

THE IMPACT OF UNIVERSITIES

ON THE UK ECONOMY



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FOREWORD

Higher education makes a fundamentally important difference – to individuals, through improved life chances and opportunities; to the economy, through innovation and skills; and to society, increasing our knowledge, through research discoveries and increasing social mobility and cohesion.

This report serves as a timely reminder of the contribution of the UK's universities to the economy. The role of universities in underpinning economic growth, through the provision of higher-level skills and ground-breaking research, has been much discussed and debated. However, what is sometimes overlooked is that UK universities form a core part of the economic infrastructure, and as large enterprises generate substantial economic activity, employment opportunities and overseas investment. Therefore, any policy changes affecting higher education will have wider macroeconomic effects for the UK.

This is the fifth study published by Universities UK on the impact of the higher education sector on the UK economy. At the time of conducting the study, the latest data available was for 2011–12 and therefore the estimates in the report relate to the year preceding the implementation of the higher education reforms. Even so, at that point in time, less than half of revenues received from UK universities were from public sources.


The report finds that in 2011–12, the higher education sector:

- made a substantial contribution to economic activity, and generated over £73 billion of output (both direct and indirect effects)
- contributed 2.8% of UK GDP, up from 2.3% in 2007
- generated significant employment opportunities across the economy, accounting for 2.7% of all UK employment, up from 2.6% in 2007; this was equivalent to 757,268 full-time jobs

These findings demonstrate that higher education is a significant sector of economic activity in its own right. Higher education generates more output than many other sectors, including advertising and market research, legal services, computer manufacturing, basic pharmaceuticals, and air transport. Universities also generate more GDP per unit of expenditure than many other sectors including health, public administration, and construction.

Another important aspect of higher education's impact is its ability to attract investment from overseas. The higher education sector generated an estimated £10.7 billion of export earnings for the UK in 2011–12. £3.8 billion of this was from expenditure on fees and accommodation from non-EU students, and a further £3.4 billion was from expenditure on goods and services bought off-campus by non-EU students. This shows that a major contributing factor to higher education's impact is the recruitment of non-EU students. Nearly 20% of the output generated by the higher education sector can be attributed to the recruitment of non-EU students, and 18% of the jobs generated.

The substantial economic activity that UK universities generate is only one aspect of the contribution that higher education makes to individuals, the economy and society. The evidence in this report also shows that the scale of activity is crucial to macroeconomic activity in the UK. While public sources of funding to universities have fallen to less than half of total income, and will continue to fall as the transition to the new funding regime is completed, there is a continued need for sustained government investment in higher education for teaching, research and capital. There is also a need for the government to ensure that non-EU students see the UK as a welcoming and attractive destination for study. Meeting these two aims will be essential if higher education is to continue to deliver wide ranging and substantial benefits to individuals across the UK, as well as to local communities and the wider economy.



Professor Sir Christopher Snowden
President, Universities UK
Vice-Chancellor, University of Surrey

SUMMARY AND KEY FINDINGS

The role of higher education in the economy and its potential contribution to supporting economic recovery and development continues to attract considerable attention in all developed countries. 2013 saw the 50th anniversary of the Robbins Report on Higher Education, which shaped much of today's UK higher education system. Fifty years on, there is a renewed and extensive public debate about the purpose and nature of higher education, the types of higher education institution society wants and, in particular, who should pay for the cost of a modern higher education sector. There is increasing divergence of higher education policy across the constituent nations of the UK. In England a new regulatory system for higher education has been announced and a new tuition fee system has been applied which has shifted the major burden for the cost of undergraduate tuition away from the public sector and onto the private individual. There have been variants of this shift in the tuition cost burden for institutions in Wales and Northern Ireland also, with Scotland continuing to support undergraduate tuition through the public purse. Other UK-wide political developments have impacted on higher education, with increased regulation of the international student market. Tighter government restrictions on the recruitment of international students have become an increasing challenge for universities to manage.

At the same time the importance of universities to supporting innovation and growth, particularly at a regional level, is coming under the spotlight again. The 2013 Witty Review of Universities and Growth explored the potential for better and stronger links between universities and their host regions, investigating how far universities can help regions develop their comparative strengths (particularly in the light of the EU Smart Specialisation Strategy¹ for regions). The contribution of universities to the economy, through the education of graduates and through research and knowledge exchange, is the subject of much discussion and debate. However, it is sometimes overlooked that the higher education sector forms a core part of the economic infrastructure of the country. As large enterprises in themselves universities are major employers and they generate economic activity, attract

export earnings and contribute to gross domestic product (GDP). The strength of the sector and its effectiveness in generating economic activity has been all the more important to the UK in the recent recession when other sectors of the economy have been contracting. Policy changes that impact on the sector have wider macroeconomic ramifications. This study presents a timely reminder of the very real, immediate and tangible impact made by the higher education sector in the UK economy.

This study presents key economic features of UK higher education in the academic year 2011–12 and those aspects of its contribution to the UK economy that can be readily measured. It does not include any assessment of the value of the sector's collaboration with business or the impact of new ideas generated by universities or their graduates. These topics have been, and continue to be, the subject of many other studies. The sector is analysed as a conventional industry, highlighting major economic characteristics of UK universities, including their sources of revenue, employment created, output generated and export earnings attracted. Modelled estimates are made of the economic activity generated in other sectors of the economy through the secondary or 'knock-on' multiplier effects of expenditure by universities and their staff, as well as international students and visitors. Additional analysis is undertaken of the overall contribution of the higher education sector to gross domestic product (GDP) and its efficiency in generating impact is compared with a range of other sectors of the economy. This study is of 2011–12, the year immediately predating the introduction of the 2012 higher education reforms and the consequent increase in privately paid tuition fees in England and the prospective opening up of the sector to some for-profit providers. Hence it provides a record of the UK higher education sector immediately prior to the most radical higher education policy shift in recent times.

The study examines the key economic characteristics of universities and the impact generated by their activity. It also examines the impact of the off-campus expenditure of non-UK-domiciled students (that is, students from the rest of the EU as well as non-EU students) studying at UK universities.

1. Smart specialisation is a policy concept designed to promote the efficient and effective use of public investment in research. For more details see: http://ec.europa.eu/research/regions/index_en.cfm?pg=smart_specialisation

Key findings

The overall impact of the higher education sector

- 'Higher education sector' impact is defined in this study to be that of the universities together with that of their non-UK students and visitors.
- **Through both direct and secondary or multiplier effects, the higher education sector generated over £73.11 billion of output and 757,268 full-time-equivalent (FTE) jobs throughout the economy. The total employment generated was equivalent to around 2.7% of all UK employment in 2011.**

Universities: direct income, expenditure and employment

- In 2011–12, the total revenue earned by UK universities amounted to £27.9 billion. This was comparable in sectoral gross output terms to the advertising and market research industry and the legal services industry and larger than the basic pharmaceuticals sector.
- Revenue from UK funding council bodies accounted for 30% of all university income.
- Total revenue from all UK public sources amounted to £13.6 billion or 49% of all income. This includes money from the research councils as well as a range of other income earned from other government departments and agencies – often on a tendered or competitive basis – for consultancy and other services.
- International revenues amounted to nearly £5.7 billion, representing over 20% of all university income. This included fee payments from non-UK students, research and consultancy income from international sources together with other operating income such as that from residence and catering services.
- In 2011–12, universities spent £26.7 billion, with the single largest component of expenditure being labour costs.
- Universities *directly* employed 378,250 people, which equated to approximately 319,474 full-time-equivalent jobs. This was equivalent to just over 1% of all UK employment in 2011.
- Universities directly contributed £17.97 billion to UK GDP.

Universities: secondary or 'knock-on' multiplier effects

- The expenditure of universities and their staff

generated additional output and employment and GVA across the economy.

- For every 100 full-time jobs within the universities themselves, another 117 full-time-equivalent jobs were generated through knock-on effects. 373,794 full-time-equivalent jobs in other sectors of the UK economy were dependent on the expenditure of the universities.
- For every £1 million of university output a further £1.35 million of output was generated in other sectors of the economy. This meant that an additional £37.63 billion of output was generated outside the universities as a result of their expenditure.
- For every £1 million of university GVA a further £1.03 million of GVA was generated in other industries.

Non-UK students and visitors

- Non-EU students paid £3.2 billion in tuition fees to UK universities (EU students paid an estimated £0.4 billion in fees to universities).
- The off-campus expenditure of all non-UK students (EU and non-EU) attending UK universities in 2011–12 was estimated to be £4.9 billion.
- Higher education makes a key contribution to UK business tourism. Personal (off-campus) expenditure of international business and recreational visitors to UK universities was estimated conservatively to be just over £136 million.
- The expenditure of non-UK students and visitors also generated output and employment throughout the UK.
- Non-UK student off-campus expenditure generated £7.37 billion of output across the economy and over 62,380 full-time-equivalent jobs.
- Non-UK visitor expenditure generated around £191 million of output and over 1,600 jobs.
- Non-UK student and visitor spend together generated £3.51 billion of GVA in industries across the UK.

UK higher education export earnings

- The higher education sector as a whole (universities plus the off-campus spending of non-UK students and visitors) generated an estimated £10.71 billion of export earnings for the UK. This figure includes: fee payments from non-EU students (£3.24 billion);

fee payments from students from the rest of the EU (£0.39 billion); research income from international sources (£0.92 billion); residence and catering income (£0.74 billion); other income, eg including consultancy from international sources (£0.37 billion); together with the off-campus expenditure of all non-UK students (£4.91 billion) and non-UK visitors (£0.14 billion).

Higher education's contribution to GDP

The importance of higher education to the economy can be seen through the generation of significant

levels of output and employment. However, a key measure of its contribution to the national economy is its impact on GDP. GDP is used by all countries as an annual measure of the total value of all goods and services produced by an economy.

In the year 2011–12, universities contributed over £36.4 billion to UK GDP. The off-campus expenditure of their international students and visitors contributed a further £3.5 billion to GDP. Taken together this contribution came to over £39.9 billion – equivalent to 2.8% of UK GDP in 2011.

Table 1: Export earnings attributable to the UK higher education sector, 2011–12

	Universities	Off-campus expenditure of international (all non-UK) students	Off-campus expenditure of international (all non-UK) visitors	Higher education sector
Export earnings	£5.66 billion	£4.91 billion	£0.14 billion	£10.71 billion

Table 2: Overall impact of the higher education sector on UK output and employment, 2011–12

	Universities	Off-campus expenditure of international (all non-UK) students	Off-campus expenditure of international (all non-UK) visitors	Higher education sector
OUTPUT				
Direct output	£27.92 billion	0	0	£27.92 billion
Secondary output	£37.63 billion	£7.37 billion	£0.19 billion	£45.19 billion
Total output generated (direct plus secondary)	£65.55 billion	£7.37 billion	£0.19 billion	£73.11 billion
EMPLOYMENT (FTE)				
Direct employment	319,474	0	0	319,474
Secondary employment	373,794	62,383	1,617	437,794
Total employment generated (direct plus secondary)	693,268	62,383	1,617	757,268

Table 3: UK higher education contribution to GDP

	GDP (£)			Higher education sector
	Universities	Off-campus expenditure of international (all non-UK) students	Off-campus expenditure of international (all non-UK) visitors	
Direct GDP	£17.97 billion	0	0	£17.97 billion
Secondary GDP	£18.43 billion	£3.42 billion	£0.09 billion	£21.94 billion
Total GDP	£36.40 billion	£3.42 billion	£0.09 billion	£39.91 billion

Methodology and data sources

The higher education institutions included in this study are the 162 universities and colleges included in Higher Education Statistics Agency (HESA) data for the academic year 2011–12. (These institutions are referred to as universities throughout this report.) All of the included institutions are ‘not-for-profit’ enterprises which receive core funding from the public purse through the higher education funding bodies. Throughout this report, wherever the term ‘international’ is used it includes all people and revenue from outside the UK, including from the rest of the EU as well as from outside the EU. Modelled estimates were also made of the impact of the off-campus expenditure of international (ie all non-UK) visitors attracted to the UK by the universities. The

off-campus expenditure of UK-domiciled students was excluded as this may not be regarded as additional to the UK economy as a whole.

