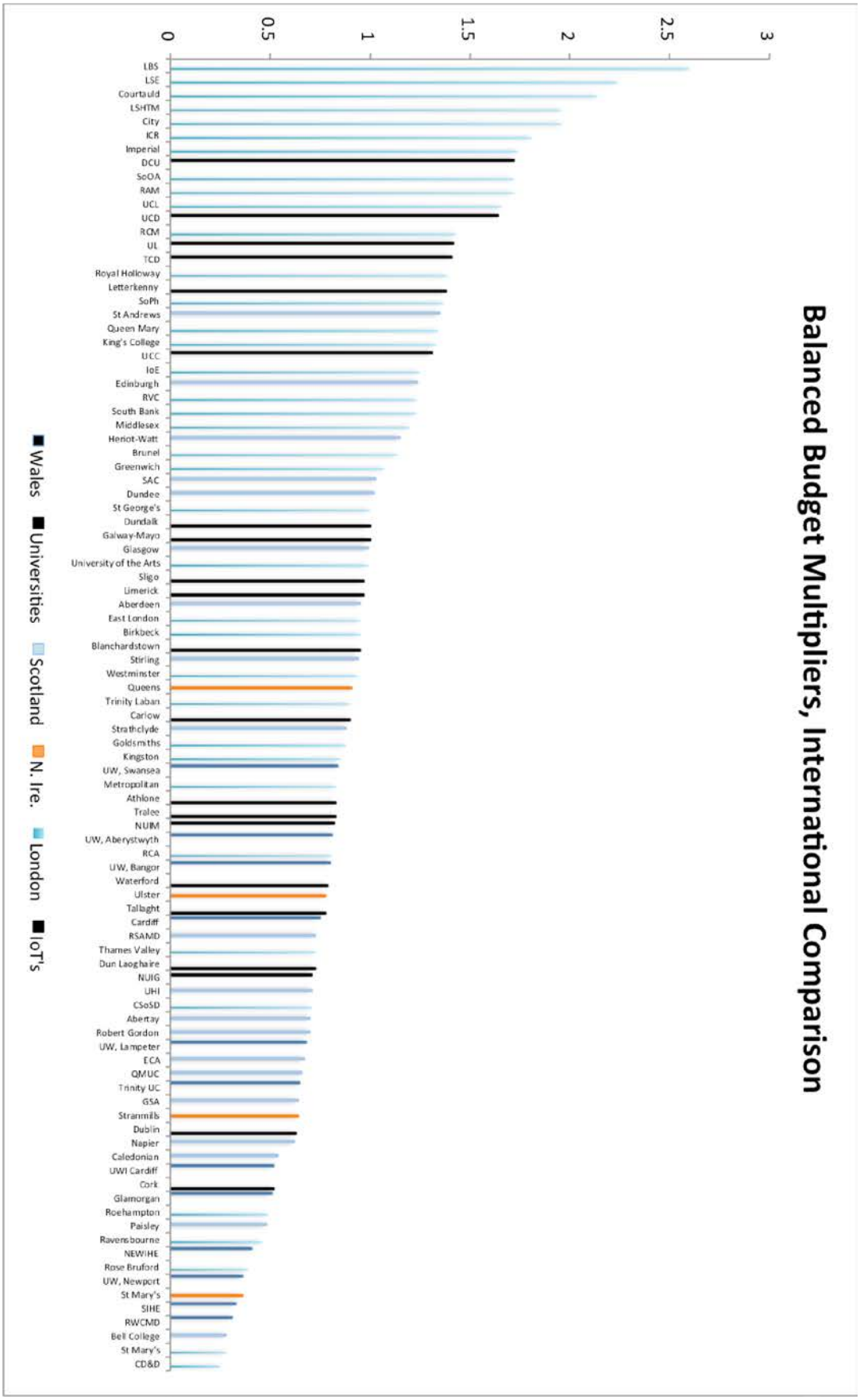
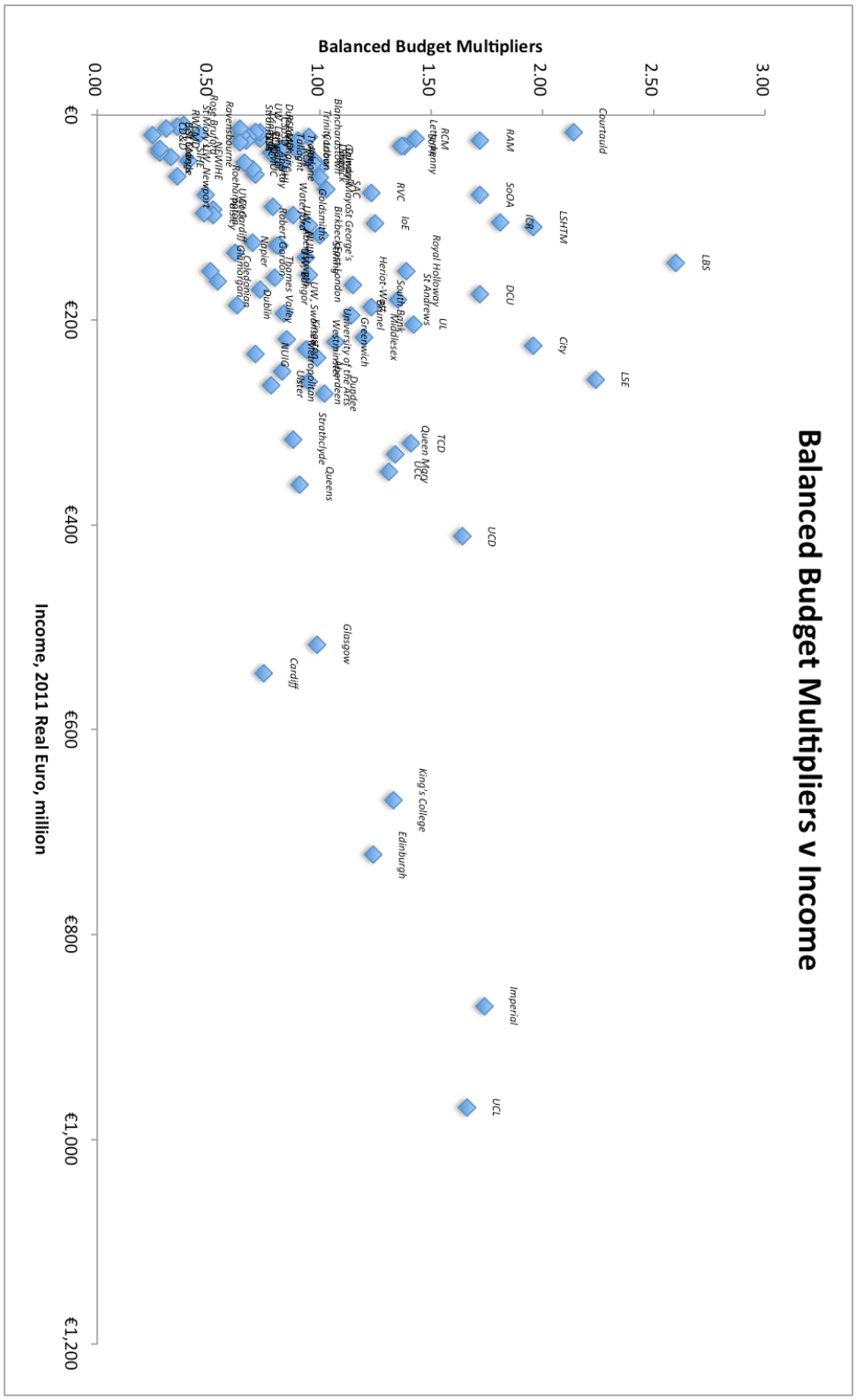