The model used was a purpose designed and specially constructed ‘type II’ input-output model based on actual UK data derived from the Office for National Statistics’ input-output tables together with data from its *Blue Book*.

Data on university finance, staffing and students was obtained from HESA. Other data sources included *Travel trends* (Office for National Statistics) and the Student Income and Expenditure Survey (2013) published by the Department for Business, Innovation and Skills (BIS).

CHAPTER 1

INTRODUCTION

This report provides an up-to-date analysis of key economic aspects of UK universities in the academic year 2011–12. It does not include any assessment of the value of the sector's collaboration with business or the impact of new ideas generated by universities or their graduates, which have been and continue to be the subject of many other studies. Analysis is made of the impact of the sector as a conventional industry, highlighting major economic characteristics of UK universities, including their sources of revenue, employment created, output generated and export earnings attracted. Modelled estimates are made of the economic activity generated in other sectors of the economy through the secondary or 'knock-on' multiplier effects of the expenditure of the universities, their staff and that of their international students and visitors.² Estimates are also made of the sector's contribution to GDP.

For the purposes of this study the sector is defined as the 162 universities and colleges included in the Higher Education Statistics Agency (HESA) data for the study year (2011–12) together with the personal off-campus expenditure of their international (non-UK-domiciled) students and visitors. The personal expenditure of UK-domiciled students is excluded since such expenditure is not additional to the UK economy but may take place anyway, irrespective of student status. All of the included institutions are 'not-for-profit' enterprises which receive core funding from the public purse through the higher education funding bodies.³

The institutions covered in this analysis are diverse in origin, mission and size. They include universities (six of which are 'ancient', with origins going back

to medieval times), art colleges, conservatoires, colleges of higher education, university colleges, agricultural colleges and research institutes. Their student numbers range in size from fewer than 700 students to over 40,000, with annual turnover ranging from less than £8 million to over £800 million; 130 are located in England, with 18 in Scotland, 10 in Wales⁴ and four in Northern Ireland.

While the institutions under examination are the major suppliers of higher education in the UK, some further education colleges also offer courses at this level. There are significant numbers of higher education students registered at further education colleges and private institutions but relevant data on these is not included in HESA publications and is not available in a comparable format from other sources. While this report will therefore capture most of the economic impact of higher education as an activity, the sector's overall impact will be somewhat greater.

This study follows on from, and updates, earlier analyses of higher education published by Universities UK since 1997.⁵ It follows essentially the same methodological approach as the earlier reports. In-depth comparisons with previous modelled expenditure results are not appropriate, as there have been some minor changes in model specification and some definitional differences in the data sources. However, as it is the same broad framework in use, broad comparisons with previous studies, reflecting general trends for instance, can be made. Some comparisons (for example in relation to an increased contribution to UK GDP and UK employment) are shown in Table 11.

2. A type II UK input-output model was constructed specifically for higher education analysis; in addition 12 regional extensions to the model were further developed, covering every part of the UK. The model and the 12 regional extensions are designed to model the impact on both the regional and national economies. Details of the UK input-output model specification are included in Annexe A.
3. Higher Education Funding Council for England (HEFCE), Scottish Funding Council (SFC), Higher Education Funding Council for Wales (HEFCW) and the Department for Employment and Learning, Northern Ireland (DELNI)
4. There are 10 institutions with registered students in Wales. The University of Wales (central functions) has a financial flow in addition to that of the 10 universities; this financial flow is also included in the analysis.
5. McNicoll I H, McCluskey K, Kelly U (1997) *The impact of universities and colleges on the UK economy: A report for CVCP* London: Committee of Vice-Chancellors and Principals
Universities UK (2002) *The impact of higher education institutions on the UK economy* [authors: U Kelly, R Marsh and I McNicoll] London: Universities UK
Universities UK (2006) *The economic impact of UK higher education institutions* [authors U Kelly, I McNicoll and D McLellan] London: Universities UK
Universities UK (2009) *The impact of universities on the UK economy* [authors U Kelly, I McNicoll and D McLellan] London: Universities UK

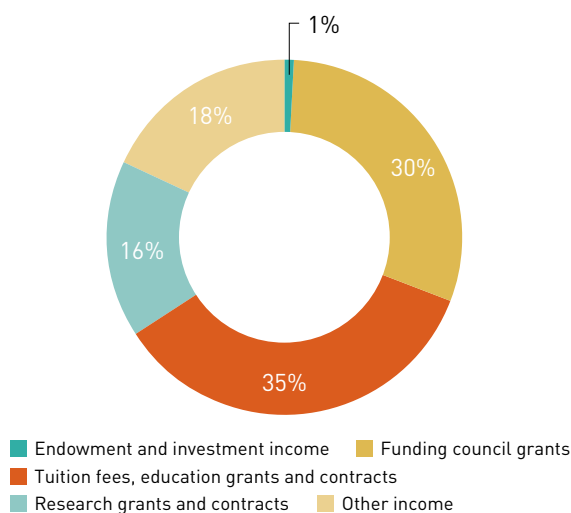
CHAPTER 2

UNIVERSITY INCOME

The 162 universities and colleges included in this study cover a wide range of types. As individual enterprises they vary in mission, size and scale of operations. All are legally independent entities and are classified as non-profit institutions serving households in the UK national accounts. Taken together they represent a significant sector of the national economy. Their total financial turnover in 2011–12 amounted to £27.9 billion. This figure should be viewed alongside the magnitude of economic activity generated by the sector, which is explored in chapters 4 to 6 of this report.

operations (which amounted to £1.7 billion in 2011–12). Residence and catering income is not only derived from individual students and staff but is also secured by providing conference and seminar facilities to other organisations. Universities play an important role in promoting and supporting business tourism – a small proportion of their contribution is reflected in the income directly generated from conferences, although many of their large events provide a wider benefit by generating income to their host regions since most of the relevant business will go to local hotels. This is discussed in more detail in Chapter 5.

Figure 1: University revenue, 2011–12



Source: HESA *HE Finance Plus* 2011–12

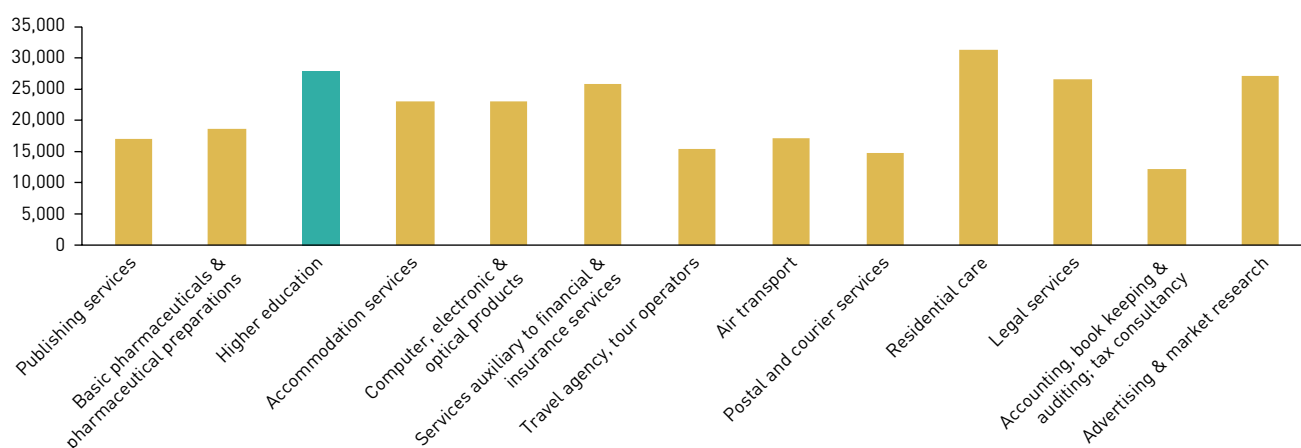
Figure 1 presents an overall picture of university income sources as classified by HESA. Most revenue is directly associated with teaching and research activity (with income from funding council grants, tuition fees and research grants and contracts amounting to 80% of the total); however, 18% of revenue was earned from the delivery of other services, with 1% from endowments and investments. Further examination of the HESA data enables some additional insight into the sources of other income earned by the higher education institutions. For example, a significant amount of other income – around 6% – comes from residence and catering

In national accounting terms, university annual turnover is equivalent to sectoral gross output as defined for all firms and industries. With revenues of £27.9 billion, the higher education sector is a significant UK industry. To put this into context, Figure 2 gives examples of similarly sized industries.⁶ It shows that the higher education sector is comparable in size to the legal services sector, slightly smaller than residential care services, slightly larger than the advertising and market research industry and considerably larger than computer manufacturing, the basic pharmaceuticals sector and the air transport industry.⁷ Overall in terms of size it sits around the 30th position in the UK out of 110 sectors in the Office for National Statistics (ONS) data used for comparison.

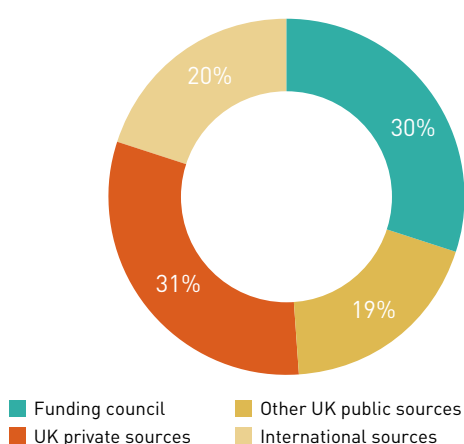
With an industry of the comparative significance of higher education (as highlighted in Figure 2), it is important to analyse who pays for its services. Further analysis of university income data gives an insight into its wide client base. HESA records the sources of revenue for research grants and contracts as well as for some elements of other income generated. It also records tuition fee revenue from non-EU sources and provides some information on the sources of other tuition fees (for example, where they are paid via the Student Loans Company), which enables estimates to be made of private fee payments. Information was also sought from other sources including individual university annual reports, which were used to inform estimates of the sources of other income generated, such as that from residence and catering operations. The outcome of this analysis is shown in Figure 3.

6. Comparator sectoral gross outputs are taken from the 2010 ONS UK Input Output Tables, available at <http://www.ons.gov.uk/ons/taxonomy/index.html?nscl=Supply+and+Use+Tables>

7. For more details of what is included in each comparator industry see: UK Standard Industrial Classification of Economic Activities 2007 – SIC (2007) Explanatory Notes (ONS, 2009)

Figure 2: Industry comparisons: sectoral gross outputs, 2011–12 (£ million)⁸

Source: Industry comparisons from ONS 2010 UK Input-Output Supply Table (2012) and HESA *HE Finance Plus* 2011–12

Figure 3: Sources of university revenue, 2011–12

Source: Viewforth Consulting analysis of HESA data

Public sector revenue to UK higher education institutions made up 48.9% of total revenue. (Public sector revenue is defined as revenue from any public source, including funding councils, research councils, health authorities, local government, development agencies, for any purpose.) This is the first time in this series of studies of higher education impact (which go back nearly 20 years) that revenue to universities from the public sector has fallen below half of all revenue. This makes it clear that universities are reliant on earning income from a wide range of other sources to sustain their work.

Figure 3 shows that 51% of university revenue derives from private sector and international sources (this compares to 39% in 2007–08). Funding council income accounted for 30% of all university income in 2011–12. Universities attracted a further 19% of revenue from other public sources – these monies are usually won on a competitive basis for a range of services, including some research contracts.

Revenue from international sources (that is, all non-UK sources) represents export earnings for the UK. In 2011–12, universities attracted nearly £5.7 billion of international revenue, which equates to universities' gross export earnings.⁹ This estimate was made by analysing the income sources within the classifications reported by HESA. The outcome figure of £5.7 billion is likely to be an underestimate of the total amount of institutions' export earnings as, for example, HESA does not entirely differentiate between UK income and that from other EU countries (a distinction is made in some income categories, but not all).

Overall sources of income are summarised in Table 4, which also compares the income from different sources in 2011–12 against the similar analysis for the last report in 2007–08. Table 5 presents the same information in terms of percentages of total income. Figure 4 gives a pictorial representation of the change in overall proportions.

8. The output data for the HEIs is for 2011–12 whereas the data for the comparator industries is taken from the ONS 2010 supply tables and relates to 2010 (the most recent available at the time of the study). Hence the comparators are intended to be indicative rather than exactly like-with-like.
9. International revenue comprises: £3.24 billion non-EU fees; £0.39 billion rest of EU fees; £0.92 billion research income from all non-UK sources; £0.74 billion in residence and catering payments from non-UK sources (students, visitors etc); £0.37 billion of other operating income from non-UK sources (total £5.66 billion).

Table 4: Estimated sources of university income, by value, 2011–12 compared to 2007–08

Type of income	Source of income (£ million)			Totals
	UK public sources	UK private sources	International sources (public and private including EU)	
Funding council grants	8,271 (8,508)	0 (0)	0 (0)	8,271 (8,508)
Tuition fees and education grants	1,287 (2,636)	4,756 (1,731)	3,634 (1,887)	9,676 (6,254)
Research grants and contracts	2,239 (1,997)	1,348 (1,176)	923 (548)	4,510 (3,722)
Other income	1,843 (1,173)	2,232 (2,771)	1,105 (504)	5,180 (4,448)
Endowment and interest	0 (0)	285 (508)	0 (0)	285 (508)
Totals	13,640 (14,314)	8,621 (6,186)	5,662 (2,939)	27,922 (23,440)

Sources: Analysis derived from HESA. See footnote explaining definition of income sources.¹⁰

Note: bracketed figures refer to 2007–08

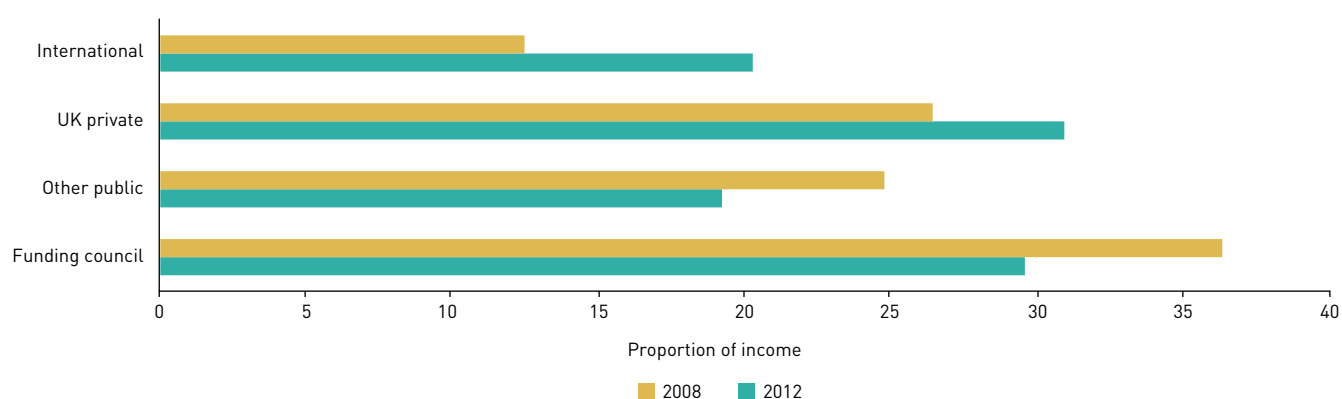
Table 5: Estimated sources of university income, by percentage, 2011–12 compared to 2007–08

Type of income	Source of income %			Totals
	UK public sources	UK private sources	International sources (public and private including EU)	
Funding council grants	29.6 (36.3)	0.0 (0.0)	0.0 (0.0)	29.6 (36.3)
Tuition fees and education grants	4.6 (11.2)	17.0 (7.4)	13.0 (8.1)	34.7 (26.7)
Research grants and contracts	8.0 (8.5)	4.8 (5.0)	3.3 (2.3)	16.2 (15.9)
Other income	6.6 (5.0)	8.0 (11.8)	4.0 (2.2)	18.6 (19.0)
Endowment and interest	0.0 (0.0)	1.0 (2.1)	0.0 (0.0)	1.0 (2.2)
Totals	48.9 (61.1)	30.9 (26.4)	20.3 (12.5)	100.0 (100.0)

Sources: Analysis derived from HESA

Note: bracketed figures refer to 2007–08

Figure 4: Proportion of university income by source, 2008 compared to 2012



Sources: Analysis derived from HESA

10. Public sector sources include revenue from any type of public source – this can include research councils, local councils, development agencies, NHS Trusts and other related bodies. There will continue to be an element of tuition fee income classed as public because it can include postgraduate and short course or continuing professional development income paid, for example, by local authorities or other bodies for their staff etc. Also at a UK level of analysis public funding also covers Scottish students. Private sources includes money from any UK private source – including business payments for research, consultancy or other services. It also includes fee payments by private individuals. International sources include income from any non-UK body or individual.

The sector's revenue has risen by just over 19% in cash terms (12% in real terms¹¹) in the four years since we published our last study, from £23.4 billion in 2007–08 to £27.9 billion in 2011–12. However, of more significance is that the overall balance of UK higher education institutions' revenue sources is changing quite radically.

This is the inevitable result of changes in higher education policy, particularly in England. Higher education policy is diverging quite rapidly across the UK with a differential system for tuition fees in each constituent nation of the UK. This study is focused on UK higher education as a whole but English universities are by far the largest number (130 institutions in England compared to 18 in Scotland, 10 in Wales and four in Northern Ireland) and hence in any study of UK higher education, changes in the system and financing in England will have a major impact on the overall UK picture.

For the purposes of comparison a sub-analysis was undertaken of the revenue proportions for English institutions (130 institutions and £23.3 billion revenue) and Scottish institutions (18 institutions and £2.8 billion revenue). While the proportion of revenue from international sources was much the same for both Scotland (20%) and England (21%) there was a notable difference in the UK public and private proportions of revenue. 35% of Scottish institutions'

revenue came from the Scottish Funding Council whereas only 29% of English institutions' revenue came from the equivalent Higher Education Funding Council for England. Scottish institutions had a considerably higher proportion of revenue from 'other' public sector sources at 25% compared to English institutions (18%). A much greater proportion of English institutions' revenue came from private sector sources (32%, compared to 20% for Scottish institutions).

Revenue from private sector sources includes fee payments by individual students, which will be the most important reason for the differences between Scottish and English institutions' revenue sources. Scottish-domiciled students do not make fee payments to Scottish institutions whereas all domestic UK students studying in England pay fees to the institutions. The current study was undertaken for the year 2011–12, before the most radical shift in English higher education policy had taken place. In 2012–13, funding council support for a wide range of university degree courses was removed and the private individual is now required to pay the costs (or a significant proportion of the costs) of tuition, albeit financed through an enhanced loan system.¹² Future analyses will reflect the full effects of the post-2012 higher education reform¹³ changes in public and private sources of institutional income in England.

11. The real terms increase was calculated by comparing the 2008 value adjusted for inflation (to 2012) using the Producers Price Index for Services.

12. While the loans are currently provided by the public sector the individual student is responsible for repayment of their individual loan and it is each individual's debt.

13. The Browne Review (2010) *Securing a Sustainable Future for Higher Education* available at: <http://webarchive.nationalarchives.gov.uk/+hereview.independent.gov.uk/hereview/>

CHAPTER 3

EMPLOYMENT PROFILE OF UK UNIVERSITIES

One of the most important roles that universities play in the economy relates to how many staff they employ. They tend to be labour-intensive enterprises and can be very large employers. Their importance as employers is well recognised at the regional level, since they are frequently among the largest employers in their regions. Universities are recognised for providing skilled and relatively high paid employment and attracting highly qualified people to an area (which in itself can contribute to increasing a region's capacity to absorb new ideas and innovations, making it more competitive). However, they are also important in providing employment in occupations right across the entire skills spectrum. Recognising the university's economic importance to the surrounding community, a number of universities have established schemes to encourage and support local residents to apply for jobs with them, so that the boost being given to the city or region can be shared across the board. For example, The University of Manchester – which is located in an area of the city with high levels of unemployment and deprivation – leads a major initiative, The Works, which is an employer-led programme specifically aimed at encouraging local residents to take up jobs in the university.¹⁴ This is with the intention of boosting the economic fortunes and social wellbeing of the local community and embedding the university more deeply into the city.

HESA first published comprehensive data on higher education staffing in 2005 and this is now regularly collected according to staff roles which broadly map to standard occupational classifications. This means that the full range of university employment can be observed and compared with the employment profile of the jobs generated by university expenditure in other industries. In 2011–12, 378,250 people were employed in universities and colleges across the UK. Table 6 shows the range of employment within institutions.

The total 'headcount' number of staff includes both full-time and part-time employment.¹⁵ 378,250 people were employed in the universities in 2011–12, which was equivalent to nearly 1.3% of all people in employment in the UK in 2012.¹⁶ According to HESA,

378,250 equates to 319,474 full-time-equivalent jobs. The full-time-equivalent employment profile of universities in 2011–12 is shown in Figure 5.