Balanced Budget Multipliers, International Comparison
0
0.5
1
1.5
2
2.5
3
LBS
LSE
Courtauld
LSHTM
City
ICR
Imperial
DCU
SoOA
RAM
UCL
UCD
RCM
UL
TCD
Royal Holloway
Letterkenny
SoPh
St Andrews
Queen Mary
King's College
UCC
IoE
Edinburgh
RVC
South Bank
Middlesex
Heriot-Watt
Brunel
Greenwich
SAC
Dundee
St George's
Dundalk
Galway-Mayo
Glasgow
University of the Arts
Sligo
Limerick
Aberdeen
East London
Birkbeck
Blanchardstown
Stirling
Westminster
Queens
Trinity Laban
Carlow
Strathclyde
Goldsmiths
Kingston
UW, Swansea
Metropolitan
Athlone
Tralee
NUIM
UW, Aberystwyth
RCA
UW, Bangor
Waterford
Ulster
Tallaght
Cardiff
RSAMD
Thames Valley
Dun Laoghaire
NUIG
UHI
CSoSD
Abertay
Robert Gordon
UW, Lampeter
ECA
QMUC
Trinity UC
GSA
Stranmills
Dublin
Napier
Caledonian
UWI Cardiff
Cork
Glamorgan
Roehampton
Paisley
Ravensbourne
NEWIHE
Rose Bruford
UW, Newport
St Mary's
SIHE
RWCMD
Bell College
St Mary's
CD&D
Wales
Universities
Scotland
N. Ire.
London
IoT's

Figure 4 Balanced Budget Multipliers v Income, UK & Ireland



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