Table 6: Employment in UK universities, 2011–12

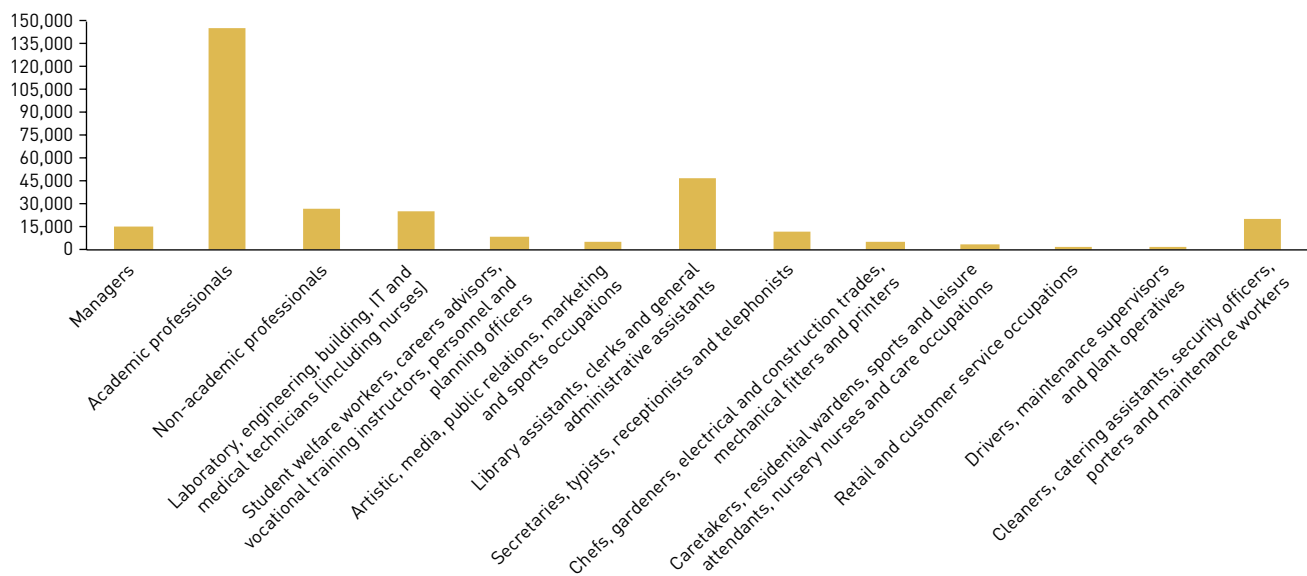
Employment in UK universities ('headcount')	Total	Percentage of total
Managers	16,250	4.3
Academic professionals (including professors, lecturers, researchers and other academic posts)	181,385	48.0
Non-academic professionals	28,905	7.6
Laboratory, engineering, building, IT and medical technicians (including nurses)	25,810	6.8
Student welfare workers, careers advisers, vocational training instructors, personnel and planning officers	11,130	2.9
Artistic, media, public relations, marketing and sports occupations	6,130	1.6
Library assistants, clerks and general administrative assistants	54,455	14.4
Secretaries, typists, receptionists and telephonists	14,475	3.8
Chefs, gardeners, electrical and construction trades, mechanical fitters and printers	4,585	1.2
Caretakers, residential wardens, sports and leisure attendants, nursery nurses and care occupations	4,915	1.3
Retail and customer service occupations	1,260	0.3
Drivers, maintenance supervisors and plant operatives	1,335	0.4
Cleaners, catering assistants, security officers, porters and maintenance workers	27,630	7.3
Totals	378,250	100.0

Source: HESA

14. The Works has been operational for just over two years and in that time has supported more than 1,000 people into work at the local universities. For more information see: www.theworksmanchester.co.uk/

15. This figure does not, however, include people classed as 'atypical'. Universities frequently have a wide range of casual, one-off or occasional workers on their payroll, eg occasional guest lecturer, student laboratory demonstrator etc. These additional numbers are excluded.

16. Based on 28,220,000 people of working age in employment in the UK in 2011. Office for National Statistics Labour Market Statistics, November 2011, available at: www.ons.gov.uk/ons/rel/lms/labour-market-statistics/november-2011/index.html

Figure 5: University full-time-equivalent employment profile, 2011–12

Source: HESA

Figure 5 illustrates the broad range of higher education employment, which reflects the multi-faceted nature of activities in which universities engage. The overall ratio (in full-time-equivalent terms) of academic to other support staff (46% academic, 54% other support staff) remains broadly similar to that observed in previous studies.

The university employment profile reflects the many inputs required to support the delivery of higher education services. Institutions need to manage a substantial infrastructure, including the maintenance of estate and buildings. Apart from laboratories, lecture theatres and offices, this includes residential accommodation, catering facilities, sports and recreation centres. The competitive environment in which universities operate also requires a diverse range of support professionals – for marketing and student recruitment as well as for business development and research management. A growing emphasis on enhancing the ‘student experience’ (coupled with students in parts of the UK paying a larger proportion of the cost than previously and harbouring greater expectations of the services provided) requires additional support staff, such as welfare officers and careers advisers.

Additionally, a proportion of university activity (particularly commercial operations such as residence and catering or conference business) aims to generate revenue not only to cross-subsidise the ‘core’ teaching and research portfolio, but also to enable the institution to support other, less financially rewarding, activities that are in keeping with their particular institutional mission. This can

include extensive public or community engagement activities such as summer schools for young people. It can also include wider educational, heritage or preservation work such as maintaining museums and galleries or artistic and scientific collections of historical importance. Such activities also require a range of specialist staff. The complex nature of the higher education business is reflected in the sector’s non-academic staff profile with, for example, over 6,100 people being employed in ‘artistic, media, public relations, marketing and sports occupations’ and over 1,200 staff in ‘retail and customer service occupations.’

Changes in university requirements for support staff are reflected in the overall employment profile of the sector, which has changed in some observable ways since the last study undertaken in 2009. While the overall balance of academic to support staff is broadly the same as in previous studies, there have been some noticeable changes in the composition of non-academic staff employment. There is a slightly greater proportion of ‘frontline’ support staff such as welfare officers and library assistants and lower proportions of ancillary ‘estates’ staff such as cleaners, porters, gardeners, etc. There has also been a slight increase in the proportion of higher skilled staff such as non-academic professionals (these include, for example, qualified librarians) and managers. It is possible that the smaller proportion of ancillary staff reflects more outsourcing of ancillary support roles such as cleaning and security. Work in these roles is still required but the jobs will be included in the university’s ‘knock-on’ impact rather than in its direct employment figures.

Table 7: Composition of non-academic staff roles

Composition of non-academic staff roles (%) Headcount	2007-08	2011-12
Managers	7.5	8.3
Non-academic professionals	13.1	14.7
Laboratory, engineering, building, IT and medical technicians (including nurses)	13.7	13.1
Student welfare workers, careers advisors, vocational training instructors, personnel and planning officers	4.7	5.7
Artistic, media, public relations, marketing and sports occupations	2.9	3.1
Library assistants, clerks and general administrative assistants	26.6	27.7
Secretaries, typists, receptionists and telephonists	9.2	7.4
Chefs, gardeners, electrical and construction trades, mechanical fitters and printers	2.6	2.3
Caretakers, residential wardens, sports and leisure attendants, nursery nurses and care occupations	2.6	2.5
Retail and customer service occupations	0.6	0.6
Drivers, maintenance supervisors and plant operatives	0.7	0.7
Cleaners, catering assistants, security officers, porters and maintenance workers	15.6	14.0
	100.0	100.0

Source: HESA Staff Record 2011-12

CHAPTER 4

UNIVERSITY EXPENDITURE AND ITS KNOCK-ON IMPACT ON THE ECONOMY

As can be seen from the previous chapters, universities make up a substantial UK industry, with an annual turnover of £27.9 billion and providing over 1% of employment in the UK. In 2011–12, university expenditure amounted to £26.7 billion, which was just slightly less than they earned (which is to be expected for non-profit-making organisations). In addition to their own output and employment, universities' expenditure generated additional output and employment in other sectors of the economy through secondary or 'knock-on' multiplier effects.

These 'knock-on' or multiplier effects are generally recognised as comprising two types of economic interaction:

- **Indirect effects:** universities purchase goods and services from other sectors in order to support their own activity, thereby stimulating activity within those industries. The supplying industries also buy from other suppliers in order to fulfil university orders, and those suppliers in turn buy, so that there is a rippling-out effect.
- **Induced effects:** universities pay wages and salaries to employees, who in turn spend this income on consumer goods and services. This creates wage income for employees in other sectors, who also spend their income and so on, creating a ripple effect throughout the economy as a whole.

In order to produce estimates of these 'knock-on effects', it is necessary to develop an operational model of the national economy. For the purposes of this study a complete type II input-output model, based on the Office for National Statistics' UK input-output tables, was used. This was an updated version of the model previously designed and used for the 2009 higher education impact study. The model also included a labour market extension, derived from official Labour Force Survey data and updated to take account of changes in labour productivity and related factors. The model enabled the impact generated by university expenditure to be traced through the economy. The specification of the model is described in Annexe B.

Details of the major components of university expenditure were available from HESA and these provided the basic initial expenditure data required.

However, this data alone is insufficient for modelling purposes, because the pattern of university expenditure (which types of goods and services they buy, and the proportion of expenditure on UK, rather than imported, goods and services) will determine the pattern of demand arising in different industries. The team made detailed estimates of university expenditure types, using data from a range of sources; these included data from a sector-wide survey conducted for previous studies, together with observations of detailed patterns of expenditure from a number of individual universities studied by the team, and information obtained from higher education purchasing consortia. This facilitated the construction of a disaggregated university expenditure vector for incorporation into the model, which enabled the calculation of the economic activity generated in other industries in terms of:

- **sectoral gross output:** this is measured in monetary units and for most industries it is approximately equivalent to the level of turnover or gross receipts. For the distribution and transport industries it is a measure reflective of gross margins. Gross margin is essentially the difference between the value of goods sold and their original purchase costs.
- **employment:** this is measured in terms of full-time-equivalent jobs (physical units) where one part-time job equals 0.5 of a full-time job.

Analysis was also undertaken of the contribution to GDP, which is discussed in Chapter 6. The results for the impact of university expenditure are summarised in Table 8.

Table 8: Output generated in the economy by universities, 2011–12

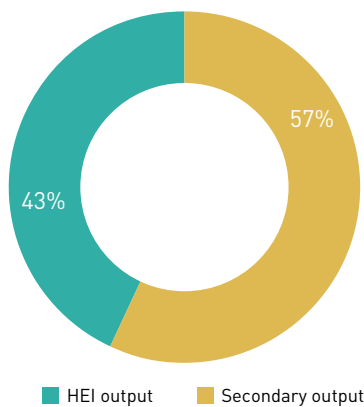
HEI gross output (definitionally equivalent to HEI income)	£27.92 billion
HEI expenditure	£26.68 billion
Secondary or knock-on output generated in other UK sectors as a result of expenditure	£37.63 billion
Total output generated by universities (HEI output plus knock-on output)	£65.55 billion

Source: HESA and the Universities UK economic impact modelling system (2013)

Universities spent some £26.68 billion in 2011–12. This expenditure generated £37.63 billion of output in other UK industries.

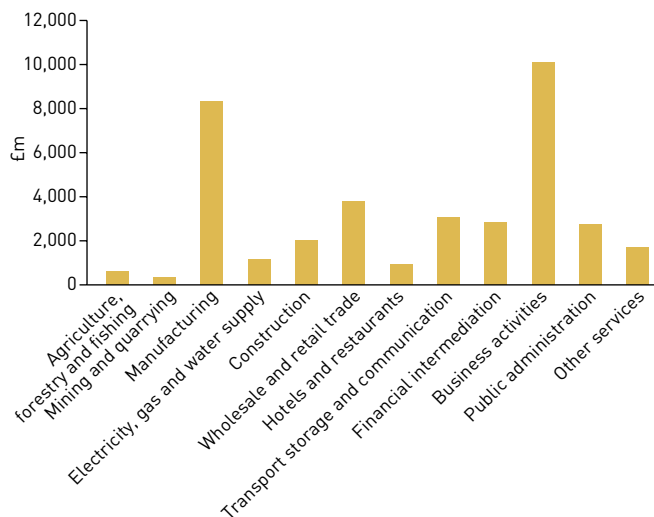
As has been highlighted earlier, universities' own direct output (equivalent to annual turnover) amounted to £27.92 billion. Therefore the total output generated by universities (their own direct output combined with the secondary output in other industries) came to £65.55 billion. This is illustrated in Figure 6.

Figure 6: Total output generated by UK universities, 2011–12



Source: Universities UK economic impact modelling system (2013)

Figure 7: Secondary output generated by UK universities by sector, 2011–12



Source: Universities UK economic impact modelling system (2013)

The ratio of total output to direct output is defined as the *sectoral gross output multiplier*, with a calculated value for UK universities of **2.35**. Therefore, for every £1 million of direct university output a further £1.35 million was generated in other sectors of

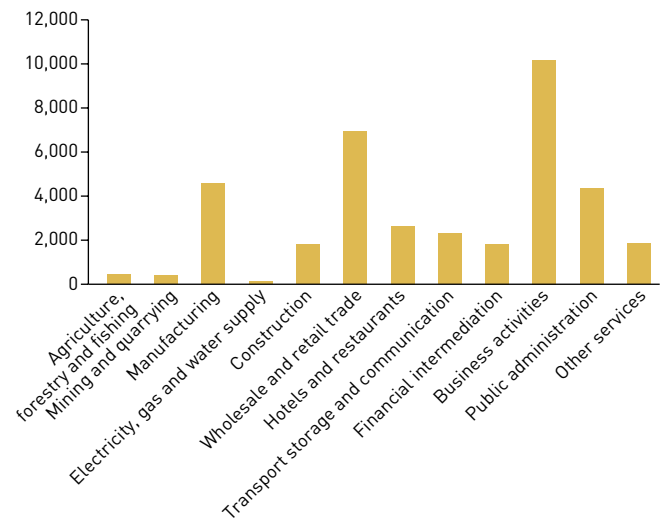
the economy. Figure 7 shows that the secondary output was spread across a range of other sectors, particularly manufacturing, wholesale and retail trade, and business activities. Although the institutions themselves had a very high propensity to purchase UK goods and services (including labour services), the overall impact was moderated by the fact that significant fractions of their labour payments were 'leaked' from the economy in the form of staff import purchases and tax payments. Figure 7 illustrates the pattern of total output generated by universities across the UK economy.

Employment generated by universities

As well as universities being large employers in their own right, their expenditure leads to jobs being generated in other industries. The team was able to analyse the impact on employment across the economy arising through secondary or 'knock-on' effects of expenditure by universities and their employees.

Analysis showed that an estimated 373,794 full-time-equivalent jobs were generated in other industries outside the higher education sector. The pattern of employment across other industries is shown in Figure 8.

Figure 8: Secondary employment generated by university expenditure, 2011–12



Source: Universities UK economic impact modelling system (2013)

As Figure 8 shows, employment was generated across all sectors of the economy, with particularly notable impacts on manufacturing, wholesale and retail trade as well as business activities. The impact made is a reflection of the types of purchases made by universities and their staff as well as the processes through which they were

made. For instance, universities make major capital and equipment purchases as well as relying on a range of business services. The expenditures of university staff will be more oriented towards individual consumer purchases – food, clothes, and other general consumer goods – from shops and other retail outlets. Wholesale and retail distributors of consumer goods will benefit from this (as they attract a retail margin even when the goods themselves are imported).

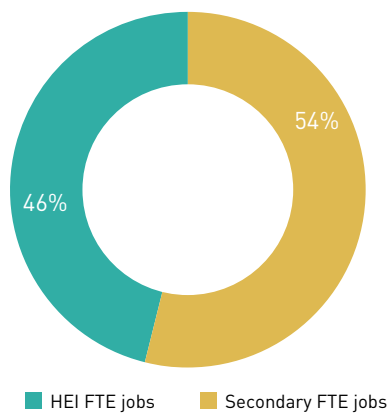
As discussed earlier, HESA data shows that universities directly employed 378,250 people in 2011–12, which equates to 319,474 full-time-equivalent jobs.

industries through secondary effects, universities generated an estimated 693,268 full-time-equivalent jobs in the UK economy in 2011–12.

This gives an *employment multiplier* (defined as total employment divided by direct employment) for universities of **2.17**, indicating that for every 100 jobs created directly within an institution, another 117 jobs are generated elsewhere in the economy.

Chapter 3 discussed the diverse pattern of employment within universities. However, the occupational profile of the secondary employment generated is more similar to that of the UK as a whole. It is also possible to compare the occupational profile of university direct employment with that of the jobs generated by the universities elsewhere in the economy. This is shown in Figure 10.

Figure 9: Employment generated by UK universities, 2011–12

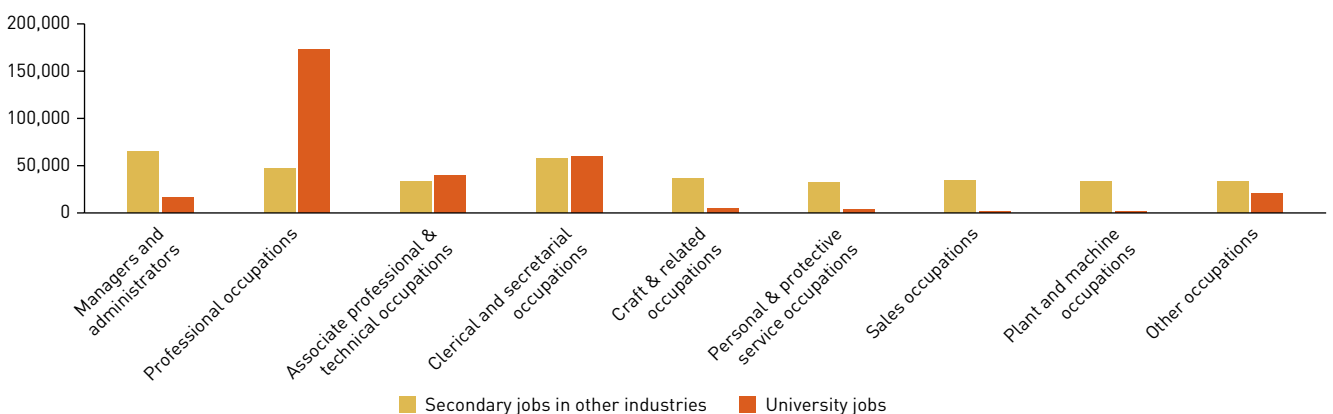


Source: Universities UK economic impact modelling system (2013)

This means that in total, both through employing staff directly and through generating jobs in other

Figure 10 compares the occupational profile of university employment with that generated elsewhere in the economy by university expenditure. This highlights the specialised nature of some of the employment within universities (with a high concentration in professional occupations and a greater proportion in associate professional and clerical occupations compared to that generated through secondary effects). It is clear that direct employment in higher education shows a lower proportion of management occupations compared to those in the secondary employment generated. However, this is predominantly an issue of classification, whereby many people who might be classified as managers in other sectors are included in the professional or associate professional occupations in university statistics (for instance, academic managers such as heads of academic departments may be classified as academic professionals).

Figure 10: Occupational profile of employment generated by universities, 2011–12



Source: HESA and the Universities UK economic impact modelling system (2013)

CHAPTER 5

ADDITIONAL IMPACT OF INTERNATIONAL STUDENTS AND VISITORS

International students

Universities attract a substantial number of international students, studying at institutions throughout the UK. In 2011–12, there were 435,235 students from outside the UK registered at UK institutions. These made up over 17% of the total student population.¹⁷

The impact of international students in the UK has been the subject of much debate in recent times. Over the last two decades the strength of the higher education sector and its attractiveness to international students has been supported by government. For instance the 1999 Prime Minister's Initiative¹⁸ – following on from the Dearing Committee's¹⁹ recognition of the economic importance to the UK of international students – explicitly sought to help universities maximise the economic benefit to the UK through the recruitment of overseas students. This was followed by a second phase of the Prime Minister's Initiative in 2006 (PMI2).²⁰

Within the current policy climate, much focus has been given to the links between international student recruitment and immigration into the UK, and several reforms have been put in place in recent years affecting the non-EU student immigration route.²¹ The economic impact of immigration reform on non-EU student recruitment has been the subject of frequent discussion, with widely varying estimates of its importance. This study is primarily focused on the impact of universities as enterprises and includes analysis of the impact of *all* non-UK students, ie including students from the rest of the EU as well as from non-EU countries. However, given the

policy interest in the impact of non-EU students in particular, we have included further detail in Annexe A, which separates out the identifiable contribution of non-EU students to the UK economy.

The 435,235 students studying in the UK contribute to the economy in various ways. Firstly, these students all make payments directly to universities for their fees, accommodation and other costs and the impact of these monies is captured within the calculation of university impact (income from residence and catering operations is covered in Chapter 2). However, students also buy a wide range of goods and services off-campus. For example, the private rented sector benefits from students' need for accommodation (while many institutions have a stock of student accommodation, few – if any – can accommodate all their students), local supermarkets provide food and drink and local pubs and clubs frequently rely heavily on student trade. Even a casual observer will note that around any university or college there is a proliferation of cafes, snack bars, pubs and shops that seem to draw a large proportion of their business from students. The contribution of students to university cities and regions is an important part of a university's impact. Bangor University is a case in point: the higher education term-time student population of over 11,000 students – 2,000 of whom are international students – almost doubles the city's resident population. Many local businesses rely for their livelihood on the university and its students.

Expenditure by students from outside the UK makes an injection into the national economy, as well as representing export earnings.²² It is important to note

17. Total student population in 2011–12 was 2,496,645 (HESA Students 2011/12)

18. Prime Minister's Initiative 1999 information online at: <http://webarchive.nationalarchives.gov.uk/+/http://www.dius.gov.uk/international/pmi/index.html> and Prime Minister's Initiative 2006 details online at: <http://www.britishcouncil.org/eumd-pmi2-about.htm>

19. Dearing Committee Report *Higher Education in the Learning Society* National Committee of Inquiry into Higher Education, London, 1997 Online at: www.leeds.ac.uk/educol/ncihe/

20. For more details of PMI2 see: www.britishcouncil.org/eumd-pmi2-about.htm

21. For more details see the UK Border Agency's guide to *Studying in the UK*, available at: www.ukba.homeoffice.gov.uk/visas-immigration/studying/

22. Students from the rest of the EU can access tuition fee loan finance on similar terms as domestic students. There would therefore be some cost to the UK in particular in relation to any possible non-repayment of loans. However, detailed analysis of this issue by BIS has shown loans to students from the rest of the EU as a very small proportion (3%) of overall student loan finance. Furthermore the recent rate of repayment in full by students from the rest of the EU has been slightly higher than that of all students. See the detailed analysis accompanying the Industrial Strategy Report, HM Government (2013) *International Education – Global Growth and Prosperity* available at: www.gov.uk/government/uploads/system/uploads/attachment_data/file/229845/bis-13-1082-international-education-accompanying-analytical-narrative.pdf

that the expenditure of all non-UK-domiciled students is relevant, whether they are from the rest of the EU or from further afield. While EU students pay the same fees as home students, they spend money off-campus in the same way as students from other countries.

There are regular surveys of UK student expenditure: the most recent was published by the Department for Business, Innovation and Skills (BIS) in 2013.²³ BIS also commissioned analysis of estimated international student expenditure, as part of analysis of the export earnings of higher education, which was published in its International Education Strategy. This analysis took into account the characteristics of international student expenditure, including adjusting for any UK-sourced income (such as through part-time work) so that the expenditure estimates reflect the international student expenditure that forms part of export earnings. The BIS estimates were therefore used for calculation of additional international student impact. In 2011–12 it was estimated that international student personal (ie non-tuition fee) and living expenditure amounted to £5.6 billion.²⁴

For this modelled analysis we took the BIS estimates as the best ones available for student personal and living (non-tuition fee) expenditure. However, as many students stay on campus, and also use university catering and other facilities, some of their personal living costs are incurred on campus. Any on-campus costs incurred will be captured within the university accounts (as part of university residence and catering or other operating income) and hence for modelling purposes we need to estimate the element of student living expenditure likely to have been incurred on campus so that we avoid double-counting the ‘knock-on’ effects. Drawing on a range of sources relating to university accommodation costs and analysis of the residence and catering income to universities, we estimated that over £740 million of the £5.6

billion may have been spent on campus rather than off campus.²⁵ This gave a final estimated *off-campus* expenditure figure for international students studying in the UK of £4.9 billion in 2011–12.

International visitors

There is another area of university activity that should be noted, which is the important role that institutions can play in attracting visitors to the UK. This does not only encompass leisure visitors such as the friends and family²⁶ of international students visiting the UK but also international conference business and international academic business visitors. The expenditure of university business and leisure visitors contributes to the UK economy in the same way as that of students. Business tourists in particular tend to be high-spending and high-value visitors.

The part that universities play in business tourism is beginning to be more widely recognised. For example, many cities have established ‘conference ambassador programmes’ to support senior academics and other professionals in attracting major international conferences to a region.²⁷ University staff can be pivotal to the success of local conference business as internationally renowned academics are in a position to influence major learned societies and research associations in their choice of conference location. The Glasgow City Marketing Bureau has recently estimated that one third of its 2012–13 business was attributable to the successful Ambassador programme.²⁸ Visit Manchester has also recently highlighted that 12 international conferences, worth £15 million to the city, were secured due to academic and professional ambassadors attracting major learned society conferences to the city.²⁹ Universities also frequently provide holiday accommodation for leisure visitors, group tours and summer school participants, as well

23. Department for Business, Innovation and Skills (2013) *Research paper No. 115: Student Income and Expenditure Survey 2011/12* London: BIS available at: www.gov.uk/government/uploads/system/uploads/attachment_data/file/209389/bis-13-P190-student-income-expenditure-survey-2011-12.pdf

24. BIS estimates for 2011–12 (based on BIS analysis of information from the Student Income and Expenditure Survey and made available to the authors) gave international student living expenses from non-UK sources as £5.6 billion (estimates adjusted to 2011 calendar year) as shown in the Industrial Strategy Report, HM Government (2013) *International Education Global Growth and Prosperity* available at: www.gov.uk/government/uploads/system/uploads/attachment_data/file/229845/bis-13-1082-international-education-accompanying-analytical-narrative.pdf

25. The estimate for monies paid to the institutions was based on analysis of institutional residence and catering income and average university accommodation costs. (Information on university costs are available from the Brightside Trust International student calculator, available at: <http://international.studentcalculator.org/further-information/accommodation>) It was assumed that c. 45% of full-time international students are likely to be staying in university accommodation.

26. Data on these aspects of universities’ activity is very sparse. Information could potentially be obtained through dedicated surveys, but this was beyond the remit and resources for this study. However, it remains worth noting that such visitors are attracted by the universities.

27. For example, the Newcastle Gateshead Ambassador Programme, available at: <http://www.newcastlegateshead.com/conferences/bid-for-an-event/become-a-conference-ambassador> or the Manchester Conference Ambassador Programme, available at: <http://conferences.visitmanchester.com/plan-an-event/ambassadors>

28. Glasgow Convention Bureau News, available at: <http://www.conference-news.co.uk/news/2013/06/03/Conference-business-generates-1bn-for-Glasgow-economy-since-2005/5776>

29. Manchester Conferences news, available at <http://conferences.visitmanchester.com/why-manchester/news/2013>

as for individual visiting scholars. The 2012 NUS/Unipol survey³⁰ of student accommodation indicated that there were 221,714 bed spaces provided directly by institutions (as distinct from private providers or commercial partners). Virtually all universities let out accommodation to visitors during the vacations. There has been a significant increase in the accommodation available in recent years, with total institutional bed spaces having grown by 47% overall between 2008 and 2011. Provision of self-catering en suite accommodation grew by 55% in that time.³¹

Furthermore, universities are becoming increasingly professional in the promotion of their facilities and accommodation to third parties, for business, conference and leisure purposes, with more dedicated conference centres being constructed. Venuemasters,³² a high profile service dedicated to promoting academic venues and facilities for conferences, now has more than 80 universities as members. There are also a number of web-based booking services for university accommodation outside term time, such as universityrooms.com

However, despite this being a thriving subsector of university business there is very limited information available on the total numbers of visitors (both business and leisure) attracted by universities. This information is not routinely collected by HESA or even by relevant tourist or conference agencies. In order to make an estimate of international visitor expenditure, the study team drew on previous survey-based information (a previous study had collected data on university visitor numbers), with an estimate of 1,148,695 business and 468,384 leisure visitor bednights in a single year. It was assumed that these numbers remained constant over the

past four years. Per diem expenditure rates were sourced from the Office for National Statistics' *Travel trends*. It was therefore possible to derive an estimate of total international visitor expenditure in 2011–12. This total figure was also reduced to take account of monies paid directly to universities (in particular for the residence and catering operations) and a final estimate of personal off-campus expenditure for international visitors amounted to £136 million. This also represents export earnings for the UK. It must be emphasised that, given the data limitations described, these figures for international visitor expenditures are therefore very conservative. With many of the major international academic and professional conferences (some scientific conferences attracting several thousand delegates), delegates often do not stay in university accommodation but rather in large city hotels. The impact of these visitors is not included in the current estimates. Further research into university engagement in business tourism could reveal a much more extensive picture.

Expenditure figures for international students and international visitors were disaggregated into the format required for the model (with expenditure vectors constructed that reflected the 'individual consumer'-oriented nature of student and visitor spend). The resulting impact on the UK economy is shown in Table 9.

It is clear that while the mainstream activity of universities has the most significant impact on the economy, the economic activity generated by the off-campus expenditure of international students and visitors is also important and adds an additional dimension to the role of higher education within the economy.

Table 9: Impact of international (all non-UK) student and visitor expenditure, 2011–12

	Non-UK students	Non-UK visitors
Total personal expenditure (off campus)	£4.91 billion	£136 million
Knock-on output generated throughout UK economy	£7.37 billion	£191 million
Knock-on employment generated	62,383 full-time-equivalent jobs	1,617 full-time-equivalent jobs

Source: Universities UK economic impact modelling system (2013)

30. NUS/Unipol Accommodation Costs Survey 2012, available at: http://www.unipol.leeds.ac.uk/News/Accommodation_Costs_Survey.asp

31. NUS/Unipol Accommodation Costs Survey 2012, available at: http://www.unipol.leeds.ac.uk/News/Accommodation_Costs_Survey.asp

32. Venuemasters, available at: www.venuemasters.co.uk

CHAPTER 6

THE CONTRIBUTION OF HIGHER EDUCATION TO UK GROSS DOMESTIC PRODUCT

The importance of higher education to the economy can be seen through the generation of significant levels of gross output and employment. However, a key measure of higher education's contribution to the national economy is its contribution to gross domestic product (GDP). While measures of industry output can give a clear indication of the contribution of an industry in terms of its magnitude and the scale of its generation of economic activity, when looking at the economy as a whole gross output measures inevitably involve an element of double counting, since some of one industry's output also forms part of another's.

GDP is used by all countries as a measure of the *net* change in their wealth or prosperity as a whole over a year. There are three measures of GDP:

- GDP (I), where the measure is taken of national income
- GDP (E), where GDP is measured through analysis of certain groups of expenditures
- GDP (O), which is measured through analysis of industry outputs and operating expenditures³³

Gross value added (GVA) is the industry measure of GDP (O). As its name indicates, it is a measure of the value an industry adds to 'bought-in' goods and services through the application of its own resources (notably capital and labour) to produce its own output. For most individual businesses GVA is

approximated by the value of its turnover less non-labour operating expenses. As a macroeconomic indicator it is a production measure of the net wealth or prosperity in the UK as a whole over the year. Therefore an analysis of higher education gross value added can provide policy-relevant information and this was undertaken as part of this study. The results are shown in Table 10.

The analysis of higher education gross value added revealed that in 2011–12 universities contributed £36.4 billion to national GDP through both direct and secondary effects. The off-campus expenditure of international students and visitors made a further £3.51 billion contribution to GDP. Therefore taken together the contribution to GDP came to nearly £40 billion – equivalent to 2.8% of GDP in 2011.³⁴ This figure excludes any contribution to GDP of the off-campus expenditure of the UK's domestic higher education students (over 2 million domestic students) since it is assumed that they may have incurred their expenditure in any event.

Comparisons with figures for previous studies (eg in 2007–08 the higher education sector generated GDP equivalent to 2.3% of UK GDP) reinforce the point that higher education's contribution to GDP is countercyclical. That is to say universities will tend to grow less than the economy as a whole in boom times but also decline less in recession. In this way the higher education sector makes an important contribution to macroeconomic stability.

Table 10: The contribution of the higher education sector to UK GDP, 2011–12

	Universities	International students	International visitors	Higher education sector
Direct GDP (O)	£17.97 billion	0	0	£17.97 billion
Secondary GDP (O)	£18.43 billion	£3.42 billion	£0.09 billion	£21.94 billion
Total GDP (O)	£36.40 billion	£3.42 billion	£0.09 billion	£39.91 billion
University GDP multiplier	2.03	N/A	N/A	N/A

Source: Universities UK economic impact modelling system (2013)

33. All three measures share the same accounting identity. In other words they are three different ways to measure the same thing and the final outcome measurement should be identical. If there are observed differences between the measures this is a result of data discrepancies.

34. Total UK GDP was estimated as £1.4 trillion. Office for National Statistics 2012, available at: www.ons.gov.uk/ons/publications/re-reference-tables.html?edition=tcM%3A77-224469

Table 11: UK higher education contribution to UK GDP and UK employment

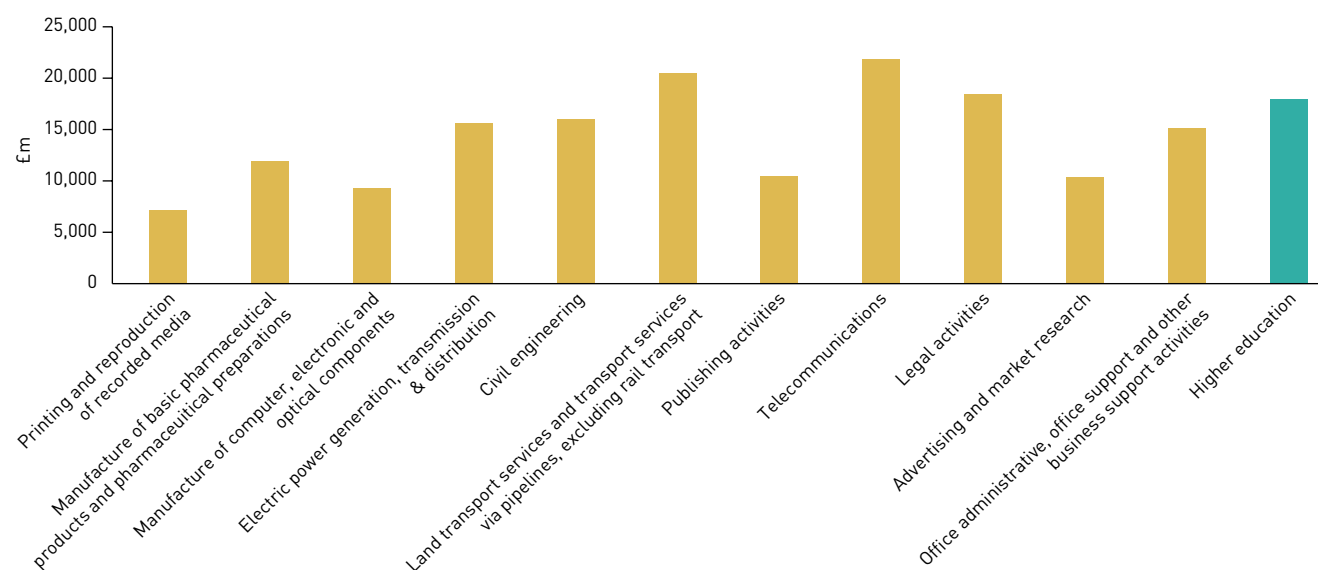
UK higher education contribution to GDP 2007–08 (as proportion of all UK GDP)	UK higher education contribution to GDP 2011–12 (as proportion of all UK GDP)
2.3%	2.8%
UK higher education contribution to UK employment 2007 (as proportion of all UK employment)	UK higher education contribution to UK employment 2011 (as proportion of all UK employment)
2.6%	2.7%

Higher education’s contribution to GDP (O) is clearly significant. Further analysis was undertaken to assess the impact of universities on GDP compared with a number of other UK sectors.

As Figure 11 shows, the higher education institutional contribution to GDP (O) in 2011–12 was comparable to that made by legal activities, greater than that of office administration and less than telecommunications. The industry figures were

sourced from the ONS Use Tables for 2010 and hence should not be regarded as a direct like-with-like comparison as the higher education figures are for the year 2011–12. However, Figure 11 is broadly indicative and is helpful in illustrating the relative position of universities in terms of their contribution to GDP. This is an industry-to-industry comparison (ie the secondary GDP generated by the universities or their students is not included).

Figure 11: Higher education’s direct contribution to GDP (O) compared to other sectors



Sources: Universities UK economic impact modelling system (2013) and ONS 2010 Combined Use Table (2012) for industry comparators

CHAPTER 7

THE EFFECTIVENESS OF HIGHER EDUCATION EXPENDITURE IN GENERATING ECONOMIC ACTIVITY

This study focuses on the economic activity generated by higher education expenditure. The policy interest in this impact of expenditure is driven by value-for-money considerations and the desire on the part of funding agencies, research councils and government itself to understand the role that higher education institutions can play in the economy. While this study does not encompass the wider economic value that may be generated by higher education research and teaching, the expenditure of the sector has important implications for the economy. Table 12 shows the overall impact delivered per £1 million of expenditure.

While the data available for this study did not permit new modelling of comparator industry sectors, to put the university position into a broader perspective and for illustrative purposes some comparators for earlier years are shown in Table 13. These are taken from the Universities UK 2009 study (the comparator industry impacts are for 2007–08).

In considering the different types of impact created per £1 million of expenditure it may be observed that the measures reflect a range of different characteristics:

- *Output generated per unit of expenditure* tends to reflect the purchasing patterns of the industry in question. Output generated per unit of expenditure tends to be higher in sectors with a relatively high concentration of expenditure on UK (rather than imported) goods and services. Table 12 shows that universities generate a relatively high output per unit of expenditure, exceeded in the selected comparators in Table 13 only by the health and public administration sectors, because they have a high propensity for purchases from UK sources rather than imports.
- *Sectors generating higher numbers of jobs per £1 million unit of expenditure* tend to be labour intensive and they also tend to purchase from other labour intensive sectors. As can be seen from the comparators in Table 13, universities tend to fall into the middle area for labour intensity, which is typical of professional services.
- *GDP (O) generated per unit of expenditure* tends to be in sectors which in themselves have high value added per unit of output and which also tend to purchase from sectors which have high value added per unit of output. As can be seen from the

Table 12: Total impact per £1m university expenditure, 2011–12

UK impact per £1 million expenditure	Total output (£m)	Total employment (FTE)	GDP (O) (£m)	Per capita GDP (£1,000)
Universities	2.46	25.98	1.36	52.52

Source: Universities UK economic impact modelling system (2013)

Table 13: Total impact per £1 million expenditure for selected other industry sectors

	Total output (£1m)	Total employment (FTE)	GDP (O) £1m	Per capita GDP (£1,000)
Electronic components	1.97	17.00	0.87	51.18
Construction	1.90	20.27	0.96	47.36
Health	3.18	37.49	1.24	33.08
Public administration	2.64	33.82	1.22	36.07
R & D	1.88	24.31	0.93	38.26
Computing services	2.39	33.20	1.39	41.87

Source: Universities UK economic impact modelling system (2009); the figures for other sectors relate to 2007–08

comparators, universities rank highly in terms of GDP per unit of expenditure (reflecting a high-skill industry).

- *Sectors which generate high GDP per capita* are those which tend to have a high income per employee and high productivity per employee – in other words sectors that tend to have higher paid and highly productive employees.

CHAPTER 8

CONCLUSIONS

This study presents an analysis of key economic characteristics of UK universities and colleges in the academic year 2011–12. It also presents modelled analyses of the impact of university expenditure in generating additional output and employment in other parts of the national economy. It highlights the additional injection to the economy made by international students and visitors and analyses the overall contribution of the sector to UK GDP. The study focuses on universities as business entities and the impact of their expenditure on the economy, which is the aspect of the sector's contribution to the economy that is most readily quantifiable. It also analyses the sector's overall contribution to national GDP.

The evidence confirms that higher education (defined as the universities together with the expenditure of their staff, international students and international visitors) is a substantial industry, with a significant impact on the national economy. It also reveals that higher education is particularly effective in generating GDP per capita, compared to several other sectors of the economy.

The higher education sector generated £73.11 billion of industry output in the national economy in 2011–12. Universities directly provided over 319,474 full-time-equivalent jobs, representing just over 1% of the workforce in employment. Over 437,794 additional jobs were generated throughout the economy through secondary effects of the

expenditure of universities, their international students and visitors, taking the total employment dependent on higher education expenditure to more than 757,268 full-time-equivalent jobs – or around 2.7% of 2011 UK employment.³⁵

Higher education was also a major service sector export earner, attracting over £10 billion of export earnings, nearly £5.7 billion of which was paid directly to universities for their services.

Analysis of the revenue base shows that while the public sector remains the largest single source of funding for universities, the majority of university revenue is earned from private and international sources.

Overall the higher education sector contributed £39.91 billion to GDP in 2011–12, equivalent to 2.8% of 2011 UK GDP. This is a greater proportion of GDP than observed in previous studies (eg 2.3% in 2007–08). Given the current economic climate of the UK, this greater proportion of GDP shows the UK higher education sector to be countercyclical and tending to promote macroeconomic stability.

The overall impact of the higher education sector (taking the impact of institutions together with that of the off-campus expenditure of international students and visitors) is presented in Table 14.

Table 14: Overall impact of the higher education sector on UK output and employment, 2011–12³⁶

	Universities	Off-campus expenditure of non-UK students	Off-campus expenditure of non-UK international visitors	Higher education sector
OUTPUT				
Direct output	£27.92 billion	0	0	£27.92 billion
Secondary output	£37.63 billion	£7.37 billion	£0.19 billion	£45.19 billion
Total output generated (direct plus secondary)	£65.55 billion	£7.37 billion	£0.19 billion	£73.11 billion
EMPLOYMENT (FTE)				
Direct employment	319,474	0	0	319,474
Secondary employment	373,794	62,383	1,617	437,794
Total employment generated (direct plus secondary)	693,268	62,383	1,617	757,268

Source: Universities UK economic impact modelling system (2013). Note: All employment figures are full-time-equivalents.

35. Based on 28,220,000 people of working age in employment in the UK in 2011. Office for National Statistics Labour Market Statistics, November 2011, available at: www.ons.gov.uk/ons/rel/lms/labour-market-statistics/november-2011/index.html

36. Summary figures are rounded.

Table 15: Export earnings attributable to the UK higher education sector

	Universities	Off-campus expenditure of non-UK students	Off-campus expenditure of non-UK international visitors	Higher education sector
Export earnings	£5.66 billion	£4.91 billion	£0.14 billion	£10.71 billion

Table 16: Total contribution of the UK higher education sector to UK GDP

	GDP (0)			
	Universities	Off-campus expenditure of non-UK students	Off-campus expenditure of non-UK international visitors	Higher education sector
Direct GDP (0)	£17.97 billion	0	0	£17.97 billion
Secondary GDP (0)	£18.43 billion	£3.42 billion	£0.09 billion	£21.94 billion
Total GDP (0)	£36.40 billion	£3.42 billion	£0.09 billion	£39.91 billion

This study did not set out to examine higher education's broader social and economic impact, such as that achieved through knowledge transfer and innovation or cultural and community engagement. Neither did it seek to place a value on the work undertaken by higher education.³⁷ It is nevertheless clear that higher education is a core part of the national economic infrastructure, generating significant employment and export earnings and making a substantial contribution to GDP.

37. In other studies the authors have constructed a framework to enable economic and social valuation of higher education outputs – for more information see: <http://strathprints.strath.ac.uk/7179/> and a 2011 report undertaken for the National Coordinating Centre for Public Engagement, *Through a Glass Darkly: Measuring the social value of higher education*: www.publicengagement.ac.uk/how-we-help/our-publications/social-value

ANNEXE A

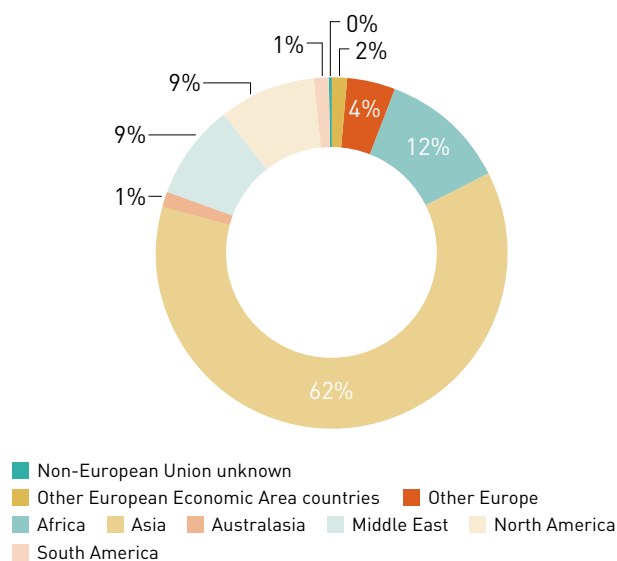
THE IMPACT OF NON-EU INTERNATIONAL STUDENTS ON THE UK ECONOMY

The economic impact of non-EU students has become a subject of debate, in the course of which there has been discussion of the extent to which international students may, or may not, contribute to the UK economy. As part of this study we have undertaken an analysis of the economic impact of all non-UK international students and the results have been presented in Chapter 5. This includes students from the rest of the EU as all revenue originating from outside the UK is additional to the UK economy and contributes to the balance of trade. However, given that the recruitment of non-EU students currently has implications for government immigration policy, we have undertaken supplementary analysis to separate out the economic impact attributable to non-EU students from that attributable to EU students. The results of this analysis are presented below.

Non-EU domiciled students at UK universities

There were 302,680 students from outside the EU registered as students in UK universities in 2011–12, representing around 70% of all international students.³⁸

Figure 12: Non-EU students at UK universities by domicile of origin, 2011–12



Source: HESA Students 2011/12

38. HESA Students 2011/12

39. The British Council guide to UK course fees. Available at: www.educationuk.org/Article/uk-course-fees-for-international-students

Non-EU students come from 185 countries across the globe with the majority of students (188,525 and around 62% of all non-EU students) coming from Asia. The country sending most students is China (78,715), followed by India (29,900). Other countries sending more than 10,000 students include Nigeria (17,620), the USA (16,335), Malaysia (14,545) and Hong Kong, Special Administrative Region of China (11,335).

Expenditure of non-EU students

Non-EU students contribute to the UK economy in a range of ways. Firstly they pay tuition fees to the universities. Tuition fees can be substantial. The British Council advises that for students from outside the European Union tuition fees can range between £9,500 and £30,000 per year.³⁹ According to HESA, the total of non-EU tuition fees paid to the universities in 2011–12 amounted to £3.24 billion.

Secondly, students need to support themselves, paying for accommodation, food and other personal living expenses. Our earlier analysis of all international students had drawn on a number of sources including the HMG International Education Strategy and the BIS Student Income and Expenditure Survey, to derive an estimate for international student expenditure, including off-campus and on-campus elements.

As non-EU students make up 69.6% of the international student population we separated out the expenditure elements associated with students from outside the EU by attributing 69.6% of all international student personal and living costs expenditure to this group, including a share of the monies paid to the universities for residence and catering etc as well as off-campus expenditure. In total £517 million was estimated to have been paid by this group to the universities for accommodation, food and other expenses and this was included as part of the monies paid to the universities and generated impact through university expenditure. The non-EU students' share of total off-campus expenditure was estimated as £3.42 billion.

Therefore total expenditure (tuition fees of £3.24 billion plus accommodation and other expenses paid

to the universities of £0.517 billion and off-campus personal and living expenses of £3.42 billion) was estimated to amount to a total of £7.17 billion, which is a positive contribution to the balance of trade. Per capita expenditure is shown in Table 17.

Table 17: Estimated average per capita expenditure of non-EU students

Total estimated average per capita expenditure in the study year	£23,692
Of which paid to the university (for both fees and accommodation etc)	£12,408
Of which spent off-campus	£11,284

Impact generated through secondary or knock-on effects

The money spent by international students represents export earnings; it also generates economic activity in the UK, generating output and jobs and contributing to GDP. We analysed the overall share of impact generated by this group of international students, combining the impact generated through the universities by their fees and other money paid to the universities as well as through their off-campus expenditure. The results are shown in Table 18. The impact generated through payments to the universities is the share of university impact that can be attributed to non-EU students (£8.8 billion of the total £65.55 billion university-generated output). The impact generated through off-campus expenditure is the non-EU

student share of the total non-UK student off-campus expenditure impact (£5.1 billion of the £7.37 total non-UK student off-campus impact).

This is a substantial impact on the economy. However, of particular policy relevance is the per capita impact, which will offer a greater insight into the economic impact of changes in non-EU student numbers. The per capita impact is shown in Table 19.

Table 19: Per capita impact of non-EU students

Non-EU students	
Average per capita impact on UK economy	
Output generated	£46,071
FTE jobs generated	0.45 FTE
Contribution to UK GDP	£24,028

In other words, Table 19 shows that nearly half of a full-time UK job is generated for every non-EU student studying in the UK.

For every non-EU student, output of £46,071 is generated in UK industries, resulting in a contribution to UK GDP of £24,028.

This is a significant impact per capita and clearly has important economic and policy implications. Policies affecting the numbers of non-EU students will have very clear ramifications for the economy and will impact substantially on jobs, output and GDP.

Table 18: Total impact generated by non-EU students at UK universities, 2011–12

	Impact generated through payments made to the universities (ie the share of university impact attributable to non-EU students)	Impact generated by off-campus expenditure of non-EU students (ie the non-EU student share of all non-UK student off-campus impact)	Total impact attributable to non-EU students at UK universities
Output	£8.8 billion	£5.1 billion	£13.9 billion
Jobs	93,254 FTE jobs	43,385 FTE jobs	136,639 FTE jobs
Contribution to GDP	£4.9 billion	£2.4 billion	£7.3 billion

ANNEXE B

NOTES ON MODELLING METHODOLOGY

The model used was a purpose designed and specially constructed 'type II' input-output model of the UK economy, based on actual data derived from the Office for National Statistics' (ONS) input-output tables (2006) together with Labour Force Survey data.⁴⁰ The labour market components were updated in 2013 to reflect changes in productivity.

Methodology and model specification

Creating the Leontief matrix

The Leontief matrix is a vital starting point within the economic model. The team used the ONS input-output tables (2006) and it proved possible to create a type I and then a type II from this data source. One additional source used was the national accounts data (*Blue Book*, 2008) in order to estimate wages ('compensation of employment' in national accounts terminology) as a proportion of the total household income from all sources. If non-wage income was not included in the denominator then the type II model would overestimate the impact of knock-on effects throughout the economy. The C-Map program was used in order to invert the 124 x 124 matrix.

First, we estimated a domestic money flows intermediate matrix, X^{DD} , and a domestic money flows final demand vector (excluding exports), Y^{DD} . We also extracted the vector of exports, E from the input-output tables. Following this we used the matrices from above to *calculate* the vector of domestic gross outputs, X^D , to be used as control totals and for the estimation of coefficients; ie:

$$(1) \quad X^D = X^{DD} + Y^{DD} + E$$

Following this we calculated the domestic flows coefficient matrix,

$$(2) \quad A^{DD} = \frac{X^{DD}}{X^D}$$

We then calculated the type I Leontief inverse as:

$$(3) \quad \{I - A^{DD}\}^{-1}$$

This was then validated by calculating the following (this is known as a *recreate base* or a *base year test*):

$$(4) \quad X^* = \{I - A^{DD}\}^{-1}\{Y^{DD} + E\}$$

As calculated X^* was found to equal actual X^D , then the type I Leontief inverse was correct since it replicates the 'model' base year outcomes.

For the type II Leontief we needed to add a row of employment income coefficients and a column of household consumption coefficients to the A^{DD} matrix. For the income coefficients we then calculated for all industries:

$$(5) \quad Y_i^E / X_i^D$$

Where Y_i^E is compensation of employees in industry I and X_i^D is domestic output of industry I from above. Total household income Y^T was estimated as employment income Y^E (estimated from the input-output tables), plus other income Y^O from the Treasury *Blue Book* (2008).

From the simulated domestic final demand matrix Y^{DD} estimated earlier, we used the column vector of domestic household consumption C^{DD} . From this the column vector of consumption coefficients is calculated as:

$$(6) \quad C^{DD} / Y^T$$

The type II Leontief inverse was now calculated. As above, validation involved ensuring that the expanded model was able to replicate actual base year outputs, including in this case total household income.

Extensions to model framework

UK employment figures by industry were created, using the Labour Force Survey where possible. Using this and the type II Leontief, the employment/output ratios can be calculated. This allows creation of the employment sub-matrix.

The UK occupation-by-industry submatrix was formed using primary data. The occupation by industry data was compiled from previous Tourism

40. This UK model was constructed specifically for analysis of higher education; in addition 12 regional extensions to the model have been developed, covering every part of the UK. The UK model and the 12 regional extensions form part of the system known as the Universities UK economic impact modelling system, which is purpose designed to model the impact of higher education institutions on both the regional and national economies. It was updated in 2013 to reflect labour market productivity changes.

Satellite Accounts, compiled by the authors for the former Department for Culture, Media and Sport,⁴¹ which used the Labour Force Survey.

The extended labour market input-output model

The following describes both the use of the data already described in the creation of the model and the nature of the extended input-output model used as the main engine of analysis.

The basic UK input-output equation here is:

$$(7) \quad X^{UK} = \sum_{i=1}^j X_{ij}^{UK} + Y^{UK}$$

where:

i, j = industrial sectors 1 to 124 *including households*

X^{UK} = vector of gross outputs

h^{UK} = total household income

X^{UK} = matrix of volumes of sales from UK sector i to UK sector j

h_i^{UK} = employment income paid by sector i

Y^{UK} = matrix of UK sectoral sales to final markets

y_h^{UK} = UK household non-employment income

Taking the conventional input-output assumption that:

$$(8) \quad X_{ij}^{UK} = a_{ij}^{UK} X_j^{UK} \quad \forall_{i,j}$$

or, in matrix form:

$$(8a) \quad X_{ij}^{UK} = A^{UK} X^{UK}$$

where : A^{UK} is a matrix of parametric constants, whose typical element a_{ij}^{UK} gives the inputs required from UK industry i per unit of output of UK industry j .

Substituting (8a) into (7):

$$(9) \quad X^{UK} = A^{UK} X^{UK} + Y^{UK}$$

and solving (9) for X^{UK} :

$$(10) \quad X^{UK} = [I - A^{UK}]^{-1} Y^{UK}$$

where $[I - A^{UK}]^{-1}$ is the UK type II Leontief Inverse

In the extended input-output model we define a vector of aggregate industry employment-output coefficients, e , with elements given by:

$$(11) \quad e_i = E_i^{UK} / X_i^{UK} \quad i = 1 \text{ to } 123 \text{ sectors}$$

where: E_i^{UK} is total full-time-equivalent employment in UK industry i . Then, the vector E^{UK} of total UK sectoral employments is:

$$(12) \quad E^{UK} = \hat{e} X^{UK}$$

Or alternatively,

$$(12a) \quad E^{UK} = \hat{e} [I - A^{UK}]^{-1} Y^{UK} \quad (\text{by substitution from (10)})$$

For the creation of the occupation by industry matrix⁴² we define a matrix, o^{UK} , of UK occupational employment shares coefficients with elements given by:

$$(13) \quad o_{oj}^{UK} = O_{oj}^{UK} / E_j^{UK} \quad o = 1 \dots\dots 371 \text{ occupations}$$

$j = 1 \dots\dots 123 \text{ sectors}$

where: O_{oj}^{UK} is FTE employment in occupation o in industry j .

Then a vector, O^{UK} , of total UK employment in each occupation is obtained as:

$$(14) \quad O^{UK} = o^{UK} \hat{E}^{UK}$$

and from (12a):

$$(15) \quad O^{UK} = o^{UK} \hat{e} [I - A^{UK}]^{-1} Y^{UK}$$

which is occupation by industry equating with overall full-time-equivalent employment across the UK. This will operate through the impact of expenditure within the economy in a consistent manner.

Overall the key results of the UK extended input-output labour market model are derived from the following equations:

Sectoral gross outputs

$$X^{UK} = [I - A^{UK}]^{-1} Y^{UK}$$

Sectoral total employment

$$E^{UK} = \hat{e} [I - A^{UK}]^{-1} Y^{UK}$$

41. Jones C, Munday M, Bryan J, Roberts A, McNicoll I H, McLellan D (2004) UK tourism satellite account – first steps project, prepared by Cardiff Business School for Department for Culture, Media and Sport. London: DCMS. Available at: <http://old.culture.gov.uk/images/research/tsafirststepprojectreportpt1.pdf>

42. From Labour Force Survey data

Employment by occupation

$$O^{UK} = o^{UK} \hat{e} [I - A^{UK}]^{-1} Y^{UK}$$

Model Gross Value Added (GVA) is calculated by deriving the matrix, g^{UK} , of UK GVA shares coefficients with elements given by:

$$(16) \quad g_{oj}^{UK} = \frac{G_{oj}^{UK}}{X_j^{UK}} \quad \begin{array}{l} G = 1 \dots\dots 123 \text{ GVA} \\ j = 1 \dots\dots 123 \text{ sectors} \end{array}$$

Where: G_{oj}^{UK} is actual GVA within industry j.

Then a vector, G^{UK} , of total UK GVA for a given I/O output is obtained as:

$$(17) \quad G^{UK} = g^{UK} [I - A^{UK}]^{-1} Y^{UK}$$

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ISBN: 978-1-84036-304-3

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April 2014

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